An Investment-and-Marriage Model with Differential Fecundity

Hanzhe Zhang

Michigan State University

Tuesday, September 3, 2019

http://www.msu.edu/~hanzhe/
Three Sets of Stylized Facts
1. College and Earnings Gender Gaps

- Reversed college gender gap
- Persistent earnings gender gap

![Graph showing the percent with college degrees among 35-39 year-olds and the average labor income (in thousands of dollars) among 35-39 year-olds over the census years from 1960 to 2010 for both males and females.](image)
2. Average Midlife Income by Age at Marriage

- Hump-shaped relationship for men
- Positive relationship for women
3. Average Spousal Income by Age at Marriage for Women

- Hump-shaped relationship
- Changing relationship: early versus late brides
Previous Explanations

1. More women than men go to college and fewer women than men earn a high income.
   - One gender difference in the model can generate these two opposite gender gaps; no paper has done that
   - Some empirical studies: Iyigun and Walsh (2007); Chiappori et al. (2009); Ge (2011); Lafortune (2013); Bruze (2015); Greenwood et al. (2016); Chiappori et al. (2017)

2. Relationship between age at marriage and personal midlife income has been persistently hump-shaped for men and positive for women.
   - Becker (1974); Keeley (1979): negative for men and negative for women due to marriage frictions; Bergstrom and Bagnoli (1993): positive for men and no relationship for women due to informational frictions

3. Relationship between age at marriage and spousal income for women has been persistently hump-shaped, with a changing marital outcome for early brides versus late brides.
   - Low (2017): non-assortative matching
Model
Model Overview

- **Infinite number of periods.**
- **A unit mass of men and a unit mass of women become adults each period.**
- **Individuals are born with heterogeneous abilities of succeeding from investments.**
- **Investments:** they make investment and marriage decisions over three periods.
- **Differential fecundity:** women stay fertile for a shorter period of time than men.
- **Marriage market:** division of marriage surplus is determined by supply and demand.
Investments
InVESTMENTS

ages 16-22   ages 23-29   ages 30-39
Investments

- ages 16-22
- ages 23-29
- ages 30-39
Investments

offer

- college
  - $\theta$
  - no college

- ages 16-22
- ages 23-29
- ages 30-39
Investments

- College
  - Offer
    - No college
      - Low income
        - Ages 16-22
        - Ages 23-29
        - Ages 30-39
      - Career offer
        - No career
          - Low income
            - High income
Investments

- Offer
  - College
    - theta
  - No college
    - low income

Ages 16-22
Ages 23-29
Ages 30-39
Investments

- College
  - Offer
    - [θ]
      - College
        - No college
          - Low income
            - Ages 16-22
            - Ages 23-29
            - Ages 30-39
Investments

ages 16-22  ages 23-29  ages 30-39

\[\theta\]

\[1 - \theta\]

no college  low income

college

offer

[\theta]

[1 - \theta]
Investments

- College: 
  - High income
  - Low income
- No college: 
  - Low income

\[ \theta \]

Ages 16-22

Ages 23-29

Ages 30-39
Investments

- ages 16-22
- ages 23-29
- ages 30-39

- college
  - offer
    - college
      - [\theta]
      - [1 - \theta]
    - no college
      - low income
  - no college
    - low income

- high income
  - low income
    - high income
Investments

- ages 16-22
  - college
    - offer
      - high income
      - [1 - \theta]
    - [\theta]
  - no college
    - low income
- ages 23-29
  - career
  - offer
- ages 30-39
  - high income
  - no career
Investments

ages 16-22

- college
  - offer
    - [\theta]
      - high income
      - [1 - \theta]
        - career
          - offer
            - no career
            - no college
              - low income

ages 23-29

- college
  - offer
    - [\theta]
      - high income
      - [1 - \theta]
        - career
          - offer
            - no career
            - no college
              - low income

ages 30-39

- college
  - offer
    - [\theta]
      - high income
      - [1 - \theta]
        - career
          - offer
            - no career
            - no college
              - low income
Investments

\[ \begin{align*}
\theta & \quad \text{college} \\
1 - \theta & \quad [1 - \theta] \\
\text{offer} & \quad \text{career} \\
\text{offer} & \\
\text{no college} & \quad \text{no career} \\
\text{low income} & \quad \text{low income}
\end{align*} \]

ages 16-22 \quad ages 23-29 \quad ages 30-39
Investments

\[
\begin{align*}
\theta & \quad \text{college} \quad \text{offer} \quad \text{[1 - } \theta] \\
\text{no college} & \quad \text{low income} \quad \text{[} \theta \text{]} \quad \text{career} \quad \text{offer} \\
& \quad \text{no career} \quad \text{low income} \\
\end{align*}
\]

ages 16-22 \quad \text{ages 23-29} \quad \text{ages 30-39}
Investments

- ages 16-22
  - offer with probability $\theta$
  - college
    - low income
    - no college
      - low income

- ages 23-29
  - offer with probability $1 - \theta$
  - career
    - low income
    - no career
      - low income

- ages 30-39
  - offer with probability $\theta$
  - high income
  - no career
    - high income
Investments

- college
  - offer with probability $\theta$
    - [1 - $\theta$]
      - career
        - offer with probability $\theta$
          - [1 - $\theta$]
            - low income
  - no college
    - low income

- no college
  - low income

- ages 16-22
- ages 23-29
- ages 30-39
Differential Fecundity

\[ y + \nu - c \]

income + marital payoff (income, fertility) – investment costs

- Men who marry in any of the three periods have the same fertility level.
- Women who marry in the third period may have a lower fertility level than those who marry in the first two periods.
- Husband’s income and wife’s income and fertility determine marriage surplus: \( s(y_m, y_w, \phi_w) \equiv s(\tau_m, \tau_w) \).
  - Surplus is increasing in each argument, supermodular in incomes, and supermodular in income and fertility.
Marriage Market

- Division of the marriage surplus is endogenously determined:
  \[ u_{m\tau_m} + u_{w\tau_w} = s(\tau_m, \tau_w) \]
  for any married couple \( \tau_m \) and \( \tau_w \).

- Marriages are stable: \( u_{m\tau_m} + u_{w\tau_w} \geq s(\tau_m, \tau_w) \) for any pair.
Investment strategies \((\sigma_m^*, \sigma_w^*)\) and marriage payoffs \((v_m^*, v_w^*)\) form an equilibrium if

- \(\sigma_m^*(\theta), \sigma_w^*(\theta)\) maximizes each ability-\(\theta\) individual’s expected payoff.
- \((v_m^*, v_w^*)\) are the stable marriage payoffs in the marriage market \((G_m^*, G_w^*)\) induced by \((\sigma_m^*, \sigma_w^*)\).
Equilibrium Existence and Uniqueness

Theorem
There exists an equilibrium. Equilibrium investment strategies \((\sigma^*_m, \sigma^*_w)\) are uniquely determined. Equilibrium marriage payoffs \((v^*_m, v^*_w)\) are uniquely determined up to a constant.

Proof Steps

0. Marriage payoffs are determined by payoff difference \(\pi_m \equiv v_{mH} - v_{mL}\).
   The mapping in consideration is \(\pi_m \overset{f_\sigma}{\longrightarrow} \sigma \overset{f_G}{\longrightarrow} G \overset{f_\pi}{\Rightarrow} \pi_m\).
1. Construct supply function \(S(\pi_m) = f_G(f_\sigma(\pi_m))\).
2. Construct demand correspondence \(D(\pi_m) = \{G : \pi_m \in f_\pi(G)\}\).
3. Show that supply is increasing and demand is decreasing.
Explanations
Men’s Midlife Income by Age at Marriage
\[
\theta_m = \frac{c_m}{(y_{mH} - y_{mL}) + (u_{mH} - u_{mL})} \equiv \frac{c_m}{\Delta z_m + \pi_m}
\]
Women’s Midlife Income by Age at Marriage

Average log personal midlife total income by age at marriage for women across different decades.
\[ \theta_{w1} = \frac{c_w}{\Delta y_w + \pi_w} < \theta_{w2} = \frac{c_w + v_{wL} - v_{wl}}{\Delta y_w + v_{wh} - v_{wl}} \]
Suppose the setting is gender-symmetric except for fertility length. More women than men go to college in equilibrium.

\[
\begin{align*}
\text{no college, no career} & \quad \text{college, career} \\
\text{no fertility difference} & \quad \text{fertility difference} \\
\text{only college} & \quad \text{All college-educated men make a career investment.} \\
\text{Only some college-educated women make a career investment.} \\
\text{Fewer women than men earn a high income.} \\
\text{High-income women are more scarce than high-income men in MM.} \\
\text{College generates higher MM returns for women than for men.}
\end{align*}
\]
College and Earnings Gender Gaps

Suppose the setting is gender-symmetric except for fertility length. More women than men go to college in equilibrium.
Suppose the setting is gender-symmetric except for fertility length. More women than men go to college in equilibrium.

- All college-educated men make a career investment.

- Only some college-educated women make a career investment.

- Fewer women than men earn a high income.

- High-income women are more scarce than high-income men in MM.

- College generates higher MM returns for women than for men.
College and Earnings Gender Gaps

Suppose the setting is gender-symmetric except for fertility length. More women than men go to college in equilibrium.

\[
\begin{array}{c|c|c|c}
0 & \text{no college, no career} & \theta^*_m & \text{college, career} & 1 \\
\hline
\text{no fertility difference} \\
\theta^*_{w1} = \theta^*_{w2} \\
0 & \text{no college, no career} & \text{college, career} & 1 \\
\end{array}
\]

- All college-educated men make a career investment.
College and Earnings Gender Gaps

Suppose the setting is gender-symmetric except for fertility length. *More* women than men go to college in equilibrium.

\[ \begin{array}{c|c|c|c}
0 & \text{no college, no career} & \theta_m^* & \text{college, career} & 1 \\
\hline
& \text{fertility difference} & & \\
\hline
0 & \text{no college, no career} & \theta_{w1}^* = \theta_{w2}^* & \text{college, career} & 1 \\
\end{array} \]

- All college-educated men make a career investment.
College and Earnings Gender Gaps

Suppose the setting is gender-symmetric except for fertility length. More women than men go to college in equilibrium.

\[ 0 \quad \text{no college, no career} \quad \theta^*_m \quad \text{college, career} \quad 1 \]

fertility difference

\[ \theta^*_{w_1} < \theta^*_{w_2} \]

\[ 0 \quad \text{no college, no career} \quad \text{college, career} \quad 1 \]

only college

- All college-educated men make a career investment.
- Only some college-educated women make a career investment.
Suppose the setting is gender-symmetric except for fertility length. *More* women than men go to college in equilibrium.

<table>
<thead>
<tr>
<th></th>
<th>no college, no career</th>
<th>( \theta^*_m )</th>
<th>college, career</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td>fertility difference</td>
<td>( \theta^<em>_{w1} &lt; \theta^</em>_{w2} )</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>no college, no career</th>
<th>college, career</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td>only college</td>
<td>( \theta^*_m )</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- All college-educated men make a career investment.
- Only some college-educated women make a career investment.
- Fewer women than men earn a high income.
College and Earnings Gender Gaps

Suppose the setting is gender-symmetric except for fertility length. More women than men go to college in equilibrium.

\[
\begin{array}{c|c|c|c}
0 & \text{no college, no career} & \theta_m^* & \text{college, career} & 1 \\
\hline
\text{fertility difference} & \theta_{w1}^* < \theta_{w2}^* \\
0 & \text{no college, no career} & \text{college, career} & 1 \\
\end{array}
\]

- All college-educated men make a career investment.
- Only some college-educated women make a career investment.
- Fewer women than men earn a high income.
- High-income women are more scarce than high-income men in MM.
College and Earnings Gender Gaps

Suppose the setting is gender-symmetric except for fertility length. More women than men go to college in equilibrium.

\[
\begin{align*}
0 & \quad \text{no college, no career} & \theta^*_m & \quad \text{college, career} & 1 \\
\text{fertility difference} & & \theta^*_w_1 < \theta^*_w_2 & \\
0 & \quad \text{no college, no career} & \quad \text{college, career} & 1 \\
\text{only college} & & & \\
\end{align*}
\]

- All college-educated men make a career investment.
- Only some college-educated women make a career investment.
- Fewer women than men earn a high income.
- High-income women are more scarce than high-income men in MM.
- College generates higher MM returns for women than for men.
Women’s Spousal Income by Age at Marriage

Average log spousal midlife total income by age at marriage for women across different cohorts (1900s to 1970s). The graph shows a trend where average income increases with age at marriage for each cohort.
Fertility-Income Tradeoff

Fraction of ability-θ women

- no college or career, marry in period 1: \( L \)
- college only, marry in period 2: \( L \)
- college and career, marry in period 3: \( H \)

No college or career

1. \( \theta_{w1} \)
2. \( \theta_{w2} \)
3. College and, if necessary, career

Ability \( \theta \)
Early versus Late Brides

Birth year

Difference in spousal incomes between early and late brides

-10 -5 0 5 10 15

-10 -5 0 5 10 15

early brides' higher

not different

late brides' higher
Mandates to Cover/Offer Infertility Treatments in Insurances

Between 1985 and 1995, thirteen states passed mandates to cover/offer infertility treatments in insurances


- **Mandate to offer:** Texas (1987), California (1989), Connecticut (1989)
Women’s Spousal Income by Age at Marriage

Average log spousal midlife labor income
Spousal Total Income Percentile Rank

Women agemarr 16-22

Women agemarr 23-29

Women agemarr 30-39

Difference between mandated and nonmandated states

-10 -5 0 5 10

lower in mandated states  no difference  higher in mandated states
<table>
<thead>
<tr>
<th>men</th>
<th>match</th>
<th>women</th>
</tr>
</thead>
<tbody>
<tr>
<td>$H$</td>
<td>$HH$</td>
<td>$H$</td>
</tr>
<tr>
<td>$HL$</td>
<td>$L \uparrow$</td>
<td></td>
</tr>
<tr>
<td>$Hh$</td>
<td>$h \downarrow$</td>
<td></td>
</tr>
<tr>
<td>$Lh$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$L$</td>
<td>$Ll$</td>
<td>$l$</td>
</tr>
</tbody>
</table>

Fertility more important

<table>
<thead>
<tr>
<th>men</th>
<th>match</th>
<th>women</th>
</tr>
</thead>
<tbody>
<tr>
<td>$H$</td>
<td>$HH$</td>
<td>$H$</td>
</tr>
<tr>
<td>$Hh$</td>
<td></td>
<td>$h \uparrow$</td>
</tr>
<tr>
<td>$HL$</td>
<td></td>
<td>$L \downarrow$</td>
</tr>
<tr>
<td>$Lh$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$L$</td>
<td>$Ll$</td>
<td>$l$</td>
</tr>
</tbody>
</table>

Income more important
Supporting Evidence and Calibration
Evolution of the Marriage Premium

Marriage premium (utils)

Census year

Men's marriage premium $\pi_m = s_{HL} - s_{LL}$

Women's marriage premium $\pi_w = s_{HH} - s_{HL}$

95% CI
Age-Income Profiles for Men and Women

Income of college age 30-39 divided by income of college age 23-29

- 1941-54 birth cohort
- 1957-64 birth cohort
- 1980-84 birth cohort

Age

- Men
- Women
## More Career Investments for Low Incomes

### Relation between career investment and logincome, men

<table>
<thead>
<tr>
<th></th>
<th>(1) ols79</th>
<th>(2) logit79</th>
<th>(3) probit79</th>
<th>(4) ols97</th>
<th>(5) logit97</th>
<th>(6) probit97</th>
</tr>
</thead>
<tbody>
<tr>
<td>logincome</td>
<td>-0.0969***</td>
<td>-0.447***</td>
<td>-0.261***</td>
<td>-0.0947***</td>
<td>-0.406***</td>
<td>-0.250***</td>
</tr>
<tr>
<td></td>
<td>(0.0142)</td>
<td>(0.0647)</td>
<td>(0.0370)</td>
<td>(0.0161)</td>
<td>(0.0723)</td>
<td>(0.0439)</td>
</tr>
<tr>
<td>age</td>
<td>-0.000539</td>
<td>0.00561</td>
<td>-0.000519</td>
<td>-0.0244***</td>
<td>-0.108***</td>
<td>-0.0664***</td>
</tr>
<tr>
<td></td>
<td>(0.00741)</td>
<td>(0.0308)</td>
<td>(0.0188)</td>
<td>(0.00719)</td>
<td>(0.0324)</td>
<td>(0.0199)</td>
</tr>
<tr>
<td>N</td>
<td>1659</td>
<td>1659</td>
<td>1659</td>
<td>1638</td>
<td>1638</td>
<td>1638</td>
</tr>
</tbody>
</table>

Marginal effects; Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$
Ability distributions are \( \text{Beta}(\alpha_m, \beta_m) \) and \( \text{Beta}(\alpha_w, \beta_w) \).

Low income is average income of the non-college-educated.

High income is average income of the college-educated.

Total investment cost is two years of low incomes; annual cost is total cost divided by 40.

Surplus in monetary terms is \( k \) times estimated surplus in utils.

Add marriage frictions (possibility of not marrying upon entering MM).

19 targeted moments.

- Percentages of early, middle, late grooms/brides (6).
- Average personal income of early, middle, late grooms (3).
- Average personal income of early, middle, late brides (3).
- Average spousal income of early brides (3).
- College enrollment rates of men and women (2).
### Fit of the Model

<table>
<thead>
<tr>
<th>moments</th>
<th>30s target</th>
<th>30s model</th>
<th>difference</th>
<th>60s target</th>
<th>60s model</th>
<th>difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>$G_{m1}$</td>
<td>0.48476</td>
<td>0.484451</td>
<td>-0.0637%</td>
<td>0.30756</td>
<td>0.307372</td>
<td>-0.0613%</td>
</tr>
<tr>
<td>$G_{m2}$</td>
<td>0.411344</td>
<td>0.412559</td>
<td>0.295%</td>
<td>0.451633</td>
<td>0.452309</td>
<td>0.015%</td>
</tr>
<tr>
<td>$G_{m3}$</td>
<td>0.103896</td>
<td>0.102989</td>
<td>-0.872%</td>
<td>0.240807</td>
<td>0.24032</td>
<td>-0.202%</td>
</tr>
<tr>
<td>$G_{w1}$</td>
<td>0.740591</td>
<td>0.740591</td>
<td>0.000051%</td>
<td>0.4494</td>
<td>0.449534</td>
<td>0.0299%</td>
</tr>
<tr>
<td>$G_{w2}$</td>
<td>0.206928</td>
<td>0.206847</td>
<td>-0.0393%</td>
<td>0.381204</td>
<td>0.380081</td>
<td>-0.295%</td>
</tr>
<tr>
<td>$G_{w3}$</td>
<td>0.0524809</td>
<td>0.0525618</td>
<td>0.154%</td>
<td>0.169396</td>
<td>0.170385</td>
<td>0.584%</td>
</tr>
<tr>
<td>$G_{m,\text{col}}$</td>
<td>0.218733</td>
<td>0.220363</td>
<td>0.745%</td>
<td>0.379722</td>
<td>0.380819</td>
<td>0.289%</td>
</tr>
<tr>
<td>$G_{w,\text{col}}$</td>
<td>0.119257</td>
<td>0.119255</td>
<td>-0.00131%</td>
<td>0.390058</td>
<td>0.389479</td>
<td>-0.148%</td>
</tr>
<tr>
<td>$y_{m1}$</td>
<td>40209.7</td>
<td>39603.7</td>
<td>-1.51%</td>
<td>44571.6</td>
<td>44730.5</td>
<td>0.357%</td>
</tr>
<tr>
<td>$y_{m2}$</td>
<td>433820.8</td>
<td>43915.8</td>
<td>0.217%</td>
<td>56434.2</td>
<td>56524.6</td>
<td>0.16%</td>
</tr>
<tr>
<td>$y_{m3}$</td>
<td>37442.</td>
<td>38350.9</td>
<td>2.43%</td>
<td>48376.5</td>
<td>48589.3</td>
<td>0.44%</td>
</tr>
<tr>
<td>$y_{w1}$</td>
<td>132204.9</td>
<td>11696.3</td>
<td>-2.93%</td>
<td>20091.</td>
<td>20510.</td>
<td>2.09%</td>
</tr>
<tr>
<td>$y_{w2}$</td>
<td>12457.2</td>
<td>12739.2</td>
<td>2.26%</td>
<td>24627.8</td>
<td>25169.9</td>
<td>2.2%</td>
</tr>
<tr>
<td>$y_{w3}$</td>
<td>12886.1</td>
<td>12421.</td>
<td>-3.61%</td>
<td>26080.1</td>
<td>24207.1</td>
<td>-7.18%</td>
</tr>
<tr>
<td>$x_{w1}$</td>
<td>41269.2</td>
<td>41155.8</td>
<td>-0.275%</td>
<td>46138.3</td>
<td>47051.6</td>
<td>1.98%</td>
</tr>
<tr>
<td>$x_{w2}$</td>
<td>45269.5</td>
<td>42290.6</td>
<td>-6.58%</td>
<td>58701.2</td>
<td>55594.8</td>
<td>-5.29%</td>
</tr>
<tr>
<td>$x_{w3}$</td>
<td>35537.5</td>
<td>38066.9</td>
<td>7.12%</td>
<td>48666.8</td>
<td>50699.8</td>
<td>4.18%</td>
</tr>
<tr>
<td>average</td>
<td>31137.1</td>
<td>31137.1</td>
<td>1.71%</td>
<td>311.7</td>
<td>311.7</td>
<td>1.51%</td>
</tr>
</tbody>
</table>
Quantifying Labor-Market Shocks on Marriage Timing

- Estimated ability distributions (labor-market opportunities).

- Labor-market shocks (due to the possibility that one does not receive a high-income offer after college) contribute to 42.7% of college-educated men and 24% of college-educated women born in the 1960s delaying marriage (the rest are explained by marriage-market frictions).
### Fit of the Model, Mandated States

<table>
<thead>
<tr>
<th>moments</th>
<th>30s target</th>
<th>30s model</th>
<th>difference</th>
<th>60s target</th>
<th>60s model</th>
<th>difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>$G_{m1}$</td>
<td>0.451869</td>
<td>0.451556</td>
<td>-0.0693%</td>
<td>0.271852</td>
<td>0.271602</td>
<td>-0.092%</td>
</tr>
<tr>
<td>$G_{m2}$</td>
<td>0.430358</td>
<td>0.431748</td>
<td>0.323%</td>
<td>0.462758</td>
<td>0.463643</td>
<td>0.191%</td>
</tr>
<tr>
<td>$G_{m3}$</td>
<td>0.117773</td>
<td>0.116697</td>
<td>-0.914%</td>
<td>0.26539</td>
<td>0.264754</td>
<td>-0.239%</td>
</tr>
<tr>
<td>$G_{w1}$</td>
<td>0.712169</td>
<td>0.714571</td>
<td>0.337%</td>
<td>0.40867</td>
<td>0.415509</td>
<td>1.67%</td>
</tr>
<tr>
<td>$G_{w2}$</td>
<td>0.227668</td>
<td>0.221022</td>
<td>-2.92%</td>
<td>0.403811</td>
<td>0.390709</td>
<td>-3.24%</td>
</tr>
<tr>
<td>$G_{w3}$</td>
<td>0.0601629</td>
<td>0.0644064</td>
<td>7.05%</td>
<td>0.187518</td>
<td>0.193783</td>
<td>3.34%</td>
</tr>
<tr>
<td>$G_{m, col}$</td>
<td>0.240621</td>
<td>0.242344</td>
<td>0.716%</td>
<td>0.392051</td>
<td>0.393502</td>
<td>0.37%</td>
</tr>
<tr>
<td>$G_{w, col}$</td>
<td>0.131002</td>
<td>0.12084</td>
<td>-7.76%</td>
<td>0.400299</td>
<td>0.370931</td>
<td>-7.34%</td>
</tr>
<tr>
<td>$y_{m1}$</td>
<td>42549.9</td>
<td>41471.4</td>
<td>-2.53%</td>
<td>55833.3</td>
<td>46347.3</td>
<td>1.12%</td>
</tr>
<tr>
<td>$y_{m2}$</td>
<td>46013.6</td>
<td>46116.</td>
<td>0.223%</td>
<td>59531.3</td>
<td>59658.5</td>
<td>0.214%</td>
</tr>
<tr>
<td>$y_{m3}$</td>
<td>38934.8</td>
<td>40058.4</td>
<td>2.89%</td>
<td>52070.5</td>
<td>52371.7</td>
<td>0.579%</td>
</tr>
<tr>
<td>$y_{w1}$</td>
<td>12664.9</td>
<td>12918.8</td>
<td>2.01%</td>
<td>20453.6</td>
<td>21866.4</td>
<td>6.91%</td>
</tr>
<tr>
<td>$y_{w2}$</td>
<td>13050.4</td>
<td>15802.5</td>
<td>21.1%</td>
<td>25514.7</td>
<td>28767.5</td>
<td>12.7%</td>
</tr>
<tr>
<td>$y_{w3}$</td>
<td>13429.7</td>
<td>12946.1</td>
<td>-3.6%</td>
<td>27373.5</td>
<td>25741.2</td>
<td>-5.96%</td>
</tr>
<tr>
<td>$x_{w1}$</td>
<td>43941.9</td>
<td>42819.1</td>
<td>-2.56%</td>
<td>48004.4</td>
<td>47777.3</td>
<td>-0.473%</td>
</tr>
<tr>
<td>$x_{w2}$</td>
<td>47304.5</td>
<td>45972.1</td>
<td>-2.82%</td>
<td>62317.6</td>
<td>60849.6</td>
<td>-2.36%</td>
</tr>
<tr>
<td>$x_{w3}$</td>
<td>37059.8</td>
<td>39648.9</td>
<td>6.99%</td>
<td>52485.</td>
<td>54120.2</td>
<td>3.12%</td>
</tr>
<tr>
<td>average</td>
<td>-&gt;</td>
<td>-&gt;</td>
<td>3.81%</td>
<td>-&gt;</td>
<td>-&gt;</td>
<td>2.94%</td>
</tr>
</tbody>
</table>
## Fit of the Model, Nonmandated States

<table>
<thead>
<tr>
<th>moments</th>
<th>30s target</th>
<th>30s model</th>
<th>difference</th>
<th>60s target</th>
<th>60s model</th>
<th>difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>$G_{m1}$</td>
<td>0.50978</td>
<td>0.509501</td>
<td>-0.0549%</td>
<td>0.334886</td>
<td>0.334418</td>
<td>-0.14%</td>
</tr>
<tr>
<td>$G_{m2}$</td>
<td>0.39688</td>
<td>0.397736</td>
<td>0.216%</td>
<td>0.443119</td>
<td>0.444872</td>
<td>0.396%</td>
</tr>
<tr>
<td>$G_{m3}$</td>
<td>0.0933392</td>
<td>0.0927631</td>
<td>-0.0617%</td>
<td>0.221995</td>
<td>0.220711</td>
<td>-0.578%</td>
</tr>
<tr>
<td>$G_{w1}$</td>
<td>0.762457</td>
<td>0.762457</td>
<td>0.000022%</td>
<td>0.480704</td>
<td>0.485707</td>
<td>0.104%</td>
</tr>
<tr>
<td>$G_{w2}$</td>
<td>0.190972</td>
<td>0.190905</td>
<td>-0.0353%</td>
<td>0.363829</td>
<td>0.354892</td>
<td>2.46%</td>
</tr>
<tr>
<td>$G_{w3}$</td>
<td>0.0465706</td>
<td>0.0466378</td>
<td>-0.144%</td>
<td>0.155467</td>
<td>0.159401</td>
<td>2.53%</td>
</tr>
<tr>
<td>$G_{m, col}$</td>
<td>0.202083</td>
<td>0.203549</td>
<td>0.725%</td>
<td>0.370287</td>
<td>0.373063</td>
<td>0.75%</td>
</tr>
<tr>
<td>$G_{w, col}$</td>
<td>0.11022</td>
<td>0.110219</td>
<td>-0.000626%</td>
<td>0.382188</td>
<td>0.36033</td>
<td>-5.72%</td>
</tr>
<tr>
<td>$y_{m1}$</td>
<td>38631.7</td>
<td>38140.6</td>
<td>-1.27%</td>
<td>43787.7</td>
<td>43444.2</td>
<td>-0.785%</td>
</tr>
<tr>
<td>$y_{m2}$</td>
<td>42012.</td>
<td>42087.2</td>
<td>0.179%</td>
<td>53959.1</td>
<td>54176.3</td>
<td>0.402%</td>
</tr>
<tr>
<td>$y_{m3}$</td>
<td>36009.2</td>
<td>36372.9</td>
<td>1.01%</td>
<td>44997.</td>
<td>45506.</td>
<td>1.13%</td>
</tr>
<tr>
<td>$y_{w1}$</td>
<td>11606.5</td>
<td>11253.5</td>
<td>-3.04%</td>
<td>19854.</td>
<td>20950.</td>
<td>5.52%</td>
</tr>
<tr>
<td>$y_{w2}$</td>
<td>11913.</td>
<td>12196.3</td>
<td>2.38%</td>
<td>23871.3</td>
<td>26551.5</td>
<td>11.2%</td>
</tr>
<tr>
<td>$y_{w3}$</td>
<td>12345.8</td>
<td>11857.2</td>
<td>-3.96%</td>
<td>24881.1</td>
<td>22856.7</td>
<td>-8.14%</td>
</tr>
<tr>
<td>$x_{w1}$</td>
<td>39414.</td>
<td>39452.6</td>
<td>0.0979%</td>
<td>44926.9</td>
<td>43993.5</td>
<td>-2.08%</td>
</tr>
<tr>
<td>$x_{w2}$</td>
<td>43434.5</td>
<td>40533.2</td>
<td>-6.68%</td>
<td>55639.5</td>
<td>55561.4</td>
<td>-0.14%</td>
</tr>
<tr>
<td>$x_{w3}$</td>
<td>34045.4</td>
<td>36624.4</td>
<td>7.58%</td>
<td>45155.8</td>
<td>47599.5</td>
<td>5.41%</td>
</tr>
<tr>
<td>average</td>
<td>-&gt;</td>
<td>-&gt;</td>
<td>1.65%</td>
<td>-&gt;</td>
<td>-&gt;</td>
<td>2.85%</td>
</tr>
</tbody>
</table>
Mandate Counterfactual Analyses
Infertility Treatment Insurance Mandate

- If mandated states were not mandated:
  - The fraction of late brides in the mandated states would decrease from 19.4 percent to 17.0 percent.
  - The average spousal income of early brides would increase by 2.92 percent.
  - The average spousal income of late brides would decrease by 0.12 percent.

- If nonmandated states were mandated:
  - The fraction of late brides in the mandated states would increase from 15.9 percent to 18.2 percent.
  - The average spousal income of early brides would decrease by 2.97 percent.
  - The average spousal income of late brides would increase by 0.07 percent.
4.96 percent of women would delay their marriage age from between 23 and 29 to between 30 and 39

Middle brides’ average spousal income would increase by 5.43 percent

Late brides’ average spousal income would increase by 3.61 percent

The average personal income of late brides would not increase, because intermediate-ability women delay marriages
Gender Equality Counterfactual Analysis 2

Gender Equality in the Labor Market

- Women’s college enrollment rate would decrease from 38.9 percent to 38.3 percent
- Fraction of
  - early brides (16-22): would increase by 0.35 percent
  - middle brides (23-29): would decrease by 2.94 percent
  - late brides (30-39): would increase by 5.64 percent
- Average spousal income of
  - early brides would decrease by 0.43 percent
  - middle brides would increase by 0.68 percent
  - late brides would increase by 0.37 percent
Gender Equality Counterfactual Analysis 3
Gender Equality in Investment Opportunities

- Women’s college enrollment rate would decrease from 38.9 percent to 38.5 percent
- Fraction of
  - early brides (16-22): would increase by 0.23 percent
  - middle brides (23-29): would increase by 1.73 percent
  - late brides (30-39): would decrease by 4.46 percent
- Average spousal income of
  - early brides would decrease by 0.43 percent
  - middle brides would increase by 0.68 percent
  - late brides would increase by 0.37 percent
Conclusion

- College and earnings gender gaps.
- Relationships between age at marriage and personal income for men and women.
- Relationship between age at marriage and spousal income for women.
- Differential fecundity, coupled with the equilibrium marriage market, leads to many observed economic and social gender differences.
THANK YOU!
References I


