Pricing the Biological Clock:
Reproductive Capital on the US Marriage Market

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Fertility, Career, and Marriage

- Older women have a much lower chance of conceiving than younger women (Women lose 97% of eggs by 40, Kelsey and Wallace 2010)
- Women face tradeoff between career and family (e.g., dearth of women in math-intensive fields, Williams and Ceci 2012)
- Older women face difficulty on marriage market (1986 TIME: ”Better chance of getting killed by a terrorist”)
- Does the age-fertility relationship create a tradeoff for women between income and optimal marriage?
- What accounts for the recent reversal in this trend, with older, educated women being increasingly likely to marry? (Stevenson and Isen 2010)
Summary

• I am interested in the economic value of fertility, and how this value may influence women’s decisions.

• I propose a matching model of the marriage market that incorporates fertility, which I call reproductive capital
  • Suppose investing heavily in one’s career (e.g., tenure, surgical residency, becoming partner at a law firm...) yields large earnings gains but delays marriage and childbearing
  • Creates choice for women between going on the marriage market as high income, low fertility (richer and older) or low income, high fertility (poorer and younger)

• Introducing this second factor allows for non-assortative matching on income at the top of the distribution
I develop a matching model with two relevant factors, fertility and income (Most closely related to Chiappori et al (2010)).

The model has four stages:

1. Women choose whether or not to invest in career
2. Matching occurs between men and women (those who have and have not invested)
3. The couple either has a child or does not
4. The couple allocates their income between private consumption and their child (a public good), if they have one
Model set-up

- Men characterized by income, $y^h$
- Women endowed with potential income, $s$
  - If women invest, they will get their full potential income, but doing so takes time, resulting in a loss of fertility
  - If they do not invest, they have less income, but higher fertility

\[(\delta s, p) \text{ if no investment} \]
\[(s, p) \text{ if investment} \]

Note $P - p$ is the same for all women, whereas $s - \delta s$ is increasing in $s$. 

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Thus, women characterized by $(y^w, \pi) = \begin{cases} (\delta s, P) & \text{if no investment} \\ (s, p) & \text{if investment} \end{cases}$

(Where $\delta < 1$ and $p < P$)

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Stage 1: Women choose whether or not to invest

Figure: Income versus skill
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Stages 3-4: Household decisions

We will solve the model backwards:

• First, how will couple allocate in stage 4 if they have a child?
• Therefore, what will be the expected surplus in stage 3?
• Knowing this, what matching is optimal in stage 2?
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\[
\begin{align*}
  u^h(q^h, Q) &= q^h(Q + 1) \\
  u^w(q^w, Q) &= q^w(Q + 1) \\
  \text{BC: } q^h + q^w + Q &= y^h + y^w
\end{align*}
\]

\[
\Rightarrow (q^h + q^w)^* = \frac{y^h + y^w + 1}{2}
\]

\[
\Rightarrow Q^* = \frac{y^h + y^w - 1}{2}
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\[ \Rightarrow (q^h + q^w)^* = \frac{y^h + y^w + 1}{2} \]
\[ \Rightarrow Q^* = \frac{y^h + y^w - 1}{2} \]

\[ T = \pi \left( \frac{y^h + y^w + 1}{4} \right)^2 + (1 - \pi)(y^h + y^w) \]
Stage 2: Matching game

What kind of matching equilibrium can we expect? On either side of the investment threshold, $\pi$ is constant, and thus match is unidimensional:

$$\frac{\partial^2 T}{\partial y^h \partial y^w} > 0$$

$\Rightarrow$ Assortative matching conditional on investment choice
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What happens at the threshold? Examine how MRS of wife’s two characteristics is changing in husband’s income:

$$\frac{d\pi}{dy^w} = -\frac{\partial T}{\partial y^w} \frac{\partial T}{\partial \pi}$$

$$\frac{\partial}{\partial y^h} \left| \frac{d\pi}{dy^w} \right| < 0$$

$\Rightarrow$ Value of fertility increasing in $y^h$. Richer men “care more” about fertility
$\Rightarrow$ Non-assortative matching possible at threshold
Stage 2: Matching game

- Let male income be distributed $U(1, Y)$
- And female potential income be distributed $U(0, S)$
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Figure: Stable equilibrium when $\frac{P - p}{p} > \frac{S}{Y - 1}$
Stage 2: Possible matching equilibria

**Figure: Equilibrium 1**

- Three-segment equilibrium when $\frac{p-p}{p} > \frac{S}{Y-1}$

**Figure: Equilibrium 2**

- Assortative-matching equilibrium when $\frac{p-p}{p} < \frac{S}{Y-1}$ and $1 - \delta$ sufficiently large
Potential historical transitions

Note that $S$, market opportunities for women, have likely changed over time (e.g. Hsieh et al 2012)
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**Figure**: Phase 1

- Initially, the potential earnings for highly educated women are so low that few invest
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- As women’s potential income ($S$) grows, some invest, but match with worse men
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- Initially, the potential earnings for highly educated women are so low that few invest
- As women’s potential income ($S$) grows, some invest, but match with worse men
- Finally, $S$ can compensate for lower fertility, and assortative matching returns
Higher education only recently offers a “marriage premium”

**Figure:** Spousal income by wife’s education level
Higher education only recently offers a “marriage premium”

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<th>VARIABLES</th>
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<th>(2)</th>
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<th>(4)</th>
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<tr>
<td>Husband’s income</td>
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<td>-0.0748***</td>
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<td>(460.9)</td>
<td>(4,213)</td>
<td>(0.00627)</td>
<td>(0.0621)</td>
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<td>highly_ed</td>
<td>-2,892***</td>
<td>-2,892*</td>
<td>-0.0523***</td>
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<td>(690.6)</td>
<td>(1,396)</td>
<td>(0.00940)</td>
<td>(0.0223)</td>
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<tr>
<td>highlyXafter</td>
<td>7,142***</td>
<td>7,142***</td>
<td>0.0960***</td>
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</tr>
<tr>
<td></td>
<td>(794.6)</td>
<td>(1,458)</td>
<td>(0.0108)</td>
<td>(0.0246)</td>
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<tr>
<td>Constant</td>
<td>64,240***</td>
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<td>10.89***</td>
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<tr>
<td></td>
<td>(402.7)</td>
<td>(3,343)</td>
<td>(0.00547)</td>
<td>(0.0504)</td>
</tr>
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Clustered Errors  N    Y    N    Y
Observations      135,886 135,886 134,333 134,333
R-squared         0.002  0.002  0.001  0.001

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1