Inequality and Household Labor Supply

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Trends in LFP and Wages

All workers

Gender Wage Gap and Female LFP, married workers

Gender wage gap is computed as mean wage of male workers over mean wage of female workers for full time, full year workers. The values are three-year moving averages.

Source: March Supplement of CPS
Trends in LFP and Wages
College and high school graduates

Gender Wage Gap and Female LFP, married workers

College

High school or less

Gender wage gap is computed as mean wage of male workers over mean wage of female workers for full time, full year workers.
Three-year moving averages.

Source: March Supplement of CPS
Trends in LFP and Wages
Skill premium by sex

**Skill Premium**

- The skill premium, as computed by dividing the mean wage of college workers by the mean wage of non-college workers for full-time, full-year workers, shows an increasing trend over the years 1975 to 2010.
- The premium for males (solid line) and females (dashed line) is consistently higher for males, indicating a skill premium.

**Ratio of Male to Female Skill Premium**

- The ratio of the skill premium for males to females also shows an increasing trend over the years 1975 to 2010.
- The ratio is consistently higher than 1, indicating that males have a higher skill premium compared to females.

**Rolling three years average**

- The data includes rolling three-year averages for both skill premiums and the ratio of male to female skill premiums.

**Source:** March Supplement of CPS

*Ratio of mean hourly wages between workers with college degree and those without a college degree, for FT-FY workers, regardless of marital status. Three year centered moving averages.*
Hypothesis

- Rise in skill premium can explain both the lack of convergence in participation and wages across genders since the early 1990s

**Mechanism:**
- Rise in male earnings generates negative wealth effect on female participation and market hours
- Reduced attachment to the labor market, reduces experience and earnings for skilled women relative to skilled men
  - Positive assortative matching amplifies effect on skilled women

**Objective:** Document empirical evidence on participation by education and household type, explore mechanism quantitatively
Hypothesis

- Rise in skill premium can explain both the lack of convergence in participation and wages across genders since the early 1990s.

- Preview of findings:
  - Mechanism can account for approx. $1/2$ of lack of convergence in female participation to male in 1995-2005, $2/3$ for college women.
  - Mechanism can account for approx. $1/3$ of lack of convergence in female wages to males for skilled workers in 1995-2005.

- Rise in female participation due to learning about costs for the household
- S-shape as learning slows with most women in the labor force
Outline

- Evidence
- Model
- Quantitative Analysis
- Ongoing work
Evidence
Skill Premium
Measuring the Phenomenon

Source: March Supplement of CPS
## Skill Premium

### Gender Wage Gap by Education

<table>
<thead>
<tr>
<th></th>
<th>Skill Premium</th>
<th>Male/Female Wages</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Male</td>
</tr>
<tr>
<td>Average 1995-2005</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Actual</td>
<td>1.86</td>
<td>1.64</td>
</tr>
<tr>
<td>Projected</td>
<td>1.75</td>
<td>1.60</td>
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<tr>
<td>Actual-Projected</td>
<td>0.11</td>
<td>0.04</td>
</tr>
<tr>
<td>Actual-Projected%</td>
<td>6.29</td>
<td>2.5</td>
</tr>
</tbody>
</table>
Labor supply of women
Participation by marital status and education

Female Labor Force Participation Rate

Source: March Supplement of CPS
Labor Supply of Married Women
Participation by Age

LFP of married women by age

Source: March Supplement of CPS
Labor supply of men

Participation

Male Labor Force Participation Rate

Source: March Supplement of CPS
Measuring the Phenomenon
Labor force participation of married women

Procedure:
- Use estimated parameters to project female labor force participation from 1992-2008
- Compare projected and actual series
Labor supply of women
Participation by marital status and education

Source: March Supplement of CPS
Labor supply of women
Participation by husband’s education

Married women

Source: March Supplement of CPS
Measuring the Phenomenon
Participation by education and husband’s education

<table>
<thead>
<tr>
<th>Average 1995-2005</th>
<th>Married Women’s Participation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Aggregate</td>
</tr>
<tr>
<td>Actual</td>
<td>0.61</td>
</tr>
<tr>
<td>Projected</td>
<td>0.67</td>
</tr>
<tr>
<td>Actual-Projected</td>
<td>-0.06</td>
</tr>
<tr>
<td>Actual-Projected%</td>
<td>-8.9</td>
</tr>
</tbody>
</table>
Labor supply of married women
Participation by husband’s earnings

Graphs by Husband’s earn. percentile

Source: March Supplement of CPS
### Labor supply of married women

#### Participation by husband’s earnings

<table>
<thead>
<tr>
<th></th>
<th>Married Women’s Participation</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Aggregate</td>
</tr>
<tr>
<td>Average 1995-2005</td>
<td></td>
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<tr>
<td>Actual</td>
<td>0.62</td>
</tr>
<tr>
<td>Projected</td>
<td>0.71</td>
</tr>
<tr>
<td>Actual-Projected</td>
<td>-0.08</td>
</tr>
<tr>
<td>Actual-Projected%</td>
<td>-11.9</td>
</tr>
</tbody>
</table>
Female participation rate
by husband’s earnings percentiles

Graphs by Wife’s own children in household

Source: March Supplement of CPS
Labor supply of women
Participation by household type

Source: March Supplement of CPS
Distribution of Household Types

Figure: Fraction of households by education pairs

Household type corresponds to husband-wife educational attainment.

Source: March Supplement of CPS
Labor supply of women
Participation by household type

<table>
<thead>
<tr>
<th>Household Types (M-F)</th>
<th>Married Women’s Participation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>HS-HS</td>
</tr>
<tr>
<td>Average 1995-2005</td>
<td></td>
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<tr>
<td>Actual</td>
<td>0.60</td>
</tr>
<tr>
<td>Projected</td>
<td>0.66</td>
</tr>
<tr>
<td>Actual-Projected</td>
<td>-0.65</td>
</tr>
<tr>
<td>Actual-Projected%</td>
<td>-9.8</td>
</tr>
</tbody>
</table>
Summary

- Skill premium for men rises by 6.3% in 1995-2005
  - Male/female wage ratio rises by 11% for college workers
- Labor force participation of married women falls by in 1995-2005
  - Falls by 14% for college women
  - Falls by 12% for women with college husbands
  - Falls by 19% for women with husbands in the top 10% of the earning distribution
- Similar behavior for hours
  - More marked decline in labor supply of women with high earning husbands on intensive margin
Theory
Theory
Household Labor Supply

- Collective labor supply: partners have independent utility functions
  - Households comprise two partners of different gender
- Marriage and educational attainment exogenous
  - Assortative matching based on empirical distribution of household types
  - Wages endogenous due to on the job learning
- Intensive and extensive labor supply decisions
  - Endogenous division of home hours
Theory
Household Problem

\[
\max_{c_j^s, h_j^s \geq 0, l_j^s, p_j^s \in \{0, 1\}, b_{j+1}, k_{j+1}^s \geq 0} \sum_{j=1}^{J} \beta_j \sum_{s=f, m} \lambda^s u \left( c_j^i, l_j^i + h_j^i \right) \\
\text{s.t.} \\
\sum_{s=f, m} c_j^i + q b_{j+1} \leq \sum_{s=f, m} \xi_j^i + b_j \text{ for } j = 1, 2, \ldots J - 1
\]

\[
b_{j+1} \geq b,
\]

for all \( j = 1, 2, \ldots J - 1, \)

\[
\sum_{s=f, m} c_j^s \leq b_J,
\]

\( k_0^s, b_0 \) given
Indivisible labor:

\[ l_{j}^{is} = 0 \quad \text{if } p_{j}^{is} = 0 \quad \text{or} \quad \geq l \quad \text{if } p_{j}^{is} = 1 \]

Endogenous allocation of home hours:

\[ H_{j} = G(h_{j}^{f}, h_{j}^{m}) \]

\[ H_{j} \text{ exogenously given for all } j = 1, 2, ... J \]
Theory
Wages and Human Capital

- Efficiency units of labor:
  \[ \xi_{j,s}^{i,s} = w_j^s \theta_i^{i,s} k_j^{i,s} \]
  for \( s = f, m, i = c, hs \), for all \( j = 1, 2, \ldots J - 1 \)
  - skill specific productivity
    \[ \theta^{c,s} > \theta^{hs,s} = 1 \]
  - gender specific wage component
    \[ w_j^f \leq w_j^m \]
- human capital
  \[ k_{j+1}^i = k_j^i (1 - \delta) + A (l_j^{is})^\alpha \]
  for \( \delta, \alpha \in [0, 1] , A > 0 \)
- Endogenous gender wage gap and skill premium:
  - \( w_j^s \) and \( \theta_i^{i,s} \) exogenous
  - wages endogenous due to on the job accumulation of human capital
Optimal Household Allocation
Consumption and Home Hours

- Consumption sharing:
  \[ \lambda^f u^f_{c,j} = \lambda^m u^m_{c,j} \]
  for \( j = 1, 2, \ldots, J \)

- Home hours allocation:
  \[ \frac{\lambda^f u^f_{l,j}}{G^f_{h,l,j}} = \frac{\lambda^m u^m_{l,j}}{G^m_{h,l,j}} \]
  for \( j = 1, 2, \ldots, J \)

- Pareto efficient consumption and home hours allocation
Optimal Household Allocation
Functional Forms

▶ Utility:

\[ u(c^j_i, l^j_i + h^j_i) = \frac{(c^j_i)^{1-\sigma}}{1 - \sigma} - \phi \frac{(l^j_i + h^j_i)^{1+\frac{1}{\gamma_s}}}{1 + \frac{1}{\gamma_s}} \]

▶ \( \sigma, \phi > 0, \gamma \in (0, 1) \)

▶ Home production:

\[ G(h^f, h^m) = \left[ \psi^f (h^f)^\rho + \psi^m (h^m)^\rho \right]^{1/\rho} \]

▶ \( \rho, \psi^s \in (0, 1) \) for \( s = f, m \), \( \sum_s \psi^s = 1 \)
Optimal Household Labor Supply
Participation and Market Hours

- Cross-income effects (household wealth effects):
  - Participation is zero if own productivity is sufficiently low and household wealth is sufficiently high.
  - Household wealth depends positively on partner’s labor income.
  - Rise in partner’s labor income causes market hours to drop and eventually participation to go to zero.

- Comparative advantage of wives in home production or gender wage gaps cause wives’ participation and market hours to be lower than husbands, and home hours to be higher.

- Even if $\gamma^f = \gamma^m$, if wives’ home hours are greater than husbands, they have higher Frisch elasticity of labor supply.
Quantitative Analysis
Calibration

- Household types: $hs - hs$, $hs - coll$, $coll - hs$, $coll - coll$
- Three periods
- Productivity distribution:
  - $\theta^{i,s} \sim logN(\bar{\theta}^{i,s}, \sigma^{i,s})$ for $s = f, m$, $i = h, c$
- Strategy: Match 1993 aggregate participation, skill premia, gender wage gap by education, within household female/male market hours ratio
Calibration

- Exogenously set parameters:
  \[
  \begin{array}{cccc}
  \lambda^m, \lambda^f & b_0 & k_0^f, k_0^m & \psi^f, \psi^m \\
  0.5, 0.5 & 0 & 1, 1 & 0.5, 0.5 \\
  \end{array}
  \]

- Parameters set based on data/independent evidence:

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td><strong>Distribution of household types</strong></td>
<td></td>
</tr>
<tr>
<td>(hs - hs)</td>
<td>(c - hs)</td>
</tr>
<tr>
<td>(hs - c)</td>
<td>(c - c)</td>
</tr>
<tr>
<td>1993</td>
<td></td>
</tr>
<tr>
<td>0.63</td>
<td>0.12</td>
</tr>
<tr>
<td>0.07</td>
<td>0.18</td>
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</table>

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<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Productivity distribution</strong></td>
<td></td>
</tr>
<tr>
<td>(\sigma_i, s)</td>
<td></td>
</tr>
<tr>
<td>(f, hs)</td>
<td>(f, c)</td>
</tr>
<tr>
<td>(m, hs)</td>
<td>(m, c)</td>
</tr>
<tr>
<td>1993</td>
<td></td>
</tr>
<tr>
<td>0.60</td>
<td>0.67</td>
</tr>
<tr>
<td>0.60</td>
<td>0.70</td>
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</table>

|                |                  |
| **Labor supply** |                  |
| \(\gamma^f\)   | \(\gamma^m\)   |
| \(l\)          | \(A, \delta\)  |
| 0.3            | 0.3             |
| 0.23           | 0.2, 0.08       |
## Calibration

Parameters set to match 1993 values

<table>
<thead>
<tr>
<th>Baseline wages</th>
<th>Productivity ratios</th>
</tr>
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<tbody>
<tr>
<td>$w^f_j$</td>
<td>$w^m_j$</td>
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<tr>
<td>0.24</td>
<td>3</td>
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<table>
<thead>
<tr>
<th>Utility parameters</th>
<th>Home production</th>
</tr>
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<tbody>
<tr>
<td>$\phi$</td>
<td>$\sigma$</td>
</tr>
<tr>
<td>2.051</td>
<td>1.1</td>
</tr>
</tbody>
</table>
### Calibration

#### Data/model comparison

<table>
<thead>
<tr>
<th>1993</th>
<th>Data</th>
<th>Model</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Women</td>
<td>Men</td>
</tr>
<tr>
<td>Participation</td>
<td>0.58</td>
<td>0.85</td>
</tr>
<tr>
<td>Skill premium</td>
<td>1.58</td>
<td>1.77</td>
</tr>
<tr>
<td>Market/home hours</td>
<td>1.02</td>
<td>5.09</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Data</th>
<th>Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male/female wages</td>
<td>1.40</td>
<td>1.40</td>
</tr>
<tr>
<td>Male/female wages HS</td>
<td>1.29</td>
<td>1.29</td>
</tr>
<tr>
<td>Male/female wages Coll</td>
<td>1.45</td>
<td>1.45</td>
</tr>
<tr>
<td>Wife/husband home hours</td>
<td>2.94</td>
<td>1.90</td>
</tr>
<tr>
<td>Wife/husband market hours</td>
<td>0.59</td>
<td>0.57</td>
</tr>
</tbody>
</table>
Experiment
Response of labor supply to a rise in the skill premium

- Exercise:
  - Increase $\theta^c$ to match projected and actual 1995-2005 average skill premium by gender
  - Compared married women’s participation for projected and actual skill premium

- Results:
  - Aggregate labor supply of women falls by 3.95%, accounts for 44% of difference between projected and actual in data
  - 8% drop in labor supply of women with college, accounts for 66% of difference between projected and actual in data
  - 20% drop in labor supply of women in college-college households, over predicts drop in data
### Experiment
Response of wages by gender

<table>
<thead>
<tr>
<th></th>
<th>Skill Premium</th>
<th>Male/Female Wages</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Male</td>
</tr>
<tr>
<td><strong>Average 1995-2005</strong></td>
<td></td>
<td>Model</td>
</tr>
<tr>
<td><strong>Actual-Projected</strong></td>
<td></td>
<td>0.11</td>
</tr>
<tr>
<td><strong>Actual-Projected%</strong></td>
<td></td>
<td>6.29</td>
</tr>
<tr>
<td><strong>Average 1995-2005</strong></td>
<td></td>
<td>Data</td>
</tr>
<tr>
<td><strong>Actual-Projected</strong></td>
<td></td>
<td>0.11</td>
</tr>
<tr>
<td><strong>Actual-Projected%</strong></td>
<td></td>
<td>6.29</td>
</tr>
</tbody>
</table>
Experiment
Response of women’s labor supply

<table>
<thead>
<tr>
<th></th>
<th>Married Women’s Participation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Aggregate</td>
</tr>
<tr>
<td>Average 1995-2005</td>
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<tr>
<td>Actual-Projected</td>
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</tr>
<tr>
<td>Actual-Projected%</td>
<td>-3.95</td>
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<tr>
<td>Average 1995-2005</td>
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<tr>
<td>Actual-Projected</td>
<td>-0.06</td>
</tr>
<tr>
<td>Actual-Projected%</td>
<td>-8.9</td>
</tr>
</tbody>
</table>
Experiment
Response of women’s labor supply

<table>
<thead>
<tr>
<th>Household Types (M-F)</th>
<th>HS-HS</th>
<th>C-HS</th>
<th>HS-C</th>
<th>C-C</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Average 1995-2005</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Actual-Projected</td>
<td>0</td>
<td>-0.09</td>
<td>0.002</td>
<td>-0.07</td>
</tr>
<tr>
<td>Actual-Projected%</td>
<td>0</td>
<td>-39.5</td>
<td>0.2</td>
<td>-13.9</td>
</tr>
<tr>
<td><strong>Average 1995-2005</strong></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Actual-Projected</td>
<td>-0.65</td>
<td>-0.115</td>
<td>-0.065</td>
<td>-0.126</td>
</tr>
<tr>
<td>Actual-Projected%</td>
<td>-9.8</td>
<td>-17.1</td>
<td>-8.1</td>
<td>-16.7</td>
</tr>
</tbody>
</table>
Discussion

- Household wealth effects (cross-income elasticity) can account for approx. 1/2 of decline in married women’s participation relative to 1975-1991 trend in 1995-2005, 2/3 for college women, and for 1/3 of the rise in male/female wages for skilled workers.

- Model over predicts fall in participation of women in C-HS households, does not predict decline in participation of women in HS-HS and HS-C households.

- Limitations:
  - Calibrated model unable to fully match asymmetric distribution of home production and distribution of participation by household type.

Ongoing Work: Additional Channels
Fertility choice with quality/quantity trade-off

- Parents will invest more in child quality as the skill premium rises (Ramey & Ramey, 2010) \implies\ reduction in secondary earner participation
- Low opportunity cost of additional children in *high income one earner* couples \implies\ quantity of children may also rise
Fertility

(a) Fertility by household type

(b) Fertility by husband’s earnings
Rise in skill premium associated with rise in performance pay (Lemieux, MacLeod and Parent, 2009) → increased labor income risk for skilled workers

Gender wage gaps positively associated with performance pay (Albanesi and Olivetti, 2009)

Implications:

- Possible negative effect on labor supply of secondary earner (makes labor force participation less rewarding)
- Resulting increase in wage dispersion for college workers may increase the gender wage gap (Blau and Kahn, 1994)
Earnings dispersion by gender

Source: March Supplement of CPS
Labor supply of married women
Participation by household type

Household type corresponds to husband-wife educational attainment.

Source: March Supplement of CPS
Labor supply of married women
Hours by household/husband type

Household type corresponds to husband-wife educational attainment.

Source: March Supplement of CPS
Labor supply of married women

Hours by education

Female Labor Market Hours
Married women

Year

Source: March Supplement of CPS
Intra-household inequality

Source: March CPS

Note: the ratio of wife to husband’s earnings was computed for household where both partners worked for at least 45 weeks that year, and each earned at least $5,000 (constant 2005 USD)