Jobless Recoveries and Gender Biased Technological Change

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Jobless Recoveries

- Strong positive correlation between output and employment probably one of the most widely accepted properties of business cycles
  - Recoveries following the 1991-92, 2001, and 2007-09 recessions exceptions to this pattern

- Question: What are the determinants of the slow recovery of employment in recent cycles?

- Goal: Explore new explanation that links the recent jobless recoveries to the changing trend in female labor force participation
Jobless Recoveries

- **Hypothesis**
  - Strong growth in female labor force participation and employment until the early 1990s reduced depth of recessions, generated strong recoveries in early US cycles
  - **Flat women’s participation** since the early 1990s contributed to the recent jobless recoveries
Jobless Recoveries

• Hypothesis
  ○ Strong growth in female labor force participation and employment until the early 1990s reduced depth of recessions, generated strong recoveries in early US cycles
  ○ Flat women’s participation since the early 1990s contributed to the recent jobless recoveries

• Complements existing explanations
  ○ Labor demand:
    - Rise in services/decline in goods sector (Groshen and Potter, 2003)
    - Job polarization (Jaimovich and Siu, 2012)
  ○ Adjustment costs on the extensive margin (Bachmann, 2001)
  ○ Mismatch in the labor market (Sahin, Topa and Violante, 2013)
Linking trends and business cycles

- Changing labor demand related to growth in female labor supply:
  - Rise in services (Buera and Kaboski 2012) associated with rise in female participation (Lee and Wolpin 2003, Rendall 2013)

- Evolution of these trends critical to account for changing nature of US business cycles
Changing Trends in Labor Force Participation

- Female LFP rose in the post-war period to a peak of 60% in 1995, and *stabilized thereafter*

Participation Trends and Business Cycles

- Gender differences in employment growth during recessions and recoveries associated with changes over time in the trend in female participation

- Early cycles: female employment was stable in recessions and strongly rising in recoveries, due to rising participation trend
Participation and Employment: Early Cycles

- 1969-70 cycle

Logarithmic variation from trough of aggregate unemployment rate. Source: CPS
**Participation and Employment: Early Cycles**

- 1973-1975 cycle

Logarithmic variation from trough of aggregate unemployment rate. Source: CPS
Participation and Employment: Early Cycles

- 1981-1982 cycle

Logarithmic variation from trough of aggregate unemployment rate. Source: CPS
Participation Trends and Business Cycles

- Gender differences in employment growth during recessions and recoveries are associated with *changes over time in the trend in female participation*.

- **Early cycles**: female employment stable in recessions and strongly rising in recoveries, following rising participation trend.

- Male participation and employment behavior similar in early and recent cycles.

- **Recent cycles**: *female participation flat* $\implies$ *cyclical behavior of female employment similar to men’s*. 
Participation and Employment: Recent Cycles

- **1991-92 cycle**: Female participation stopped rising in 1993-95

Logarithmic variation from trough of aggregate unemployment rate. Source: CPS
Participation and Employment: Recent Cycles

- **2001 cycle**: Similar female and male employment behavior

Logarithmic variation from trough of aggregate unemployment rate. Source: CPS
Participation and Employment: Recent Cycles

- 2007-09 cycle

Logarithmic variation from trough of aggregate unemployment rate. Source: CPS
Implications for Aggregate Employment

• Strong growth in female participation until early 1990s contributed to shallow recessions and very strong recoveries for aggregate employment in early cycles

⇒ The flattening of female labor force participation since the early 1990s has made recoveries in recent cycles appear jobless

• Similar behavior of hours per capita
**Implications for Aggregate Employment**

- Female employment growth **same as the average in early cycles**  \( \Rightarrow \) **stronger employment growth in recovery for recent cycles**

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**Counterfactual E/P** : Female E/P replaced with average for early cycles.

**Source**: Bureau of Labor Statistics.
Implications for Aggregate Employment

- Rescaling employment change to match decline in employment in each recession

Rescaled Counterfactual E/P: Female E/P replaced with average for early cycles, rescaled to match the decline in female E/P in each recession.

Implications for Aggregate Employment

- Exercise for *male* employment growth

Male Counterfactual E/P: Male E/P replaced with average for early cycles, rescaled to match the decline in female E/P in each recession.

**Labor Demand Explanations**

- **Labor supply** potentially important for slow recoveries in recent cycles
- Existing explanations based on labor demand:
  - Rise in services/decline in goods production (Groshen and Potter 2003)
  - Job polarization (Jaimovich and Siu 2012)
- Can these phenomena account for the recent jobless recoveries?
  
  Labor demand explanations not exhaustive, additional forces needed
Labor Demand Explanations

- Growth of employment share in Services and Non-Routine occupations

Employment shares by industry and occupation.

Source: CPS
Rise in Service Sector

- Contribution of declining Goods employment small for 2001 and 2007-09

E/P counterfactual: Goods E/P replaced with average for early cycles
**Rise in Services**

- **Convergence** of job destruction and job finding rates in Goods and Services

Job destruction and job finding rates by industry. Source: CPS.
**Rise in Services**

- Recent cycles: job finding rate for Services drops as much as for Goods in recessions, and fails to recover

Job finding rates by industry. Logarithmic variation from the trough of the aggregate unemployment rate in each cycle. Source: CPS
**Job Polarization**

- Routine employment variation as in early cycles $\rightarrow$ limited recovery for 1991-92 and 2007-09 cycles

\[\text{E/P counterfactual: Routine E/P replaced with average for early cycles.}\]
**Job Polarization**

- Job destruction rates highest for Routine-Manual occupations
- Job finding rates for Routine occupations not systematically lower, drop by more than Nonroutine-Manual in recent cycles

![Graph showing job destruction and job finding rates by occupation. Source: CPS.](image-url)
Job Polarization

- Job finding rates similar across occupations during recoveries in recent cycles

Job finding rates by occupation. Logarithmic variation from the trough of the aggregate unemployment rate in each cycle. Source: CPS.
Gender Biased Technological Change

- Women have a comparative advantage in skilled ("brain") work, relative to unskilled ("brawn") work (Galor and Weil 1996)
  - Sources of increased demand for skilled labor
    - Rise in Services (Buera and Kaboski 2012)
    - Rise in Cognitive-Nonroutine occupations (Acemoglu and Autor 2001)
- Reflects occupational/industry distribution of women entering workforce
  - Rise in female labor force participation parallel to rising demand for female labor
  - Use simple model to guide understanding of contribution of changing female labor supply
Gender Biased Technological Change: Model

- Captures changes in labor supply and changes in labor demand by skill
  - Two types of labor:
    - Skilled, complementary to capital
    - Unskilled, substitute with capital
- Exercise:
  - Calibrate trends in female labor supply and growth in skilled sector
  - Trace out response to recession of employment by gender, by skill and in aggregate
Model: Households

- Representative household comprising a continuum of measure 1 of agents equally split by gender/skill, with utility function:

$$\sum_{t=0}^{T} \beta^t \left[ \log(C_t) - \sum_i p_{ij}^t \sum_j \phi_j^i \frac{(h_{ij}^t)^{1+\nu_j}}{1+\nu_j} \right],$$

$p_{ij}^t$ fraction of skill $i = u, s$, gender $j = f, m$

$h_{ij}^t \geq 0$ per capita hours for gender $j$, skill $i$

$\phi_j^i$ disutility of working

Assumption: $\phi_t^m$ constant, $\phi_t^f$ declining
**Model: Production**

- **Griliches (1969) production function:**

  \[ Y_t = A_t(K_t + H_t^u)^\alpha(H_t^s)^{1-\alpha} \]

  for \( \alpha \in [0, 1] \), \( A_t > 0 \)

- **Labor input by skill:**

  \[ H^i = \left[ \psi_{if} (h_{if})^{\rho^i} + \psi_{im} (h_{im})^{\rho^i} \right]^{1/\rho^i} \]

  for \( \psi_{ij} \geq 0 \) and \( \sum_{j=f,m} \psi_{ij} = 1 \) for \( i = u, s \)

  \( \rho^i \leq 1 \)
**Model: Equilibrium**

- Competitive firms pay factors their *marginal product*

  \[ W_{ij}^t \] real wage for gender \( j \) in sector \( i \)

  \( r_t \) rental rate on capital

- Standard capital accumulation process:

  \[ K_{t+1} = (1 - \delta)K_t + I_t \]

  \( \delta \in [0, 1] \)

- Resource constraint:

  \[ C_t + I_t = Y_t \]
Model: Properties

- Trend growth in $A_t$ causes demand for skilled labor to expand
- Trend decline in $\varphi^f_t$ causes female labor supply to increase
- Experiments to assess the role of changing trend in female hours in jobless recoveries:
  - Back out $A_t$ from data, captures business cycles
  - Assess behavior of hours in aggregate, by gender and skill, with and without trend in female labor supply
Quantitative Analysis

- Calibration: target year 1975
  - Targets:
    gender wage gap by skill, skill premium for men, aggregate Frisch elasticity, female/male hours ratio
  - Parameters from independent evidence:
    relative Frisch elasticity by gender, elasticity of substitution of hours by gender in aggregate hours
Quantitative Analysis

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- Simulation: 1975-2010
  - $A_t$ backed out from data
  - $\varphi_t^f = \varphi_{1975}^f (\gamma^f)^t$
    $\gamma^f \in (0, 1)$ set to match growth in female hours 1975-1995
Calibrated parameters

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
<th>Target/Source</th>
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<tbody>
<tr>
<td>$\beta$</td>
<td>0.994</td>
<td>annual frequency</td>
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<tr>
<td>$\delta$</td>
<td>0.0254</td>
<td></td>
</tr>
<tr>
<td>$\alpha$</td>
<td>0.393</td>
<td>to match skill premium for men</td>
</tr>
<tr>
<td>$\nu_f$</td>
<td>0.21</td>
<td>to match aggregate Frisch elasticity</td>
</tr>
<tr>
<td>$\nu_m$</td>
<td>0.63</td>
<td></td>
</tr>
<tr>
<td>$\varphi^f_{1975}/\varphi^m$</td>
<td>13.2</td>
<td>to match female/male hours ratio</td>
</tr>
<tr>
<td>$\psi^u_f$</td>
<td>0.264</td>
<td>to match gender wage gap for unskilled</td>
</tr>
<tr>
<td>$\psi^s_f$</td>
<td>0.374</td>
<td>to match gender wage gap for skilled</td>
</tr>
<tr>
<td>$\rho_u$</td>
<td>0.75</td>
<td>(Acemoglu, Autor and Lyle 2004)</td>
</tr>
<tr>
<td>$\rho_s$</td>
<td>0.75</td>
<td></td>
</tr>
<tr>
<td>$\gamma^f$</td>
<td>0.988</td>
<td>to match growth in female hours 1975-95</td>
</tr>
</tbody>
</table>
Simulation: Driving Forces

- $A_t$ backed out from data using model production function
- Trend in $\varphi^f$ set to match female/male hours ratio 1975-1995
Counterfactual: Continued trend in $\varphi^f$ post-1995

- Induces stronger recoveries, especially for unskilled hours
- Continued trend in skilled hours
Counterfactual: No trend in $\varphi^f$ pre-1990

- Trend decline in $\varphi^f$ stopped in 1980 $\implies$ exacerbated response of unskilled hours in 1980-1982 cycle, trend in skilled hours slows

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**Aggregate hours**

**Y**

**Hours by gender**

**Hours by skill**
Discussion

• Lesson:

Growth in female participation until the early 1990s contributed to dampen recessions and boost recoveries in early cycles, making recent recoveries seem jobless in the US

• Ongoing work:

Extend production structure allowing for equipment and structures, derive implications for differential wage dynamics

Explore role of female participation trends for:

Lower cyclicality of Services in early cycles, rising comovement between Services and Goods in recent cycles (Galesi and Michelacci 2013)

Apparent reversal of demand for skilled labor in 2000 (Beaudry, Green and Sands 2013)
**Jobless Recoveries**

**Figure:** Log change in E/P from the trough of the aggregate unemployment rate to three years after the peak.
Gender Biased Technological Change

- Steeper rise in Service employment for women.

Growth in employment by industry: E/P by sex. Source: CPS.
Gender Biased Technological Change

- Steeper rise in Cognitive-Nonroutine employment for women.

Growth in employment by occupation: E/P by sex, Non-Routine.
Gender Biased Technological Change

- Steep decline in Cognitive-Routine employment for women.

Growth in employment by occupation: E/P by sex, Routine.