Search and Dynamic Household Labor Supply

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June 21, 2008
Introduction

Why Household unemployment duration?

- Individual unemployment duration has rich literature
- But
  - For married, do spousal wage earnings affect their job search?
  - What’s the pattern of household unemployment duration?
  - how it reveals intra-household bargaining (Sharing Rule)?

Methods: Simulated Methods of Moment
The derived Household Unemployment Duration In US

- If husbands earn more, wives search longer for jobs
- If wives earn more, husbands search pattern is mixed.
  - Without unobserved heterogeneity, husbands find jobs sooner;
  - With unobserved heterogeneity, this trend is uncertain.

Husbands private consumption is responsive to their employment status

- Husbands take 54% of non-labor income if work,
Motivation (1):
Pattern of Household Unemployment Duration

**Danish data** (Lentz and Trans, 2005) show **gender asymmetry**
- If wives earn more, husbands find jobs **sooner**
- If husbands earn more, wives search **longer** for jobs

Does this pattern also apply to **US**?

- Difficulty: US panel data, large observed household unemployment spells (**red line**) 
- An alternative (**Blue line**)
Motivation (2): Theoretical Contribution

To study household job search, we need household search model, which is not fully studied.

- Why household search model?
  - Empirical tests are done at the household level data
  - Search-theoretic models are at the individual level
  - There is discrepancy between data and theory
Motivation (3): Family Decision—Bargaining

- Individual Model: Two independent individuals
- Unitary Model: One household header

Though convenient, these models fail in family internal decision

- Collective model — This work
  - Chiappori (1992, 2002) Two individuals set consumption of each spouse as the outcomes of bargaining
  - Sharing rule $\phi$ is a function of spousal income and non-labor income

$$\phi(w_m, w_f, y) = a_0 + a_1 w_m + a_2 \log w_f + a_3 y$$

$$\max_{c_i, l_i} u_i(c_i, l_i) \quad \text{s.t.} \quad c_m = w_m + \phi I$$

$$c_f = w_f + y - \phi I$$

$$l_i = 1 - h_i$$
1. **(M)odel**: build a household job search model, incorporating sharing rule

2. **(P)arameterization**: recover decision rules and sharing rule

3. **(A)nalyze the simulate data**: derive the pattern of household unemployment duration in US
Data Parameterization Model

Simulate data

Household Job Search Pattern
Benchmark Model Set Up

Discrete time

- Two types of agents — husbands and wives — play **Nash** game. They make strategic decisions simultaneously, **taking the other’s response as given**.

- State variables:
  - Husband wage: \(0\) if not work, \(w_m\) if employed
  - Wife wage: \(0\) if not work, \(w_f\) if employed

- Value function \(W^i(., .), i = m \text{ or } f\)
  - \(W^i(w_m, w_f)\), if both husbands and wives are employed
  - \(W^i(w_m, 0)\), if husbands are employed but wives are not
  - \(W^i(0, w_f)\), if wives are employed but husbands are not
  - \(W^i(0, 0)\), if neither are employed

- Next, we take \(W^m(0, w_f)\) as an example, and show the timing of husband decision
Model: value function definition
Equilibrium Definition

Equilibrium is a set of reservation functions of husbands and wives on their spousal wages \( \{R_m, R_f\} \) that satisfy the below cut-off rules.

\[
W^f(0, 0) = W^f(0, R_f(0)) \\
W^m(0, 0) = W^m(R_m(0), 0) \\
W^f(w_m, 0) = W^f(w_m, R_f(w_m)) \\
W^m(0, w_f) = W^m(R_m(w_f), w_f)
\]

Compared to Individual Search

\[ V(0) = V(R) \]

Working with reservation wage R is same as Getting unemployed
Model Prediction: A Simplest Case
Assume couples are identical and split income equally.
Data

Model

Parameterization

Simulate data

Household Job Search Pattern
Estimation: Recovered Parameters

Data: SIPP2001 — household panel data
- Simulated Methods of Moments

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Definition</th>
<th>Estimated Value</th>
<th>Standard Error</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\lambda_{ft}$</td>
<td>offer arrival rate for full-time job</td>
<td>.3731</td>
<td>.0008</td>
</tr>
<tr>
<td>$\lambda_{pt}$</td>
<td>offer arrival rate for part-time job</td>
<td>.1966</td>
<td>.0010</td>
</tr>
<tr>
<td>$\alpha_{m}$</td>
<td>Husbands preference for consumption over leisure</td>
<td>.1540</td>
<td>.0003</td>
</tr>
<tr>
<td>$\alpha_{f}$</td>
<td>Wives preference</td>
<td>.1523</td>
<td>.0007</td>
</tr>
<tr>
<td>$\gamma$</td>
<td>Risk Aversion Index</td>
<td>1.3133</td>
<td>.0040</td>
</tr>
<tr>
<td>$\delta_{m}$</td>
<td>Job Destruction Rate for Husbands</td>
<td>.0041</td>
<td>.0000</td>
</tr>
<tr>
<td>$\delta_{m}$</td>
<td>Job Destruction Rate for Wives</td>
<td>.0038</td>
<td>.0000</td>
</tr>
</tbody>
</table>

- Wives prefer leisure more than husbands
Results (1) : Sharing Rule

- If husbands work
  \[ \phi(w_m, w_f, y) = 12.0805 + .5097w_m - .1981 \log w_f + .5426y. \]
  \[ (.0189) \quad (.0011) \quad (.0038) \quad (.0005) \]

- If husbands do not work
  \[ \phi(w_m, w_f, y) = 12.0805 + .8201(.5097w_m - .1981 \log w_f + .5425y). \]
  \[ (.0007) \]

- More husbands earn and less spouses earn, more they consume
- husbands share is responsive to their employment status
  - In the dual-earner family, husbands take 54\% of other income; but
  - if husbands do not work, their shares shrink to 82\% of original amount
- Sharing rule is the outcomes of bargaining
Results (2) : Implication of Sharing Rule

On average, the monthly transfer from husbands to wives in our sample is $1355.30 in 2000 dollar

- Women Labor Supply is dominated by income effect
  \[ h_f = -0.5472 + 0.1981 \log w_f - 0.000024 y_f. \]
  \[ (0.0094) \quad (0.0012) \quad (6.14e^{-7}) \]

- Men Participation Frontier
  \[ w_m^* = 2.8637 + 0.2614 \log w_f - 0.0085 y_f. \]
  \[ (0.3058) \quad (0.0403) \quad (0.0002) \]

- More wives earn, higher frontier men have.
- More transfer to women, lower frontier men have.
Data

Parameterization

Simulate data

Household Job Search Pattern
Results (3) : Derived Unemployment Duration In US

Using recovered parameters, we simulate a sizable sample to derive household unemployment duration in US

<table>
<thead>
<tr>
<th>Variables</th>
<th>Without Unobserved Heterogeneity</th>
<th>With Unobserved Heterogeneity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Is Female</td>
<td>.0069** (.0027)</td>
<td>.0038** (.0016)</td>
</tr>
<tr>
<td>College Graduate</td>
<td>-.0664 (.0601)</td>
<td>-.0426 (.0315)</td>
</tr>
<tr>
<td>Spousal Wage</td>
<td>-.0011** (.0004)</td>
<td>.0002 (.0022)</td>
</tr>
<tr>
<td>Number of Children (age ≤ 7)</td>
<td>.0002 (.0017)</td>
<td>.0035 (.0036)</td>
</tr>
<tr>
<td>Number of Children (age 7 ≤, ≤ 18)</td>
<td>-.0013 (.0067)</td>
<td>.0034 (.0126)</td>
</tr>
<tr>
<td>Is Female × Spousal Wage</td>
<td>.0029** (.0007)</td>
<td>.0086** (.0039)</td>
</tr>
<tr>
<td>Estimates of Σ</td>
<td></td>
<td>.2207** (.0037)</td>
</tr>
<tr>
<td>Controlling for Unobserved Heterogeneity</td>
<td>No</td>
<td>Yes</td>
</tr>
</tbody>
</table>

Standard errors are shown in parentheses.
** Variables are 5% significant.
Conclusion and Future Work

Accomplishments

- Fill in the existing gap between the individual-level model and household-level data
- Recover the sharing rule—the intra-family bargaining
- Derive household job search pattern in US

Future work

- Effect of tax-filing on household labor supply
- Intra-family Decision with Children

I would like to thank Dr. Russell W. Cooper for helpful discussions.

Thank You
# Appendix A: Fitness of Model

<table>
<thead>
<tr>
<th></th>
<th>Sample Moment</th>
<th>Simulated Moment</th>
</tr>
</thead>
<tbody>
<tr>
<td>% of unemployed husband</td>
<td>.0314</td>
<td>.0348</td>
</tr>
<tr>
<td>% of unemployed wife</td>
<td>.1368</td>
<td>.1266</td>
</tr>
<tr>
<td>% of employed husbands if wives employed</td>
<td>.9712</td>
<td>.9687</td>
</tr>
<tr>
<td>% of employed wives if husbands employed</td>
<td>.8655</td>
<td>.8867</td>
</tr>
<tr>
<td>% of full-time husbands if wives employed full-time</td>
<td>.9797</td>
<td>.9642</td>
</tr>
<tr>
<td>% of full-time wives if husbands employed full-time</td>
<td>.7284</td>
<td>.7394</td>
</tr>
<tr>
<td>% of full-time working husband if employed</td>
<td>.9811</td>
<td>.9510</td>
</tr>
<tr>
<td>% of full-time working wife if employed</td>
<td>.7311</td>
<td>.7357</td>
</tr>
<tr>
<td>% of working husband get unemployed in 5 periods</td>
<td>.0167</td>
<td>.0147</td>
</tr>
<tr>
<td>% of working wife get unemployed in 5 periods</td>
<td>.0345</td>
<td>.0233</td>
</tr>
<tr>
<td>% husbands remain not employed after 5 periods</td>
<td>.3754</td>
<td>.4297</td>
</tr>
<tr>
<td>% wives remain not employed after 5 periods</td>
<td>.7361</td>
<td>.7741</td>
</tr>
<tr>
<td>% husbands full-time employed after 5 periods from unemployment</td>
<td>.2098</td>
<td>.1787</td>
</tr>
<tr>
<td>% wives full employed after 5 periods from unemployment</td>
<td>.0368</td>
<td>.0484</td>
</tr>
<tr>
<td>Wage Correlation between husbands and wives</td>
<td>.2248</td>
<td>.2344</td>
</tr>
</tbody>
</table>
Appendix B: Extended Model for Estimation

Discrete time

- Two types of agents -- husbands and wives – make strategic decisions simultaneously
- State variables:
  - Employment status \((ft_m, ft_f)\): \{not work, full-time, part-time\}
  - Wage rates \((w_m, w_f)\): \{0 if not work, working\}
  - Non-labor income: \(y\)
- Value function:
  - \(W_i (w_m, w_f, ft_m, ft_f, y)\), if both husbands and wives are employed
  - \(W_i (w_m, 0, ft_m, 0, y)\), if husbands are employed but wives are not
  - \(W_i (0, w_f, 0, ft_f, y)\), if wives are employed but husbands are not
  - \(W_i (0, 0, 0, 0, y)\), if neither are employed
Appendix C1: 
Modeling husbands decision at $(0, w_f)$

Case (1): wife lost job and husband gets an offer, $Pr = \delta_f \lambda_m$

$$
\int_{R_m(0)} W^m(w'_m, 0) dF(w'_m) + \int_{R_m(0)} W^m(0, 0) dF(w'_m).
$$

Case (2): wife lost job and husband has no offer, $Pr = \delta_f (1 - \lambda_m)$

$$
W^m(0, 0).
$$

Case (3): wife still works and husband gets an offer, $Pr = (1 - \delta_f) \lambda_m$

$$
\int_{R_m(w_f)} W^m(w'_m, w_f) dF(w'_m) + \int_{R_m(w_f)} W^m(0, w_f) dF(w'_m)
$$

Case (4): wife still works and husbands gets no offer, $Pr = (1 - \delta_f)(1 - \lambda_m)$

$$
W^m(0, w_f)
$$
Appendix C2:
Value function of husbands: $(0, w_f)$

\[ W^m(0, w_f) = u_m(0, w_f) + \beta \{ \delta_f \lambda_m(\int_{R_m(0)} W^m(w'_m, 0) dF(w'_m)) \]

\[ + \int_{R_m(0)} W^m(0, 0) dF(w'_m)) \]

\[ + \delta_f (1 - \lambda_m) W^m(0, 0) + (1 - \delta_f) \lambda_m \]

\[ \left( \begin{array}{l}
(w_f \geq R_f(0)) \left[ \int_{R_m(w_f)} W^m(w'_m, w_f) dF(w'_m) + \int_{R_m(w_f)} W^m(0, w_f) dF(w'_m) \right] \\
+(w_f < R_f(0)) \int_{R_m(0)} W^m(w'_m, 0) dF(w'_m) + \int_{R_m(0)} W^m(0, 0) dF(w'_m) \\
+(1 - \delta_f)(1 - \lambda_m)(w_f \geq R_f(0)) W^m(0, w_f) + (w_f < R_f(0)) W^m(0, 0) \right) \right) \]