Selection, Separation, and Unemployment

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Data Facts: unemployment

- Unemployment rate differs by skill
  (Mincer, 1991; Nagypal, 2007; Layard, Nickell, and Jackman, 1991; Juhn, Murphy, and Topel, 2002)
  - low-skill has 2 times higher unemployment rate

Calculated using Basic CPS. High-skill: at least college degree.
Data Facts: job finding probability

- Job finding probabilities are similar across skill groups
  (Nagypal, 2007; Layard, Nickell, and Jackman, 1991)
  - it can account for at most 10% of the difference.

Calculated using merged Basic CPS. High-skill: at least college degree.
Data Facts: job separation probability

- Job separation probabilities also differ by skill (Nagypal, 2007; Layard, Nickell, and Jackman, 1991)
  - low-skill job separation rate is 3 times higher

Calculated using merged Basic CPS. High-skill: at least college degree.
Van Ours & Ridder (1993) find: Most of vacancy duration is selection of employees (Dutch establishment data).

Barron, Berger, and Black (1997): as level of education required increases

- # of interviews / offer ↑
- # of applicants / offer ↑
This paper

- Can (and how much of) the unemployment differences between skill groups come from differences in employee selection procedures?

Answer

<table>
<thead>
<tr>
<th></th>
<th>High-Skill</th>
<th>Low-Skill</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Data</td>
<td>Model</td>
</tr>
<tr>
<td>unemployment rate</td>
<td>0.02</td>
<td>0.021</td>
</tr>
<tr>
<td>job finding probability</td>
<td>0.294</td>
<td>0.294(^+)</td>
</tr>
<tr>
<td>job separation probability</td>
<td>0.006</td>
<td>0.0063</td>
</tr>
</tbody>
</table>

\(^+\): Targeted moments.
Road Map

- Motivation: Data facts
- Model
- Equilibrium analysis
- Quantitative Analysis
- Conclusion
Environment

- infinite horizon, discrete time search model
- 2 exogenous types of workers: high-skill & low-skill
- 2 types of jobs: high-skill & low-skill
- Skill is observable.
- High-skill and low-skill sectors are *segregated*
- Solve equilibrium of these sectors separately.
- Environment applies to each of high and low-skill sectors.
Environment

- Skill specific matching markets determine job finding/vacancy filling rates
- Production unit: firm-worker pair
- A filled job produces \( y = y_i \)
- Uncertain match quality (good or bad).
- \( y_i = y_g (y_b) \) if the match is good (bad) quality (\( y_g > y_b \)).

<table>
<thead>
<tr>
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<th>High Skill</th>
<th>Low Skill</th>
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<tbody>
<tr>
<td>good</td>
<td>( y_g^{hs} )</td>
<td>( y_g^{ls} )</td>
</tr>
<tr>
<td>bad</td>
<td>( y_b^{hs} )</td>
<td>( y_b^{ls} )</td>
</tr>
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</table>

\( y_g^{hs} > y_g^{ls} \)

\( y_b^{hs} = y_b^{ls} = b \)

- Quality revealed in 1st period of match.
Environment

- Exogenous job destruction at rate $\delta$
- Assume $y^i_b \leq b$ and $y^i_g > b$, for all skill $i \in \{hs, ls\}$
- When parties meet: draw probability of match being good quality (produce high output)($\pi$)
- Distribution of $\pi$: 2 selection technologies
  - Effective (costly) technology $\Omega(\pi)$
  - Less effective (costless) technology $\Gamma(\pi)$
- Firms choose the technology.
Timing of Events

1. active matches produce
2. exogenous separations occur
3. matching occurs
4. t
5. All matches decide whether to break up
6. vacancies choose selection technl.
7. vacancies and workers meet
8. draw π
9. t+1
10. All matches decide whether to break up
Bellman Equations, the worker

- $\lambda$: Probability firm uses $\Omega$
- $U(\lambda)$: discounted present value of unemployment
- $\tilde{W}(\pi, \lambda)$: value of producing with $\pi$
- $W(\pi, \lambda)$: value of employment position with $\pi$

\[
W(\pi, \lambda) = \max \left\{ U(\lambda), \tilde{W}(\pi, \lambda) \right\}
\]

\[
U(\lambda) = b + \beta(1 - f(\theta))U(\lambda) + \beta f(\theta) \left\{ \lambda \int_0^1 W(\pi, \lambda) d\Omega + (1 - \lambda) \int_0^1 W(\pi, \lambda) d\Gamma \right\}
\]

\[
\tilde{W}(\pi, \lambda) = w(\pi, \lambda) + \beta \delta U(\lambda) + \beta (1 - \delta) \left[ \pi W(1, \lambda) + (1 - \pi) W(0, \lambda) \right]
\]

quality: good bad
Bellman Equations, the firm

- $J(\pi, \lambda)$: value of employment position with $\pi$
  \[ J(\pi, \lambda) = \max \left\{ V(\lambda), \tilde{J}(\pi, \lambda) \right\} \]

- $V$: discounted present value of a vacancy

- $\tilde{J}(\pi, \lambda)$: value of producing with $\pi$
  \[ \tilde{J}(\pi, \lambda) = E(y|\pi) - w(\pi, \lambda) + \beta \delta V(\lambda) + \beta (1 - \delta) \left[ \pi J(1, \lambda) + (1 - \pi) J(0, \lambda) \right] \]

  quality: good bad

where $E(y|\pi) = \pi y_g + (1 - \pi) y_b$
Bellman Equations, the firm - cont’d

\[ V(\lambda) = \max \left\{ -c - \kappa + \beta(1 - q(\theta))V(\lambda) + \beta q(\theta) \int_{0}^{1} J(\pi, \lambda) d\Omega, \right. \\
\left. -c + \beta(1 - q(\theta))V(\lambda) + \beta q(\theta) \int_{0}^{1} J(\pi, \lambda) d\Gamma \right\} \]

- \( \Omega \) is more effective than \( \Gamma \) \( \Rightarrow \) \( \Omega \) fosd \( \Gamma \)
  (i.e., \( \Omega(\pi) \leq \Gamma(\pi) \quad \forall \pi \))

- fosd implies

\[ \int_{0}^{1} J(\pi, \lambda) d\Omega \geq \int_{0}^{1} J(\pi, \lambda) d\Gamma \]
Job separation probability is

\[ s = \delta + (1 - \delta)(1 - E(\pi|X(\pi))) \frac{\delta}{\delta + (1 - \delta)E(\pi|X(\pi))} \]

\[ \Rightarrow s = \frac{\delta}{\delta + (1 - \delta)E(\pi|X(\pi))} \]

Only source of difference for separation rates across skill: 
\( E(\pi|X(\pi)) \)
Quantitative Analysis

- Assign values to common parameters
- Estimate model specific parameters
  - Minimize the distance between model moments and data moments
- Given parameters, calculate other moments.
## Results

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<td>unem. rate</td>
<td>0.02</td>
<td>0.021</td>
<td>0.05</td>
<td>0.05+</td>
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<tr>
<td>job finding prob.</td>
<td>0.294</td>
<td>0.294+</td>
<td>0.323</td>
<td>0.323+</td>
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<tr>
<td>job separation prob.</td>
<td>0.006</td>
<td>0.0064</td>
<td>0.017</td>
<td>0.017</td>
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<tr>
<td>vacancy filling prob.</td>
<td>-</td>
<td>0.67</td>
<td>-</td>
<td>0.59</td>
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<tr>
<td>selection tech (λ)</td>
<td>-</td>
<td>1</td>
<td>-</td>
<td>0</td>
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</table>

+: Targeted moments.
### Results; a counterfactual exercise-only 1 distribution available

<table>
<thead>
<tr>
<th></th>
<th>Bnc</th>
<th>$\Gamma$</th>
<th>$\Omega$</th>
<th>$\Omega (\kappa = 0)$</th>
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<td><strong>High Skill</strong></td>
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<tr>
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<td>0.031</td>
<td>0.021</td>
<td>0.011</td>
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<td>0.508</td>
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<td>0.567</td>
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<td>0.0063</td>
<td>0.0162</td>
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<td>0.0061</td>
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<td>vacancy filling prob.</td>
<td>0.65</td>
<td>0.349</td>
<td>0.6554</td>
<td>0.347</td>
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<tr>
<td>$\theta$</td>
<td>0.45</td>
<td>1.452</td>
<td>0.449</td>
<td>1.634</td>
</tr>
<tr>
<td>$\pi^*$</td>
<td>0.059</td>
<td>0.037</td>
<td>0.059</td>
<td>0.109</td>
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<tr>
<td><strong>Low Skill</strong></td>
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<tr>
<td>unem. rate</td>
<td>0.05</td>
<td>0.05</td>
<td>0.043</td>
<td>0.0162</td>
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<td>0.14</td>
<td>0.375</td>
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<td>job separation prob.</td>
<td>0.017</td>
<td>0.017</td>
<td>0.0064</td>
<td>0.0062</td>
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<tr>
<td>vacancy filling prob.</td>
<td>0.58</td>
<td>0.58</td>
<td>0.8326</td>
<td>0.563</td>
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<tr>
<td>$\theta$</td>
<td>0.56</td>
<td>0.56</td>
<td>0.17</td>
<td>0.665</td>
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<tr>
<td>$\pi^*$</td>
<td>0.024</td>
<td>0.024</td>
<td>0.029</td>
<td>0.074</td>
</tr>
</tbody>
</table>
Concluding Remarks

- Low-skill have higher unemployment rate
- It is because they have higher job separation rates
- One explanation: firms select high-skill workers more effectively.
- \( \Rightarrow \) skilled workers are less likely to separate
- This differences in selection process by skill can explain differences in unemployment rates.
- Future work:
  - other reasons for firms using different selection procedures for high-skill jobs.
  - other reasons for lower job separation of high-skill workers