Matching Efficiency and Heterogeneous Workers in the UK

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Motivation

- This paper explores the determinants of the job finding rate in the UK over the period from Q3 2001 to Q3 2014.

- The fluctuations of the job finding rate depend on:
  - Labour demand (vacancies)
  - Labour supply (unemployment)
  - Matching efficiency – captures what is still unexplained by unemployment and vacancies

- Matching efficiency – the ability of the labour market to match available jobs and unemployed workers promptly.
  - Low matching efficiency leads to high unemployment, which is costly.
  - Making sure that the right workers are matched with the right firms is important for high productivity.
    ➞ need to account for worker heterogeneity and differences in the sub-labour markets.
Motivation

- During the Great Recession in the UK:
  - Unemployment rate increased from around 5% to 8% and remained high in the aftermath of the recession.
  - Vacancies dropped by approximately 43% during the recession, but recovered quicker.
  - Job finding rate decreased by around 20%.

- Dramatic decrease in the job finding rate:
  - Need to understand the compositional changes of unemployment pool.
  - The effect of the recession on different sub-labour markets (industries).

- Contribution: This paper is first to account for worker composition effect in the matching function in the UK.
Literature

US

- **Barnichon and Figura (2015)**
  - Standard matching function breaks down after 2007.
  - Introduced worker heterogeneity and labour market segmentation.
  - Reason of unemployment and unemployment duration - two characteristics that are most responsible for decrease in matching efficiency.

- **Sahin, Song, Topa and Violante (2014)**
  - Labour market segmentation.
  - Theoretical mismatch index - comparison to optimal planner’s allocation.
  - No geographical mismatch, industrial and occupational mismatch - 4% additional hires lost during the Great Recession.

UK

- **Smith (2012)**
  - LFS and VS by industry.
  - Uses Sahin et al. (2014) mismatch index.
  - The rise in mismatch led to up to 4% fewer hires per quarter.

- **Patterson, Sahin, Topa and Violante (2016)**
  - Nomis by occupation, LFS for employment counterfactuals.
  - Use Sahin et al. (2014) model to investigate productivity loss due to mismatch across occupations.
  - Mismatch explains about 2/3 of the deviations from trend-growth in the UK labour productivity since 2007.
Matching Function

- The aggregate matching function

\[ m_t = \mu_t U_t^\sigma V_t^{1-\sigma} \]

where \( \mu_t = \mu e^{\varepsilon_t} \).

- can be estimated in log-linear form

\[ \ln f_t = \ln \mu + (1 - \sigma) \ln \theta_t + \varepsilon_t \]

here \( \theta_t = \frac{V_t}{U_t} \) and \( f_t = \frac{m_t}{U_t} \).
A matching function with heterogeneous workers

\[ m_{it} = \mu_i V_{it}^{1-\sigma} (s_{it} U_{it})^\sigma \]

\[ i \in \{1, ..., I\} \text{ and } t \in \{1, ..., T\} \]

- matching efficiency can be aggregated to

\[ \mu_t = \sum_{i=1}^{I} \frac{U_{it}}{U_t} \mu_i s_{it}^\sigma (\frac{\theta_{it}}{\theta_i})^{1-\sigma} \]

- search efficiency in industry \( i \) over period \( t \) is

\[ s_{it} = \sum_{j=1}^{J} \frac{U_{jit}}{U_{it}} s_{jit} \]

- individual search efficiency is assumed to take form

\[ s_{jit} = e^{\beta X_{jit}}, \text{ where } X_{jit} = [1, x_{jit}^1, ..., x_{jit}^K]. \]
Matching Function

- the individual job finding rate then is
  \[ f_{jit} = \frac{s_{jit}}{s_{it}} \frac{m_{it}}{U_{it}} = \mu_{i} s_{jit} \theta_{it}^{1-\sigma} \]

- and the job finding probability becomes
  \[ F_{jit} = 1 - e^{-\mu_{i} s_{jit} \theta_{it}^{1-\sigma}} \]

- can be estimated by minimising the log-likelihood function
  \[ \ell(\beta, \mu_{i}, \sigma) = \sum_{t=1}^{T} \sum_{i=1}^{I} \sum_{j=1}^{J_{i}} [(1 - y_{jit}) \ln(1 - F_{jit}) + y_{jit} \ln F_{jit}] \]

  where \( y_{jit} = 1 \) if individual of type \( j \) in segment \( i \) over a period \( t \) finds a job.
Data: Q3 2001 – Q3 2014

Unemployment
- ILO Unemployment - Longitudinal **Labour Force Survey**
  - worker characteristics: age, gender, ethnicity, education, number of dependent children, unemployment duration, immigration status and region.
  - labour market segmentation: 1-digit SIC2007

Vacancies
- **Vacancy Survey**
  - labour market segmentation: 1-digit SIC2007 (excl. Agriculture, Forestry and Fishing)

Matches
- Longitudinal **Labour Force Survey**
  - UE transitions
### Results

**Table 1:** Matching Function with labour market segmentations and heterogeneous workers

<table>
<thead>
<tr>
<th></th>
<th>OLS</th>
<th>ML (1)</th>
<th>ML (2)</th>
<th>ML (3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>$1 - \sigma$</td>
<td>0.372**</td>
<td>0.347**</td>
<td>0.405**</td>
<td>0.287**</td>
</tr>
<tr>
<td></td>
<td>(0.022)</td>
<td>(0.013)</td>
<td>(0.018)</td>
<td>(0.018)</td>
</tr>
<tr>
<td>Sample size</td>
<td>53</td>
<td>59,201</td>
<td>59,201</td>
<td>59,201</td>
</tr>
<tr>
<td>Quarter dummies</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Industries</td>
<td>–</td>
<td>–</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Worker type</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>Yes</td>
</tr>
</tbody>
</table>
Job Search Efficiency: $\beta$etas

By Age (relative to 50+):

By Duration (relative to 2 yrs+):

% change in job finding rate
Job Search Efficiency: $\beta$etas

By Ethnicity (relative to White)

By Education (relative to No Qual)

By Region (relative to London)

By number of dep. children (relative to 3+)

Elena Lisauskaite (RHUL)
Matching Efficiency

Predicted JFR and Residuals

Job Finding Rate

2002q1 2005q1 2008q1 2011q1 2014q1

data ML - industry ML - composition + industry ML - simple

% difference in JFR

2002q1 2005q1 2008q1 2011q1 2014q1

ML - industry ML - composition + industry ML - simple
### Table 2: Change in residual sum of squares

<table>
<thead>
<tr>
<th></th>
<th>ML (1)</th>
<th>ML (2)</th>
<th>ML (3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2001Q3 - 2007Q4</td>
<td>1</td>
<td>-0.19</td>
<td>-0.51</td>
</tr>
<tr>
<td>2007Q4 - 2014Q3</td>
<td>1</td>
<td>-0.12</td>
<td>-0.23</td>
</tr>
<tr>
<td>2001Q3 - 2014Q3</td>
<td>1</td>
<td>-0.15</td>
<td>-0.38</td>
</tr>
<tr>
<td>Quarter dummies</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Industries</td>
<td>–</td>
<td>Yes</td>
<td>Yes</td>
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<tr>
<td>Worker type</td>
<td>–</td>
<td>–</td>
<td>Yes</td>
</tr>
</tbody>
</table>
Isolating the effect of composition vs. labour market tightness

• Keeping the labour market tightness constant at the pre-recessional level, the estimated job finding rate is:

\[ \hat{f}_t = \sum_{i=1}^{I} \mu_i s_{it} \bar{\theta}^{1-\sigma}, \]

where \( \bar{\theta} = \frac{1}{T_{<2007Q4}} \sum_{t=1}^{T} \sum_{i=1}^{I} \theta_{it}. \)

• Letting the labour market tightness move freely and restricting the job search efficiency to its pre-recessional level, the job finding rate becomes:

\[ \hat{f}_t = \sum_{i=1}^{I} \mu_i s^\sigma \theta_{it}^{1-\sigma}, \]

where \( s^\sigma = \frac{1}{T_{<2007Q4}} \sum_{t=1}^{T} \sum_{i=1}^{I} s_{it}^\sigma. \)
Isolating the effect of composition vs. labour market tightness

Counterfactual JFR

Date | Job Finding Rate
--- | ---
2002q1 | 0.35
2005q1 | 0.35
2008q1 | 0.35
2011q1 | 0.35
2014q1 | 0.35

Data, constant theta, predicted, constant composition
Robustness: composition effect excluding unemployment duration

- Barnichon and Figura (2015) base their results of composition effect’s importance heavily on the duration of unemployment.

- job finding rate $f_t$ is also called unemployment spell duration hazard.

- the lower the rate at which people find jobs, the longer the unemployment duration, $d_t$.

- $f_t = \frac{1}{d_t}$

- unemployment duration might cause endogeneity issue in the estimation of the matching function!
Robustness: composition effect excluding unemployment duration

Predicted JFR and Residuals: no unemployment duration
Robustness: isolating the effect of composition vs. labour market tightness

Counterfactual JFR and Residuals: no unemployment duration
Conclusions

- Matching efficiency decreased during the Great Recession and remained low
- Probability of finding a job decreases with age and unemployment duration
- Accounting for worker composition can explain 38% of the unexplained movements in the matching efficiency
- Labour market tightness is the most important aspect of the matching function in explaining the movements in the job finding rate
- Unemployment duration is the only characteristic that significantly contributes to the worker composition effect
Thank You!
The Great Recession (2007Q4 - 2009Q2)

Source: Labour Force Survey.
Unemployment and Vacancies

Unemployment and Vacancies