Mismatch Unemployment in the U.K.

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Bank of England, June 2013
Unemployment rate in the U.K.
Unemployment rate in the U.K.

- increased to above 8% during the recession
- remained persistently high
The mismatch hypothesis

• Growing *misalignment* between distributions of job seekers and job openings across sectors (locations, industries, occupations)
The mismatch hypothesis

• Growing **misalignment** between distributions of job seekers and job openings across sectors (locations, industries, occupations)

• A priori, plausible:
  - Outward shift in the Beveridge curve
  - Job losses concentrated in certain sectors
Job destruction rates

Patterson-Şahin-Topa-Violante, "Mismatch Unemployment in the U.K."
The mismatch hypothesis

• Growing **misalignment** between distributions of job seekers and job openings across sectors (locations, industries, occupations)

• A priori, plausible:
  ▶ Outward shift in the Beveridge curve
  ▶ Job losses concentrated in certain sectors

• **Questions:**
  ▶ How much of the rise in unemployment is due to mismatch?
  ▶ Along which dimensions has mismatch worsened?
Methodology analogous to “misallocation” literature
Methodology analogous to “misallocation” literature

- Economy with $I$ frictional labor markets indexed by $\{\phi_{it}, z_{it}, \delta_{it}\}$

- $\{v_{it}\}$: observed allocation of vacancies

- $\{u_{it}\}$: observed allocation of unemployed
Methodology analogous to “misallocation” literature

• Economy with $I$ frictional labor markets indexed by $\{\phi_{it}, z_{it}, \delta_{it}\}$

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• $\{u^*_{it}\}$: benchmark allocation under free mobility across markets (constrained first-best)
Methodology analogous to “misallocation” literature

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• $\{v_{it}\}$: observed allocation of vacancies

• $\{u_{it}\}$: observed allocation of unemployed

• $\{u_{it}^*\}$: benchmark allocation under free mobility across markets (constrained first-best)

• Discrepancy between $\{u_{it}\}$ and $\{u_{it}^*\}$
  $\rightarrow$ lower aggregate job-finding rate
  $\rightarrow$ additional (mismatch) unemployment
Environment

- $I$ distinct frictional labor markets
  - New production opportunities $v_{it}$ arise **exogenously**
Environment

- $I$ distinct frictional labor markets
  - Infinite cost-elasticity of vacancy creation
Environment

- $I$ distinct frictional labor markets
  - Infinite cost-elasticity of vacancy creation
  - CRS matching function: $\Phi_t \phi_{it} m (u_{it}, v_{it})$
  - Worker-firm match subject to productivity shocks $(Z_t, z_{it})$
Environment

- $I$ distinct frictional labor markets
  - Infinite cost-elasticity of vacancy creation
  - CRS matching function: $\Phi_t \phi_{it} m (u_{it}, v_{it})$
  - Worker-firm match subject to productivity shocks $(Z_t, z_{it})$
- Measure one of infinitely-lived agents with linear utility
  - Agents can be employed ($e$) or unemployed ($u$)
  - Unemployed: search directed toward one market only
  - Employed: no OJS, exogenous separation shocks $(\Delta_t, \delta_{it})$
Planner’s allocation rule

1. Shocks $\{\phi_{it}, z_{it}, \delta_{it}\}$ are i.i.d. across sectors, orthogonal to each other, and follow positive martingales

2. No impediment to mobility of labor across markets
Planner’s allocation rule

1. Shocks \( \{\phi_{it}, z_{it}, \delta_{it}\} \) are i.i.d. across sectors, orthogonal to each other, and follow positive martingales.

2. **No impediment** to mobility of labor across markets.

The **planner’s allocation rule** requires equalizing (across sectors):

\[
\frac{z_{it}}{1 - \beta (1 - \Delta_t) (1 - \delta_{it})} \phi_{it} m_{ui} \left( \frac{v_{it}}{u^*_{it}} \right)
\]

productive and matching efficiency-weighted \( v/u \) ratios.
Planner’s allocation rule

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The planner’s allocation rule requires equalizing (across sectors):

\[
\frac{z_{it}}{1 - \beta (1 - \Delta_t) (1 - \delta_{it})} \phi_{it} m_{u_{it}} \left( \frac{v_{it}}{u_{it}^*} \right)
\]

productive and matching efficiency-weighted \( v/u \) ratios

Assume: \( m(u_{it}, v_{it}) = v_{it}^\alpha u_{it}^{1-\alpha} \)
Mismatch Index (special case: no heterogeneity)

• Observed aggregate hires: \[ h_t = \Phi_t \sum_{i=1}^{I} v_{it}^{\alpha} u_{it}^{1-\alpha} \]

• Planner’s aggregate hires: \[ h_t^* = \Phi_t v_t^{\alpha} u_t^{1-\alpha} \]
Mismatch Index (special case: no heterogeneity)

- Observed aggregate hires: \( h_t = \Phi_t \sum_{i=1}^{I} v_{it}^\alpha u_{it}^{1-\alpha} \)
- Planner’s aggregate hires: \( h_t^* = \Phi_t v_t^\alpha u_t^{1-\alpha} \)
- Mismatch index:

\[
M_t \equiv \frac{h_t^* - h_t}{h_t^*} = 1 - \sum_{i=1}^{I} \left( \frac{v_{it}}{v_t} \right)^\alpha \left( \frac{u_{it}}{u_t} \right)^{1-\alpha} \in [0, 1]
\]

measures the fraction of hires lost because of misallocation
Mismatch Index (special case: no heterogeneity)

- Observed aggregate hires: \( h_t = \Phi_t \sum_{i=1}^I v_{it}^\alpha u_{it}^{1-\alpha} \)

- Planner’s aggregate hires: \( h_t^* = \Phi_t v_t^\alpha u_t^{1-\alpha} \)

- Mismatch index:

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\mathcal{M}_t \equiv \frac{h_t^* - h_t}{h_t^*} = 1 - \sum_{i=1}^I \left( \frac{v_{it}}{v_t} \right)^\alpha \left( \frac{u_{it}}{u_t} \right)^{1-\alpha} \in [0, 1]
\]

measures the fraction of hires lost because of misallocation

- Mismatch shifts the aggregate matching function:

\[
h_t = (1 - \mathcal{M}_t) \cdot h_t^* = (1 - \mathcal{M}_t) \cdot \Phi_t v_t^\alpha u_t^{1-\alpha}
\]
Add heterogeneity in $\phi_{it}$

$$\mathcal{M}_{\phi_t}^h \equiv \frac{h^*_t - h_t}{h^*_t} = 1 - \sum_{i=1}^{I} \left( \frac{\phi_{it}}{\bar{\phi}_t} \right) \left( \frac{v_{it}}{v_t} \right)^{\alpha} \left( \frac{u_{it}}{u_t} \right)^{1-\alpha}$$

where

$$\bar{\phi}_t = \left[ \sum_{i=1}^{I} \phi_{it}^{\frac{1}{\alpha}} \left( \frac{v_{it}}{v_t} \right) \right]^\alpha$$
Add heterogeneity in $\phi_{it}$

\[
M_{\phi t}^h \equiv \frac{h^*_t - h_t}{h^*_t} = 1 - \sum_{i=1}^{I} \left( \frac{\phi_{it}}{\bar{\phi}_t} \right) \left( \frac{v_{it}}{v_t} \right)^\alpha \left( \frac{u_{it}}{u_t} \right)^{1-\alpha}
\]

where

\[
\bar{\phi}_t = \left[ \sum_{i=1}^{I} \phi_{it}^{\frac{1}{\alpha}} \left( \frac{v_{it}}{v_t} \right) \right]^\alpha
\]

- With heterogenous $(\phi_{it}, z_{it}, \delta_{it}) \rightarrow M_{xt}^h$
Counterfactual unemployment

- Observed unemployment:

\[ u_{t+1} = u_t + s_t \cdot (1 - u_t) - f_t \cdot u_t \]
Counterfactual unemployment

- Observed unemployment:

\[ u_{t+1} = u_t + s_t \cdot (1 - u_t) - f_t \cdot u_t \]

- Aggregate job finding rate:

1. observed:

\[ f_t = (1 - M_t) \cdot \Phi_t \cdot \left( \frac{v_t}{u_t} \right)^\alpha \]

2. no mismatch:

\[ f^*_t = \Phi_t \cdot \left( \frac{v_t}{u^*_t} \right)^\alpha = f_t \cdot \frac{1}{1 - M_t} \cdot \left( \frac{u_t}{u^*_t} \right)^\alpha \]

Direct Effect Feedback through \(u\)
Counterfactual unemployment

• Observed unemployment:

\[ u_{t+1} = u_t + s_t \cdot (1 - u_t) - f_t \cdot u_t \]

• Aggregate job finding rate:

1. observed:  
   \[ f_t = (1 - M_t) \cdot \Phi_t \cdot \left( \frac{v_t}{u_t} \right)^\alpha \]

2. no mismatch:  
   \[ f^*_t = \Phi_t \cdot \left( \frac{v_t}{u^*_t} \right)^\alpha = f_t \cdot \frac{1}{1 - M_t} \cdot \left( \frac{u_t}{u^*_t} \right)^\alpha \]

• Counterfactual unemployment in absence of mismatch:

\[ u^*_{t+1} = u^*_t + s_t \cdot (1 - u^*_t) - f^*_t \cdot u^*_t \]

• Mismatch unemployment:  
  \[ u_t - u^*_t \]
Data used: July 2006 - June 2012

- **Unemployed** \( \{u_{it}\} \): Jobseeker’s Allowance Claimant Counts
- **Vacancies** \( \{v_{it}\} \): Jobcentre Plus Vacancy Statistics

  ▶ Sought occupation

  ▶ Geographic location (Travel To Work Area)
Data used: July 2006 - June 2012

- **Unemployed** $\{u_{it}\}$: Jobseeker’s Allowance Claimant Counts
- **Vacancies** $\{v_{it}\}$: Jobcentre Plus Vacancy Statistics
  - Sought occupation
  - Geographic location (Travel To Work Area)
- **Productivity** $\{z_{it}\}$: Annual Survey of Hours and Earnings (ASHE)
- **EU rates** $\{\delta_{it}\}$: Labor Force Survey (LFS)
- **Matching function parameters** $\alpha, \{\phi_{it}\}$: estimated
Summary statistics
Summary statistics

<table>
<thead>
<tr>
<th></th>
<th>No. Sectors</th>
<th>Vacancies</th>
<th>Claims</th>
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</thead>
<tbody>
<tr>
<td>2-digit occupation</td>
<td>24</td>
<td>7712</td>
<td>23173</td>
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<tr>
<td>3-digit occupation</td>
<td>76</td>
<td>1510</td>
<td>6471</td>
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<tr>
<td>Travel To Work Areas</td>
<td>215</td>
<td>619</td>
<td>2288</td>
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<tr>
<td>TTWA x 2-digit</td>
<td>1059</td>
<td>118</td>
<td>314</td>
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<tr>
<td>Region</td>
<td>11</td>
<td>26920</td>
<td>113725</td>
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</table>
Unemployment: Claimant Count vs. LFS
Unemployment: Claimant Count vs. LFS

Correlation = 0.98
Vacancies: Jobcentre Plus vs. ONS vacancy survey
Vacancies: Jobcentre Plus vs. ONS vacancy survey

Correlation = 0.92
Comparisons

• **Claimants**: more prime-age males relative to LFS.

• Interesting pattern re unemployment duration:
  
  ▶ fewer ST unemployed than in LFS, **pre-recession**;
  
  ▶ duration distribution matches LFS, **post-recession**.
## Claimant Count vs. LFS

<table>
<thead>
<tr>
<th>Age</th>
<th>Pre-Recession</th>
<th>Post-Recession</th>
<th>Pre-Recession</th>
<th>Post-Recession</th>
</tr>
</thead>
<tbody>
<tr>
<td>16-24</td>
<td>0.42</td>
<td>0.39</td>
<td>0.42</td>
<td>0.35</td>
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<td>25-49</td>
<td>0.43</td>
<td>0.45</td>
<td>0.52</td>
<td>0.57</td>
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<tr>
<td>50+</td>
<td>0.14</td>
<td>0.15</td>
<td>0.07</td>
<td>0.08</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Gender</th>
<th>Pre-Recession</th>
<th>Post-Recession</th>
<th>Pre-Recession</th>
<th>Post-Recession</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>0.57</td>
<td>0.59</td>
<td>0.73</td>
<td>0.71</td>
</tr>
<tr>
<td>Female</td>
<td>0.43</td>
<td>0.41</td>
<td>0.27</td>
<td>0.29</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Duration</th>
<th>Pre-Recession</th>
<th>Post-Recession</th>
<th>Pre-Recession</th>
<th>Post-Recession</th>
</tr>
</thead>
<tbody>
<tr>
<td>under 6 months</td>
<td>0.60</td>
<td>0.52</td>
<td>0.47</td>
<td>0.54</td>
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<td>6-12 months</td>
<td>0.16</td>
<td>0.19</td>
<td>0.21</td>
<td>0.21</td>
</tr>
<tr>
<td>12-24 months</td>
<td>0.13</td>
<td>0.16</td>
<td>0.16</td>
<td>0.14</td>
</tr>
<tr>
<td>24+ months</td>
<td>0.11</td>
<td>0.13</td>
<td>0.17</td>
<td>0.12</td>
</tr>
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Comparisons

- **Claimants**: more prime-age males relative to LFS.

- Interesting pattern re unemployment duration:
  
  - fewer ST unemployed than in LFS, **pre-recession**;
  
  - duration distribution matches LFS, **post-recession**.

- **Jobcentre Plus vacancies**: more concentrated in banking, finance and insurance.

- Under-represent manufacturing; distribution, hotels and restaurants; transport and communications.
### Jobcentre Plus vacancies vs. ONS

<table>
<thead>
<tr>
<th>Industry</th>
<th>Vacancy Survey</th>
<th>JobCentre Plus</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pre-Rec</td>
<td>Post-Rec</td>
</tr>
<tr>
<td>Energy and Water</td>
<td>0.01</td>
<td>0.01</td>
</tr>
<tr>
<td>Manufacturing</td>
<td>0.09</td>
<td>0.07</td>
</tr>
<tr>
<td>Construction</td>
<td>0.04</td>
<td>0.03</td>
</tr>
<tr>
<td>Distribution, Hotels &amp; Restaurants</td>
<td>0.28</td>
<td>0.28</td>
</tr>
<tr>
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<td>0.23</td>
<td>0.21</td>
</tr>
<tr>
<td>Public Admin., Education &amp; Health</td>
<td>0.21</td>
<td>0.24</td>
</tr>
<tr>
<td>Other Services</td>
<td>0.04</td>
<td>0.04</td>
</tr>
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</table>

Patterson-Şahin-Topa-Violante, "Mismatch Unemployment in the U.K."
Change in unemployment shares across occupations
Change in unemployment shares across occupations

Skilled Construction, Corporate Managers particularly hit

Patterson-Şahin-Topa-Violante, "Mismatch Unemployment in the U.K."
Change in vacancy shares across occupations
Change in vacancy shares across occupations

Sharp decline in Construction, Customer Service, Manufacturing

Patterson-Şahin-Topa-Violante, "Mismatch Unemployment in the U.K."
Correlation between \((u, v)\) shares across occupations
Correlation between \((u, v)\) shares across occupations

A decline in the correlation is a sign of worsening mismatch.

Patterson-Şahin-Topa-Violante, "Mismatch Unemployment in the U.K."
Unemployment outflow data
We use the average of the two series to estimate $\alpha$ and $\{\phi_i\}$.
Matching function estimation

- At the aggregate level:

\[ \ln \left( \frac{h_{it}}{u_{it}} \right) = \text{const} + \gamma'QTT_t + \alpha \ln \left( \frac{v_{it}}{u_t} \right) + \epsilon_t \]
Matching function estimation

• At the aggregate level:

\[
\ln \left( \frac{h_{it}}{u_{it}} \right) = const + \gamma' QTT_t + \alpha \ln \left( \frac{v_{it}}{u_t} \right) + \epsilon_t
\]

• At the sectoral level:

\[
\ln \left( \frac{h_{it}}{u_{it}} \right) = \gamma' QTT_t + \chi_{t \leq 8.03} \ln \phi_i^{pre} + \chi_{t > 8.03} \ln \phi_i^{post} + \alpha \ln \left( \frac{v_{it}}{u_{it}} \right) + \epsilon_t
\]
Estimation results
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<tr>
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<th>$\alpha$</th>
<th>Sample Size</th>
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<tr>
<td>Aggregate</td>
<td>0.559***</td>
<td>72</td>
</tr>
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<td></td>
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</tr>
<tr>
<td>$\phi_i$ Fixed</td>
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<td>1728</td>
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Distribution of estimated $\phi_i$ varies between 0.43 and 0.67.
About 6 pct of hires lost in the recession bc of higher mismatch

About 0.5 pct points increase in mismatch unemployment
About 7 pct of hires lost in the recession bc of higher mismatch

About 0.75 pct points increase in mismatch unemployment
Geographic mismatch (TTWA’s)

Negligible increase in mismatch unemployment
Occupation X geography mismatch (2-digit x TTWA)

About 6\% of hires lost in the recession bc of higher mismatch

About 0.6\% points increase in mismatch unemployment
Routine-Cognitive Occupations

• Notion of job polarization:
  ▶ more jobs in highest/lowest skill (non-routine) occupations;
  ▶ fewer opportunities in middle skill (routine) occupations.

Patterson-Şahin-Topa-Violante, "Mismatch Unemployment in the U.K."
Routine-Cognitive Occupations

• Notion of job polarization:
  ▶ more jobs in highest/lowest skill (non-routine) occupations;
  ▶ fewer opportunities in middle skill (routine) occupations.

• Some examples:
  ▶ (C, NR): Managers; professionals; culture, media, sports;
  ▶ (C, R): Office and administrative support occupations;
  ▶ (M, R): Skilled trades (metal, construction, printing, ...);
  ▶ (M, NR): Sales and customer service occupations.

Patterson-Şahin-Topa-Violante, "Mismatch Unemployment in the U.K."
Routine-Cognitive Occupations

About 6 \textit{pct} of hires lost in the recession bc of higher mismatch

About 0.4 \textit{pct points} increase in mismatch unemployment
Summary of results
## Summary of results

<table>
<thead>
<tr>
<th>Contribution</th>
<th>Δ(ū − ū*)</th>
<th>Δ(ū − ū*)/Δu</th>
</tr>
</thead>
<tbody>
<tr>
<td>2-digit occupation</td>
<td>0.53 ppts</td>
<td>18.9%</td>
</tr>
<tr>
<td>3-digit occupation</td>
<td>0.75 ppts</td>
<td>26.9%</td>
</tr>
<tr>
<td>Travel To Work Areas</td>
<td>0.03 ppts</td>
<td>1.2%</td>
</tr>
<tr>
<td>TTWA x 2-digit</td>
<td>0.59 ppts</td>
<td>21.2%</td>
</tr>
<tr>
<td>Region</td>
<td>0.07 ppts</td>
<td>2.6%</td>
</tr>
<tr>
<td>Routine-Cognitive</td>
<td>0.36 ppts</td>
<td>12.8%</td>
</tr>
</tbody>
</table>

Contribution of mismatch unemployment highest for 3-digit occupations and occupations X geography
Endogenous vacancy creation

- **Equilibrium:**

  1. Free entry
     - vacancy creation cost: \( K_i(v_{it}) = \kappa_{it}^\varepsilon \cdot \frac{v_{it}^{1+\varepsilon}}{1+\varepsilon} \)

  2. Hosios condition

Endogenous vacancy creation

- **Equilibrium:**

1. Free entry
   - vacancy creation cost: \( K_i(v_{it}) = \kappa_i^{\varepsilon} \cdot \frac{v_{it}^{1+\varepsilon}}{1+\varepsilon} \)

2. Hosios condition


\[
(k_{it} v_{it})^{\varepsilon} = \Phi_t \phi_{it} \left( \frac{u_{it}}{v_{it}} \right)^{1-\alpha} \alpha \frac{Z_t z_{it}}{1 - \beta (1 - \Delta_t) (1 - \delta_{it})}
\]

- **Given** \( \varepsilon \), back out \( \{k_{it}\} \) which replicates data on \( \{v_{it}\} \)
Endogenous vacancy creation

• **Equilibrium** free-entry condition:

\[
(\kappa_{it} v_{it})^\varepsilon = \Phi_t \phi_{it} \left( \frac{u_{it}}{v_{it}} \right)^{1-\alpha} \frac{Z_t z_{it}}{1 - \beta (1 - \Delta_t) (1 - \delta_{it})}
\]

• **Planner’s** optimal vacancy creation:

\[
(\kappa_{it} v_{it}^*)^\varepsilon = \Phi_t \phi_{it} \left( \frac{u_{it}^*}{v_{it}^*} \right)^{1-\alpha} \frac{Z_t z_{it}}{1 - \beta (1 - \Delta_t) (1 - \delta_{it})}
\]
Endogenous vacancy creation

- **Equilibrium** free-entry condition:

\[
(\kappa_{it} v_{it})^{\varepsilon} = \Phi_{t} \phi_{it} \left( \frac{u_{it}}{v_{it}} \right)^{1-\alpha} \frac{Z_{t} z_{it}}{1 - \beta (1 - \Delta_{t}) (1 - \delta_{it})}
\]

- **Planner’s** optimal vacancy creation:

\[
(\kappa_{it} v_{it}^{*})^{\varepsilon} = \Phi_{t} \phi_{it} \left( \frac{u_{it}^{*}}{v_{it}^{*}} \right)^{1-\alpha} \frac{Z_{t} z_{it}}{1 - \beta (1 - \Delta_{t}) (1 - \delta_{it})}
\]

- **Comparison:**

\[
\frac{v_{it}}{v_{it}^{*}} = \left( \frac{u_{it}}{u_{it}^{*}} \right)^{\frac{1-\alpha}{1-\alpha + \varepsilon}}
\]
Endogenous vacancy creation

• Planner vs. observed job finding rate

\[ f^*_t = f_t \cdot \frac{1}{1 - \mathcal{M}_t} \cdot \left( \frac{u_t}{u^*_t} \right)^\alpha \cdot \left( \frac{v^*_t}{v_t} \right)^\alpha \]

Direct Effect Feedback through u Feedback through v

More misallocation \rightarrow fewer vacancies \rightarrow more mismatch unempl.
Mismatch $u$ with endogenous vacancies

Mismatch Unemployment Rate (ppts)

$\varepsilon = 0.5$

$\varepsilon = 1$

$\varepsilon = 2$

Patterson-Şahin-Topa-Violante, "Mismatch Unemployment in the U.K."
Mismatch $u$ with endogenous vacancies

- Quantitatively, the value of $\varepsilon$ is critical

- With $\varepsilon = 0.5$, increase in mismatch $u$ is twice as large as baseline
Endogenous vacancies: sensitivity
## Endogenous vacancies: sensitivity

<table>
<thead>
<tr>
<th>2-digit occupation</th>
<th>$\Delta(u - u^*)$</th>
<th>$\Delta(u - u^*) / \Delta u$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline</td>
<td>0.53 ppts</td>
<td>18.9%</td>
</tr>
<tr>
<td>$\epsilon = 0.5$</td>
<td>1.16 ppts</td>
<td>41.2%</td>
</tr>
<tr>
<td>$\epsilon = 1$</td>
<td>0.88 ppts</td>
<td>31.5%</td>
</tr>
<tr>
<td>$\epsilon = 2$</td>
<td>0.70 ppts</td>
<td>25.1%</td>
</tr>
</tbody>
</table>

Patterson-Şahin-Topa-Violante, "Mismatch Unemployment in the U.K."
Conclusion and future work

- **Contribution of mismatch** to unemployment in the U.K.
  - Mismatch explains about 1/3 of rise in unemployment
  - Unlike the U.S., mismatch is on the rise again
Comparison to the U.S.

- More gradual increase and decline of mismatch in the U.S.
- Mismatch has been increasing again in the U.K. since 2011
Conclusion and future work

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• **Structural equilibrium** models
  - Sources of mismatch? Skill specificity, wage rigidity, policy, ...