Housing and the Labor Market: Time to Move and Aggregate Unemployment

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search class
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Motivation

- How do relocation frictions and commuting costs affect:
  - Job acceptance decisions?
  - Unemployment?
  - Job creation?
Application

- Accounting for unemployment rates across countries:
This Paper

- Job acceptance depends crucially on commuting time/costs and housing frictions.
  - Strategy depends on distance.
- Low mobility
  - Job offers less attractive (difficult to relocate)
  - Might commute longer distances
    - High commuting costs an obstacle
Findings

- Low mobility, higher benefits and commute costs
  - More job offers rejected
  - Shorter commute times
  - Higher unemployment
  - Longer unemployment duration
  - Fewer vacancies are created
Quantitative findings

- Taxes and benefits
  - Account for about 1/2 of the differences in unemployment.
  - Can not explain mobility differences.

- Adding commute costs and frictions:
  - With low commute costs, housing frictions not that important.
  - With high commute costs, housing frictions play a large role.

- Can account for high unemployment and low mobility in Europe relative to the U.S.
Mobility Facts

Big difference in mobility rates for the U.S. and E.U.:

<table>
<thead>
<tr>
<th></th>
<th>US</th>
<th>Europe</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total</strong></td>
<td>15.5%</td>
<td>4.95%</td>
</tr>
<tr>
<td>Employed workers</td>
<td>17.1%</td>
<td>5.38%</td>
</tr>
<tr>
<td>Unemployed workers</td>
<td>25.2%</td>
<td>10.94%</td>
</tr>
<tr>
<td>Out of labor force</td>
<td>11.3%</td>
<td>2.63%</td>
</tr>
<tr>
<td>Between counties / areas</td>
<td>42%</td>
<td>20.5%</td>
</tr>
</tbody>
</table>

### Reasons for moving

<table>
<thead>
<tr>
<th></th>
<th>US</th>
<th>EU15</th>
</tr>
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<tbody>
<tr>
<td>All pop. (1+)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Work related</td>
<td>16.2%</td>
<td></td>
</tr>
<tr>
<td>Family related</td>
<td>26.3%</td>
<td></td>
</tr>
<tr>
<td>House related</td>
<td>51.6%</td>
<td></td>
</tr>
<tr>
<td>Others</td>
<td>6.0%</td>
<td></td>
</tr>
<tr>
<td>All reasons</td>
<td>100%</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>EU15</td>
<td></td>
</tr>
<tr>
<td>Job related</td>
<td>14.3%</td>
<td></td>
</tr>
<tr>
<td>Personal Reason</td>
<td>31.3%</td>
<td></td>
</tr>
<tr>
<td>House Related</td>
<td>52.7%</td>
<td></td>
</tr>
<tr>
<td>Not Available</td>
<td>1.8%</td>
<td></td>
</tr>
<tr>
<td>All reasons</td>
<td>100%</td>
<td></td>
</tr>
</tbody>
</table>
Housing Market Regulation and Mobility

Regulation index from Djankov, et al., QJE (2003)
Importance of Commuting?

- Happiness study
  - Kahneman and Krueger, JEP, 2006
    - Day Reconstruction Study
  - 909 women in Texas
<table>
<thead>
<tr>
<th>Activity</th>
<th>Index (0-5)</th>
<th>Time (hrs/week)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex</td>
<td>4.7</td>
<td>0.2</td>
</tr>
<tr>
<td>Socialising after work</td>
<td>4.1</td>
<td>1.1</td>
</tr>
<tr>
<td>Dinner</td>
<td>4.0</td>
<td>0.8</td>
</tr>
<tr>
<td>Relaxing</td>
<td>3.9</td>
<td>2.2</td>
</tr>
<tr>
<td>Lunch</td>
<td>3.9</td>
<td>0.6</td>
</tr>
<tr>
<td>Exercising</td>
<td>3.8</td>
<td>0.2</td>
</tr>
<tr>
<td>Praying</td>
<td>3.8</td>
<td>0.5</td>
</tr>
<tr>
<td>Socialising at work</td>
<td>3.8</td>
<td>1.1</td>
</tr>
<tr>
<td>Shopping, Cooking</td>
<td>3.2</td>
<td>3.1</td>
</tr>
<tr>
<td>Computer at home</td>
<td>3.1</td>
<td>0.9</td>
</tr>
<tr>
<td>Housework</td>
<td>3.0</td>
<td>1.1</td>
</tr>
<tr>
<td>Childcare</td>
<td>3.0</td>
<td>1.1</td>
</tr>
<tr>
<td>Evening commute</td>
<td>2.8</td>
<td>0.6</td>
</tr>
<tr>
<td>Working</td>
<td>2.7</td>
<td>6.9</td>
</tr>
<tr>
<td>Morning commute</td>
<td>2.0</td>
<td>0.4</td>
</tr>
</tbody>
</table>
Environment: Simplified Model, No Family Shocks

- A dwelling: bundle of services generating utility, fixed at a particular location.
- Commuting time, $\rho$.
- Space is symmetric (isotropy): the unemployed have the same chance of finding a job wherever their current residence.
- $\rho$ will be a sufficient statistic.
Model

- Time is continuous. Individuals discount at $r > 0$. 

- Can be in one of two states: Employed or Unemployed.

- Employed
  - Receive exogenous wage $w$.
  - Face an exogenous separation rate $s$.
  - Search (for closer housing).

- Unemployed
  - Receive flow $b$.
  - Receive job offers, indexed by distance to work $\rho$.
  - Find jobs at Poisson rate $p$. 
Model

- Time is continuous. Individuals discount at $r > 0$.
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  - Receive flow $b$.
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Search with Frictions in the Housing Market

- **Unemployed:**
  - Arrival rate of job offers is Poisson with intensity $\rho$
    - Draw from commute time distribution $F(\rho)$

- **Employed**
  - Arrival rate of new housing opportunities: $\lambda_H$.
    - Distributed as $G_N(\rho)$. 
Bellman Equations

- $E(\rho)$: Value of employment at distance $\rho$.
- $U$: Value of unemployment.

\[
(r + s)E(\rho) = w - \tau \rho + sU + \lambda_H \int \max[0, (E(\rho') - E(\rho))] \, dG_N(\rho')
\]

\[
(r + p)U = b + p \int \max[U, E(\rho')] \, dF(\rho'),
\]

where $\tau \rho$ is the total commuting cost.
Reservation Strategies

- Job acceptance, moving strategies: $E$ downward sloping in $\rho$,

$$\frac{\partial E}{\partial \rho} = \frac{-\tau}{r + s + \lambda_H G_N(\rho)},$$

- $E(\rho)$ is monotonic, so a well-defined reservation strategy.
  - For those employed, $\rho^E(\rho) = \rho$.
    - Accept any housing offer that is closer.
  - For those unemployed, $E(\rho^u) = U$.
    - Accept any job offer closer than $\rho^u$. 
Reservation Strategies

- $\rho^U$ determines:
  - job acceptance $F(\rho^U)$;
  - residential mobility rate $\int \lambda_H G_N(\rho)$ over the distribution of commute distance of employed workers.
Reservation Strategies

Using the fact that $E(\rho^U) = U$,

$$b + p \int_0^{\rho^U} [E(\rho') - U] dF(\rho') = w - \tau \rho^U + \lambda_H \int_0^{\rho^U} [E(\rho') - U] dG_N(\rho').$$

Then,

$$\rho^U = \frac{w - b}{\tau} + \int_0^{\rho^U} \frac{\lambda_H G_N(\rho) - pF(\rho)}{r + s + \lambda_H G_N(\rho)} d\rho.$$

- Higher $\lambda_H$ leads to a higher acceptance rate: Easy to relocate.
Reservation Strategies

\[ F(\rho^U) : \text{equilibrium acceptance rate} \]
Equilibrium

- Higher $p$ implies lower $\rho^U$ (lower job acceptance). Workers can wait for a closer job!

- Implies a **negative link** between $\rho^U$ and labor market tightness $p$ (or $\theta = \frac{V}{U}$).
Equilibrium

- Assuming free entry of firms
  - job advertising cost, $c$;
  - output of the match, $y$;
  - $q(\theta)$ probability of the firm meeting a worker:

  $$\frac{y - w}{r + s} = \frac{c}{q(\theta)F(\rho^U)}$$

- This generates a **positive link** between $\theta$ and $F(\rho^U)$: higher job acceptance by workers makes firms more willing to post vacancies.
...Equilibrium

\[ F(\rho^U): \text{equilibrium job acceptance rate} \]

\[ \lambda_H \]

Labor demand (vacancy supply)

Reservation strategy for \( \rho^U \)

\( \theta \)
Effects of Housing Frictions

**Proposition 1**: An increase in $\lambda_H$ makes the unemployed less choosy about jobs: $\partial \rho^U / \partial \lambda_H > 0$.

**Proposition 2**: An increase in $\lambda_H$ increases job creation: $\partial \theta / \partial \lambda_H > 0$.

- Or, firms won’t create jobs where people can’t find houses!
Let $p = p(\theta) = \theta q(\theta)$, the unemployment rate is:

$$u = \frac{s}{s + p(\theta)F(\rho^U)},$$
Proposition 3: An increase in $\lambda_H$ has two effects on unemployment:

- raises the job acceptance rate of workers (through a higher threshold $\rho^U$), $\Rightarrow u \downarrow$.

- raises $\theta$ (Proposition 2) and thus job creation, $\Rightarrow u \downarrow$. 

Effects of Housing Frictions on Unemployment
...Unemployment and the Beveridge Curve

Equilibrium $\theta$

Beveridge curve

$\lambda_H$

$\theta$

$V$

$u$
Mobility Rate

- Steady-state distribution of employed workers living at a distance closer than $\rho$: $\Phi(\rho)$

$$
\Phi(\rho) = \frac{\lambda_H G_N(\rho) + pF(\rho) \frac{u}{1-u}}{\lambda_H G_N(\rho) + s} \\
= \frac{\lambda_H G_N(\rho) + \frac{F(\rho)}{F(\rho^u)} s}{\lambda_H G_N(\rho) + s} \leq 1
$$

- $\Phi$ is governed by the following law of motion:

$$
(1-u) \frac{\partial \Phi(\rho)}{\partial t} = upF(\rho) + (1-u)(1-\Phi(\rho)) \lambda_H G_N(\rho) - (1-u)\Phi(\rho) s
$$
Extension: Family Shocks

- For calibration purposes we add a “family” shock
  - Moves necessitated by marriage, divorce, children, etc.
  - Poisson arrival with parameter $\delta$
  - Draw from the existing stock of housing vacancies, $G_S(\rho)$. 
Calibration

- Time period is a month, \( r = 4\% \) annually.

- Distributions (note: incorporated a “family shock”):
  
  - \( G_S \), the stock of houses, \( G_N \), new housing offers and \( F \), job offers in terms of commute time, \( \rho \).

  - Assume \( F = G_N = 1 - e^{-\alpha \rho} \) and \( G_S = 1 - e^{-\left(\alpha/3\right) \rho} \)

  - exponential distribution (\( \alpha \)).

  - Use data on commute times to find \( \alpha \).
Calibration...Distribution of Commute Times

![Cumulative probability plot]

- **Y-axis:** Cumulative probability
- **X-axis:** Data

- Green line: commute times
- Red line: exponential fit
Calibration...Distribution of Commute Times

Table: Commute time as a fraction of total hours worked

<table>
<thead>
<tr>
<th></th>
<th>US</th>
<th>Fr</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>0.102</td>
<td>0.079</td>
</tr>
<tr>
<td>10\text{th} percentile</td>
<td>0.020</td>
<td>0.021</td>
</tr>
<tr>
<td>25\text{th} percentile</td>
<td>0.041</td>
<td>0.031</td>
</tr>
<tr>
<td><strong>Median</strong></td>
<td>0.083</td>
<td>0.063</td>
</tr>
<tr>
<td>75\text{th} percentile</td>
<td>0.125</td>
<td>0.094</td>
</tr>
<tr>
<td>90\text{th} percentile</td>
<td>0.188</td>
<td>0.167</td>
</tr>
</tbody>
</table>

- From median commute time and $\alpha = 9.77$

$$\tau = \frac{0.083/2 \times (w/y)}{\ln 2/\alpha} = 0.585$$
Calibration

- Each hour of commute time has a utility cost estimated to be half of the hourly wage of workers
  - Median commute cost: $0.083/2 \times (w/y)$
## Gas Prices

### Cost of commuting higher in Europe?

<table>
<thead>
<tr>
<th>Country</th>
<th>US$/gal.</th>
</tr>
</thead>
<tbody>
<tr>
<td>United States</td>
<td>1.80</td>
</tr>
<tr>
<td>France</td>
<td>5.60</td>
</tr>
<tr>
<td>Belgium</td>
<td>6.17</td>
</tr>
<tr>
<td>Germany</td>
<td>5.79</td>
</tr>
<tr>
<td>Italy</td>
<td>5.79</td>
</tr>
<tr>
<td>Hungary</td>
<td>7.51</td>
</tr>
<tr>
<td>Netherlands</td>
<td>6.47</td>
</tr>
<tr>
<td>Norway</td>
<td>6.09</td>
</tr>
</tbody>
</table>

Source: German Technical Corporation, 2007
More Facts

- IRS, 2007: standard mileage rate for the use of a car is:
  - 0.485$ per mile
  - 0.21 euro per kilometer

- Tax authority France (BO Impôts Janvier 2007): for less than 5000 km, **0.514 euro per kilometer** for a 6CV car (rate is progressive with power! from 0.37 to 0.67)
...Calibration

- The program then finds the parameters of the model to match:
  - Job hiring rate: \( p_F(\rho^U) = 1/2.4 \) monthly \( \implies \) unemployment duration of 2.4 months,
    - which imposes, separation rate = \( s + \text{quits} = 0.0183 \).
  - Mobility target of 17.1% annually.
  - Matching: \( p(\theta) = A\theta^{0.5} \) and \( q(\theta) = A\theta^{-0.5} \).
  - \( y = 1, \ w = 0.6 \) (exogenous), \( b = 0.25 \).
Mechanically adjust wages to account for taxes, \( t \).

Labor cost: \( w(1 + \varepsilon t) \)

Net wage: \( w(1 - (1 - \varepsilon)t) \)

Where \( \varepsilon = 0.35 \): A 10% increase in taxes increases labor cost by 3.5% and decreases net wages by 6.5%.

and \( t = 0.22 \).

Also allow benefits to affect wages directly

\( w(b) = w_{US} + (1 - \beta)(b - b_{US}) \)

Where \( \beta = 0.5 \) is the bargaining power of the worker.
Findings:

Table: U.S. Calibration

<table>
<thead>
<tr>
<th></th>
<th>Benchmark</th>
<th>Higher b</th>
<th>Higher b, tax</th>
<th>$\tau \times 1.5$</th>
<th>$\lambda_h/2.1$</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\theta_h$</td>
<td>1.000</td>
<td>0.685</td>
<td>0.268</td>
<td>0.194</td>
<td>0.186</td>
</tr>
<tr>
<td>$\rho_U$</td>
<td>0.055</td>
<td>0.051</td>
<td>0.043</td>
<td>0.036</td>
<td>0.036</td>
</tr>
<tr>
<td>Unemp</td>
<td>0.042</td>
<td>0.054</td>
<td>0.096</td>
<td>0.129</td>
<td>0.133</td>
</tr>
<tr>
<td>Un. Dur.</td>
<td>2.400</td>
<td>3.125</td>
<td>5.802</td>
<td>8.015</td>
<td>8.336</td>
</tr>
<tr>
<td>Reject</td>
<td>0.836</td>
<td>0.848</td>
<td>0.869</td>
<td>0.889</td>
<td>0.891</td>
</tr>
<tr>
<td>Mobility (x 100)</td>
<td>0.244</td>
<td>0.227</td>
<td>0.197</td>
<td>0.169</td>
<td>0.082</td>
</tr>
</tbody>
</table>

- Column 1: 24.4 corresponds to 17.7% annual rate
- Last column: .082 represents one-third of that, the EU rate.
Conclusion

- Tractable model of the labor market and housing market.
- Two “spatial” margins:
  - Commuting
  - Relocation
- Big effects if both are difficult.
- Suggests housing policy reform as well as labor market reforms.
- Future work
  - Allow for anisotropy
  - Long distance vs. short distance moves
  - Cyclical behavior
<table>
<thead>
<tr>
<th>Changes in $\beta$</th>
<th>Benchmark</th>
<th>Higher b</th>
<th>Higher b, tax</th>
<th>$\tau * 1.5$</th>
<th>$\lambda_h/2.1$</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\beta = 0.5$</td>
<td>0.042</td>
<td>0.054</td>
<td>0.0956</td>
<td>0.1272</td>
<td>0.1322</td>
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<td>$\beta = 0.4$</td>
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<td>0.054</td>
<td>0.0911</td>
<td>0.1212</td>
<td>0.1263</td>
</tr>
<tr>
<td>$\beta = 0.3$</td>
<td>0.042</td>
<td>0.054</td>
<td>0.0877</td>
<td>0.1166</td>
<td>0.1219</td>
</tr>
<tr>
<td>$\beta = 0.6$</td>
<td>0.042</td>
<td>0.054</td>
<td>0.1013</td>
<td>0.1349</td>
<td>0.1399</td>
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<tr>
<td>$\beta = 0.7$</td>
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<td>0.054</td>
<td>0.1088</td>
<td>0.1449</td>
<td>0.1499</td>
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<tr>
<td>Changes in $\epsilon$</td>
<td></td>
<td></td>
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<tr>
<td>$\epsilon = 0.15$</td>
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<td>0.0597</td>
<td>0.1475</td>
<td>0.197</td>
<td>0.2026</td>
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<td>0.0564</td>
<td>0.1124</td>
<td>0.1498</td>
<td>0.1551</td>
</tr>
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<td>$\epsilon = 0.35$</td>
<td>0.042</td>
<td>0.054</td>
<td>0.0956</td>
<td>0.1272</td>
<td>0.1322</td>
</tr>
<tr>
<td>$\epsilon = 0.45$</td>
<td>0.042</td>
<td>0.0522</td>
<td>0.0861</td>
<td>0.1143</td>
<td>0.1193</td>
</tr>
<tr>
<td>$\epsilon = 0.55$</td>
<td>0.042</td>
<td>0.051</td>
<td>0.0805</td>
<td>0.1068</td>
<td>0.1118</td>
</tr>
<tr>
<td>Changes in $\alpha$</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>$\alpha = 9.77$</td>
<td>0.042</td>
<td>0.054</td>
<td>0.0956</td>
<td>0.1272</td>
<td>0.1322</td>
</tr>
<tr>
<td>$\alpha = 11$</td>
<td>0.042</td>
<td>0.0539</td>
<td>0.0953</td>
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<td>0.1317</td>
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<tr>
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<td>0.095</td>
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<td>0.1309</td>
</tr>
<tr>
<td>$\alpha = 9$</td>
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<td>0.054</td>
<td>0.0957</td>
<td>0.1275</td>
<td>0.1325</td>
</tr>
<tr>
<td>$\alpha = 7$</td>
<td>0.042</td>
<td>0.0541</td>
<td>0.0961</td>
<td>0.1282</td>
<td>0.1334</td>
</tr>
</tbody>
</table>