The Return to Big City Experience: Evidence from Danish Refugees

Fabian Eckert, Mads Hejlesen, Conor Walsh

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Yale University, Aarhus University
Outline

Introduction

The Danish Refugee Program of 1986-1998 and Data

Documenting The Treatment Effect

Mechanisms

Sorting in a Spatial Model of Earnings Dynamics
• **Urban wage premium**: Workers earn higher wages in cities even after controlling for observables
  - Is the urban wage premium only due to selection across areas?
  - If not, which mechanisms explain the urban wage premium?

• **Problem**: Hard to pin down premium and mechanisms due to endogeneity of location choice

• **This Paper**: Combine Danish administrative data & natural experiment to study the anatomy of the urban wage premium for a particular population
Outline of the Paper

1. Document the causal effect on wage growth of assignment to a big city using a natural experiment from 1986-1998
   • 20,000 refugees quasi-randomly assigned to Danish municipalities
   • Assignment to a big city led to a causal difference of 0.8% per year of experience in hourly wages, 2.1% for earnings

2. Use rich administrative data to provide evidence on mechanisms driving the premium
   • Establishment and occupation sorting explains 60% of the difference

3. Quantify contribution of sorting on unobserved ability
   • Natural experiment identifies key model parameter
   • Sorting within cities important in explaining observed patterns
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The Danish Refugee Program of 1986-1998

• Goal: Assign refugees to municipalities proportionally to local population size
• Quasi-random assignment conditioning on information available to the council officer through a questionnaire:
  • Age, number of children, marital status, nationality
• Eligible for Danish social security and specialized programs
• Assisted in finding permanent housing
• Danish classes
• Eligible to work immediately upon assignment

Used before Damm & Dustmann (2014), Damm (2009)
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Note: Statistics are males only. Married is an indicator taking value 1 if the individual is married. Missing education, 10 years of education, 12 years of education, and ≥ 12 years of education are all indicator variables.
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Commuting Zones of Denmark 1986
Persistence of Initial Assignment by Education Groups

![Graph showing persistence of initial assignment by education groups over years in Denmark.](image-url)
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Sorting in a Spatial Model of Earnings Dynamics
The Treatment Effect of Initial Assignment

• We stratify the sample by location of initial assignment, and follow refugees over time

• **Document:** The causal effect of initial assignment to a big city on
  1. Wage- and earnings-experience profiles
  2. Extensive margin of labour supply

• **Interpretation:** The causal effect of initial assignment to a big city on population-level labor market outcomes
We estimate a simple linear model by initial assignment where:

- $y_{it}$ is log hourly wages or earnings
- $\mu_t$ is time fixed effects
- $\text{Exp}_{it}$ is the number of years of experience
- $\text{InitCop}_i$ is a dummy for initially allocated to Copenhagen
- $X_{it}$ is a vector of individual assignment variables: nationality, married at assignment, age at assignment, children at assignment

Map to static ($\beta_2$) and dynamic premia ($\beta_3$) in this linear setting.

Non-parametric results very similar.
• We estimate a simple linear model by initial assignment

\[ y_{it} = \mu_t + \beta_1 \text{Exp}_{it} + \beta_2 \text{InitCop}_i + \beta_3 (\text{InitCop}_i \times \text{Exp}_{it}) + \mathbf{X}_{it}'\mathbf{\theta} + \epsilon_{it} \]

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Wage- & Earnings-Experience Profiles by Initial Assignment

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<td>0.0186***</td>
<td>0.0261***</td>
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<td></td>
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<td>(0.00303)</td>
<td>(0.00330)</td>
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<td>Observations</td>
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<td>39,408</td>
<td>107,297</td>
<td>63,870</td>
<td>43,427</td>
</tr>
<tr>
<td><strong>R&lt;sup&gt;2&lt;/sup&gt;</strong></td>
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<td>0.062</td>
<td>0.055</td>
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## Wage- & Earnings-Experience Profiles by Initial Assignment

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<tr>
<th></th>
<th>(1) ( \logwage_{it} )</th>
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<th>(3) ( \logwage_{it} )</th>
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<td>0.0784*** (0.00370)</td>
<td>0.0750*** (0.00341)</td>
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<td>-0.104*** (0.0237)</td>
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<tr>
<td>( InitCph_i \times ) ( Exp_{it} )</td>
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<td>0.00736*** (0.00163)</td>
<td>0.00813*** (0.00134)</td>
<td>0.0214*** (0.00303)</td>
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### Extensive Margin of Labour Supply

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<tr>
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<th>(1) $neveremployed_i$</th>
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<td></td>
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<td>Cohort FE</td>
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Sorting in a Spatial Model of Earnings Dynamics
What is Driving the Dynamic Urban Wage Premium?

We consider the following channels to explain the dynamic urban wage premium:

1. More experience at high-wage establishments
2. Differential sorting into occupations
3. Differential take-up of education
4. Differential aggregate wage trends
5. Effects of ethnic enclaves
6. Selection into labour force
What is Driving the Dynamic Urban Wage Premium?

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1. More experience at high-wage establishments ✓
2. Differential sorting into occupations ✓
3. Differential take-up of education X
4. Differential aggregate wage trends X
5. Effects of ethnic enclaves X
6. Selection into labour force X
Accumulation of Experience at High-Wage Establishments

![Graph showing accumulation of experience at high-wage establishments. The graph compares Years of High-Wage Experience with Years of Experience, distinguishing between CPH and Non-CPH categories. The graph indicates a trend where CPH experiences a higher increase in Years of High-Wage Experience compared to Non-CPH.](image-url)
Differential Sorting into Occupations by Initial Allocation

Years of Experience

- CPH
- NCPH

CPH: High Skill, Manual, Low Skill
NCPH: High Skill, Manual, Low Skill

Years of Experience:
- 5
- 10
- 15
## High-Wage Establishment Experience & Occupational Ladder

<table>
<thead>
<tr>
<th></th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
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<td>$\log wage_{it}$</td>
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<tr>
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<td>(0.00159)</td>
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<tr>
<td>$HighExp_{it}$</td>
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<td>0.0259***</td>
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<td>0.0225***</td>
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<td>(0.00121)</td>
<td>(0.00124)</td>
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<td>0.00597</td>
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<td>$InitCph_i \times Exp_{it}$</td>
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<td>0.00566***</td>
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<td>0.00278*</td>
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<td></td>
<td>(0.00163)</td>
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<tr>
<td>Observations</td>
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<td>48,183</td>
<td>44,135</td>
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<tr>
<td>$R^2$</td>
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<td>0.137</td>
<td>0.188</td>
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<tr>
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<td>Industry FE</td>
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Outline

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Mechanisms

Sorting in a Spatial Model of Earnings Dynamics
Motivation for Spatial Model to Understand Sorting Within Cities

- Want to understand contribution of sorting *within* cities on unobserved ability in driving these patterns.

- At least three reasons why such sorting could matter:
  1. Who gets experience *at all* may differ fundamentally within a city and without, even with identical populations in both locations.
  2. Correlation between type and working at certain establishments/occupations.
  3. Complementarities between worker type and establishment type.

- Estimate a spatial model with unobserved heterogeneity to quantify role of sorting following Baum-Snow & Pavan (2012).
Ingredients of Model

• **Agents**:
  - Two types of refugees, ability $h = \{H, L\}$
  - Either work or receive unemployment benefit
  - Receive random job offers at the beginning of each period

• **Locations**:
  - Copenhagen and remainder, $j = \{CPH, NCPH\}$
  - Agents dropped in a random location at year 0
  - Agents can change locations each period subject to frictions

• **Earnings** driven by:
  - Establishment productivity
  - Experience
  - Individual ability (unobserved to econometrician)
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- **Earnings** driven by:
  - Establishment productivity
  - Experience
  - Individual ability (unobserved to econometrician)
Earnings and Value Functions

- The wage earned by a type $h$ worker, conditional on having a job at a establishment of type $f$ is given by:

$$w_h \sim Gumbel(0, \sigma)$$

- Value of starting in a location with a job given by:

$$\bar{U}_{Et}(j, h, x, f) = \delta_{hj} \bar{V}_{UE}(j, h, x, f) + (1 - \delta_{hj}) \left[ (1 - \lambda_{hj}) E_u \max \left\{ \bar{V}_{E}(j, h, x, f|u), \bar{V}_{UE}(j, h, x, f) \right\} + \lambda_{hj} E_u, u \max \left\{ \bar{V}_{E}(j, h, x, f|u'), \bar{V}_{UE}(j, h, x, f), \bar{V}_{E}(j, h, x, f'|u') \right\} \right]$$

where $\lambda_{hj}$ is the probability of receiving an offer from type $f$ and $\delta_{hj}$ denotes the job destruction probability.
Earnings and Value Functions

- The wage earned by a type $h$ worker, conditional on having a job at a establishment of type $f$ is given by:

$$\ln w_j(h, x, f) = \bar{w} + \theta^h + \psi_f + \Phi^{h,f} + \sum_f \beta^{h,f}_1 x_f + \beta_2 \left( \sum_f x_f \right)^2 + u$$

where $u$ is a match specific structural error, $\sim \text{Gumbel}(0, \sigma)$
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  where $u$ is a match specific structural error, $iid \sim Gumbel(0, \sigma)$

- Value of starting in a location with a job given by:

  $$\bar{U}^E_t(j, h, x, f) = \delta^h_j \bar{V}^{UE}_t(j, h, x)$$

  $$+ (1 - \delta^h_j) \left[ (1 - \lambda^{h,f'}) \mathbb{E}_{u} \max \{ \bar{V}^E_t(j, h, x, f | u), \bar{V}^{UE}_t(j, h, x) \} 

  + \lambda^{h,f'} \mathbb{E}_{u,u'} \max \{ \bar{V}^E_t(j, h, x, f | u), \bar{V}^{UE}_t(j, h, x), \bar{V}^E_t(j, h, x, f' | u') \} \right]$$

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$$+ (1 - \delta^h_j) \left[ (1 - \lambda_j^{h,f'}) \mathbb{E}_u \max \{ \bar{V}_t^E(j, h, x, f | u), \bar{V}_{t,UE}^E(j, h, x) \} \right.$$  

$$+ \lambda_j^{h,f'} \mathbb{E}_{u,u'} \max \{ \bar{V}_t^E(j, h, x, f | u), \bar{V}_{t,UE}^E(j, h, x), \bar{V}_t^E(j, h, x, f' | u') \} \right]$$

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$$\bar{U}_t^E(j, h, x, f) = \delta_j^h \bar{V}_t^{UE}(j, h, x) + (1 - \delta_j^h) \left[ (1 - \lambda_j^{h,f'}) \mathbb{E}_u \max\{ \bar{V}_t^{E}(j, h, x, f \mid u), \bar{V}_t^{UE}(j, h, x) \} + \lambda_j^{h,f'} \mathbb{E}_{u,u'} \max\{ \bar{V}_t^{E}(j, h, x, f \mid u), \bar{V}_t^{UE}(j, h, x), \bar{V}_t^{E}(j, h, x, f' \mid u') \} \right]$$

where $\lambda_j^{h,f}$ is the probability of receiving an offer from type $f$ and $\delta_j^h$ denotes the job destruction probability
Treatment Decomposition

![Bar chart showing relative effects of different components: Baseline, Mobility, Exp. Coeffs, No Complementarities. Baseline has the highest effect, followed by Exp. Coeffs, and then Mobility. No Complementarities has the lowest effect.]
Summary of the Paper

- **Contribution:** First paper to use a natural experiment to study the anatomy of the urban wage premium
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- **Setting:** Danish refugee dispersal policy from 1986-1998
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- **Contribution:** First paper to use a natural experiment to study the anatomy of the urban wage premium

- **Setting:** Danish refugee dispersal policy from 1986-1998

- **Key results:**
  1. Causal big city experience premium of 0.8% in hourly wage and 2.1% in earnings
  2. 60% of dynamic premium can be explained by experience at high-wage establishments and high-skill occupations
  3. Structural decomposition suggests effect of assignment to cities depends crucially on unobserved types
Appendix
# Initial Years of Education - Balancing Tests

<table>
<thead>
<tr>
<th></th>
<th>( yearseduc_i )</th>
<th>( yearseduc_{i} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>CPH</td>
<td>0.164***</td>
<td>0.0980</td>
</tr>
<tr>
<td></td>
<td>(0.0491)</td>
<td>(0.0571)</td>
</tr>
<tr>
<td>Married</td>
<td>0.213***</td>
<td>0.145*</td>
</tr>
<tr>
<td></td>
<td>(0.0617)</td>
<td>(0.0691)</td>
</tr>
<tr>
<td>No. of children</td>
<td>-0.121***</td>
<td>-0.0549*</td>
</tr>
<tr>
<td></td>
<td>(0.0218)</td>
<td>(0.0247)</td>
</tr>
<tr>
<td>Age</td>
<td>0.431***</td>
<td>0.233***</td>
</tr>
<tr>
<td></td>
<td>(0.0191)</td>
<td>(0.0243)</td>
</tr>
<tr>
<td>Constant</td>
<td>5.046***</td>
<td>9.434***</td>
</tr>
<tr>
<td></td>
<td>(0.369)</td>
<td>(0.482)</td>
</tr>
</tbody>
</table>

| Observations | 11,812 | 7,386 |
| Sample       | All    | Educ≥12 |

Individuals with missing education information are dropped from the regression. Robust standard errors clustered at the level of initial commuting zone. Standard errors in parentheses. * p<0.05, ** p<0.01, *** p<0.001.
Aggregate Hourly Wage Trends - CPH and NCPH

<table>
<thead>
<tr>
<th>Year</th>
<th>CPH</th>
<th>NCPH</th>
</tr>
</thead>
<tbody>
<tr>
<td>1986</td>
<td>4.6</td>
<td>4.8</td>
</tr>
<tr>
<td>1992</td>
<td>5</td>
<td>5.2</td>
</tr>
<tr>
<td>1998</td>
<td>5.4</td>
<td>5.6</td>
</tr>
<tr>
<td>2004</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2010</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Differential Take-up of Education

- CPH
- NCPH

Categories:
- +6 years
- +4 years
- +2 years
- 0 years
Occupation Distribution of Natives

![Occupation Distribution of Natives](image)

Years of Experience:
- 5
- 10
- 15

Occupations:
- High Skill
- Manual
- Low Skill

Legend:
- Orange: High Skill
- Light Gray: Manual
- Blue: Low Skill
Non-Parametric Differential Return to Experience - Wages

Log Points

Three Year Experience Bins
Earnings and Value Functions

- The wage earned by a type $h$ worker, conditional on having a job at an establishment of type $f$, is given by:

$$\ln w_j(h, x, f) = \bar{w} + \theta h + \psi f + \Phi h f + \sum_f \beta h f x f + \beta_2 (\sum_f x f)^2 + u$$

where $u$ is a match-specific structural error, iid $\sim$ Gumbel $(0, \sigma)$.

- Each period workers receive random location preference shocks $\eta$, iid $\sim$ Gumbel $(0, \kappa)$, which induce a desire to move at a utility cost $\tau$.

- Value for working given by:

$$V_{E_j}(h, x, f, t|u, \eta_j, \eta_j') = a_j + \ln w(\cdot) + \rho \max_j, j' \{\bar{U}_{E_j}(h, x + 1, f, t + 1) + \eta_j, \bar{U}_{E_j'}(h, x, t + 1) - \tau + \eta_j'\}$$

where $\bar{U}_{E_j}(\cdot)$ is the value function for $E$ prior to labor market shocks realizing, likewise for $UE$. 
The wage earned by a type $h$ worker, conditional on having a job at a establishment of type $f$ is given by

$$\ln w_j(h, x, f) = \bar{w} + \theta^h + \psi^f + \Phi^{h,f} + \sum_f \beta_1^{h,f} x_f + \beta_2 \left( \sum_f x_f \right)^2 + u$$

where $u$ is a match specific structural error, $\sim Gumbel(0, \sigma)$
Earnings and Value Functions

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• Each period workers receive random location preference shocks $\eta \sim Gumbel(0, \kappa)$: induces desire to move at a utility cost $\tau$

• Value for working given by

$$V_j^E(h, x, f, t | u, \eta_j, \eta_{j'}) = a_j + \ln w(\cdot) + \rho \max_{j, j'} \{ \bar{U}_j^E(h, x + 1, f, t + 1) + \eta_j, \bar{U}_{j'}^{UE}(h, x, t + 1) - \tau + \eta_{j'} \}$$

here $\bar{U}_j^E(\cdot)$ is the value function for $E$ prior to labor market shocks realizing, likewise for $UE$
In a location, worker receives random job offers from different establishment types. The probability of receiving an offer from type $f$ is given by $\lambda_{h,j}$. The probability of exogenous job destruction is denoted by $\delta_{h,j}$. Value of starting in a location with a job given by:

$$\bar{U}_E(t)(j,h,x,f) = \delta_{h,j}\bar{V}_U(t)(j,h,x) + (1 - \delta_{h,j})\left[ (1 - \lambda_{h,f})\mathbb{E}_{u_{max}}\{\bar{V}_U(t)(j,h,x,f)|u\}, \bar{V}_U(t)(j,h,x) \} + \lambda_{h,f}\mathbb{E}_{u_{max}}\{\bar{V}_U(t)(j,h,x,f)|u'\} \right]$$

Gumbel assumption on $u$ allows use to solve for these in closed form.
• In a location, worker receives random job offers from different establishment types
  - The probability of receiving an offer from type \( f \) is given by \( \lambda_{h,f} \)
  - The probability of exogenous job destruction is denoted by \( \delta_{h,j} \)
• In a location, worker receives random job offers from different establishment types
  • The probability of receiving an offer from type $f$ is given by $\lambda^h\,_{f\,j}$
  • The probability of exogenous job destruction is denoted by $\delta^h\,_{j}$

• Value of starting in a location with a job given by:

$$\bar{U}^E_t (j, h, x, f) = \delta^h\,_{j} \bar{V}^E_t (j, h, x)$$

$$+ (1 - \delta^h\,_{j}) \left[ (1 - \lambda^h\,_{f\,j}^\prime) E_u \max \{ \bar{V}^E_t (j, h, x, f | u), \bar{V}^E_t (j, h, x) \} \right]$$

$$+ \lambda^h\,_{f\,j}^\prime E_{u,u'} \max \{ \bar{V}^E_t (j, h, x, f | u), \bar{V}^E_t (j, h, x), \bar{V}^E_t (j, h, x, f' | u') \}$$
• In a location, worker receives random job offers from different establishment types
  • The probability of receiving an offer from type $f$ is given by $\lambda_{j}^{h,f}$
  • The probability of exogenous job destruction is denoted by $\delta_{j}^{h}$

• Value of starting in a location with a job given by:
  $$\bar{U}_{t}^{E}(j, h, x, f) = \delta_{j}^{h} \bar{V}_{t}^{UE}(j, h, x)$$
  $$+ (1 - \delta_{j}^{h}) \left[ (1 - \lambda_{j}^{h,f'}) \mathbb{E}_u \max\{ \bar{V}_{t}^{E}(j, h, x, f | u), \bar{V}_{t}^{UE}(j, h, x) \} ight.$$ 
  $$+ \lambda_{j}^{h,f'} \mathbb{E}_{u,u'} \max\{ \bar{V}_{t}^{E}(j, h, x, f | u), \bar{V}_{t}^{UE}(j, h, x), \bar{V}_{t}^{E}(j, h, x, f' | u') \} \right]$$

• Gumbel assumption on $u$ allows use to solve for these in closed form
Maximum Likelihood Estimation

- Likelihood of observing a sequence of wages and transitions, given unobserved type \( h \) and parameter vector \( \theta \) by

\[
P(Y^i| h; \theta) = P(Y_1^i | h; \theta) \prod_{t=w}^{T} P(Y_t^i | Y_{t-1}^i, h; \theta)
\]
Maximum Likelihood Estimation

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- Solve the model backwards and derive closed form joint location and labor market transition probabilities
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\]

• Solve the model backwards and derive closed form joint location and labor market transition probabilities

• An individual’s contribution to the overall likelihood function is given by weighted average across unobserved types

\[
L(\theta) = \chi_L P(Y^i|L, \theta) + (1 - \chi_L) P(Y^i|H, \theta)
\]
Model Fit - Actual and Simulated Moving Profiles

Fraction Never Moved vs. Years in Denmark

- CPH
- S-CPH
- NCPH
- S-NCPH
Model Fit - Actual and Simulated Wage Densities

[Graph showing wage densities for Data, Sim-hL, and Sim-hH across different log hourly wages.]
Model Fit - Wage-Experience Profiles

![Graph showing mean log hourly wage against years of experience for different categories: CPH, NCPH, S-CPH, S-NCPH. The graph indicates trends in wage growth and plateaus for each category.](image-url)
Treatment Decomposition - Sequential

Relative Effect

Baseline Mobility Exp. Coeffs No Complementarities