CHARACTERIZING WORK, DISABILITY IN WORK: A MULTI-STATE APPROACH

PRELIMINARY WORK

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Aims

Project Premise: Cumulative effects of work over the life course may be as important as decisions around the time of retirement

- Calculating transitions rates between various states of work and disability across working life.

- Characterize common trajectories between work and disability in a cohort of workers.

- Identify differences in trajectories across socio-demographic and health characteristics.

- Test associations between work trajectories and retirement patterns
Background

• While a number of factors have resulted in longer work-life, disability claims are also rising at all ages (Autor and Duggan, 2006, 2008)

• Transitions into short and long-term disability is associated with:
  • Loss of lifetime earnings (Breslin et al. 1999)
  • Increased medical cost (Sears et al. 2012)
  • Family disruption (Eriksen 1999)
  • Psychological distress (Bultmann 2002)

• Little known about the transitions in and out of disability in individual’s working life
Stanford-Yale Alcoa Data Vault

**Workplace Safety & Environment**
- Injury experience
- Hygienius workplace samples
- Job Demand Survey
- Production/Quantity & Quality by month
- Community Health Indices (Census/BRFSS)
- Employee Engagement Survey

**Financial**
- Payroll (hours)
- W-2’s
- 401K and Pension
- Housing Values
- Links to SSA-household earnings, life-work and disability

**Health**
- OHM: Cardiovascular data, PFTS, Audiometry, and Workplace Medical Surveillance Files
- Medical Claims Files
- EAP (roll-up by plant)
- Disability claims
- Injury Management System
- Medicare Claims linked to work-life claims
- Death - NDI
- Health Risk Scores

**Demographic Data**
- SSN – Childhood Locale
- Geocoded addresses
- Human Resources
- Dependent Information
Location of large Alcoa plants

Plant Size, Number of Employees

- 125-249
- 250-499
- 500-999
- 1000+
Data and Sample

  - Daily data → monthly states
  - 5 states: Regular work, STD, LTD, On Leave, Terminated (Left Alcoa)
Data and Sample

  • Daily data → monthly states
  • 5 states: Regular work, STD, LTD, On Leave, Terminated (Left Alcoa)

• Whole Sample: 26 plants
  • N= 42,146 workers
  • N= 2+ million worker-time observations

• Covariate sample: 14 plants
  • N= 16,148 workers
State Definitions

- **STD**
  - Alcoa administrative code
  - Up to 6 months of coverage with medical proof
- **LTD**
  - Alcoa administrative code
  - Up to 5 year coverage
  - Must be “fully disabled”/applied to SSDI
- **Leave**
  - Includes FMLA, military leave, union leave, work probation, etc.
- **Terminate**
- **Retire**
  - Some data from data
  - Some data from pension files
  - Awaiting SSA data linkages
Multiple Transitions across States Are Possible

- Regular Work
- STD
- LTD
- On Leave
- Terminate
- Retire
Measures of Demographics, Health and Job Conditions

• **Demographic Characteristics**
  • Self-reported Race, Ethnicity, Age, Sex
  • Marital Status, Children under 6

• **Health Characteristics**
  • Incidence of Asthma, Depression, Diabetes, Hypertension, IHD
  • Risk Score

• **Job Characteristics**
  • Plant location
  • Hourly/Salaried
  • Hourly wage/W2
  • Job Exposures and Job Demand
Data Limitations

- No measure of work-status and income post-Alcoa*
- No measure of spouse working status
- No measure of household income
- No measure of SSDI claiming
Empirical Strategy

• Calculate transition rates
  • Transition rates calculated monthly/yearly/total
  • Model predicting probability of state j conditional on state i
  • By sex, age less than 40/40+
Empirical Strategy

• Calculate transition rates
  • Transition rates calculated weekly
  • Model predicting probability of state j conditional on state i
  • By sex, age less than 40/40+

• Use sequence and cluster analysis to build trajectories of work and disability.
Empirical Strategy

- Calculate transition rates
  - Transition rates calculated weekly
  - Model predicting probability of state j conditional on state i
  - By sex, age less than 40/40+

- Use sequence and cluster analysis to build trajectories of work and disability.

- Model early retirement as a function of work trajectory
# Cohort Characteristics

<table>
<thead>
<tr>
<th>N = 42,160</th>
<th>%</th>
<th>Risk Score</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Gender</strong></td>
<td></td>
<td><strong>Risk Score</strong></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>82.2</td>
<td>0-1</td>
<td>64.6</td>
</tr>
<tr>
<td><strong>Race/Ethnicity</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>White</td>
<td>82.3</td>
<td>1-2</td>
<td>26.0</td>
</tr>
<tr>
<td>Black</td>
<td>8.3</td>
<td>2-3</td>
<td>6.4</td>
</tr>
<tr>
<td>Hispanic</td>
<td>6.3</td>
<td>3-4</td>
<td>2.0</td>
</tr>
<tr>
<td>Asian</td>
<td>2.2</td>
<td>4-6</td>
<td>0.98</td>
</tr>
<tr>
<td><strong>Chronic Disease</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>0.8</td>
<td>COPD/Asthma</td>
<td>3.4</td>
</tr>
<tr>
<td><strong>Employee Type</strong></td>
<td></td>
<td>Depression</td>
<td>3.4</td>
</tr>
<tr>
<td>Hourly</td>
<td>76.6</td>
<td>Diabetes</td>
<td>6.1</td>
</tr>
<tr>
<td><strong>Median Age</strong></td>
<td></td>
<td>Hypertension</td>
<td>20.0</td>
</tr>
<tr>
<td>Median Annual Salary</td>
<td>$53,312</td>
<td>IHD</td>
<td>3.1</td>
</tr>
</tbody>
</table>
Part 1: Transition Rates
Probability of Entering Short Term Disability From Regular Work in a Year

Transition Probability

Age (Years)
Probability of Entering Long Term Disability From Regular Work in a Year

![Graph showing the probability of entering long term disability from regular work in a year. The x-axis represents age (years) ranging from 20 to 60, and the y-axis represents transition probability ranging from 0.001 to 0.004. The graph shows an increasing trend with age.]
Probability of Going From Short Term Disability to Regular Work in a Year

Transition Probability

Age (Years)
Probability of Going From Long Term Disability to Regular Work in a Year

![Graph showing transition probability over age](image-url)
Part 2: Characterizing common trajectories of work and disability

• What are the most common trajectories of work and disability?

• How, if at all, do demographics, health and job characteristics differ across the individuals in these different trajectories?
Methodology: Sequence Analysis

Goal: Create Groupings of workers based on similar work/disability/leave trajectories

Comparison. Using distance measures to determine (dis)similarity

Grouping. Similar sequences are grouped using cluster analysis or multidimensional scaling (Elzinger’s Longest Common Sequence)

Application. Use the grouped sequences as dependent or independent variables in standard analysis (regression, survival analysis, etc...
Sequence Distribution Plot

- Leave
- LTD
- OL
- Retire
- STD
- Unhired
- Work
Methodology: Sequence Analysis

Results: 10 clusters of workers with similar trajectories

4 typologies
Identifying typologies: “Continuous Work”

68.8% (N=11,111) of the sample stays continuously employed (and/or leave Alcoa for other reasons) through sample period.
Identifying typologies: “Minor STD”

1. WORK → STD → WORK
   - (7.5%)

2. WORK → STD → WORK → TERM
   - (6.0%)

3. WORK → STD → WORK → STD → WORK
   - (3.2%)
Identifying typologies: “Disruptive”

( 3.9% )

( 3.9% )

( 3.1% )
Identifying typologies: “LTD”

WORK → LTD → WORK (1.6%)

WORK → LTD → WORK → TERM (2.0%)
Demographics differ across trajectory groups (Relative to continuous work group)

<table>
<thead>
<tr>
<th>LTD</th>
<th>Age</th>
<th>Tenure</th>
<th>Hourly</th>
<th>Male</th>
<th>Health</th>
</tr>
</thead>
<tbody>
<tr>
<td>STD (minor)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>STD (disruptive)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cluster Medoids</td>
<td>Continuous Work</td>
<td>Minor STD</td>
<td>Disruptive</td>
<td>LTD</td>
<td></td>
</tr>
<tr>
<td>-----------------</td>
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<td></td>
</tr>
<tr>
<td></td>
<td>1 15</td>
<td>121121512121</td>
<td>15121121</td>
<td>131</td>
<td></td>
</tr>
<tr>
<td>N</td>
<td>13,533 15,475</td>
<td>3,162 2,530 1,349</td>
<td>1,644 1,641 1,307</td>
<td>675 843</td>
<td></td>
</tr>
<tr>
<td>Disability States</td>
<td></td>
<td>100.0% 100.0% 100.0%</td>
<td>100.0% 100.0% 100.0%</td>
<td>5.6% 1.9%</td>
<td></td>
</tr>
<tr>
<td>Short Term Disability</td>
<td>0.0% 0.0%</td>
<td>0.9% 1.3% 2.9%</td>
<td>6.2% 3.8% 2.5%</td>
<td>100.0% 100.0%</td>
<td></td>
</tr>
<tr>
<td>Long Term Disability</td>
<td>0.0% 0.0%</td>
<td>37 38 39</td>
<td>40 41 40</td>
<td>40 41</td>
<td></td>
</tr>
<tr>
<td>Age (January 2007)</td>
<td>35 35</td>
<td>75.1% 78.4% 75.4%</td>
<td>70.3% 73.8% 75.4%</td>
<td>81.5% 86.8%</td>
<td></td>
</tr>
<tr>
<td>% Male</td>
<td>84.8% 80.8%</td>
<td>84.8% 78.5% 85.4%</td>
<td>75.1% 78.4% 75.4%</td>
<td>81.5% 86.8%</td>
<td></td>
</tr>
<tr>
<td>% White</td>
<td>85.3% 76.8%</td>
<td>82.6% 73.9% 82.9%</td>
<td>70.3% 73.8% 75.4%</td>
<td>57.4% 60.0%</td>
<td></td>
</tr>
<tr>
<td>Risk Score</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average Max Risk</td>
<td>1.00 0.84</td>
<td>1.75 2.12 2.23</td>
<td>2.77 2.74 2.99</td>
<td>1.42 1.23</td>
<td></td>
</tr>
<tr>
<td>Average Min Risk</td>
<td>0.46 0.53</td>
<td>0.54 0.74 0.51</td>
<td>0.82 0.64 0.67</td>
<td>0.63 0.43</td>
<td></td>
</tr>
<tr>
<td>% Hourly Worker</td>
<td>69.5% 69.7%</td>
<td>89.6% 82.8% 94.0%</td>
<td>90.4% 94.8% 96.3%</td>
<td>81.8% 89.4%</td>
<td></td>
</tr>
<tr>
<td>Average Hourly Wage</td>
<td>18.31 17.31</td>
<td>17.48 16.86 17.25</td>
<td>16.67 17.01 17.13</td>
<td>16.18 16.67</td>
<td></td>
</tr>
<tr>
<td>Median W2</td>
<td>55,420 34,910</td>
<td>52,430 37,120 51,390</td>
<td>36,080 48,870 47,760</td>
<td>35,800 52,250</td>
<td></td>
</tr>
</tbody>
</table>

1- Regular work, 2=STD, 3=LTD, 4=On Leave 5= Terminate
Are work typologies associated with early retirement?

- Early retirement: Retire at no or partial retirement eligibility
- Typologies are grouped into 4 broad categories: Continuous work, minor STD, disruptive, LTD
- Caveat: Pension eligibility code poorly coded in data
- SSA linkages pending
Are work typologies associated with early retirement?

<table>
<thead>
<tr>
<th>Early Retirement</th>
<th>Typology: LTD</th>
<th>Typology: Minor STD</th>
<th>Typology: Disruptive</th>
<th>Continuous Work</th>
</tr>
</thead>
<tbody>
<tr>
<td>Early Retirement</td>
<td>1.03</td>
<td>0.97</td>
<td>1.16</td>
<td>1.00</td>
</tr>
</tbody>
</table>

Early retirement defined as partially or not pension eligible. Controlled for: Sex, hourly/salary, chronic disease, risk score, marital status, W2 income.

Bold numbers statistically significant at p<0.10

Early Retirement N= 958
Summary

• There are a number of disparate work/disability transitions and trajectories; some very disruptive

• Small differences across socio-demographic characteristics, larger difference across health

• Suggestive evidence of selection in and out of Alcoa and certain jobs

• Suggestive evidence that disruptive work trajectories may be associated with early retirement

• 40% of U.S. workers have jobs that require some physical demand (Johnson, 2004)
Next steps

• Estimate and model duration between states and transitions

• Model dynamics in changes in health and work exposures

• Explore transitions between jobs within Alcoa

• Link to Social Security Administration data to refine retirement status
Thanks to:
Sepideh Modrek
Sloan Foundation Working Longer

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Data Limitations

- No measure of work-status and income post-Alcoa
- No measure of spouse working status
- No measure of household income
- No measure of SSDI claiming
Characterizing common trajectories of work and disability

- What are the most common trajectories of work and disability? How, if at all, do demographics differ across the individuals in these different trajectories?

- 68.8% (N=11,111) of the sample stays continuously employed (and/or leave Alcoa for other reasons) through sample period.
For example, for the sequences 1 2 3 2 5 and 1 4 5, the Jaccard similarity between them would be 2/5, since their intersection is \{1, 5\} and their union is \{1, 2, 3, 4, 5\}