Cash-on-Hand and Competing Models of Intertemporal Behavior: New Evidence from the Labor Market

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MOTIVATION

• Does disposable income ("cash-on-hand") affect household behavior?

• In macro, answer distinguishes between commonly used models:
  - Tax cuts as consumption stimulus
  - Value of transitory insurance, welfare programs (Chetty 2006)

• In public finance, answer matters for analysis of government policies
  - Tax cuts as consumption stimulus
  - Value of transitory insurance, welfare programs (Chetty 2006)
• Large existing literature tests for excess sensitivity using consumption data (Parker 1999, Souleles 1999, Hsieh 2003, Johnson et. al. 2006,…)

  • Does cash-on-hand (tax rebate) affect non-durable consumption?

• We test for “excess sensitivity” using data from the labor market instead

  • Does cash-on-hand (severance pay) affect job search behavior?

  • Excess sensitivity of labor/leisure to cash-on-hand violates PIH as does excess sensitivity of consumption
ADVANTAGES OF LABOR MARKET APPROACH

1. Large dataset + sharp research design $\rightarrow$ precise estimates.

   Consumption: small samples + noise $\rightarrow$ imprecision

   Parker et. al. (AER 2006): $1$ tax rebate raises non-durable consumption by 5-65 cents.

2. Large lump-sum severance payments ($3000$ on average)

   Consumption: Variation in grants often small ($300$ rebate)

   Browning and Crossley (2001): low welfare costs from failure to smooth over small amounts

3. Policy variation + rich panel data $\rightarrow$ identification of long run consequences of cash grant
OVERVIEW

• Use discontinuities in the Austrian UI system to estimate effects of:

  1. severance pay (cash-on-hand) on unemployment duration
  2. UI benefit extension (incentives) on unemployment duration
  3. both of these policies on subsequent job match quality

• Using empirical estimates, compute a moment \( m \) that identifies the “location” of representative household in data relative to models:

\[
\begin{align*}
      & m \\
  PIH & \quad \blacktimes \quad Data \\
\end{align*}
\]

• The moment \( m \) identifies a plane within the space of preferences and financial technologies but rules out some benchmark models
OUTLINE

I) Job search model and testable predictions
II) Institutional background and estimation strategy
III) Empirical results
IV) Calibration: Testing between models
V) Conclusions
SEARCH MODEL

• Analyze a simple search model that nests a range of intertemporal models, from the PIH to CM.

• Use model for two purposes:

  1. Derive tests of full insurance and rule-of-thumb models.

  2. Derive a sample moment that can be estimated empirically and used to calibrate and test between models.
SETUP

- Discrete time model with finite planning horizon $T$
- Interest rate $r$, discount rate $\delta$
- Individual loses job in period $t = 0$
- Let $u(c_t)$ denote utility over consumption
- Dynamic budget constraint:
  \[ A_{t+1} = (1+r)(A_t + y_t - c_t) \]
- Asset limit: $A_t \geq L$
JOB SEARCH

• If unemployed in period $t$, worker first chooses search intensity $s_t$.

• Finds a job that begins in period $t$ with probability $s_t$.

\[ c_t^e = c_{t+1}^e = \ldots \]

If job found: permanent, fixed wage $w \rightarrow$ consumption $c_t^e$.

If no job: enters period $t+1$ unemployed $\rightarrow$ consumption $c_t^u$.

Cost of job search: $\psi(s_t)$.
• Value function for agent who finds a job in period $t$:

$$V_t(A_t) = \max_{A_{t+1} \geq L} u(A_t - A_{t+1}/(1 + r) + w) + \frac{1}{1+\delta} V_{t+1}(A_{t+1})$$

• Value function for agent who does not find a job in period $t$:

$$U_t(A_t) = \max_{A_{t+1} \geq L} u(A_t - A_{t+1}/(1 + r) + b_t) + \frac{1}{1+\delta} J_{t+1}(A_{t+1})$$

where $J(A_{t+1})$ is value of entering next period unemployed.

• Agent chooses $s_t$ to maximize expected utility:

$$J(A_t) = \max_{s_t} s_t V_t(A_t) + (1 - s_t) U_t(A_t) - \psi(s_t)$$

• First order condition for optimal search intensity:

$$\psi'(s_t^*) = V_t(A_t) - U_t(A_t)$$
TESTABLE COMPARATIVE STATICS

1. Effect of cash grant (severance pay):

\[ \frac{\partial s^*_t}{\partial A_t} = \frac{u'(c^e_t) - u'(c^u_t)}{\psi''(s^*_t)} \leq 0 \]

- provides a test of perfect cons smoothing, where \( c^e_t = c^u_t \)

2. Effect of future benefit increase (benefit extension):

\[ \frac{\partial s^*_t}{\partial b_{t+j}} = -\frac{1}{(1+\delta)^j} \left[ p^*_j, t \frac{u'(c^u_{t+j})}{\psi''(s^*_t)} \right] \leq 0 \]

- provides a test of complete myopia, where \( \delta = \infty \)

3. Effects of sev pay and EB on job match quality

- some reservation-wage models (e.g. Mortensen 1979) predict improvements in match quality from longer search duration
• Ratio of severance pay to EB effect identifies “location” of representative agent in data relative to models:

\[ m_j \equiv \frac{\partial s^*_0/\partial A_0}{\frac{1}{p^*_j} \partial s^*_0/\partial b_j} = \frac{u'(c^u_0)-u'(c^u_0)}{u'(c^u_0)} \times \frac{u'(c^u_0)}{u'(c^u_j)} \times (1+\delta)^j \]

• In our empirical setting, we can estimate \( m_2 \)

• Since \( \psi \) cancels out, moment \( m_2 \) can be predicted purely from simulated consumption path.
• Value of $m_j$ also of interest for analysis of optimal UI (Chetty 2006)

• Effect of benefits on durations has two components when agents cannot smooth perfectly:

\[
\frac{\partial s_t^*}{\partial b_t} = \frac{\partial s_t^*}{\partial A_t} - \frac{\partial s_t^*}{\partial w_t}
\]

\rightarrow \text{Liquidity} \quad \text{Moral Hazard}

• Ratio of liquidity to MH effect can be used to calculate marginal welfare gain from raising benefit level

\rightarrow \text{New test for optimal benefits based purely on duration data}

• Empirical counterpart of Hansen-Imrohoglu (JPE 1992) and related analyses of calibrated models.
<table>
<thead>
<tr>
<th>Prediction</th>
<th>Perfect cons. smoothing</th>
<th>Buffer stock w/match quality</th>
<th>Buffer stock w/search intensity</th>
<th>Complete Myopia “Rule of Thumb”</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Sev Pay affects duration?</td>
<td>N</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
</tr>
<tr>
<td>2. Benefit extension affects initial hazards?</td>
<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>N</td>
</tr>
</tbody>
</table>
EMPIRICAL ANALYSIS

- Identification based on discontinuities in two components of Austria’s unemployment benefit system: severance pay and weekly UI benefits

- Severance payment is made by firms out of their own funds

- Formula for sev. pay amount for all non-construction workers:

```
Job Tenure | Severance Amt. (months of pay)
---|---
0-35 | 0
36-60 | 2
61+ | 3
```
• All individuals who worked 52 or more weeks in last 2 years also receive weekly UI benefits

  - Avg. UI benefit rate: 55% of prior wage

• Maximum duration is a discontinuous function of months worked in past five years:

  - 20 weeks if < 36 months of work
  
  - 30 weeks if 36 or more months of work

• Overlapping discontinuities at 36 months creates a “double discontinuity” complication in empirical analysis
Figure 2a

Eligibility for Extended Benefits by Job Tenure

Fraction Eligible for 30 Weeks of UI Benefits

Previous Job Tenure (Months)
Figure 2b

Eligibility for Severance Pay by Past Employment

Fraction Eligible for Severance Pay

Months Employed in Past Five Years
DATA

• Austrian social security registry 1980-2001
  - daily records on employment status
  - unemployment and *nonemployment* duration
  - annual earnings by employer
  - some demographic information on worker and firms

• Sample restrictions:
  1. non-construction workers between age of 20 and 50
  2. took up UI within 28 days after job loss (eliminating quits)
  3. previous job tenure between 1 and 5 years
  4. between 1 and 5 years of employment in past 5 years
  5. not recalled to prior firm (no temporary layoffs)

• Sample size: 650,922
TABLE 2

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>Median</th>
<th>Std. Dev.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unemployment duration</td>
<td>4.75</td>
<td>2.93</td>
<td>8.37</td>
</tr>
<tr>
<td>Nonemployment duration (months to next job)</td>
<td>16.93</td>
<td>4.29</td>
<td>38.19</td>
</tr>
<tr>
<td>Previous wage (Euros/Yr)</td>
<td>17,034</td>
<td>16,950</td>
<td>7,588</td>
</tr>
<tr>
<td>Change in Log Wage</td>
<td>-0.03</td>
<td>-0.01</td>
<td>0.51</td>
</tr>
<tr>
<td>Number of Employees at Firm</td>
<td>299.4</td>
<td>31</td>
<td>1271.82</td>
</tr>
</tbody>
</table>
ESTIMATION STRATEGY

- Regression discontinuity design: examine change in durations around 3 year cutoff for severance pay eligibility

- Key identifying assumption: randomization around discontinuity
  - Workers laid off just before 3 years must be comparable to those laid off just after 3 years
  - Potential concern: Firms have an incentive to lay off workers before 3 years, creating selection around the break

- We begin by evaluating this identification assumption
  - Check for jumps in observables around eligibility cutoffs
Figure 3

Frequency of Layoffs by Job Tenure
WHY NO SPIKE IN FIRING?

1. Every layoff must be vetted and approved by firm’s works council.

2. Strict enforcement of severance pay law (lawsuits, reputation).

3. Little scope for selective firing in many firms because of small size.
Figure 4a

Age by Job Tenure

Mean Age vs. Previous Job Tenure (Months)
Figure 4b

Wage by Job Tenure

Mean Annual Wage (Euro x 1000) vs. Previous Job Tenure (Months)

- The graph shows a positive correlation between Mean Annual Wage and Previous Job Tenure.
- The wage increases as the job tenure increases.
- The data points are plotted and a trend line is drawn to illustrate the relationship.

Note: The specific values and trends are not detailed here, but the general pattern of increasing wages with job tenure is evident.
SELECTION ON OBSERVABLES

• We evaluate magnitude of selection on observables by examining how predicted job finding hazards vary around the discontinuity

• Set of observable covariates used in prediction:
  
  A. gender, age, education, marital status, nationality
  
  B. wage, firm size, blue collar status
  
  C. duration of job before the one lost, recalled to that job, blue collar at that job
  
  D. last nonemployment duration, total breaks in career, total work experience
  
  E. year, month, industry, and region dummies
Figure 4c

Selection on Observables

Mean Predicted Hazard Ratios vs. Previous Job Tenure (Months)
ADDITIONAL CHECKS FOR SELECTION

1. Focus on subsamples where selection is ex-ante less plausible and wage discontinuities are not observed
   - layoffs of a group of individuals
   - small firms

2. Placebo test
Figure 5a

Effect of Severance Pay on Nonemployment Durations

Mean Nonemployment Duration (days) vs. Previous Job Tenure (Months)
Figure 5b

Effect of Severance Pay in Restricted Sample

Mean Nonemployment Duration (days)

Previous Job Tenure (Months)
Figure 6a

Effect of Severance Pay on Job Finding Hazards

Average Daily Job Finding Hazard in First 20 Weeks

Previous Job Tenure (Months)
Figure 6b

Job Finding Hazards Adjusted for Covariates

Average Daily Job Finding Hazard in First 20 Weeks

Previous Job Tenure (Months)
Figure 6c

Effect of Severance Pay Adjusted for Tenure Seasonality

Average Daily Job Finding Hazard in First 20 Weeks vs. Previous Job Tenure (Months)
Figure 7
Placebo Test: Lagged Job Tenure and Nonemployment Durations

Mean Nonemployment Duration (days)

Job Tenure in Job Before the One Just Lost (Months)
<table>
<thead>
<tr>
<th>Prediction</th>
<th>Model</th>
</tr>
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<tbody>
<tr>
<td>1. Sev Pay affects duration?</td>
<td>PIH with complete markets</td>
</tr>
<tr>
<td></td>
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</tr>
<tr>
<td></td>
<td>Buffer stock w/ search intensity</td>
</tr>
<tr>
<td></td>
<td>N</td>
</tr>
</tbody>
</table>
Figure 9a

Effect of Benefit Extension on Nonemployment Durations

Mean Nonemployment Duration (days)

Months Employed in Past Five Years

12 18 24 30 36 42 48 54 60

135 140 145 150 155 160 165
Figure 8b

Effect of Extended Benefits on Job Finding Hazards by Week

Weekly Job Finding Hazard

Weeks Elapsed Since Job Loss

- 20 Weeks of UI
- 30 Weeks of UI
<table>
<thead>
<tr>
<th>Prediction</th>
<th>Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>2. Benefit extension affects <em>initial</em> hazards?</td>
<td>PIH with complete markets</td>
</tr>
<tr>
<td></td>
<td>Y</td>
</tr>
</tbody>
</table>

TABLE 1
Testable Predictions
PARAMETRIC RD MODEL ESTIMATES

• Estimate magnitude of sev pay and EB effects by fitting Cox hazard models with cubic control functions for job tenure and months worked.

• Nonemployment durations censored at 20 weeks
<table>
<thead>
<tr>
<th></th>
<th>(1) No Controls</th>
<th>(2) With Controls</th>
<th>(3) Reweight Sample</th>
</tr>
</thead>
<tbody>
<tr>
<td>Severance pay</td>
<td>-0.125</td>
<td>-0.115</td>
<td>-0.119</td>
</tr>
<tr>
<td></td>
<td>(0.017)</td>
<td>(0.018)</td>
<td>(0.021)</td>
</tr>
<tr>
<td>Extended benefits</td>
<td>-0.084</td>
<td>-0.064</td>
<td>-0.064</td>
</tr>
<tr>
<td></td>
<td>(0.016)</td>
<td>(0.017)</td>
<td>(0.019)</td>
</tr>
<tr>
<td>Sample size</td>
<td>650,922</td>
<td>565,835</td>
<td>565,835</td>
</tr>
</tbody>
</table>

NOTE--All specs are Cox hazard models that include cubic control functions with interactions with sevpay and extended benefit dummy.
Figure 10a

Effect of Severance Pay on Subsequent Wages

Wage Growth vs. Previous Job Tenure (Months)
Figure 10b

Effect of Severance Pay on Subsequent Job Duration

Average Monthly Job Ending Hazard in Next Job

Previous Job Tenure (Months)
Figure 11a

Effect of Extended Benefits on Subsequent Wages

Months Worked in Past Five Years

Wage Growth
Figure 11b

Effect of Extended Benefits on Subsequent Job Duration

Average Monthly Job Ending Hazard in Next Job

Months Worked in Past Five Years

Effect of Extended Benefits on Subsequent Job Duration

Average Monthly Job Ending Hazard in Next Job

Months Worked in Past Five Years
TABLE 4
Effects of Severance Pay and EB on Search Outcomes

<table>
<thead>
<tr>
<th></th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No controls</td>
<td>Full controls</td>
<td>No controls</td>
<td>Full controls</td>
</tr>
<tr>
<td>log wage change</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Severance pay</td>
<td>-0.009</td>
<td>-0.002</td>
<td>-0.017</td>
<td>0.000</td>
</tr>
<tr>
<td></td>
<td>(0.007)</td>
<td>(0.006)</td>
<td>(0.014)</td>
<td>(0.015)</td>
</tr>
<tr>
<td>Extended benefits</td>
<td>-0.005</td>
<td>-0.008</td>
<td>-0.005</td>
<td>0.007</td>
</tr>
<tr>
<td></td>
<td>(0.006)</td>
<td>(0.006)</td>
<td>(0.013)</td>
<td>(0.014)</td>
</tr>
</tbody>
</table>

All specs include cubic polynomials with interactions with sevpay and EB. Columns (1) and (2) report coefficients from OLS regressions; columns (3) and (4) report Cox hazard model coefficient estimates.
### TABLE 1
Testable Predictions

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<td>Prediction</td>
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</tr>
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<td>2. Benefit extension affects initial hazards?</td>
<td>Y</td>
</tr>
</tbody>
</table>
CALIBRATION

- We characterize models that fit the data using the moment

\[
m_2 = \frac{\partial s_0^*/\partial A_0}{p_2^* \partial s_0^*/\partial b_2} = \frac{\beta_{sp}}{\beta_{eb}} \times \frac{v_{eb}}{v_{sp}} \times p_2^*
\]

- First, calculate empirical value of \( m_2 \)
  
  - Calculate scale factor using mean values of UI, UA, sev. pay., family income, and empirical job-finding probabilities.
  
  - Then use hazard model estimates of sev pay and EB coefficients

\[
\Rightarrow \quad m_2 = 0.174 \text{ (se} = 0.041)\]
PREDICTED VALUES OF MOMENT FOR COMPETING MODELS

• What types of models generate $m_2$ that fits the data?

• Recall theoretical expression for $m_2$ from model:

\[
m_2 = \frac{u'(c^u_0) - u'(c^e_0)}{u'(c^u_0)} \times \frac{u'(c^u_0)}{u'(c^u_2)} \times (1 + \delta)^2
\]

• Use this formula to calculate $m_2$ for two standard models:

1. PIH with intertemporal smoothing but no private insurance

2. Credit constrained but forward looking (binding asset limit)

• Calibration methodology:

- Assume CRRA utility
- Compute consumption path using mean values of UI, spouse inc., etc.
- Annuityization of wealth at interest rate in PIH case
- Obtain bound on $m_2$ for PIH by bounding rate of decline in assets
CALIBRATION RESULTS

- These calculations assume $r = 0.05$ and CRRA = 2.
- PIH rejected with any combination of CRRA < 4 and $r < 15\%$

→ Representative household’s behavior 70% of the way between PIH and credit-constrained in terms of sensitivity to cash-on-hand.
IMPLICATIONS FOR MODELS OF HOUSEHOLD BEHAVIOR

• Behavior of job searchers fit by intertemporal models such as:
  - Campbell and Mankiw’s (1991) spenders-savers model with 30% lifecycle maximizers and 70% credit-constrained
  - Deaton (1991) buffer stock model

• Search behavior fit by a model with limited reservation-wage effects
  - Possibly a model with low arrival rate of offers, where agents essentially take first offer they get
• Role for temporary income assistance programs (UI, welfare, etc.) given imperfect smoothing by households

• Liquidity important relative to moral hazard in UI, consistent with Chetty (2006) findings in U.S. data