The Optimal Timing of Unemployment Benefits: Theory and Evidence from Sweden

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Social insurance programs are inherently dynamic
1. specify a **full time profile** of benefits
2. affect **dynamics of household behavior**

How should we design **optimal time profile of benefits**?
- UI policy debate: pressure for steeper benefit profiles
- SS policy debate: pressure for increase in full retirement age
- debate lacks evidence-based welfare framework

Sufficient statistics literature on “average” generosity of SI
⇒ *empirical implementation, but silent about optimal timing*

Theoretical literature on optimal timing of UI in particular
⇒ *insights are model-dependent and hard to connect to data*
We revisit the optimal timing of UI and provide:

(1) a simple characterization

(2) in a general framework

(3) that connects to data.

We then implement this characterization:

- use Swedish data from UI registers linked to admin data on income and wealth and consumption surveys
- estimate all relevant statistics to provide an evidence-based evaluation of the benefit profile.
Consider dynamic model of unemployment (with search, heterogeneity, duration dependence, assets, ...)

**Key Result:** Baily ['78] intuition generalizes for UI benefit $b_t$ paid at any unemployment duration $t$:

1. *Insurance gain* depends on drop in consumption at $t$
2. *Incentive cost* depends on response of (full) survival function to $b_t$

**Implication:** Simple to evaluate welfare of a benefit profile. Identifying model’s primitives is not necessary (Chetty ’06, ’09)
Extensive literature on unemployment responses to UI
  - limited attention for timing of benefits

We implement a Regression Kink design using Swedish UI registers
  - exploit variation in the time profile of benefits
  - consider the impact on the relevant moments of the survival function

Incentive cost of UI decreases over the spell
  - estimated cost of increasing benefits is high overall ($\varepsilon \approx 1.5$)
  - incentive cost for ST benefits $\geq$ LT benefits
• Limited evidence on impact of labor shocks on consumption
  • Gruber (’97) studies consumption drop when unemployed
  • survey data on consumption: limited ability to observe unemployment status and duration

• We obtain residual measure of yearly expenditures using unique admin data on income and wealth in Sweden

• Insurance gain of UI increases over the spell
  • household consumption drops: 6% for ST and 13% for LT unemployed
  • limited ability to smooth consumption, but generous LT benefits
Limited evidence on impact of labor shocks on consumption

Gruber ('97) studies consumption drop when unemployed
survey data on consumption: limited ability to observe unemployment status and duration

We obtain residual measure of yearly expenditures using unique admin data on income and wealth in Sweden

Insurance gain of UI increases over the spell
household consumption drops: 6% for ST and 13% for LT unemployed
limited ability to smooth consumption, but generous LT benefits

Evaluated at a flat profile in Sweden, our evidence indicates that slightly increasing profile increases welfare!
Outline

1 Introduction

2 Theory: Identifying Sufficient Statistics in Dynamic Setting

3 Context & Data

4 Empirics I: Duration Responses

5 Empirics II: Consumption Profiles

6 Welfare Calibrations
Setup: Workers’ Behavior

- Dynamic model of unemployment: focus on worker’s behavior

- Each individual $i$ optimizes her job search strategy
  - results in an exit rate out of unemployment $h_{i,t}$ at each duration $t$
  - observed survival function equals
    \[ S(t) = \sum_{i=1}^{N} \left[ \prod_{s=0}^{t} (1 - h_{i,s}) \right] / N \]

- Each individual $i$ optimizes intertemporal consumption
  - results in contingent consumption plan $c_{i}^{e}$ and $c_{i,t}^{u}$
  - observed unemployment consumption at duration $t$
    \[ C_{u}(t) = \sum_{i=1}^{N} \left[ \frac{S_{i}(t)}{S(t)} \times c_{i,t}^{u} \right] / N \]
We consider policies of the form \((b_1, b_2, \ldots)\) providing UI benefit \(b_1\) for the first \(B_1\) periods of unemployment, \(b_2\) for the next \(B_2 - B_1\) periods etc.

The benefits are funded by a uniform tax \(\tau\) on the employed.

The average unemployment duration equals sum of survival rates at each duration:

\[
D = \sum_t S(t) = \sum_{0}^{B_1} S(t) + \sum_{B_1}^{B_2} S(t) + \ldots + \sum_{B_{n-1}}^{T} S(t),
\]

where \(D_i\) is the average duration spent receiving benefit \(b_i\).
Illustration: Two-Part Policy

UI benefits vs. Unemployment duration

- B
- b1
- b2
- 0

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Average unemployment duration equals $D = \sum_t S(t)$. 
Average duration spent receiving benefit $b_1$ equals $D_1 = \sum_0^B S(t)$. 
Average unemployment duration \( D = \sum_t S(t) = D_1 + D_2 \).
Gvt BC: \( \tau \cdot (T - D) = b_1 \cdot D_1 + b_2 \cdot D_2. \)
The optimal unemployment policy solves

$$\max_{b, \tau} \sum_i U_i(b, \tau) \text{ for } U_i(b, \tau) = \max_{\tilde{x}_i \in X} U_i(\tilde{x}_i | b, \tau)$$

such that $$\sum_k D_k \cdot b_k = [T - D] \cdot \tau.$$
The optimal unemployment policy solves

\[
\max_{b, \tau} \sum_i U_i(b, \tau) \quad \text{for} \quad U_i(b, \tau) = \max_{\tilde{x}_i \in X} U_i(\tilde{x}_i | b, \tau)
\]

such that \( \sum_k D_k \cdot b_k = [T - D] \cdot \tau \).

Baily-Chetty benchmark: the optimal flat profile \( b \) solves

\[
\frac{E[u'(c^u)] - E[u'(c^e)]}{E[u'(c^e)]} = \varepsilon_{D,b} \quad \text{\( \underbrace{=}_{=CS_b} \)} \quad \text{\( \underbrace{=}_{=MH_b} \)}
\]  

(1)
The optimal unemployment policy solves

$$\max_{b, \tau} \sum_i U_i(b, \tau) \quad \text{for} \quad U_i(b, \tau) = \max_{\tilde{x}_i \in X} U_i(\tilde{x}_i|b, \tau)$$

such that

$$\sum_k D_k \cdot b_k = [T - D] \cdot \tau.$$ 

Baily-Chetty benchmark: the optimal flat profile \( b \) solves

$$\frac{E[u'(c^u)] - E[u'(c^e)]}{E[u'(c^e)]} = \varepsilon_{D,b}.$$ (1)

Key insight (∼ Env. Thm): behavioral responses have first-order welfare effect through the fiscal externality only
- Baily-Chetty formula generalizes for benefit paid at any duration $t$
- Two-part example:
Baily-Chetty formula generalizes for benefit paid at any duration $t$

Two-part example;

For $b_1$:

$$
\frac{E [u'(c^u) | t \leq B] - E [u'(c^e)]}{E [u'(c^e)]} = \varepsilon_{D_1,b_1} + \frac{b_2 D_2}{b_1 D_1} \cdot \varepsilon_{D_2,b_1}
$$
Baily-Chetty formula generalizes for benefit paid at any duration $t$

Two-part example;

For $b_1$:

$$
\frac{E[u'(cu) | t \leq B] - E[u'(ce)]}{E[u'(ce)]} = \varepsilon_{D_1,b_1} + \frac{b_2D_2}{b_1D_1} \cdot \varepsilon_{D_2,b_1}
$$

For $b_2$:

$$
\frac{E[u'(cu) | t > B] - E[u'(ce)]}{E[u'(ce)]} = \frac{b_1D_1}{b_2D_2} \cdot \varepsilon_{D_1,b_2} + \varepsilon_{D_2,b_2}
$$
Baily-Chetty formula generalizes for benefit paid at any duration $t$

Two-part example:

for $b_1$:

$$\frac{E[u'(c^u) | t \leq B] - E[u'(c^e)]}{E[u'(c^e)]} = \varepsilon_{D_1,b_1} + \frac{b_2 D_2}{b_1 D_1} \cdot \varepsilon_{D_2,b_1}$$

for $b_2$:

$$\frac{E[u'(c^u) | t > B] - E[u'(c^e)]}{E[u'(c^e)]} = \frac{b_1 D_1}{b_2 D_2} \cdot \varepsilon_{D_1,b_2} + \varepsilon_{D_2,b_2}$$
A Sufficient Statistics Approach

**Generality:**
- Robust to variations in underlying primitives of the model
- Allows for duration dependence, heterogeneity, assets, etc.
- Externalities, equilibrium effects, internalities ⇒ additional terms

**Sufficient for what?**
- Statistics sufficient for characterizing optimal benefit profile
- Evaluate welfare effect of small deviations from actual policy

\[ CS_k \geq MH_k \Rightarrow b_k \uparrow \]

**Implementation:**
- \( MH_k \) cost: estimated from the benefit duration response to \( \Delta b_k \)
- \( CS_k \) gain: consumption implementation \( CS_k \approx \gamma_k \cdot \Delta C_k / C \)

\[ CS_1 / CS_2 \geq MH_1 / MH_2 \Rightarrow b_1 / b_2 \]
$b_1 = b_2$

Unemployment duration

UI benefits

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\[ \varepsilon_{D_1, b_1} = b_1 \times \Delta D_1 / D_1 \]
\[ \varepsilon_{D_2, b_1} = b_1 \cdot \Delta D_2 / D_2 \]
MH Costs: Implementation

Optimal Timing of UI

Unemployment duration

UI benefits

b1

b2'

B

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$\varepsilon_{D1, b2} = b2 \cdot \Delta D1/D1$
\[ \varepsilon_{D2, b2} = b2 \times \frac{\Delta D2}{D2} \]
CS Gains: Consumption Implementation

\[ CS_k \equiv \gamma_k \frac{\Delta C_k}{C^e} \]

\[ \Delta C_k = \sum S(t) \frac{(C^u(t) - C^e)}{D_k} \]
Dynamic Policy Insights Revisited

If \( CS_{bt} \) and \( MH_{bt} \) were constant over the spell, constant benefits would be optimal. However,

- **Forward-looking job seekers** \( \Rightarrow \) \( MH_{bt} \) increasing over the spell
  - *declining* benefits become optimal
  - see Shavel&Weiss '79, Hopenhayn&Nicolini '97,...

- **Unobservable savings** \( \Rightarrow \) \( CS_{bt} \) increasing over the spell
  - *inclining* benefits would be optimal
  - see Werning '02, Shimer&Werning '08,...

- **Non-stationarity, heterogeneity** \( \Rightarrow \) ??
  - example: negative duration dependence of exit rates
  - \( MH_{bt} \) may well be decreasing over the spell \( \Rightarrow *inclining* \) benefits
  - see Pavoni '09, Shimer&Werning '09
Introduction

Theory: Identifying Sufficient Statistics in Dynamic Setting

Context & Data

Empirics I: Duration Responses

Empirics II: Consumption Profiles

Welfare Calibrations
Context and Data

- Universe of unemployment spells from unemployment registers in Sweden (1999-2013)

- Sweden levied a wealth tax, up until 2007. We link unemployment registers to income and wealth registers for full Swedish population (1999-2007).

- Unemployment benefits replace 80% of pre-unemployment wage, but are capped at a threshold close to the median wage.

- Unemployment benefits can be received forever. Participation into ALMP is required after 60 or 90 wks of unemployment.
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Flat Benefit Profile with Benefit Cap ['99-'00]

1999-2000

Kink in b1 and b2

Daily Benefits (SEK)

b1: benefit for the first 20 wks
b2: benefits after 20 wks

Daily Wage (SEK)
Duration-Dependent Benefit Cap ['01]

**2001 Kink in b2**

- **b1**: benefit for the first 20 wks
- **b2**: benefits after 20 wks

**Daily Benefits (SEK)**

- 600
- 650
- 700
- 750
- 800
- 850

**Daily Wage (SEK)**

- 600
- 650
- 700
- 750
- 800
- 850

- KLNS (LSE)
Flat Benefit Profile (with High Benefit Cap) ['02-'06]

2002-2006

No Kink

Daily Benefits (SEK)

Daily Wage (SEK)

b1: benefit for the first 20 wks

b2: benefits after 20 wks

2002-2006

No Kink
Regression Kink Design

- **General model:**
  \[ Y = y(b_1, b_2, w, \varepsilon) \]
  - \( Y \): duration outcome of interest
  - \( b_k \): endogenous regressor of interest; deterministic, continuous function of earnings \( w \), kinked at \( w = \bar{w}_k \)

- **Non-parametric identification** of the average marginal effect of \( b_k \) on \( Y \):
  \[ \alpha_k = \frac{\lim_{w \to \bar{w}_k^+} \frac{\partial E[Y|w]}{\partial w} - \lim_{w \to \bar{w}_k^-} \frac{\partial E[Y|w]}{\partial w}}{\lim_{w \to \bar{w}_k^+} \frac{\partial b_k}{\partial w} - \lim_{w \to \bar{w}_k^-} \frac{\partial b_k}{\partial w}} = \frac{\hat{\delta}_k}{\nu_k} \]
  - \( \hat{\delta}_k \): estimated change in slope between \( Y \) and \( w \) at kink \( \bar{w}_k \)
  - \( \nu_k \): deterministic change in slope between \( b_k \) and \( w \) at kink \( \bar{w}_k \)

- **Identifying assumptions:**
  - direct marginal effect of \( w \) on \( Y \) is smooth
  - smooth pdf of \( \varepsilon \) at \( \bar{w}_k \)
Wage and Unemployment Duration: Kink in $b_1$ and $b_2$
Wage and Unemployment Duration: Kink in $b_2$

Kink in $b_2$ only

Duration of unemployment spell

Daily Wage (SEK)

Kink in $b_2$ only
Wage and Unemployment Duration: No Kink

No kink

Duration of unemployment spell

Daily Wage (SEK)

No kink

Daily Wage (SEK)
RKD: Estimated Duration Responses

Kink in b1, b2

Kink in b2

No kink

$\varepsilon_D = 1.53 (0.13)$

$\varepsilon_D = 0.68 (0.13)$

Estimated Change in Slope in D

1999-2000

2001

2002-2006

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Duration Responses: Takeaways

- Estimates imply $MH_{b_1} > MH_{b_2}$
  - $\epsilon_{D,b_1} = \epsilon_{D,b} - \epsilon_{D,b_2} = .84 (.19) \geq \epsilon_{D,b_2} = .69 (.14)$
  - $MH_{b_k} = \epsilon_{D,b_k} \frac{D}{D_k}$, for flat profile, and $D_1 \approx D_2$

- Unemployed are forward-looking ($\epsilon_{D_1,b_2} > 0$), but non-stationary more than offsets this!

- Estimates can explain different findings in earlier works
  - $\epsilon_{D,b_1} \approx$ Meyer [1990], Landais [2015] in U.S. (where $b_1$ for 26 weeks)
  - Schmieder&al. [2012], Rothstein [2011], Valetta&Farber [2011]: smaller effects of extensions from long baseline durations

- Robustness: RKD by year, Smooth pdf density, Covariate tests, Bandwidth tests, Placebo kinks, Inference, Polynomial order
RKD: Estimated Responses for $D_1$

<table>
<thead>
<tr>
<th>Year</th>
<th>Kink in b1, b2</th>
<th>Kink in b2</th>
<th>No kink</th>
</tr>
</thead>
<tbody>
<tr>
<td>1999-2000</td>
<td>$\varepsilon_{D_1} = 1.32 (.06)$</td>
<td>$\varepsilon_{D_1} = .60 (.10)$</td>
<td>-0.04</td>
</tr>
<tr>
<td>2001</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2002-2006</td>
<td></td>
<td></td>
<td>0.02</td>
</tr>
</tbody>
</table>

Estimated Change in Slope in $D_1$
Non-stationarity: Elasticity of Remaining Duration

Estimated elasticity of remaining duration conditional on survival

Time t since start of spell (months)
1. Introduction

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5. Empirics II: Consumption Profiles

6. Welfare Calibrations
Consumption Profile: Empirical Strategy

- **Data**: household consumption surveys (HUT) merged with universe of administrative UI records and income & wealth registers.
  - Observe full employment history of individuals surveyed in the HUT.
  - Sample: individuals unemployed or who will be unemployed
  - Flow measure of consumption at time of HUT itw
  - Confirm findings with registry-based residual measure of consumption from income and wealth

- **Model**: event studies

\[
c_{it} = \sum_t \beta_t \cdot I[HUT = t] + X_i'\gamma + \varepsilon_{it} \tag{2}
\]

- \(I[HUT = t]\): indicator for being surveyed at spell time \(t\).

- **Investigate role of selection**
  - Selection on consumption levels
  - Selection on consumption profiles
Household Consumption Over the Spell

Pre-U level: 343 (k2003SEK)

Δ consumption after 1 year (%)
-18.1 (5.4)

Consumption (cst SEK)
-18 -12 -6 0 6 12 18

Months relative to start of U spell

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Optimal Timing of UI

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## Log Household Consumption Relative To Pre-U

<table>
<thead>
<tr>
<th></th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1[0 &lt; t \leq 20 \text{ wks}])</td>
<td>-0.0606*</td>
<td>-0.0415</td>
<td>-0.0379</td>
<td>-0.0465</td>
</tr>
<tr>
<td></td>
<td>(0.0316)</td>
<td>(0.0302)</td>
<td>(0.0305)</td>
<td>(0.0413)</td>
</tr>
<tr>
<td>(1[t &gt; 20 \text{ wks}])</td>
<td>-0.130***</td>
<td>-0.131***</td>
<td>-0.113***</td>
<td>-0.108***</td>
</tr>
<tr>
<td></td>
<td>(0.0328)</td>
<td>(0.0326)</td>
<td>(0.0379)</td>
<td>(0.0414)</td>
</tr>
<tr>
<td>(1[L &gt; 20 \text{ wks}])</td>
<td>-0.0294</td>
<td>-0.0342</td>
<td>-0.0204</td>
<td>-0.0342</td>
</tr>
<tr>
<td></td>
<td>(0.0300)</td>
<td>(0.0378)</td>
<td>(0.0300)</td>
<td>(0.0378)</td>
</tr>
<tr>
<td>(1[t \leq 20 \text{ wks}] \times 1[L &gt; 20 \text{ wks}])</td>
<td>0.0134</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>(0.0629)</td>
</tr>
</tbody>
</table>

### Year F-E
- \(\times\)

### Calendar months F-E
- \(\times\)

### Marital status
- \(\times\)

### Family size
- \(\times\)

### Age group F-E
- \(\times\)

### \(R^2\)
- 0.0493
- 0.139
- 0.139
- 0.0872

### \(N\)
- 1551
- 1548
- 1548
- 1548

**Notes:** Robust standard errors in parentheses. * \(p<.10\), ** \(p<.05\), *** \(p<.01\)
Household consumption drops significantly and quickly over the spell. Average drop in consumption after a year $\approx$ average drop in annual household income.

Corroborated by evidence from residual measure of expenditures based on registry-data.

Limited means to smooth consumption and high MPC out of UI:
- Majority starts spell with **no financial nor real assets**.
- Limited added-worker effect.
- Limited use of debt over the spell.
- UI transfers play entire role in smoothing consumption.
Consumption Implementation Approach

- CS gains can be approximated using consumption drops

\[ CS_k \approx \gamma_k \cdot \Delta C_k / C \]

Consumption ↓ ⇒ CS gains ↑ over U spell

Robustness to selection:
- No significant selection on consumption levels or profiles, nor on wealth
- Limited evidence of selection on risk preferences

Consumption vs Expenditures
- Unemployed increase home production
- Unemployed decrease durable good expenditures
- No dynamic selection on profiles of various categories of expenditures
**Welfare: Putting Things Together**

<table>
<thead>
<tr>
<th>(1) Moral hazard cost, $MH_x$</th>
<th>(2) Consumption drop, $\Delta C_x$</th>
<th>(3) Value of kroner spent, $CS_x/MH_x$</th>
</tr>
</thead>
<tbody>
<tr>
<td>$b$</td>
<td>.10</td>
<td>$\tilde{\gamma} \times .07$</td>
</tr>
<tr>
<td>(.13)</td>
<td>(.01)</td>
<td></td>
</tr>
<tr>
<td>$b_1$</td>
<td>.06</td>
<td>$\tilde{\gamma}_1 \times .04$</td>
</tr>
<tr>
<td>(.37)</td>
<td>(.03)</td>
<td></td>
</tr>
<tr>
<td>$b_2$</td>
<td>.13</td>
<td>$\tilde{\gamma}_2 \times .09$</td>
</tr>
<tr>
<td>(.27)</td>
<td>(.03)</td>
<td></td>
</tr>
</tbody>
</table>

- Benefits are too high throughout the spell (for standard $\gamma \leq 2$)
- Value of marginal kroner spent on unemployed after 20wks is twice as high as before 20wks (for equal $\tilde{\gamma}_k$)
- Starting from existing flat profile, our local evaluation pushes towards an inclining benefit profile!
  - Calibration: optimal inclining tilt $b_2 \geq b_1$ survives at lower generosity level

*fig*
Optimal Profile: CS vs. MH in Calibrated Model

![Graph showing costs/gains vs. b for MH and CS scenarios]

- **MH** (blue dashed line)
- **CS** (black solid line)

- **MH1**
- **MH2**
- **CS1**
- **CS2**

 Axes:
- X-axis: b
- Y-axis: costs / gains

Legend:
- **MH1**: Blue dashed line
- **MH2**: Black solid line
- **CS1**: Blue dashed line
- **CS2**: Black solid line
Conclusion

- We provided a simple framework to connect theory to data in the context of dynamic UI policies:
  - focus on the timing of benefits for behavioral responses
  - use admin data to evaluate consumption smoothing effects
  - find no evidence to support the switch from flat to declining benefit profiles

- Framework can be used to think about various policy-relevant issues: role of business cycles, role of heterogeneity,...

- Framework can be used to think about any time-dependent policies: pensions (career length/age), poverty relief (child’s age),...
APPENDIX SLIDES
RKD estimates on hazard rates at the SEK725 kink

Estimated effect on hazard rate

Time t since start of spell (weeks)

Effect of b1 and b2
Effect of b2

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RKD estimates at the SEK725 kink by year of entry

<table>
<thead>
<tr>
<th>Year of entry into unemployment</th>
<th>Estimated change in slope</th>
</tr>
</thead>
<tbody>
<tr>
<td>1999</td>
<td>-0.075</td>
</tr>
<tr>
<td>2000</td>
<td>-0.05</td>
</tr>
<tr>
<td>2001</td>
<td>-0.025</td>
</tr>
<tr>
<td>2002</td>
<td>0</td>
</tr>
<tr>
<td>2003</td>
<td>0.025</td>
</tr>
<tr>
<td>2004</td>
<td>0.05</td>
</tr>
<tr>
<td>2005</td>
<td>0.05</td>
</tr>
<tr>
<td>2006</td>
<td>0.05</td>
</tr>
</tbody>
</table>

- **Kink in b1 & b2**
- **Kink in b2**
- **No kink**
McCrary tests

Discontinuity: 994.6 (596.5)
1st deriv. discontinuity: -31.1 (22.7)
Non-parametric detection using placebo kinks

![Graph showing R-square of polynomial model vs. location of placebo kink (daily wage SEK)].

- **R-square of polynomial model**
  - 0.0005
  - 0.001
  - 0.0015

- **Location of placebo kink (daily wage SEK)**
  - 600
  - 650
  - 700
  - 750
  - 800
  - 850
### RKD estimates: Inference

<table>
<thead>
<tr>
<th></th>
<th>Unemployment Duration $D$</th>
<th>Duration $D_1$ ($&lt; 20$ weeks)</th>
<th>Duration $D_2$ ($\geq 20$ weeks)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>I. 1999-2000: Kink in $b_1$ and $b_2$</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Linear - $\delta_k$</td>
<td>-.0569</td>
<td>-.0246</td>
<td>-.0299</td>
</tr>
<tr>
<td>Robust s.e.</td>
<td>(.0047)</td>
<td>(.0013)</td>
<td>(.0036)</td>
</tr>
<tr>
<td>Bootstrapped s.e.</td>
<td>(.0050)</td>
<td>(.0012)</td>
<td>(.0039)</td>
</tr>
<tr>
<td>95% CI - permuted test</td>
<td>[-.0595 ; -.0566]</td>
<td>[-.0319 ; -.0189]</td>
<td>[-.0402 ; -.019]</td>
</tr>
<tr>
<td><strong>II. 2001: Kink in $b_2$ only</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Linear - $\delta_k$</td>
<td>-.0255</td>
<td>-.0115</td>
<td>-.0105</td>
</tr>
<tr>
<td>Robust s.e.</td>
<td>(.005)</td>
<td>(.0021)</td>
<td>(.0028)</td>
</tr>
<tr>
<td>Bootstrapped s.e.</td>
<td>(.0049)</td>
<td>(.0020)</td>
<td>(.0030)</td>
</tr>
<tr>
<td>95% CI - permuted test</td>
<td>[-.0325 ; -.0190]</td>
<td>[-.0127 ; -.0103]</td>
<td>[-.0115 ; -.0091]</td>
</tr>
</tbody>
</table>
RKD estimates: Sensitivity to polynomial order

<table>
<thead>
<tr>
<th></th>
<th>(1) Unemployment Duration $D$</th>
<th>(2) Duration $D_1$ (&lt; 20 weeks)</th>
<th>(3) Duration $D_2$ (≥ 20 weeks)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Linear</strong> - $\delta_k$</td>
<td>-.0569 (.0047)</td>
<td>-.0246 (.0013)</td>
<td>-.0299 (.0036)</td>
</tr>
<tr>
<td><strong>Quadratic</strong> - $\delta_k$</td>
<td>-.0474 (.0185)</td>
<td>-.0344 (.0049)</td>
<td>-.0183 (.0143)</td>
</tr>
<tr>
<td><strong>Cubic</strong> - $\delta_k$</td>
<td>-.0527 (.0455)</td>
<td>-.0291 (.0122)</td>
<td>-.0221 (.0351)</td>
</tr>
<tr>
<td><strong>RMSE</strong></td>
<td>28.285</td>
<td>7.049</td>
<td>23.972</td>
</tr>
<tr>
<td><strong>AIC</strong></td>
<td>1785650.8</td>
<td>1264546</td>
<td>1723601.1</td>
</tr>
</tbody>
</table>

**I. 1999-2000: Kink in $b_1$ and $b_2$**

**Back**
### Table: Summary statistics at start of U spell: HUT sample

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>P10</th>
<th>P50</th>
<th>P90</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>I. Unemployment</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Duration of spell (wks)</td>
<td>26.64</td>
<td>2.86</td>
<td>13.43</td>
<td>65.29</td>
</tr>
<tr>
<td>Duration on $b_1$ (wks)</td>
<td>12.87</td>
<td>2.86</td>
<td>13.43</td>
<td>20</td>
</tr>
<tr>
<td>Duration on $b_2$ (wks)</td>
<td>12.22</td>
<td>0</td>
<td>0</td>
<td>45.29</td>
</tr>
<tr>
<td><strong>II. Demographics</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>34.12</td>
<td>21</td>
<td>33</td>
<td>51</td>
</tr>
<tr>
<td>Fraction men</td>
<td>.49</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Fraction married</td>
<td>.39</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Number of children</td>
<td>1.27</td>
<td>0</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td><strong>III. Income and Wealth, SEK 2003(K)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gross earnings (individual)</td>
<td>202.9</td>
<td>9.8</td>
<td>172.6</td>
<td>386.2</td>
</tr>
<tr>
<td>Household disposable income</td>
<td>354.4</td>
<td>116.9</td>
<td>330.1</td>
<td>585.3</td>
</tr>
<tr>
<td>Household consumption</td>
<td>343</td>
<td>150.3</td>
<td>305.1</td>
<td>572.6</td>
</tr>
<tr>
<td>Household net wealth</td>
<td>510.1</td>
<td>-258.3</td>
<td>0</td>
<td>1691.6</td>
</tr>
<tr>
<td>Household bank holdings</td>
<td>65.6</td>
<td>0</td>
<td>0</td>
<td>149.8</td>
</tr>
<tr>
<td>Household real estate</td>
<td>770.7</td>
<td>0</td>
<td>44</td>
<td>1948.3</td>
</tr>
<tr>
<td>Household debt</td>
<td>427.2</td>
<td>0</td>
<td>193.3</td>
<td>1154.3</td>
</tr>
</tbody>
</table>
Household Consumption: Registry Based Measure

Δ consumption after 1 year (%)
-15.8 (1.6)

Consumption relative to last quarter before U (cst SEK)

-12  -6  0  6  12  18

Months relative to start of unemployment spell

Δ consumption after 1 year (%)
-15.8 (1.6)
Yearly Income of All Other HH Members

- Income relative to last quarter before U (cst SEK)
  - -12
  - -6
  - 0
  - 6
  - 12
  - 18

- Months relative to start of unemployment spell
  - 0
  - 6
  - 12
  - 18

- Δ income after 1 year (%)
  - -.6 (.8)

- Income relative to last quarter before U (cst SEK) changes by -0.6% after 1 year.
Yearly Change in Non-Mortgage Debt

\[ \Delta \text{change in debt after 1 year (\%) } = -29.6 (11.3) \]

<table>
<thead>
<tr>
<th>Income relative to last quarter before U (cst SEK)</th>
<th>-12</th>
<th>-6</th>
<th>0</th>
<th>6</th>
<th>12</th>
<th>18</th>
</tr>
</thead>
<tbody>
<tr>
<td>Months relative to start of unemployment spell</td>
<td>-12</td>
<td>-6</td>
<td>0</td>
<td>6</td>
<td>12</td>
<td>18</td>
</tr>
</tbody>
</table>

\[ \Delta \text{change in debt after 1 year (\%)} = -29.6 (11.3) \]
Decomposition: Earnings

Consumption relative to last quarter before U (cst SEK)

Quarter relative to start of unemployment spell

Pre-U level: 151 (k2003SEK)
Decomposition: + Transfers

Pre-U level: 160 (k2003SEK)

Δ consumption flow after 1 year (%)
-27 (.7)

Consumption relative to last quarter before U (cst SEK)

Quarter relative to start of unemployment spell
Earnings
Earnings + Transfers

KLNS (LSE)
Optimal Timing of UI
February 23, 2016
Decomposition: + Other Income

- Pre-U level: 140 (k2003SEK)
- Δ consumption flow after 1 year (%): -26 (.4)
- Consumption relative to last quarter before U (cst SEK)
  - Pre-U level: 140 (k2003SEK)
  - Δ consumption flow after 1 year (%): -26 (.4)
  - Quarter relative to start of unemployment spell

Earnings
Earnings + Transfers
Disposable Income
Decomposition: + Changes in Assets

Pre-U level: 137 (k2003SEK)
Average change after 1 year (%)
-26 (1.8)

Consumption relative to last quarter before U (cst SEK)
-3
0
1
4
8

Quarter relative to start of unemployment spell
Earnings
Earnings + Transfers
Disposable Income
Consumption

Average change after 1 year (%)
-26 (1.8)
Log Household Consumption Relative To Pre-U

<table>
<thead>
<tr>
<th></th>
<th>(1) Total exp.</th>
<th>(2) Food</th>
<th>(3) Rents</th>
<th>(4) Purch. of new vehicles</th>
<th>(5) Furn. &amp; house appl.</th>
<th>(6) Transport.</th>
<th>(7) Recreation</th>
<th>(8) Restaurant</th>
</tr>
</thead>
<tbody>
<tr>
<td>I[t ≤ 20 weeks]</td>
<td>-0.0606*</td>
<td>-0.0441</td>
<td>-0.0404</td>
<td>-0.418**</td>
<td>-0.160</td>
<td>-0.0788</td>
<td>-0.106</td>
<td>-0.0807</td>
</tr>
<tr>
<td></td>
<td>(0.0316)</td>
<td>(0.0388)</td>
<td>(0.0380)</td>
<td>(0.187)</td>
<td>(0.102)</td>
<td>(0.0661)</td>
<td>(0.0649)</td>
<td>(0.0876)</td>
</tr>
<tr>
<td>I[t &gt; 20 weeks]</td>
<td>-0.130***</td>
<td>-0.0823*</td>
<td>0.0430</td>
<td>-0.252</td>
<td>-0.0883</td>
<td>-0.348***</td>
<td>-0.189***</td>
<td>-0.165*</td>
</tr>
<tr>
<td></td>
<td>(0.0328)</td>
<td>(0.0441)</td>
<td>(0.0310)</td>
<td>(0.176)</td>
<td>(0.0884)</td>
<td>(0.0803)</td>
<td>(0.0719)</td>
<td>(0.0888)</td>
</tr>
</tbody>
</table>

Year fixed effects: √
Marital status: ×
Family size: ×

$R^2$: 0.0493 0.0650 0.0365 0.0205 0.00975 0.0208 0.0252 0.0154
N: 1551 1548 798 982 1548 1488 1543 1119
Pre-U characteristics of individuals with spells $\geq 20$ wks

<table>
<thead>
<tr>
<th></th>
<th>(1)</th>
<th>(2)</th>
<th>(3)</th>
<th>(4)</th>
<th>(5)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Duration of future spell $\geq 20$ weeks</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age: 30 to 39</td>
<td>0.129***</td>
<td>0.118***</td>
<td>0.116***</td>
<td>0.119***</td>
<td>0.120***</td>
</tr>
<tr>
<td></td>
<td>(0.00237)</td>
<td>(0.00250)</td>
<td>(0.00251)</td>
<td>(0.00305)</td>
<td>(0.00311)</td>
</tr>
<tr>
<td>Age: 40 to 49</td>
<td>0.164***</td>
<td>0.153***</td>
<td>0.153***</td>
<td>0.162***</td>
<td>0.163***</td>
</tr>
<tr>
<td></td>
<td>(0.00277)</td>
<td>(0.00293)</td>
<td>(0.00295)</td>
<td>(0.00357)</td>
<td>(0.00363)</td>
</tr>
<tr>
<td>Age: 50+</td>
<td>0.272***</td>
<td>0.261***</td>
<td>0.265***</td>
<td>0.281***</td>
<td>0.282***</td>
</tr>
<tr>
<td></td>
<td>(0.00288)</td>
<td>(0.00307)</td>
<td>(0.00319)</td>
<td>(0.00367)</td>
<td>(0.00371)</td>
</tr>
<tr>
<td>Gender: Female</td>
<td>-0.00226</td>
<td>-0.00209</td>
<td>-0.00279</td>
<td>-0.0146***</td>
<td>-0.0135***</td>
</tr>
<tr>
<td></td>
<td>(0.00192)</td>
<td>(0.00193)</td>
<td>(0.00203)</td>
<td>(0.00230)</td>
<td>(0.00230)</td>
</tr>
<tr>
<td>0&lt;Net wealth $\leq$ 200k</td>
<td>-0.0503***</td>
<td>-0.0116***</td>
<td>-0.0116***</td>
<td>-0.0122***</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.00234)</td>
<td>(0.00271)</td>
<td>(0.00315)</td>
<td>(0.00335)</td>
<td></td>
</tr>
<tr>
<td>200k&lt;Net wealth $\leq$ 500k</td>
<td>-0.0466***</td>
<td>-0.0146***</td>
<td>-0.0146***</td>
<td>-0.0114***</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.00324)</td>
<td>(0.00350)</td>
<td>(0.00325)</td>
<td>(0.00425)</td>
<td></td>
</tr>
<tr>
<td>500k&lt;Net wealth $\leq$ 5M</td>
<td>-0.0186***</td>
<td>0.00576*</td>
<td>0.00774*</td>
<td>0.00418*</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.00300)</td>
<td>(0.00336)</td>
<td>(0.00372)</td>
<td>(0.00418)</td>
<td></td>
</tr>
<tr>
<td>Net wealth $&gt;5M$</td>
<td>0.0731***</td>
<td>0.0852***</td>
<td>0.0866***</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.0173)</td>
<td>(0.0172)</td>
<td>(0.0174)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Fraction of portfolio in stocks

<p>| | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>3rd quartile</td>
<td>-0.000542</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.00787)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4th quartile</td>
<td>0.0303***</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.00259)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Leverage: debt / assets

<p>| | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>2nd quartile</td>
<td>0.0153***</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.00390)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3rd quartile</td>
<td>-0.0120***</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.00322)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4th quartile</td>
<td>-0.00629*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.00361)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

$R^2$                  | 0.0465     | 0.0490     | 0.0511     | 0.0624     | 0.0620     |
N                      | 269931     | 269931     | 269931     | 190176     | 190176     |
Consumption Implementation: Taylor Approximations

- **Homogeneous preferences**

\[
CS_k \approx \frac{v'(\bar{c}^u_k) - v'(\bar{c}_0)}{v'(\bar{c}_0)} \approx -\frac{v''(\bar{c}_0)}{v'(\bar{c}_0)} \times \frac{\bar{c}_0 - \bar{c}^u_k}{\bar{c}_0},
\] (3)

- **Heterogeneous preferences**

\[
CS_k \approx \frac{E_k [v'_i (c_{i,0})] - E_0 [v'_i (c_{i,0})]}{E_0 [v'_i (c_{i,0})]} - \frac{E_k [v''_i (c_{i,0}) (c_{i,0} - c_{i,t}^u)]}{E_0 [v'_i (c_{i,0})]}.
\] (4)

Selection