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

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Motivation

- 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

  $\Rightarrow$ *empirical implementation, but silent about optimal timing*
- Theoretical literature on optimal timing of UI in particular

  $\Rightarrow$ *insights are model-dependent and hard to connect to data*

This Paper:

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 **consumption surveys** and **admin data on income and wealth**
- estimate all relevant statistics to provide an evidence-based evaluation of the benefit profile.

Theory: Robust Characterization, Simple Implementation

- 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)

Empirics Preview I: Unemployment Responses

- 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. (LT $\geq$ 20 wks)

Empirics Preview II: Consumption Profile

- Limited evidence on impact of labor shocks on consumption
  - Gruber ('97) studies consumption drop when unemployed
  - consumption survey data: limited ability to observe unemployment status and duration
- We link consumption surveys to unemployment registers in Sweden. We also obtain residual measure of yearly expenditures using unique admin data on income and wealth
- 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

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$\Rightarrow$ Evaluated at a flat profile in Sweden, our evidence indicates that benefits are too high overall, but inclining 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

$$S\left(t\right) = \Sigma_{i=1}^{N}\left[\Pi_{s=0}^{t}\left(1-h_{i,s}\right)\right]/N$$

- 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

$$C^u(t) = \Sigma_{i=1}^{N}\left[\frac{S_i(t)}{S(t)} \times c_{i,t}^u\right]/N$$

Setup: Unemployment Policy

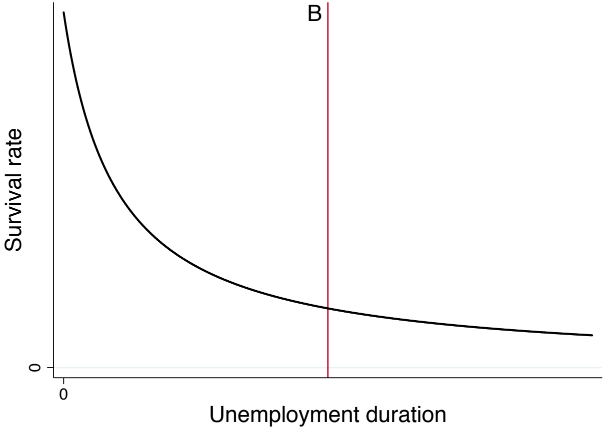
- We consider policies of the form $(b_1, b_2, ...)$ providing UI benefit b_1 for the first B_1 periods of unemployment, b_2 for the next $B_2 - B_1$ periods etc.
- The benefits are funded by a uniform tax τ on the employed.
- The average unemployment duration equals sum of survival rates at each duration:

$$D = \Sigma_t S(t) = \underbrace{\Sigma_0^{B_1} S(t)}_{=D_1} + \underbrace{\Sigma_{B_1}^{B_2} S(t)}_{=D_2} + .. + \underbrace{\Sigma_{B_{n-1}}^{T} S(t)}_{=D_n},$$

where D_i is the average duration spent receiving benefit b_i.

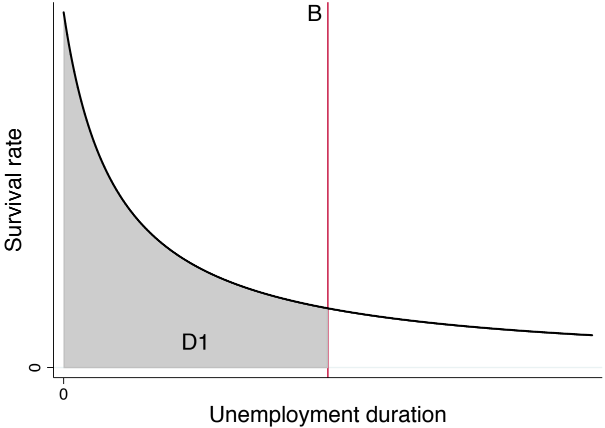
Illustration: Two-Part Policy

Illustration: Survival Rate Function S(t)



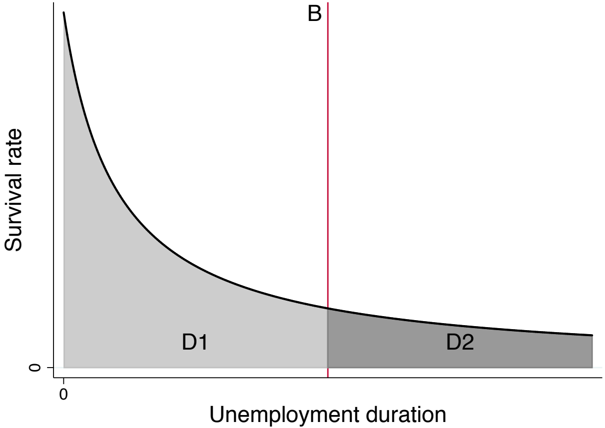
- Average unemployment duration equals $D = \Sigma_t S(t)$.

Illustration: ST Benefit Duration



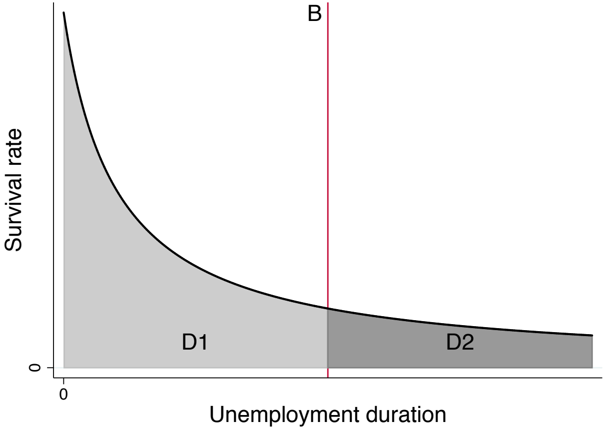
- Average duration spent receiving benefit b_1 equals $D_1 = \Sigma_0^B S\left(t\right)$.

Illustration: LT Benefit Duration



- Average unemployment duration $D = \Sigma_t S(t) = D_1 + D_2$.

Illustration: LT Benefit Duration



- Gvt BC: $\tau \cdot (T - D) = b_1 \cdot D_1 + b_2 \cdot D_2.$

Optimal Unemployment Policy: Welfare

- The optimal unemployment policy solves

$$\max_{\mathbf{b},\tau} \;\; \Sigma_i \mathcal{U}_i(\mathbf{b},\tau) \text{ for } \mathcal{U}_i(\mathbf{b},\tau) = \max_{\tilde{x}_i \in X} U_i(\tilde{x}_i|\mathbf{b},\tau)$$

such that $\Sigma_k D_k \cdot b_k = [T - D] \cdot \tau.$

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- Baily-Chetty benchmark: the **optimal flat profile** b solves

$$\underbrace{\frac{E\left[u'\left(c^u\right)\right] - E\left[u'\left(c^e\right)\right]}{E\left[u'\left(c^e\right)\right]}}_{=\mathbf{CS_b}} = \underbrace{\varepsilon_{D,b}}_{=\mathbf{MH_b}}. \qquad (1)$$

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- **Key insight** ($\sim$ Env. Thm): behavioral responses have *first-order* welfare effect through the fiscal externality only

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

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A Sufficient Statistics Approach

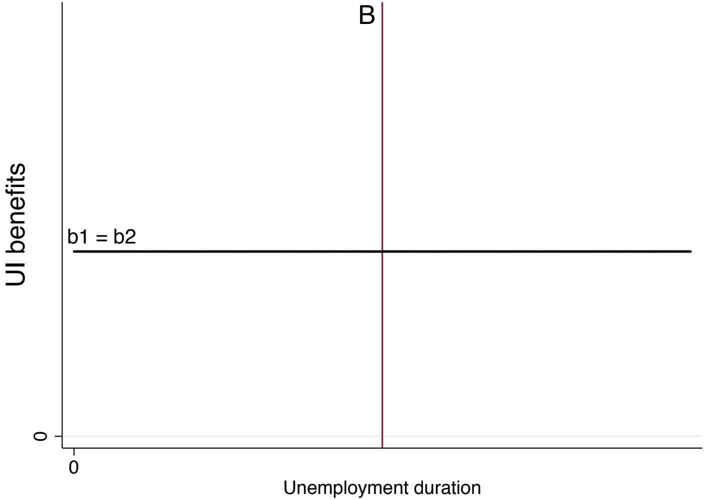
- **Generality**:
  - Robust to variations in underlying primitives of the model
  - Allows for duration dependence, heterogeneity, assets, etc.
  - Externalities, equilibrium effects, internalities $\Rightarrow$ additional terms
- **Sufficient** for what?
  - Statistics sufficient for characterizing optimal benefit profile
  - Evaluate welfare effect of small deviations from actual policy

$$CS_k \geq MH_k \Rightarrow \uparrow b_k$$

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

$$CS_2 / CS_1 \geq MH_2 / MH_1 \Rightarrow \uparrow b_2 / b_1$$

MH Costs: Implementation



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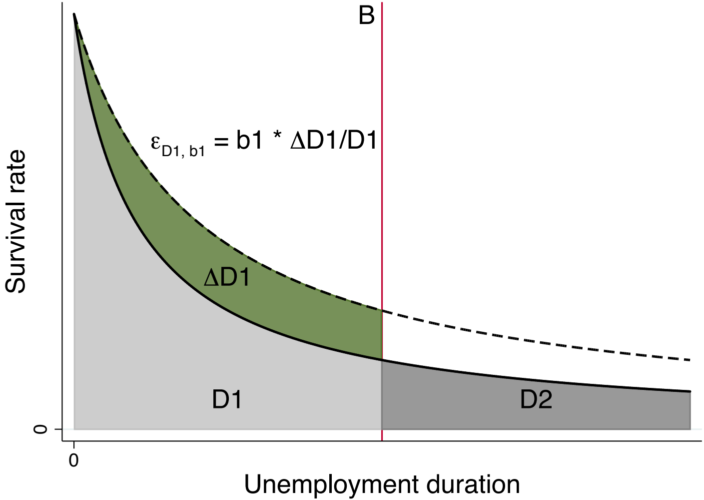

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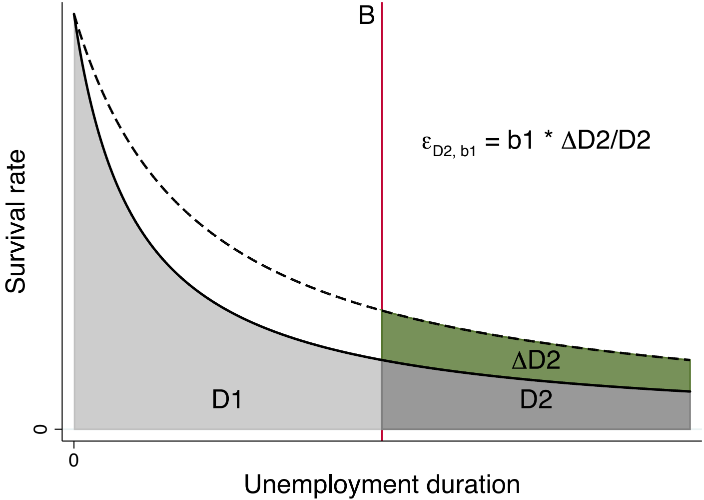

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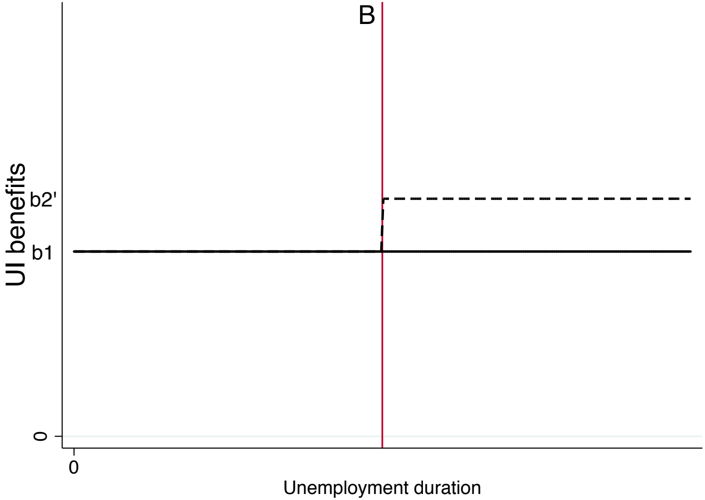

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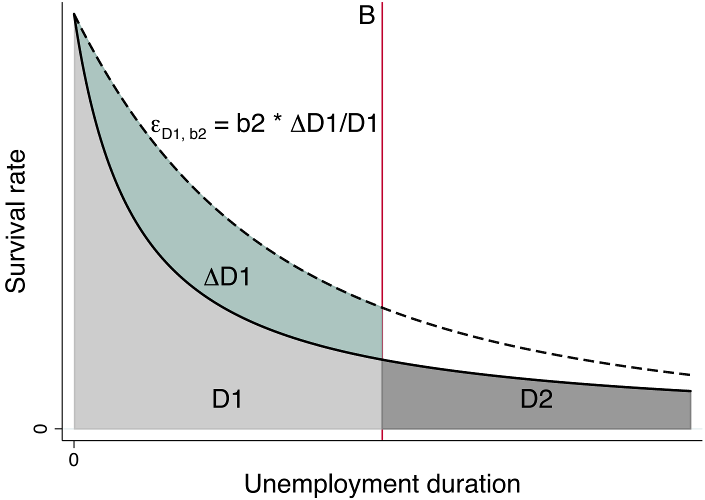

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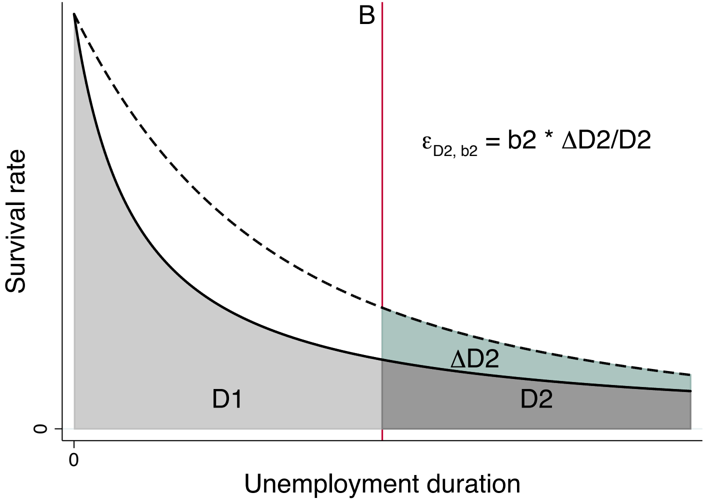
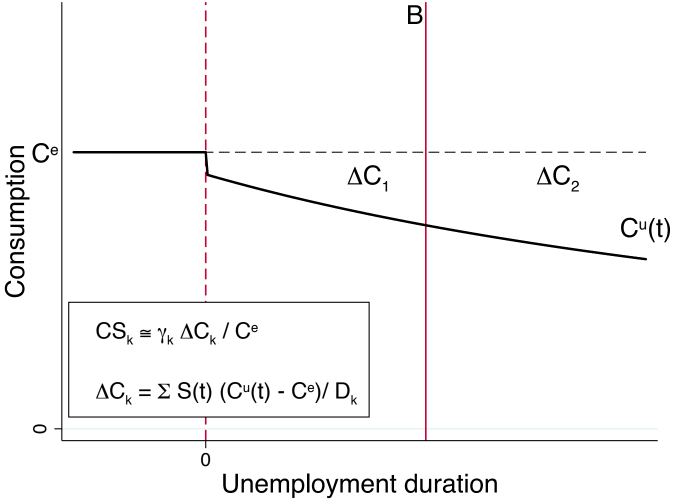


CS Gains: Consumption Implementation



Dynamic Policy Insights Revisited

If CS_{b_t} and MH_{b_t} were constant over the spell, *constant* benefits would be optimal. However,

- **Forward-looking job seekers** $\Rightarrow$ MH_{b_t} increasing over the spell
  - *declining* benefits become optimal
  - see Shavel&Weiss '79, Hopenhayn&Nicolini '97,...
- **Unobservable savings** $\Rightarrow$ CS_{b_t} 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_{b_t} may well be decreasing over the spell $\Rightarrow$ *inclining* benefits
  - see Pavoni '09, Shimer&Werning '09

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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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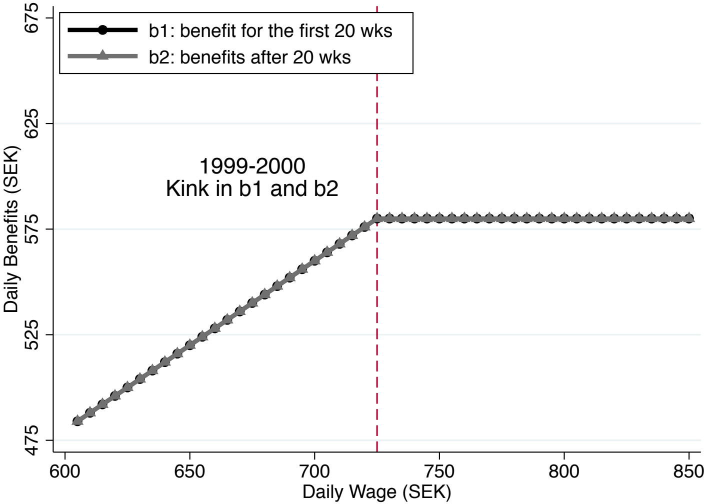
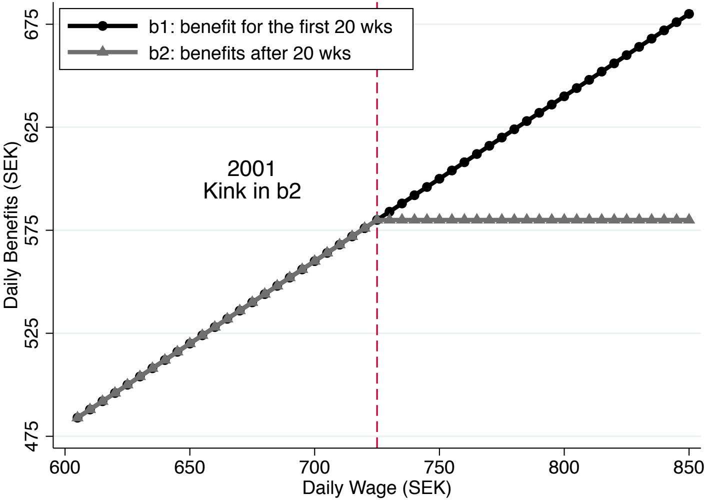
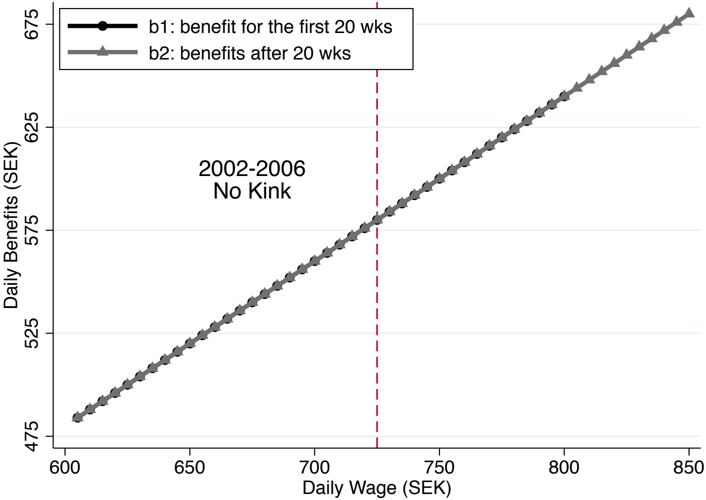
Flat Benefit Profile with Benefit Cap ['99-'00]



Duration-Dependent Benefit Cap ['01]



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



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 $w = \bar{w}_k$

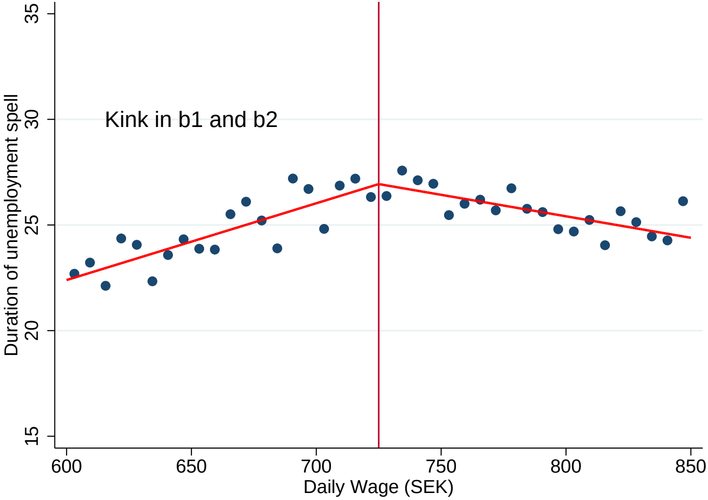
- **Non-parametric identification** of the average marginal effect of b_k on Y:

$$\alpha_k = \frac{\lim_{w \to \bar{w}_k^+} \frac{\partial E[Y|w]}{\partial w} - \lim_{w \to \bar{w}_k^-} \frac{\partial E[Y|w]}{\partial w}}{\lim_{w \to \bar{w}_k^+} \frac{\partial b_k}{\partial w} - \lim_{w \to \bar{w}_k^-} \frac{\partial b_k}{\partial w}} = \frac{\hat{\delta}_k}{\nu_k}$$

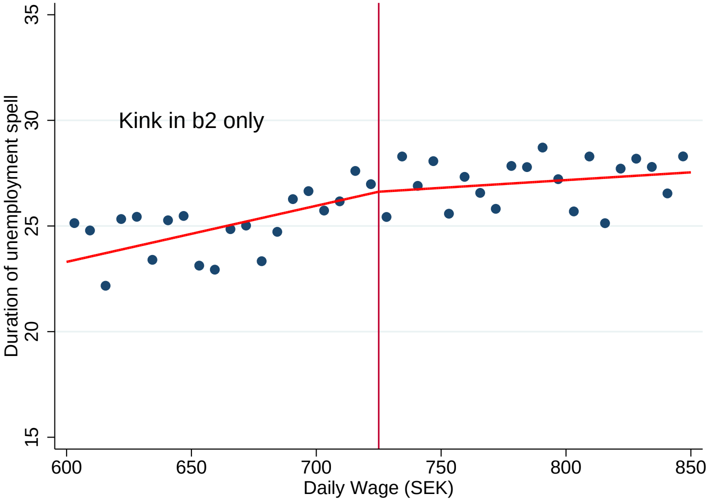
  - $\hat{\delta}_k$: estimated change in slope between Y and w at kink $\bar{w}_k$
  - ν_k: deterministic change in slope between b_k and w at kink $\bar{w}_k$

- **Identifying assumptions:**
  - direct marginal effect of w on Y is smooth
  - smooth pdf of ε at $\bar{w}_k$

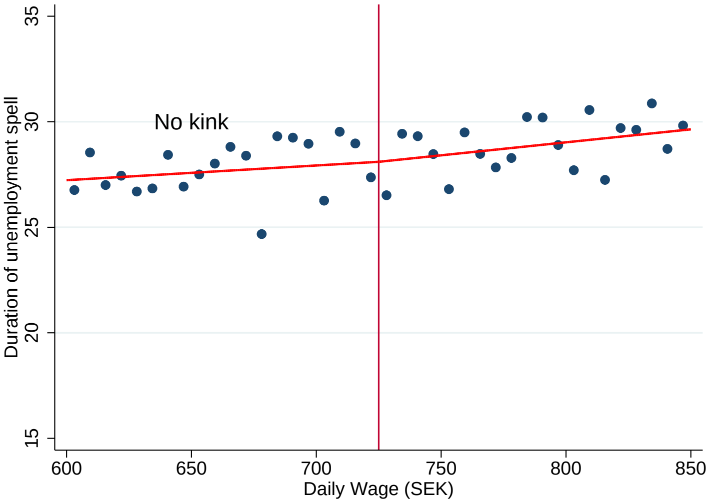
Wage and Unemployment Duration: Kink in b_1 and b_2



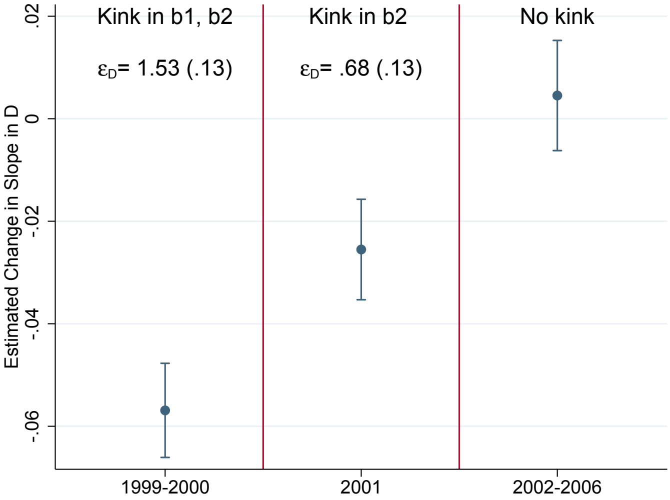
Wage and Unemployment Duration: Kink in b_2



Wage and Unemployment Duration: No Kink



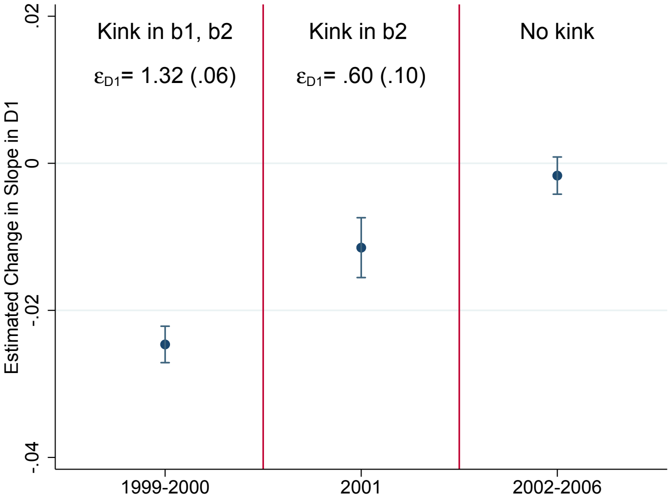
RKD: Estimated Duration Responses



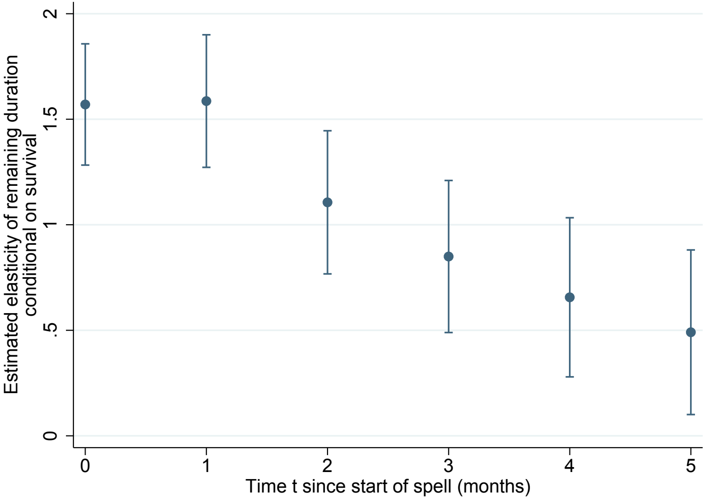
Duration Responses: Takeaways

- Estimates imply $MH_{b_1} > MH_{b_2}$
  - $\varepsilon_{D,b_1} = \varepsilon_{D,b} - \varepsilon_{D,b_2} = .84\ (.19) \geq \varepsilon_{D,b_2} = .69\ (.14)$
  - $MH_{b_k} = \varepsilon_{D,b_k} \frac{D}{D_k}$, for flat profile, and $D_1 \approx D_2$
- Unemployed are forward-looking ($\varepsilon_{D_1,b_2} > 0$), but non-stationary more than offsets this! ▸ Hazard Rates
- Estimates can explain different findings in earlier works
  - $\varepsilon_{D,b_1} \approx$ 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



Non-stationarity: Elasticity of Remaining Duration



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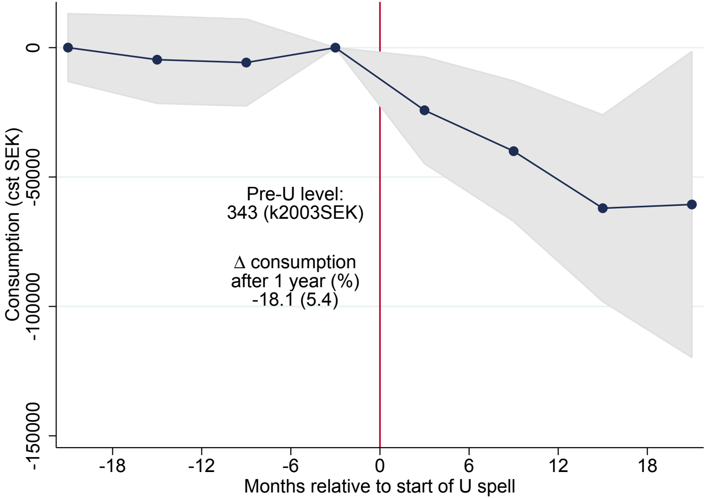
Consumption Profile: Empirical Strategy

- **Data**: household consumption surveys (HUT) merged with universe of administrative UI records:
  - flow measure of consumption at time of HUT interview
  - observe full employment history of individuals surveyed in the HUT.
  - sample: individuals unemployed or who will be unemployed
- **Event Study**:

$$c_{it} = \sum_t \beta_t \cdot \mathbb{1}[HUT = t] + X_i'\gamma + \varepsilon_{it} \tag{2}$$

  - $\mathbb{1}[HUT = t]$: indicator for being surveyed at spell time t
  - investigate role of selection on consumption levels and profiles
- **Robustness**: Confirm all findings with registry-based residual measure of consumption using comprehensive admin data on income and wealth

Household Consumption Over the Spell



Log Household Consumption Relative To Pre-U

	(1)	(2)	(3)	(4)
$\mathbb{1}[0 < t \leq 20 \text{ wks}]$	-0.0606*	-0.0415	-0.0379	-0.0465
	(0.0316)	(0.0302)	(0.0305)	(0.0413)
$\mathbb{1}[t > 20 \text{ wks}]$	-0.130***	-0.131***	-0.113***	-0.108***
	(0.0328)	(0.0326)	(0.0379)	(0.0414)
$\mathbb{1}[L > 20 \text{ wks}]$			-0.0294	-0.0342
			(0.0300)	(0.0378)
$\mathbb{1}[t \leq 20 \text{ wks}] \times \mathbb{1}[L > 20 \text{ wks}]$				0.0134
				(0.0629)
Year F-E	×	×	×	×
Calendar months F-E	×	×	×	×
Marital status		×	×	×
Family size		×	×	×
Age group F-E		×	×	×
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

Consumption Smoothing Means Over the Spell

- 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 ▸ Registry consumption
- Limited means to smooth consumption (high MPC out of UI)
  - majority starts spell with **no financial nor real assets** ▸ Table Wealth
  - limited added-worker effect ▸ HH Income
  - limited use of debt over the spell ▸ Debt
  - UI transfers basically do all the smoothing for the LT unemployed ▸ Decomposition

From Consumption Profile To CS Gains of UI

- Consumption-Implementation approach:
  - CS gains can be approximated using consumption drops ▸ Taylor

$$CS_k \approx \gamma \cdot \Delta C_k / C$$

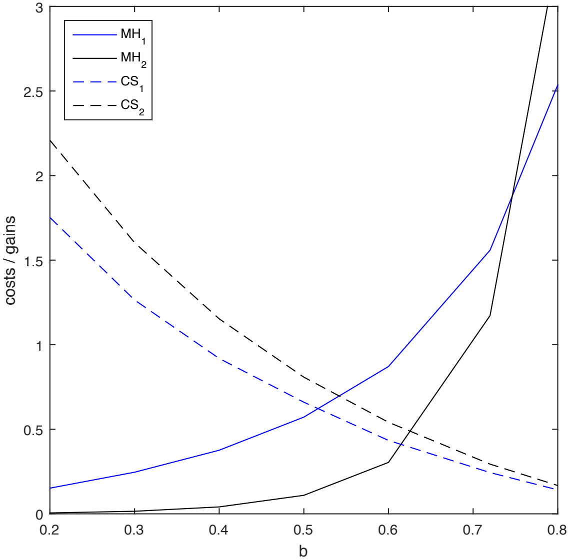
  - Consumption $\downarrow \Rightarrow$ CS gains $\uparrow$ over U spell
- Robustness to dynamic selection:
  - with heterogeneous preferences, selection on consumption levels or profiles would matter
  - limited evidence of selection on risk preferences ▸ Risk Preferences
- Consumption vs Expenditures ▸ Expenditure categories
  - unemployed increase home production
  - unemployed decrease durable good expenditures
  - no dynamic selection on various categories of expenditures

Welfare: Putting Things Together

	(1) Moral hazard cost, MH_x	(2) Consumption drop, ΔC_x	(3) Value of kroner spent, CS_x / MH_x
b	1.53	.10	$\gamma \times .07$
	(.13)	(.01)	
b_1	1.67	.06	$\gamma \times .04$
	(.37)	(.03)	
b_2	1.38	.13	$\gamma \times .09$
	(.27)	(.03)	

- Benefits are too high throughout the spell (for "standard" $\gamma = 2$)
- Value of marginal kroner spent on unemployed after 20wks is twice as high as before 20wks (for constant γ)
- Flat profile in place: our local evaluation pushes towards inclining profile!
- Calibration: optimal inclining tilt $b_2 \geq b_1$ survives for lower generosity

Optimal Profile: CS vs. MH in Calibrated Model

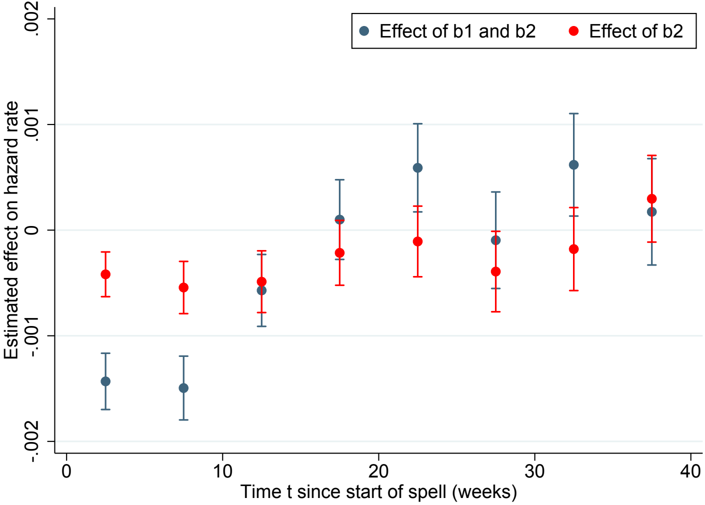


Conclusion

- 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



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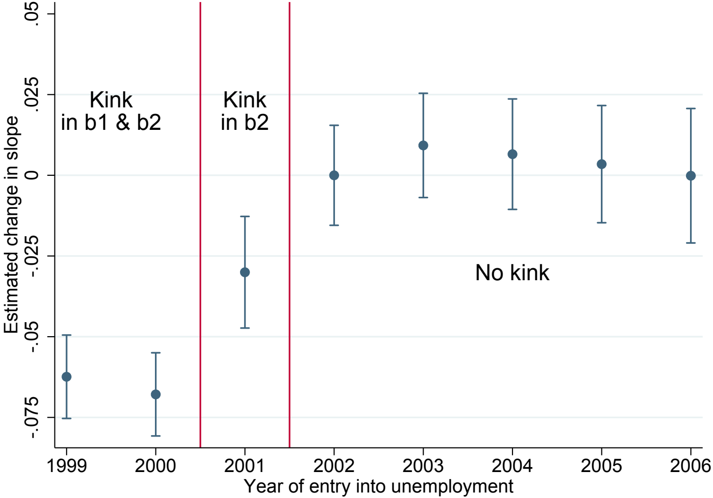
RKD estimates at the SEK725 kink by year of entry



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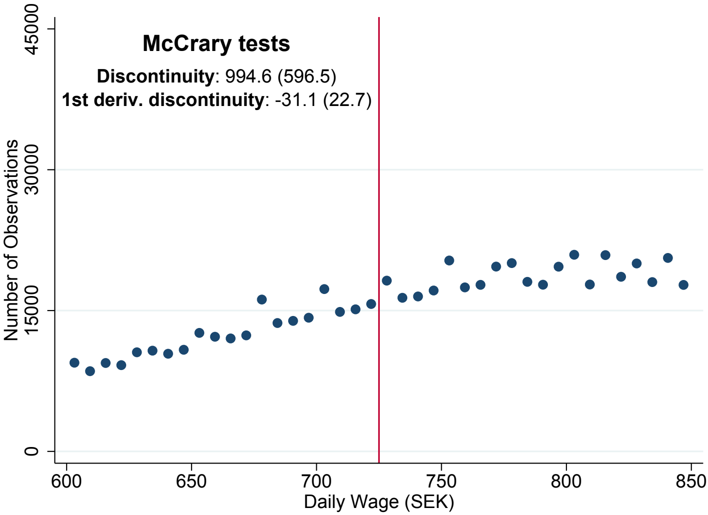
RKD: P.d.f. of Daily Wage



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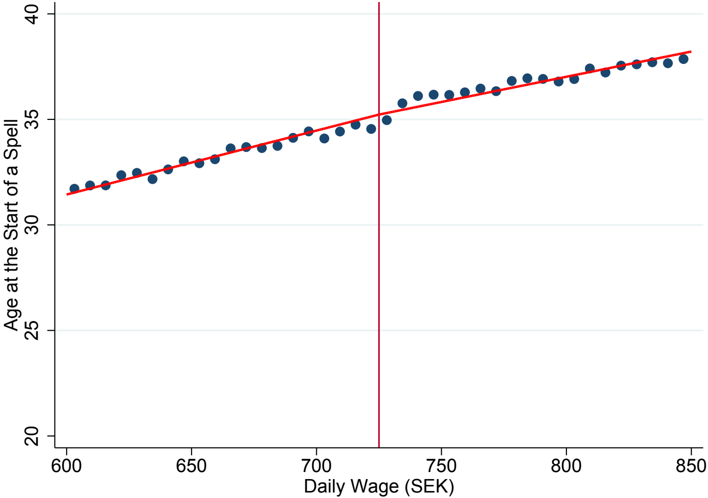
RKD: Wage and Age



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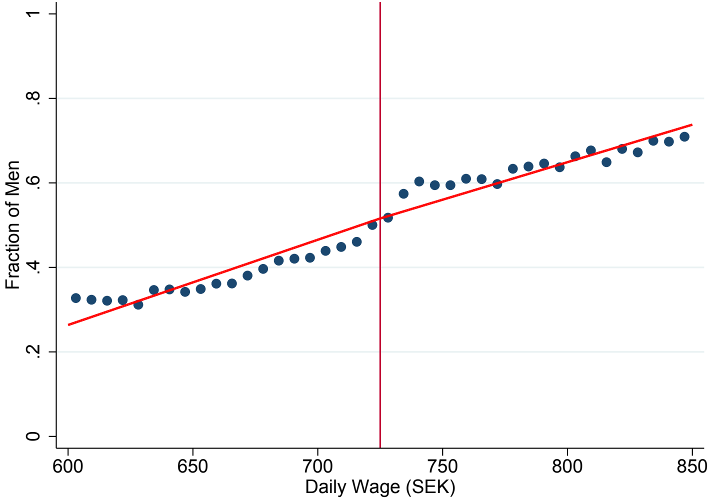
RKD: Wage and Fraction Men



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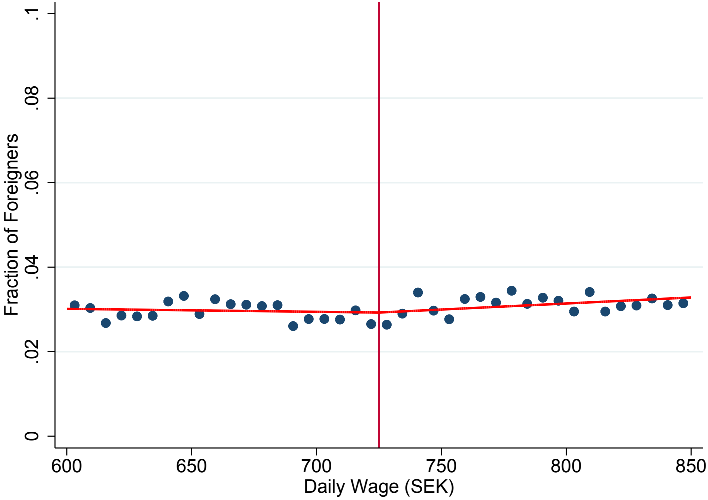
RKD: Wage and Fraction Foreigners



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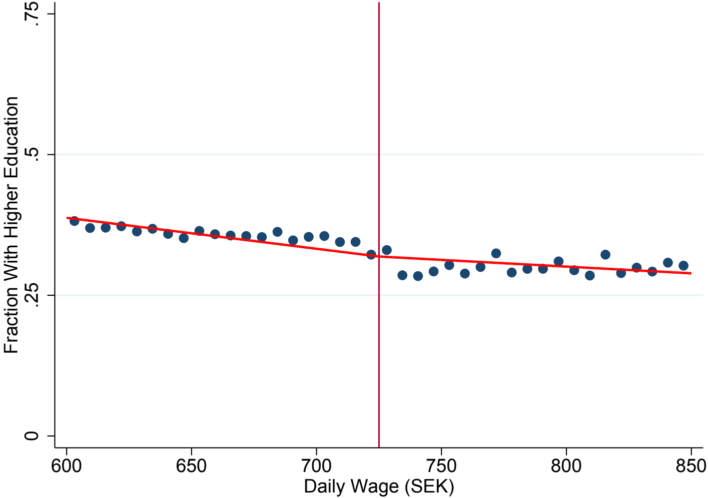
RKD: Wage and Fraction With Higher Education



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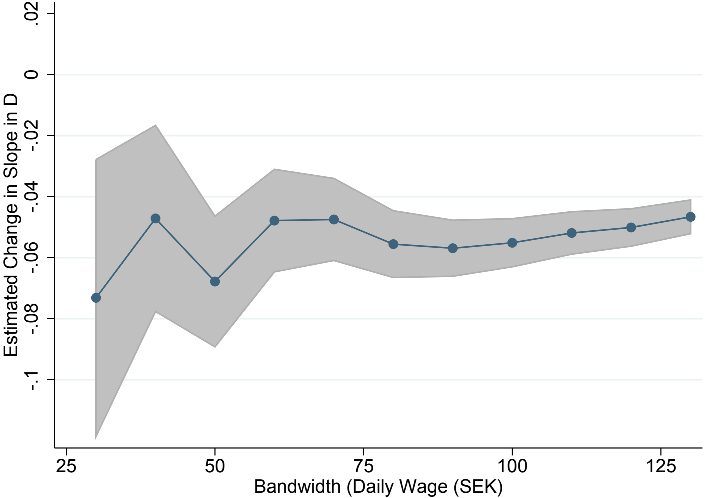
RKD Estimates by Bandwidth Size



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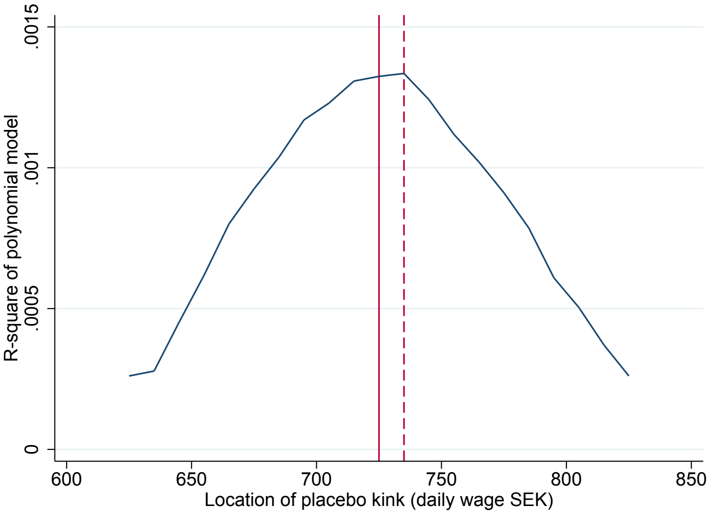
Non-parametric detection using placebo kinks



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RKD estimates: Inference

	(1) Unemployment Duration D	(2) Duration D_1 (< 20 weeks)	(3) Duration D_2 (≥ 20 weeks)
	I. 1999-2000: Kink in b_1 and b_2		
Linear - δ_k	-.0569	-.0246	-.0299
Robust s.e.	(.0047)	(.0013)	(.0036)
Bootstrapped s.e.	(.0050)	(.0012)	(.0039)
95% CI - permut. test	[-.0595 ; -.0566]	[-.0319 ; -.0189]	[-.0402 ; -.019]
	II. 2001: Kink in b_2 only		
Linear - δ_k	-.0255	-.0115	-.0105
Robust s.e.	(.005)	(.0021)	(.0028)
Bootstrapped s.e.	(.0049)	(.0020)	(.0030)
95% CI - permut. test	[-.0325 ; -.0190]	[-.0127 ; -.0103]	[-.0115 ; -.0091]

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RKD estimates: Sensitivity to polynomial order

	(1) Unemployment Duration D	(2) Duration D_1 (< 20 weeks)	(3) Duration D_2 (≥ 20 weeks)
	I. 1999-2000: Kink in b_1 and b_2		
Linear - δ_k	-.0569	-.0246	-.0299
	(.0047)	(.0013)	(.0036)
RMSE	28.285	7.049	23.972
AIC	1785650.8	1264546	1723601.1
Quadratic - δ_k	-.0474	-.0344	-.0183
	(.0185)	(.0049)	(.0143)
RMSE	28.285	7.048	23.971
AIC	1785650.5	1264518.9	1723588.4
Cubic - δ_k	-.0527	-.0291	-.0221
	(.0455)	(.0122)	(.0351)
MSE	28.284	7.046	23.971
AIC	1785644.8	1264394.7	1723590

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Table: Summary statistics at start of U spell: HUT sample

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

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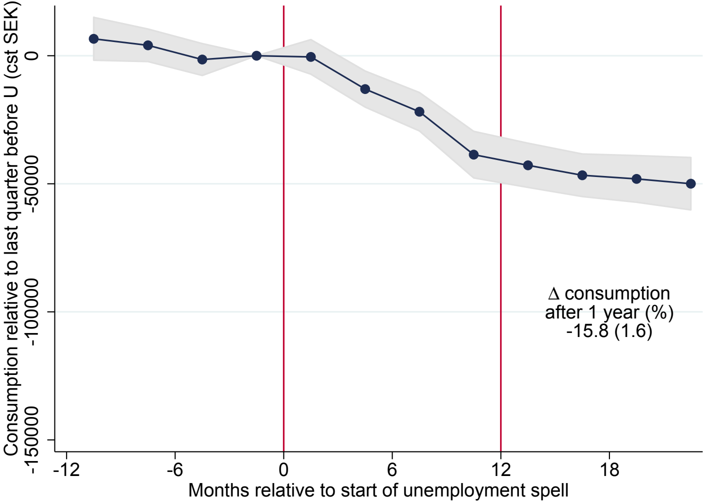
Household Consumption: Registry Based Measure



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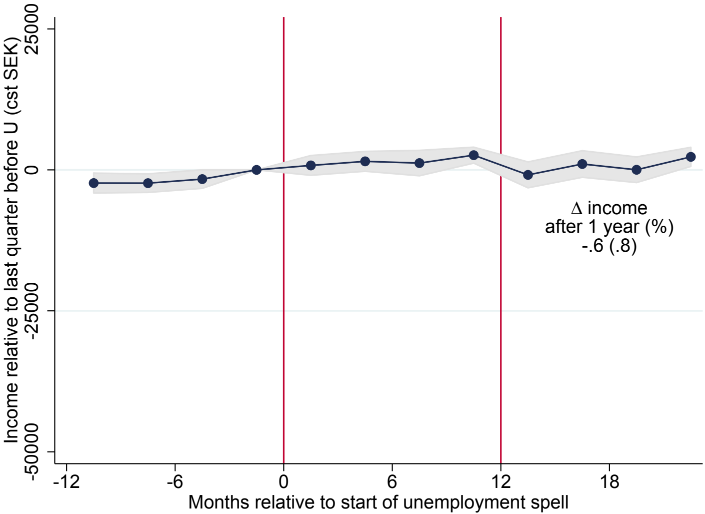
Yearly Income of All Other HH Members



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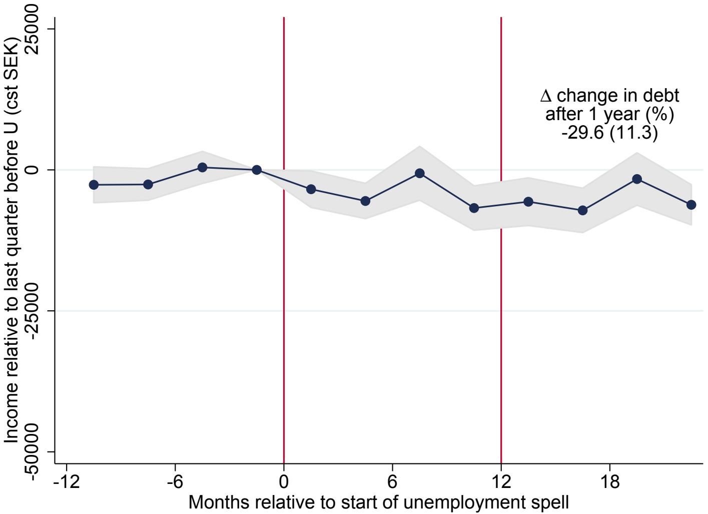
Yearly Change in Non-Mortgage Debt



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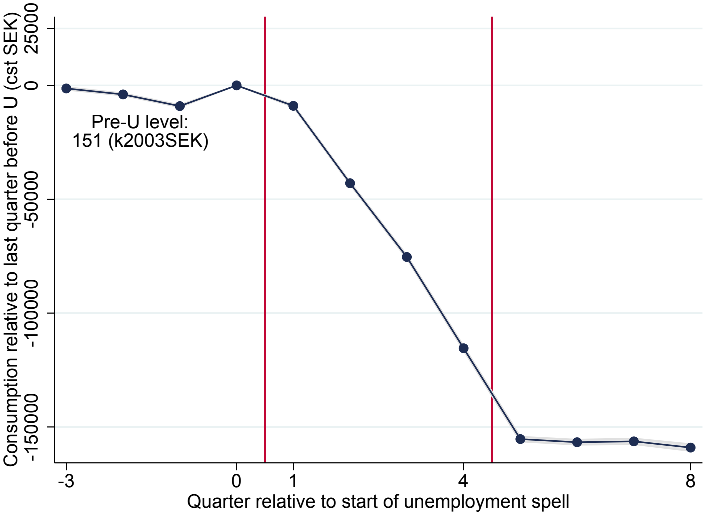
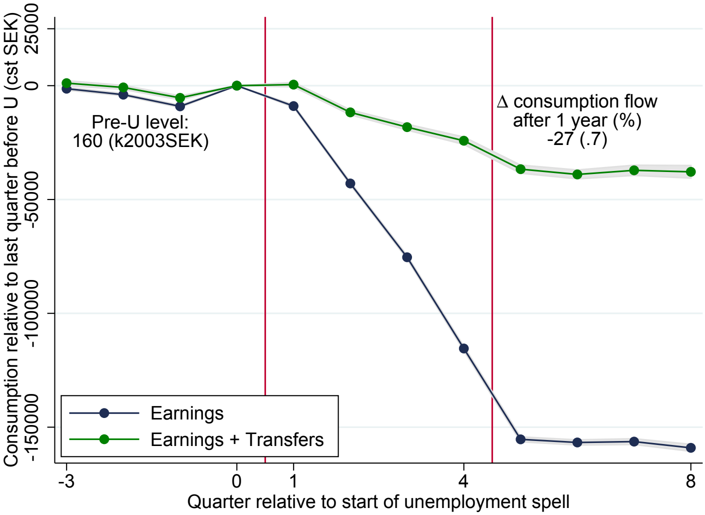
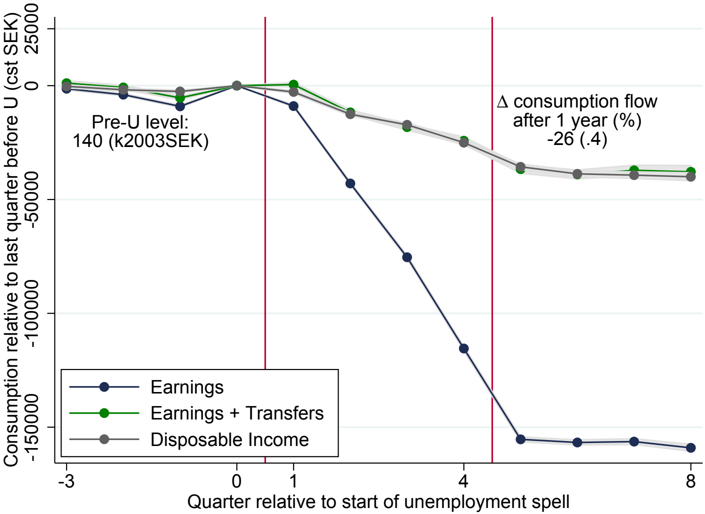
Decomposition: Earnings



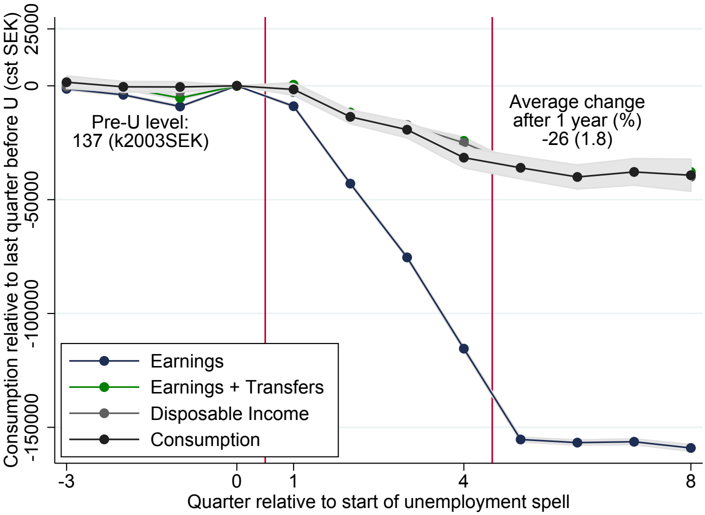
Decomposition: + Transfers



Decomposition: + Other Income



Decomposition: + Changes in Assets



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Log Household Consumption Relative To Pre-U

	(1) Total exp.	(2) Food	(3) Rents	(4) Purch. of new vehicles	(5) Furn. & house appl.	(6) Trans- port.	(7) Recre- ation	(8) Restau- rant
$\mathbb{1}[t \leq 20 \text{ weeks}]$	-0.0606*	-0.0441	-0.0404	-0.418**	-0.160	-0.0788	-0.106	-0.0807
	(0.0316)	(0.0388)	(0.0380)	(0.187)	(0.102)	(0.0661)	(0.0649)	(0.0876)
$\mathbb{1}[t > 20 \text{ weeks}]$	-0.130***	-0.0823*	0.0430	-0.252	-0.0883	-0.348***	-0.189***	-0.165*
	(0.0328)	(0.0441)	(0.0310)	(0.176)	(0.0884)	(0.0803)	(0.0719)	(0.0888)
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

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Pre-U characteristics of individuals with spells $\geq$ 20 wks

	(1)	(2)	(3)	(4)	(5)
	Duration of future spell $\geq$ 20 weeks				
Age: 30 to 39	0.129***	0.118***	0.116***	0.119***	0.120***
	(0.00237)	(0.00250)	(0.00251)	(0.00305)	(0.00311)
Age: 40 to 49	0.164***	0.153***	0.153***	0.162***	0.163***
	(0.00277)	(0.00293)	(0.00295)	(0.00357)	(0.00363)
Age: 50+	0.272***	0.261***	0.265***	0.281***	0.282***
	(0.00288)	(0.00307)	(0.00319)	(0.00367)	(0.00371)
Gender: Female	-0.00226	-0.00209	-0.00279	-0.0146***	-0.0135***
	(0.00192)	(0.00193)	(0.00193)	(0.00230)	(0.00230)
0<Net wealth≤200k			-0.0503***	-0.0116***	-0.0122***
			(0.00234)	(0.00271)	(0.00315)
200k<Net wealth≤500k			-0.0466***	-0.0146***	-0.0114***
			(0.00324)	(0.00350)	(0.00425)
500k<Net wealth≤5M			-0.0186***	0.00576*	0.00774*
			(0.00300)	(0.00336)	(0.00418)
Net wealth>5M			0.0731***	0.0852***	0.0866***
			(0.0173)	(0.0172)	(0.0174)
Fraction of portfolio in stocks					
3rd quartile				-0.000542	
				(0.00787)	
4th quartile				0.0303***	
				(0.00259)	
Leverage: debt / assets					
2nd quartile					0.0153***
					(0.00390)
3rd quartile					-0.0120***
					(0.00322)
4th quartile					-0.00629*
					(0.00361)
R^2	0.0465	0.0490	0.0511	0.0624	0.0620
N	269931	269931	269931	190176	190176

Consumption Implementation: Taylor Approximations

- **Homogeneous preferences**

$$CS_k \cong \frac{v'\left(\bar{c}_k^u\right) - v'\left(\bar{c}_0\right)}{v'\left(\bar{c}_0\right)} \cong -\frac{v''\left(\bar{c}_0\right)\bar{c}_0}{v'\left(\bar{c}_0\right)} \times \frac{\bar{c}_0 - \bar{c}_k^u}{\bar{c}_0}, \quad (3)$$

- **Heterogeneous preferences**

$$CS_k \cong \underbrace{\frac{E_k\left[v_i'\left(c_{i,0}\right)\right] - E_0\left[v_i'\left(c_{i,0}\right)\right]}{E_0\left[v_i'\left(c_{i,0}\right)\right]}}_{\text{Selection}} - \frac{E_k\left[v_i''\left(c_{i,0}\right)\left(c_{i,0} - c_{i,t}^u\right)\right]}{E_0\left[v_i'\left(c_{i,0}\right)\right]}. \quad (4)$$

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