Causes and Consequences of the Reemployment Wage Decrease: New Findings and Policy Implications

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- ↓ **Reemployment earnings** ∼ ↑ **Unemployment duration**

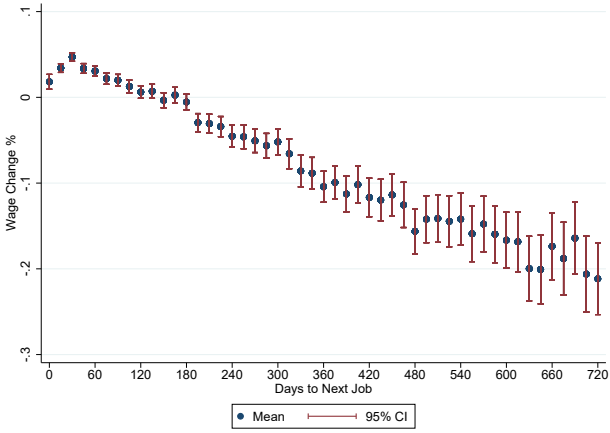


Figure: Change in daily re-employment wage over time in unemployment. Source: MCVL

Question:

1. Is there any causal effect from unemployment duration to re-employment earnings?
   - Kroft et al. [2013], Erickson et al. [2014], Schimieder et al. [2016], Marinescu et al. [2021]

2. **New: How to disentangle the mechanisms behind the causal impact?**
   1. Target wage decreases as the UI exhaustion approaches.
   2. Human capital depreciates over time (or signaling effect)

This Paper

We use Spanish Social Security Data (MCVL) to investigate the causal link between time in unemployment and re-employment wages:

1. **Causes:** We empirically identify the two mechanisms, controlling for ex-ante heterogeneity.
2. **Consequences**: We implement a structural model to answer the policy question – Does the timing of UI interventions matter for increasing re-employment earnings?
   - We compare a UI extension v.s. a UI benefit level increase

Empirical findings:

To explain the causal effect of time in unemployment on re-employment wages:

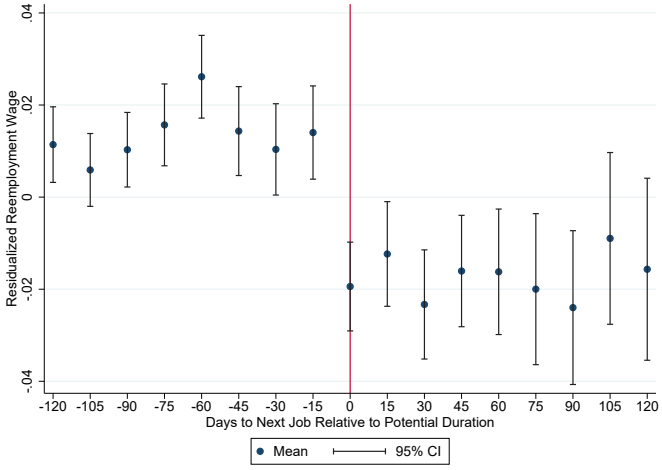
Both the target wage response to the UI exhaustion and the human capital depreciation matter!

- Target wage response: A sharp reduction of 3.2% around the exhaustion of UI
- The human capital depreciation rate: 1.1% re-employment wage decrease per month
- On average, the former accounts for 10% of the causal impact of time in unemployment on re-employment wages; the latter accounts for the remaining 90%.

The Response of Re-employment Wages to UI Exhaustion I

- Data: Spanish Social Security Data (MCVL): Employment, Unemployment, UI status, wages etc

Figure: Residualized re-employment wage over time relative to exhaustion of UI



1. Institutional feature of Spain's UI system

   - Potential duration (B) of unemployment insurance (UI):

Table: Schedule of B: Tenure-based Discontinuity

Days Worked in Previous 6 Years (T^{exp})											
From	360	540	720	900	1080	1260	1440	1620	1800	1980	>2160
To	539	719	899	1079	1259	1439	1619	1799	1979	2159	
Potential Unemployment Benefit Duration (B) (Months)											
	4	6	8	10	12	14	16	18	20	22	24

   - Quasi-experiments around the discontinuities. Bunching Test of discontinuities Balance Tests

The Response of Re-employment Wages to UI Exhaustion II

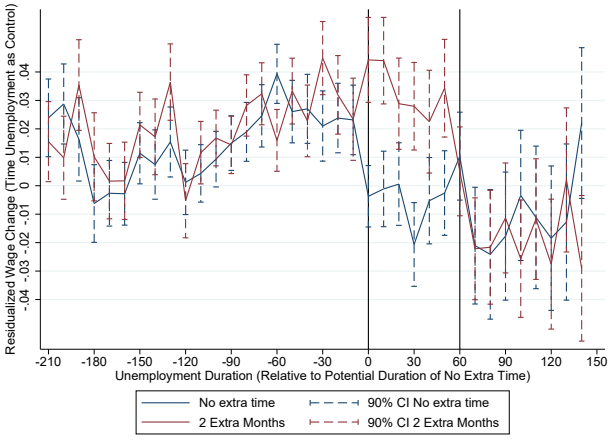


Figure: Residualized re-employment wage evolution for workers with and without an exogenous 2-month extension of UI benefits.

Identification strategy: Difference-in-Difference + Regression Discontinuity Design

1. Define treatment and control group using RD design, selecting near the policy discontinuities
   - Treatment Group: Workers exogenously given 2 addt'l months of UI benefits
   - Control Group: Workers exogenously not given 2 addt'l months of UI benefits
2. Run difference-in-difference regression
   - *Post* period: Period from 15 days prior to UI exhaustion to 30 days post UI exhaustion in the control Group.

Assumption: No UI exhaustion specific selection

- Workers can select themselves to exit unemployment earlier or later, and that being correlated with re-employment earnings.
- But conditional on time unemployed, selection does not depend on the proximity to the exhaustion of UI.

Table: Effect of UI Exhaustion on Re-employment Wages

	ln Daily Wage (First Month of the Re-employment).			
	No Controls		All Controls	
RD Bandwidth	85 days	24 days (MSE optimal)	85 days	24 days (MSE optimal)
Post × *Treat*	-0.028***	-0.019**	-0.032***	-0.022**
	[0.006]	[0.010]	[0.006]	[0.010]
N	208554	56226	208007	56071

p-value: * 0.10 ** 0.05, *** 0.01.

Regression Specification | Robustness: RD bandwidth, DID window | Other wage measures | Individual FE

How to identify target wage response to UI exhaustion? Direct search model (Nekoei [2018]):

1. A hand-to-mouth worker with $\beta \in (0,1)$, chooses on two dimensions (w, s).
2. The human capital stock: $\rho(t)$
3. Unemployment insurance: $b(t) = \overline{b}$ for $t \leq B$ and $= \underline{b}$ for $t > B$

- Under the assumption:

  The human capital depreciation process is smooth when UI exhausts (**Key Assumption!**)

- The following equivalence exists:

  The causal impact of UI exhaustion on re-employment wage $\Longleftrightarrow$ The target wage response to the *exhaustion* of UI

  Answer (Mechanism 1): workers reduce their target wage by 3.2% to UI exhaustion

- Moreover, the following equivalence is also true (under some assumptions).

  The causal impact of UI exhaustion on re-employment wage $\Longleftrightarrow$ The target wage response to an *extension* of UI

How to identify the human capital depreciation rate?

- **Key**: **causal impact of a UI benefit extension on expected re-employment wages**
  — Schmieder et al. [2016], Nekoei et al.[2018]

$$\frac{dE(ln(w^*(t)))}{dB} = \underbrace{\sum_0^\infty (\frac{\partial ln(w^*(t))}{\partial B} \mathrm{pr}(t))}_{\text{① Target wage increase to an UI extension}} + \underbrace{\sum_0^\infty (ln(w^*(t)) \frac{\partial \mathrm{pr}(t)}{\partial B})}_{\text{② Shift to longer unemployment}} \quad (1)$$

- ①: we already know it!
- ② ≤ 0 since wage decreases over time:
  1. **Human capital depreciation**
  2. A wage decrease when exhausting UI (we already know it!)

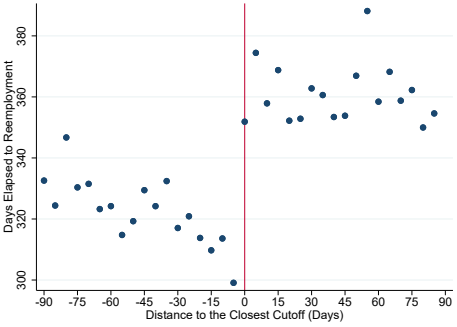
Proposition 1

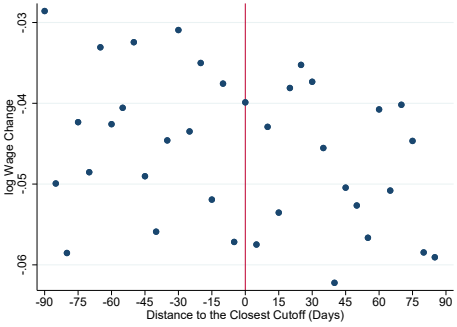
$$\frac{dln(w)}{dt} \equiv \underbrace{-\left(\frac{dE(D^*)}{dB}\right)^{-1} \cdot \left(\frac{dE(ln(w^*(t)))}{dB} - \Delta ln(\mathbf{w}(B+dB)) \cdot \mathrm{pr}(D^* \in (B, B+dB))\right)}_{f\left(\frac{dE(D^*)}{dB}, \frac{dE(ln(w^*(t)))}{dB}, \Delta ln(\mathbf{w}(B+dB))\right)}$$

$$\underbrace{-\left(\frac{dE(D^*)}{dB}\right)^{-1} \cdot \left(\sum_{\tau=0}^{B} \frac{\partial ln(w(\tau))}{\partial B} \cdot \mathrm{pr}(D^* = \tau) + \sum_{\tau=0}^{B} \Delta ln(w(\tau)) \cdot \frac{\partial \mathrm{pr}(D^* = \tau)}{\partial B}\right)}_{\mathbf{o}(\beta)} \tag{2}$$

1. $f(\cdot)$:
   - $\frac{dE(D^*)}{dB}$: the effect on expected unemployment duration (D^*) of an UI extension
   - $\frac{dE(ln(w^*(t)))}{dB}$: the effect on re-employment wages of an UI extension
   - $\Delta ln(\mathbf{w}(B+dB))$: the target wage increase at $(B, B+dB]$ to an UI extension
2. $\mathbf{o}(\beta)$:
   - $\frac{\partial \Delta ln(w(t))}{\partial B}$: the increase in target wage at $t = 1, \cdots, B$ due to the UI extension
   - $\frac{\partial \mathrm{pr}(D^*=\tau)}{\partial B}$: the decrease in the probability of finding a job at $t = 1, \cdots, B$ due to the UI extension

Figure: Impact of crossing thresholds, eligible for 2 extra months of UI





Y	Days Unemployment		Log Wage Change	
$\hat{\alpha}$	31.75***	32.34***	0.000	-0.008*
	[5.39]	[2.78]	[0.008]	[0.004]
Bandwidth	24*	85	24*	85
N	65,003	240,755	56,226	208,554

RD Separate Graph | Balance Test | Bunching Test

Table: Human Capital Depreciation Rate

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
This Paper	-0.0118*	-0.0109**	-0.0100**	-0.0116**	-0.0113***	-0.0120***	-0.0114***
se	0.0065	0.0056	0.0040	0.0047	0.0042	0.0038	0.0035
Controls	All	All	All	All	All	All	All
Method	P	P	P	P	P	P	P
Bandwidth	25	35	45	55	65	75	85
Bootstraps	300	300	300	300	300	300	300

Robustness to choices of RD bandwidth | Other wage outcomes

Answer (Mechanism 2): workers suffer a -1.1% decline in re-employment wage per month, due to human capital depreciation

Taking care of Target wage response matters! Using Schmieder's [2016] estimator (no target wage response) = -0.7% decline in re-employment wage per month. 40% smaller!

Conclusion:

- **Mechanism 1:** Spanish workers react to the exhaustion of UI by reducing their target wage by 3.2% at the end
- **Mechanism 2:** Human capital depreciation rate is -1.1% per month
- The overall causal impact of unemployment duration is -1.21% per month
  - 10% of it is due to target wage reduction
  - 90% of it is due to human capital depreciation

Model: We estimate a two-type structural model – **Myopic type (L) vs Forward-looking type (H)**. SMM to the causal moments recovered empirically.

Model Fit

Policy experiments: Effect on wages of budget-equivalent UI extension vs UI benefit increase.

Conclusion: The timing of the UI transfers matters, but it does so differently for workers with different UI potential durations.

- UI extensions $>$ UI level increases for the workers with a short potential duration
- UI extensions $<$ UI level increases for the workers with a long potential duration

Extensions vs RR increases along PD distribution

Why? "Mandatory Savings" role of UI extensions.

The marginal return of a UI extension decreases over the UI potential duration.

- **Mechanism 1:** Spanish workers react to the exhaustion of UI by reducing their target wage by 3.2% at the end.

- **Mechanism 2:** Human capital depreciation rate is -1.1% per month.
- The overall causal impact of unemployment duration is -1.21% per month.
  - 10% of it is due to target wage reduction.
  - 90% of it is due to human capital depreciation.

- **Policy Implication**: Cash transfers at the end of the spell can be helpful, especially for workers with short UI potential duration.

In practice, run the regression as follows:

$$y_{it} = \gamma_0 \cdot E_{0,t} \times Treat_i + \sum_{j=1,2} \gamma_j E_{j,t} \times Treat_i + \theta Treat_i + \sum_{j=0,1,2} \beta_j^E \; E_{j,t} + \beta_b \cdot B_i + X_{it}\beta_X + \epsilon_{it} \qquad (3)$$

for the sample $|T_i^{exp} - cutoff_i| < h$

- $Treat_i$ denotes one belongs to the left-hand side of its closet discontinuities, therefore treated first by UI exhaustion.
- $E_{0,t}$ denotes whether the worker finds a job 15 days (or later) before the UI exhaustion in the treatment group.
- $E_{1,t}$ denotes whether the worker finds a job 45 days (or later) after the UI exhaustion in the treatment group
- $E_{2,t}$ denotes whether the worker finds a job 105 days (or later) after the UI exhaustion in the treatment group.
- B_i denotes potential duration fixed effects, X_{it} denotes workers' characteristics or the economy wide controls.

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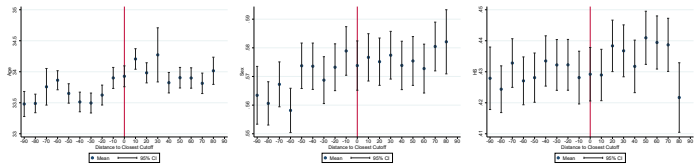
Table: **Balance test: all cutoffs combined**

	Panel A: Bandwidth – MSE Optimal 24 days					
	Age	Male	HS	College	ln Wealth	ln Previous Wage
	-0.135	-0.006	-0.007	-0.015*	-.002	-0.009
	[0.170]	[0.009]	[0.009]	[0.011]	[0.15]	[0.006]
N	65,033	65,033	65,033	65,033	65,033	65,033
	Panel B: Bandwidth: 90 Days					
	Age	Male	HS	College	ln Wealth	ln Previous Wage
	.345***	-0.003	-.0051	0.006	0.038***	-0.002
	[0.089]	[0.004]	[0.0056]	[0.004]	[0.008]	[0.003]
N	222,652	222,652	222,652	222,652	222,652	222,652

Degree of local polynomial: Linear. p-value: * 0.10 ** 0.05, *** 0.01

Figure: **Balance test of observed characteristics**



(a) Age (b) Gender (c) HS

(d) College (e) Wealth (f) Benefit

Note: This graph presents the balance of the observed characteristics at around the $T_{tenure,i}$ cutoff thresholds. We pool people with different potential duration together. The red line at 0 of x-axis is the cutoff thresholds of the policy scheme for potential duration.

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Table: Effect of the exhaustion of UI. All discontinuities

	Panel A: Re-employment *ln* daily wage change							
DiD Estimate	-0.025***	-0.027***	-0.028***	-0.032***	-0.024***	-0.027***	-0.019**	-0.021**
	[0.006]	[0.006]	[0.006]	[0.006]	[0.007]	[0.006]	[0.010]	[0.010]
Controls	D	All	D	All	D	All	D	All
Bandwidth	85	85	85	85	85	85	24	24
Start (Days)	-30	-30	-15	-15	-15	-15	-15	-15
End (Days)	30	30	45	45	30	30	45	45
N	208554	208007	208554	208007	208554	208007	56226	56071

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Table: Effect of the exhaustion of UI. All discontinuities

	Panel A: Re-employment *ln* daily wage change (1Y average)							
DiD Estimate	-0.028***	-0.028***	-0.029***	-0.032***	-0.026***	-0.028***	-0.020**	-0.021**
	[0.006]	[0.005]	[0.006]	[0.005]	[0.006]	[0.006]	[0.011]	[0.010]
Controls	D	All	D	All	D	All	D	All
Bandwidth	85	85	85	85	85	85	24	24
Start (Days)	-30	-30	-15	-15	-15	-15	-15	-15
End (Days)	30	30	45	45	30	30	45	45
N	218736	218167	218736	218167	218736	218167	59287	59126
	Panel B: Re-employment *ln* daily wage change (5Y average)							
DiD Estimate	-0.019***	-0.019***	-0.021***	-0.024***	-0.018***	-0.020***	-0.019**	-0.021**
	[0.005]	[0.005]	[0.006]	[0.005]	[0.006]	[0.005]	[0.010]	[0.009]
Controls	D	All	D	All	D	All	D	All
Bandwidth	85	85	85	85	85	85	24	24
Start (Days)	-30	-30	-15	-15	-15	-15	-15	-15
End (Days)	30	30	45	45	30	30	45	45
N	219485	218908	219485	218908	219485	218908	59496	59334

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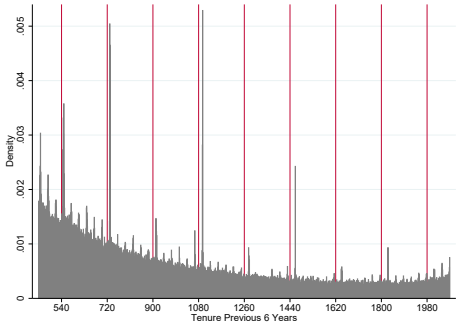
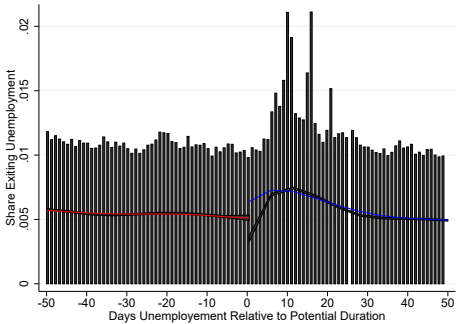
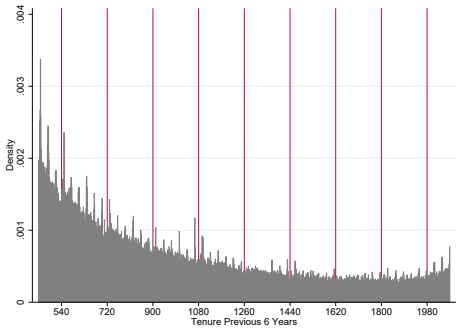
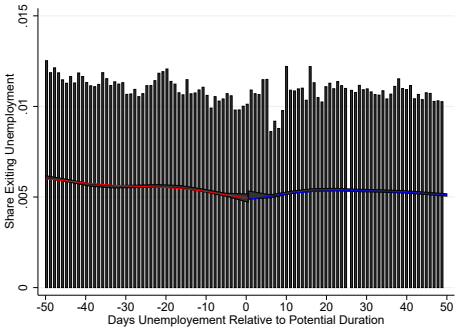
Pre data restriction:





Our final sample after removing **temporary contract with predetermined length of half year, 1 year, ...**:





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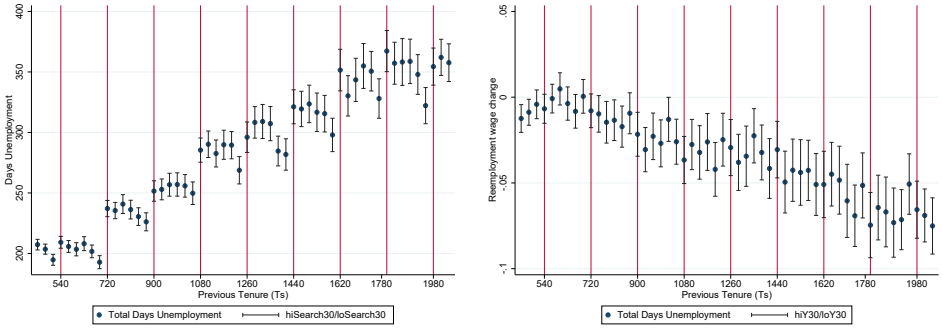
RD Separate Graph



Note: These figures non-parametrically show the impact of crossing the cutoff threshold on time in unemployment (panel (a)) and re-employment wages (panel (b)). The re-employment wage variable is the log of the re-employment wage (relative to the log previous wage).The red lines on the x-axis marks the thresholds where workers start receiving two additional months potential duration.

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Table: Labor market opportunity loss estimates (LMOS). Bootstrap sample

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
LMOS	-0.0118*	-0.0109**	-0.0100**	-0.0116**	-0.0113***	-0.0120***	-0.0114***
SD	0.0065	0.0055	0.0040	0.0047	0.0042	0.0038	0.0035
$p5 - p95$	[-0.021, 0.000]	[-0.020, -0.002]	[-0.016, -0.004]	[-0.020, -0.004]	[-0.018, -0.006]	[-0.018, -0.006]	[-0.018, -0.006]
$p1 - p99$	[-0.027, 0.004]	[-0.024, 0.000]	[-0.020, -0.001]	[-0.024, -0.002]	[-0.022, -0.002]	[-0.022, -0.003]	[-0.020, -0.003]
Controls	All	All	All	All	All	All	All
Method	P	P	P	P	P	P	P
Bandwidth	25	35	45	55	65	75	85
Bootstraps	300	300	300	300	300	300	300

Note: Table 7 presents the estimated labor market opportunity loss in re-employment wage (monthly) from 300 bootstraps of the complete sample. The sample is bootstrapped at the spell level. *SD*: Standard deviation of the LMOS estimate. Controls "All": All controls included in both RDD and DID specifications (see text). Method "P": Parametric estimation of RD results with linear regression. Bandwidth: Indicates the length of the bandwidth used for the RD estimation and for the creation of the treatment and control groups in the DID specification (see text for details).

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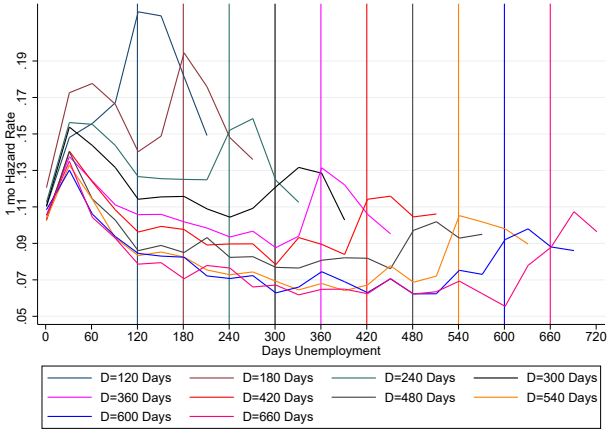

Figure: Hazard rate by potential duration

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How can we see the relevance of storable offers?

Evidence from hazard rate of job findings.

- Workers strategically manipulate their working start date to coincide with the benefit exhaustion.
- A missing "mass" of workers before benefit expiration, in companion with a bunching "mass" shortly afterwards.
- Perform a bunching analysis approach developed by Chetty et al. (2011) and Keleven et al.(2013).

Are there any other reasons driving the reemployment wage drop around benefit exhaustion?

1. Storable Offers (Boone et al (2012))

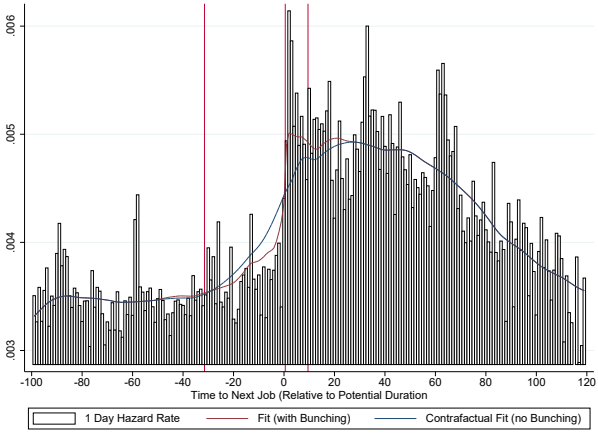
- Once the workers receive a job offer, they are allowed a certain period of time to store it until they accept it.
- A typical strategy for workers is to delay the working start date to coincide with the benefit expiration.
- Therefore, the workers who start working shortly before the UI exhaustion on average find a job much earlier than the workers who starts working shortly after the UI exhaustion.
- **If $\frac{dln(w)}{dt} < 0$, the wage drop around the benefit exhaustion is reflecting a timing difference in receiving a job offer.**

- Fit a flexible polynomial to the empirical distribution of the hazard rate $h_{i,t}$, excluding a region around the benefit exhaustion $[D_{B,-}, D_{B,+}]$.
- With the fitted regression, we predict the counterfactual distribution $\hat{h}_{i,t}$ for the excluded region.
- We iterate over all possible combinations of $(D_{B,-}, D_{B,+})$ such that the difference between the missing "mass" $\hat{M}$ and the spiking "mass" $\hat{S}$ is minimized:

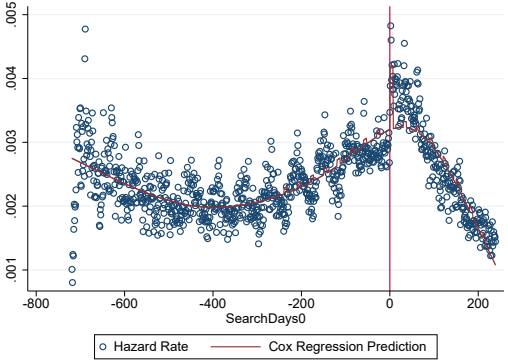
$$(D^*_{B,-}, D^*_{B,+}) = \arg\min |\hat{S} - \hat{M}| \tag{4}$$

$$\hat{S} = \sum_{t=B}^{D_{B,+}} (h_{i,t} - \hat{h_{i,t}}) \quad \hat{M} = \sum_{t=D_{B,-}}^{B} (\hat{h_{i,t}} - h_{i,t})$$

Figure: **Manipulation Analysis of re-employment Time**



V. Robustness Check: Present-bias v.s. Storable Offers



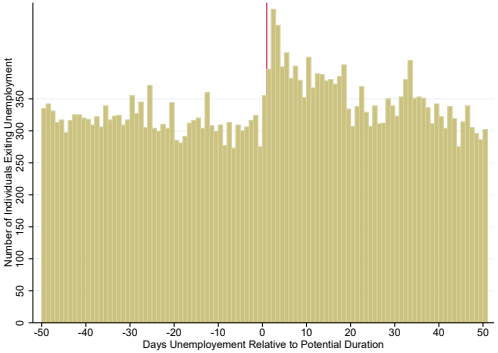
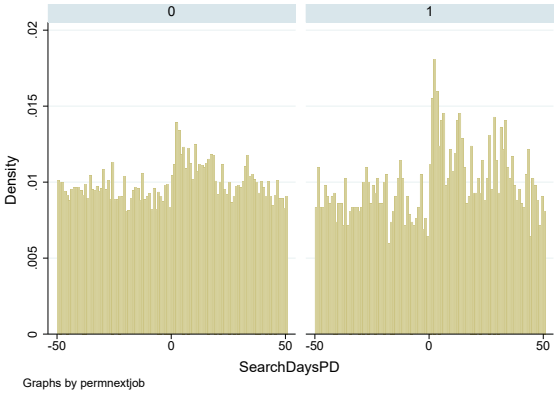
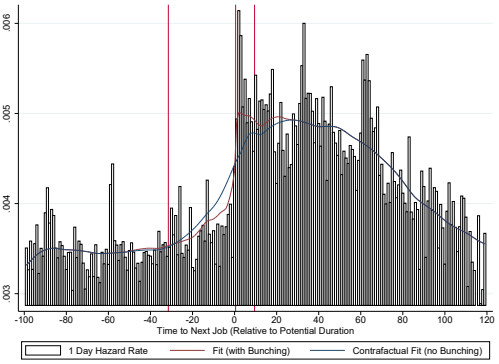


Figure: Distribution of time elapsed to reemployment by next job contract type



Note: This graph presents the histogram of the time elapsed to reemployment (relative to benefit exhaustion) for workers whose next job renders a permanent contract v.s workers whose next job renders a temporary contract.

Figure: Manipulation Analysis of Reemployment Time



Note: 9 presents the empirical distribution of the 1 day hazard rate. We plot in blue smooth line the estimated counterfactual distribution of the hazard rate if workers are not allowed to manipulate their working start date. The two extra vertical red line are respectively the optimal solution to the minimization problem of equation (24), $(D_{B,-}, D_{B,+})$.

Table: **Manipulation estimation**

Parameters	Estimates
$D_{B,-}$	-28.5** (11)
$D_{B,+}$	14**(6.3)

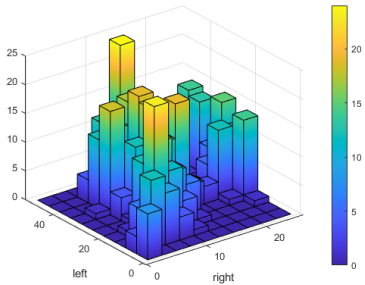


Figure: **Graphic Presentation of Solutions of $(D_{B,-}, D_{B,+})$ from 100 times Bootstrap**

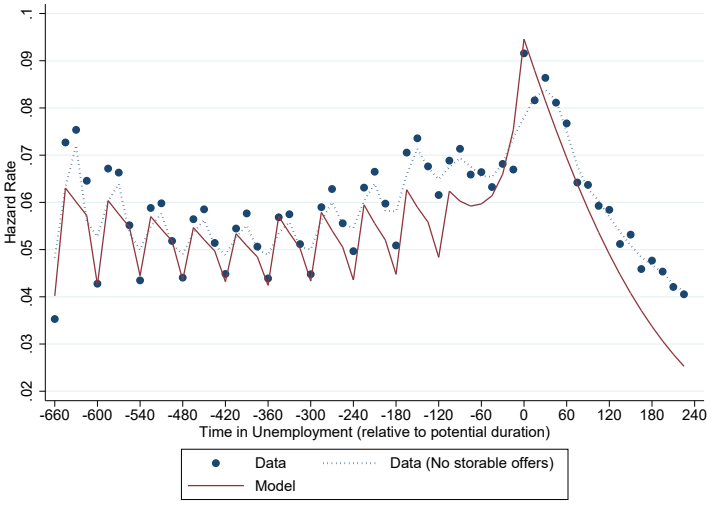
Does including the mechanism of storable offers change our estimation formula for labor market opportunity loss?

- No. It induces a change in time elapsed to next job and a change in observed wage in an offsetting way.

Does it change the interpretation of the reemployment wage drop at benefit exhaustion?

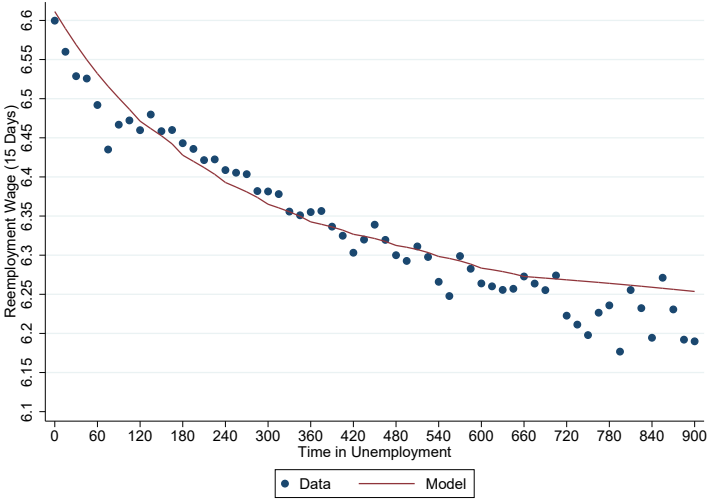
- Yes. However, limited.
- Since workers delay for one month, then 77% of the wage drop at the benefit exhaustion is due to the reduced wage selectivity; while 23% of it is accounted by the strategic delaying.

IV. Structural Model: Goodness-of-fit for hazard rate



Hazard rate fit by entitlement
Back

IV. Structural Model: Goodness-of-fit for re-employment wage evolution



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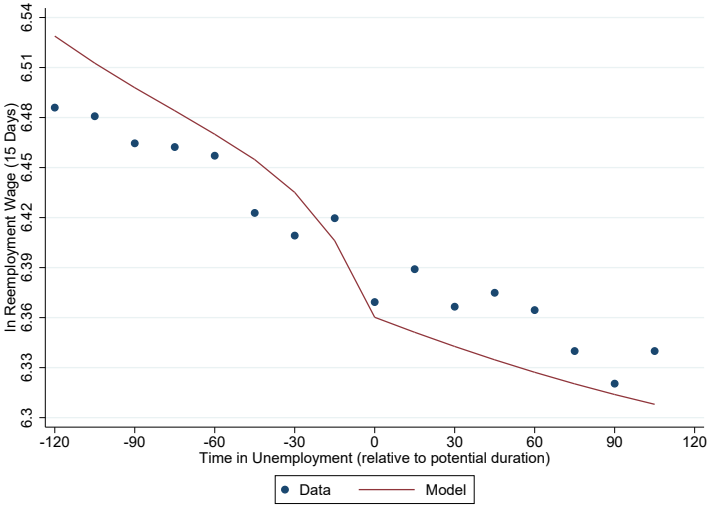
IV. Model: Goodness-of-fit for re-employment wage evolution



Re-employment wage fit by entitlement Back

RDD on unemployment duration		RDD on re-employment wages	
data	model	data	model
20.3***	21.9	-0.004	-0.0002

Table: Model prediction for RDD sample

- The model predicts very well the effect of UI extensions on unemployment duration.
- The model predicts a slightly negative effect of UI extensions on wages.

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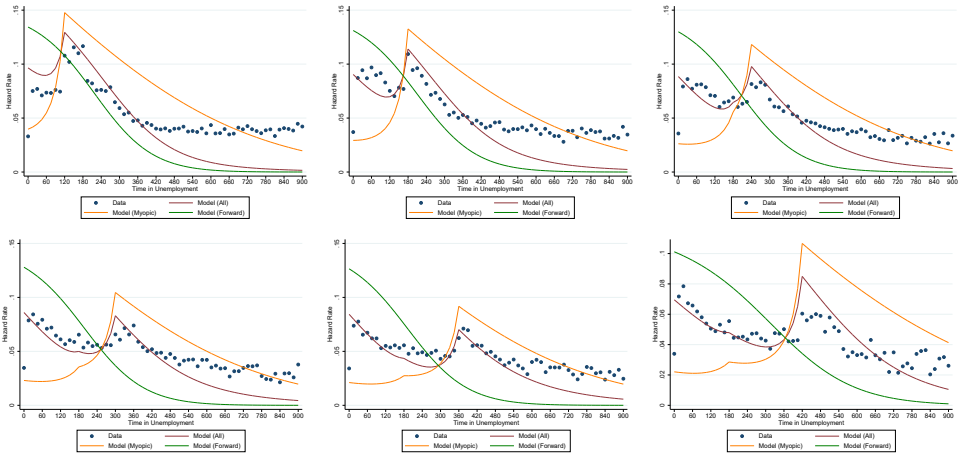
Goodness-of-fit for hazard rate: by entitlement



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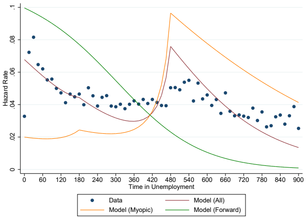
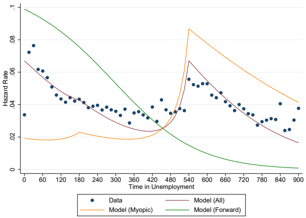
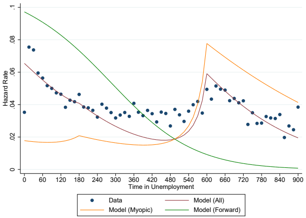
Goodness-of-fit for hazard rate: by entitlement







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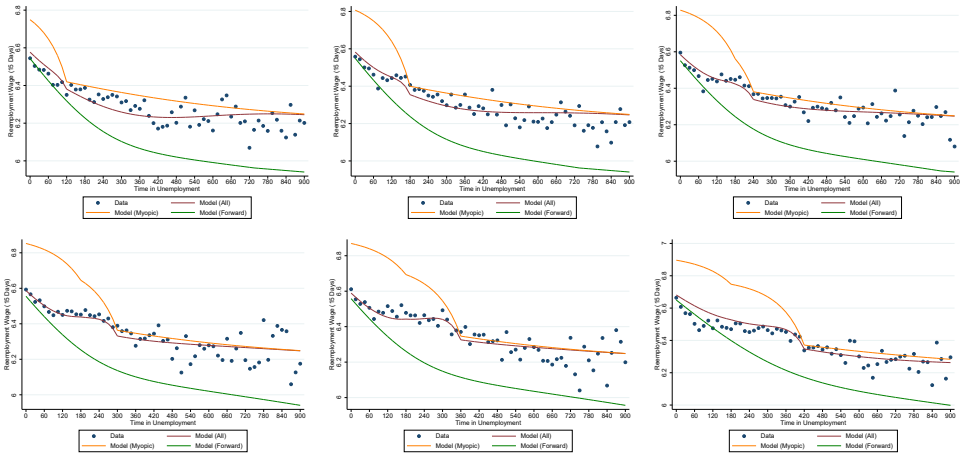
Goodness-of-fit for hazard rate: by entitlement



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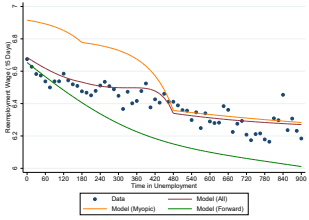
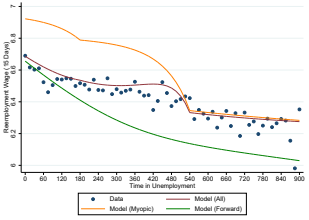
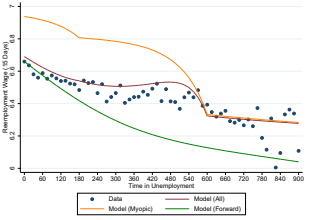
Goodness-of-fit for hazard rate: by entitlement







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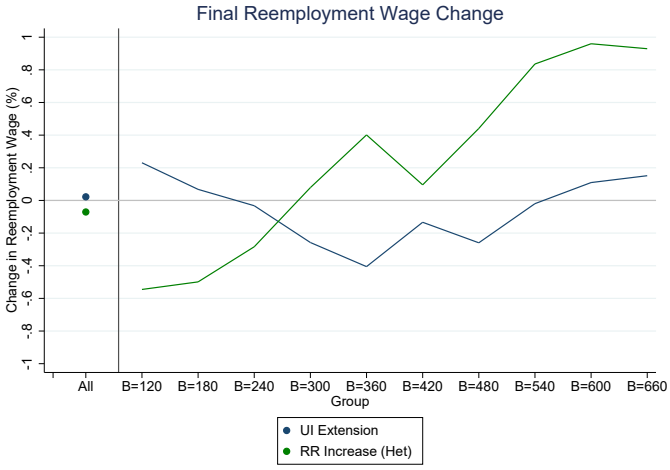
UI extensions v.s. UI level increase (Fixing ex-post expenditure the same)



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