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Unemployment insurance entitlement rules and the wage effect of unemployment insurance reform

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Unemployment insurance entitlement rules and the wage effect of unemployment insurance reform*

[working paper]

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Abstract

I study the extent to which unemployment insurance (UI) eligibility rules affect the wage effect of UI reforms. First, I show that a standard Mortensen-Pissarides model calibrated to Austria can rationalise both large and small average wage effects of changes in UI generosity depending on the rate at which UI recipients lose their entitlement. Second, exploiting the progressive introduction of the 2001 Austrian UI reform, I find moderate though only occasionally weakly marginally significant support for the discontinuity in reemployment wages predicted by the theory.

1 Introduction

UI extensions during the Great Recession stimulated discussions regarding the potential negative effect of making UI more generous on job creation through increased wage pressure (Hagedorn, Karahan, Manovskii, & Mitman (2013), Lalive, Landais, & Zweimüller (2015), Landais, Michaillat, & Saez (2018), Chodorow-Reich, Coglianese, & Karabarbounis (2019), Fredriksson & Söderström (2020)).[1] The proposed mechanism is that making UI more generous raises jobseekers' opportunity cost of employment, leading to higher reservation wages, increased wage pressure, lower expected profits from vacancy creation, and ultimately a drop in vacancy posting by potential employers and higher equilibrium unemployment.[2]

The first contribution of the paper is to look at the extent to which UI eligibility rules matter for the wage effect of UI reforms. To avoid the confusion arising from the potential interplay between eligibility rules and generosity, the variation in UI generosity considered here stems from the variation of the benefit rate (daily/monthly benefit amount) and leaves the eligibility rules unaffected.

In the present paper, UI-eligibility and UI-entitlement are used interchangeably and both designate whether

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[1] The discussion regarding the equilibrium impact of UI has a long history and goes back to at least Ehrenberg & Oaxaca (1976).

[2] This effect goes by various names in the literature including the "macro effect", the "equilibrium effect", or the "job creation effect" of UI.

an unemployed individual is entitled for the receipt of UI benefits or not. Many UI systems restrict access to UI by making it conditional on past employment (i.e. contribution) history, and limit the duration during which the entitlement lasts (Tatsiramos & van Ours, 2014).

Using a standard Mortensen-Pissarides model (Mortensen & Pissarides (1994)) with exogenous job separations calibrated to Austrian data originating from social security records, I show that a higher UI exhaustion rate implies a significantly smaller predicted wage effect of a change in UI generosity. The moderating effect of benefit exhaustion can be decomposed into two channels. On the one hand, if benefit recipients lose their entitlement at a higher rate, the proportion of UI-ineligible individuals among the unemployed is likely to be higher as well. For unemployed individuals without UI entitlement, an increase in the UI benefit rate raises the value of reemployment as it allows them to gain access to UI benefits that are now more generous. The wage impact of UI is thus negative for the UI-ineligible unemployed. This mechanism is reminiscent of the entitlement effect documented by Hamermesh (1979) in the context of job search and labor market participation. On the other hand, a higher UI benefit expiry rate implies that UI benefits may constitute only a small share of the total expected discounted income when unemployed. This second source of attenuation has been discussed by Chodorow-Reich, Coglianese, & Karabarbounis (2019) as well as Jäger, Schoefer, Young, & Zweimüller (2020).

The second contribution of the paper is to empirically test the discontinuity in reemployment wages implied by the progressive introduction of the 2001 Austrian UI reform. The reform changed the benefit calculation formula, resulting in higher benefits for individuals with reference earnings withing a certain interval. For UI claims filed on or after the 1st of January 2001, the new benefit calculation rule was applicable, whereas for UI claims that were ongoing on the 1st of January, the pre-reform benefit calculation rule remained valid. For individuals whose reference earnings made them potential beneficiaries of the reform, but who were already UI recipients at the time of the reform, employment became more valuable. The theory thus predicts that the reemployment wages of such individuals was negative. This negative effect of future benefits on current wages was noted for instance by Beissinger & Egger (2004). Given that losing one's job immediately before the reform date implies current UI benefits according to the pre-reform benefit rule, whereas losing one's job immediately after the reform date means UI benefits according to the post-reform benefit rule, in the former case, the jobseeker has more to gain if reemployed sooner, therefore she/he would accept a lower wage. The implied discontinuity can, in principle, be substantial given that the effect is entirely due to a difference in current benefits (whereas the total effect includes changes in future benefits as well). In the data, controlling for seasonality using equivalently selected samples from surrounding years, I find an occasionally and weakly marginally statistically significant difference in reemployment wages in the case of the 2001 sample. The validity of the strategy rests upon the assumption that the combined "control" sample from other years is an appropriate control.

The rest of the paper is organised as follows. Section 2 presents the model, Section 3 presents predicted average wage impact of varying UI generosity, Section 4 presents the predicted discontinuity and the empirical test.

2 Model

This section presents a slightly modified simple model à la Mortensen-Pissarides with exogenous job separations. The only modifications relative to the simple canonical model are the possibility of UI benefit expiry and the indexation of UI benefits to pre-separation earnings.

2.1 Environment

There are two types of agents: workers and employers. There is a continuum of workers who make up the working population. The size of the working population is constant over time and is normalised to 1. Workers enter and exit the working population at an exogenous rate ν. While part of the working population, workers alternate between employment and unemployment. On the employer's side, there is free entry: employers find it worthwhile to enter as long as the expected discounted payoff associated with opening an unfilled vacancy is non-negative. Employers need to pay a flow cost κ to keep their vacancy open.

The model is in continuous time. Agents' horizon is infinite. All agents are risk neutral and discount future income at rate ρ.

2.2 Employment

2.2.1 Worker-employer matching

Worker-employer matching on the labor market is one-to-one: each employer can be matched with only one worker at a time and each worker can be matched with only one employer at a time. Match formation is governed by a standard matching function (homogeneous function of degree 1) taking as inputs the mass of unemployed workers, denoted u, and the mass of vacancies, denoted v:

$$M(u, v) = \mu \cdot u^{\eta} \cdot v^{(1-\eta)}$$

where μ is a scale parameter capturing matching efficiency.

From the point of view of unmatched employers, the arrival rate of workers equals:

$$m(\theta) = \frac{M(u, v)}{v} = \theta^{-\eta}$$

where $\theta = \frac{v}{u}$ is the labor market tightness, the ratio of the mass of vacancies to the mass of unemployed workers, and the weight parameter η corresponds to the negative of the elasticity of the arrival rate of workers with respect to labor market tightness.
From the point of view of unmatched workers, the arrival rate of jobs, which in the present framework is equal to the rate at which unemployed workers find jobs, can be written as:

$$f = \theta m(\theta) = \frac{M(u, v)}{u}$$

2.2.2 Employment relationship

Once matched, the worker and the employer start bargaining over the wage. Immediately after the start of negotiation, the parties agree on the wage w that is given by the Nash bargaining solution. In the wage bargaining process, the worker has bargaining power $\gamma \in [0, 1]$. The resulting employment contract stipulates that the employer is required to pay the worker w, the wage agreed upon, in return for the worker's labor service. Once the contract is signed, production begins. The match produces a flow output y which remains constant throughout the entire duration of the match, i.e. until separation.

Conditional on the worker not exiting the working population, exogenous separation occurs at rate δ.

In the absence of exogenous separation and conditional on the worker not exiting the working population, the worker and the employer remain matched as long as there is at least one feasible employment contract that makes the worker weakly better off relative to becoming unemployed and the employer weakly better off relative to firing the worker.

2.2.3 Renegotiation

Renegotiation of the wage is possible in principle only if both parties agree to it. Renegotiation thus requires that one party has a credible threat to terminate the relationship under the current terms of employment.[3] In practice, the assumptions of the model imply that there will be no renegotiation in equilibrium.

2.3 Unemployed workers' payoff

Irrespective of their income, workers get a flow payoff, denoted a, when unemployed.[4] In addition to their flow amenity payoff from unemployment amenity, workers ineligible for UI benefits, receive a flow income, denoted z.[5] Upon entering the working population, all workers are ineligible to receive UI benefits. Upon exogenous separation from their employer, workers become entitled for UI benefits b and simultaneously lose access to their exogenous unemployment income flow z.[6] Symmetrically, when unemployed workers stop receiving UI benefits due to UI benefit expiry, they simultaneously regain access to their exogenous unemployment income flow z.

2.4 UI policy

Let UI policy regimes be indexed by p. Each UI policy regime is characterised by a benefit calculation formula $b_p(.)$ and an expiration rate ξ_p, the rate at which UI-eligible workers lose their entitlement for UI benefit receipt.

UI benefits are a linear function of the wage w^r the worker had immediately before her/his previous separation:

$$b_p(w^r) = b_p(0) + \frac{\partial b_p}{\partial w^r} \cdot w^r$$

where the base pay $b_p(0)$ and the UI indexation parameter $\frac{\partial b_p}{\partial w^r}$ are constant for a given policy regime p.

2.5 Worker groups in equilibrium

2.5.1 Flows across worker groups

For each individual worker, let unemployment spells be indexed according to the number of unemployment spells the individual has had since gaining eligibility to UI benefits. Let u_n denote the mass of UI-eligible unemployed workers who are in their n-th unemployment spells since gaining eligibility for UI benefits and let u_0 denote the mass of unemployed workers who are not entitled to receive UI benefits. Furthermore, let the employment spells take on the index of the unemployment spell that immediately precedes them, i.e. let e_n stand for the mass of employed workers who have had n unemployment spells since gaining eligibility to UI benefits.

The various flows from and to the various worker subgroups are depicted in the figure below:

[3]In line with the plausibility arguments regarding employment contracts by Malcomson (1999), wage renegotiation requires the consent of both parties.

[4]This flow payoff can be viewed as unemployment amenity, which can be negative due to factors like stigma or human capital depreciation, but can also be positive if free time away from declared employment is highly valuable (e.g. for individuals with informal employment opportunities or people with young children or elderly relatives to look after).

[5]This can be interpreted as income unrelated to UI (minor employment, social assistance, family allowance, disability allowance, etc.).

[6]In order to avoid wage renegotiations induced by the updating of benefits during an employment spell, benefits are assumed to be updated upon exogenous separation.

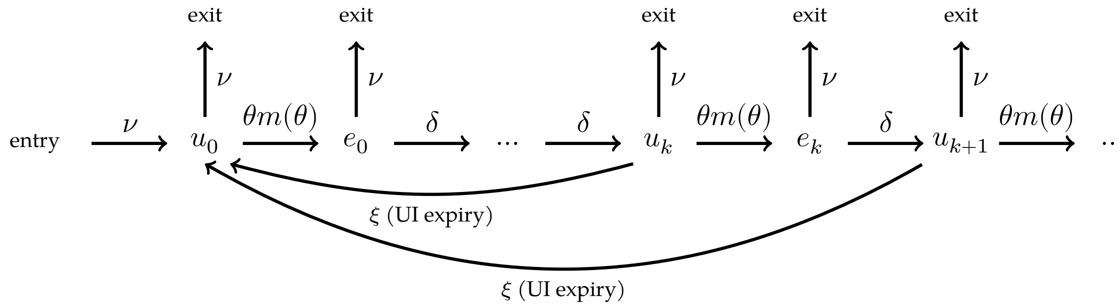

Figure 1: Labor market transitions from and to the various worker groups with the terms next to the arrows corresponding to the instantaneous transition rates

2.5.2 Stationary equilibrium

In a stationary equilibrium, all worker group sizes are fixed which requires that:

- the inflows into ineligible unemployment equal the outflows from ineligible unemployment:

$$\underbrace{\nu}_{\text{worker entry}} + \underbrace{\xi_p \cdot (u_p - u_{0,p})}_{\text{UI benefit expiry}} = \underbrace{\nu \cdot u_{0,p}}_{\text{worker exit}} + \underbrace{\theta_p m(\theta_p) \cdot u_{0,p}}_{\text{job finding}}$$

- the inflows into UI-eligible unemployment equal the outflows from UI-eligible unemployment:

$$\underbrace{\delta \cdot e_{(n-1),p}}_{\text{separation}} = \underbrace{\nu \cdot u_{n,p}}_{\text{worker exit}} + \underbrace{\theta_p m(\theta_p) \cdot u_{n,p}}_{\text{job finding}} + \underbrace{\xi_p \cdot u_{n,p}}_{\text{UI benefit expiry}}$$

- the inflows into employment equal the outflows from employment:

$$\underbrace{\theta_p m(\theta_p) \cdot u_{n,p}}_{\text{job finding}} = \underbrace{\nu \cdot e_{n,p}}_{\text{worker exit}} + \underbrace{\delta \cdot e_{n,p}}_{\text{separation}}$$

2.6 Value function equations in equilibrium

2.6.1 The worker's value function equations

The worker's expected discounted flow value associated with being unemployed and receiving unemployment benefits b can be written as:

$$\rho \cdot U_p(b) = b + a + \underbrace{\theta_p m(\theta_p) \cdot \left[E_p(\phi_p(b)) - U_p(b)\right]}_{\text{finding a job}} + \underbrace{\xi_p \cdot \left[U_p(z) - U_p(b)\right]}_{\text{benefit expiry}} + \underbrace{\nu \cdot \left[0 - U_p(b)\right]}_{\text{exiting the workforce}}$$

and the worker's expected discounted flow value of being employed at wage w writes:

$$\rho \cdot E_p(w) = w + \underbrace{\delta \cdot \left[U_p(b_p(w)) - E_p(w)\right]}_{\text{separation}} + \underbrace{\nu \cdot \left[0 - E_p(w)\right]}_{\text{exiting the workforce}}$$

2.6.2 The employer's value function equations

The free entry of employers means that employers enter the market (equivalently create vacancies) as long as doing so gives them non-negative expected discounted profits. As a result, in equilibrium, the expected discounted value associated with an unfilled vacancy equals zero ($V = 0$).

Given this and the assumed exogeneity of separations and worker exits, the employer's expected discounted flow profits when employing a worker at wage w do not depend on the policy regime p and are equal to:

$$\rho \cdot J(w) = y - w + \underbrace{\delta \cdot [V - J(w)]}_{\text{separation}} + \underbrace{\nu \cdot [0 - J(w)]}_{\text{worker exit}}$$

and the employer's expected discounted flow profits associated with an unfilled vacancy can be written as:

$$\rho \cdot V = -\kappa + \underbrace{m(\theta_p) \cdot \left[\mathbb{E}_p \left[J(\phi_p(b))\right] - V\right]}_{\text{worker arrives}}$$

2.7 Wages at equilibrium

Since wages are determined according to Nash wage bargaining, the wage as a function of the worker's (potential) unemployment benefits b maximises the bargaining-power-weighted geometric average of the parties net gains from the ongoing relationship:

$$\phi_p(b) = \arg\max_w \left[J(w) - V\right]^{1-\gamma} \left[E_p(w) - U_p(b)\right]^{\gamma}$$

2.7.1 Closed-form solution for the wage function

The wage can be written as a bargaining-power-weighted average of the worker's productivity and reservation wage:

$$\phi_p(b) \ = \ \gamma \ \cdot y \ + \ (1-\gamma) \ \cdot \ \underbrace{\hat{\phi}_p(b)}_{\substack{\text{reservation} \\ \text{wage}}}$$

where the worker's reservation wage is a weighted average of the worker's productivity and lowest feasible productivity:[7,8,9]

$$\hat{\phi}_p(b) \ = \ \underbrace{\frac{\partial \hat{\phi}_p}{\partial y}}_{= \frac{\theta_p m(\theta_p)\cdot\gamma}{\rho+\mu+\delta+\theta_p m(\theta_p)\cdot\gamma}} \cdot y \ + \ \left(1 - \frac{\partial \hat{\phi}_p}{\partial y}\right) \ \cdot \ \underbrace{\hat{y}_p(b)}_{\substack{\text{lowest} \\ \text{feasible} \\ \text{productivity}}}$$

2.8 Market equilibrium

A stationary market equilibrium under UI policy regime p is characterised by the following three conditions:

(1) the unemployed and employed worker group sizes are constant over time;[10]

(2) the average hiring wage w_p is constant over time;[11]

[7] The lowest feasible productivity is $\hat{y}_p(b) = \frac{B_p(b)+(1-\Omega_p)\cdot\Lambda_p\cdot[b-b_p(0)]}{1+(1-\Omega_p)\cdot\Lambda_p\cdot\frac{\partial b_p}{\partial w^r}}$ where the flow expected discounted payoff of an unemployed individual with benefits b is $B_p(b) = (1-\Omega_p)\cdot[a+b] + \Omega_p \cdot [a+z]$ with the weight due to UI benefit exhaustion being $\Omega_p = \frac{\xi_p}{\rho+\nu+\xi_p+\theta m(\theta)\cdot\gamma}$ and the coefficient on future benefit effects being $\Lambda_p = \frac{\delta}{\rho+\nu+\theta m(\theta)\cdot\gamma}$.

[8] For the derivation of the closed-form solution for the wage see Appendix A: wage determination.

[9] This model nests the canonical Mortensen-Pissarides model with exogenous job separations when $\xi_p = 0$ and $\frac{\partial b_p}{\partial w^r} = 0$. In that special case, the lowest feasible worker type is simply equal to current UI benefits b. In that case, one obtains the wage-benefit sensitivity term in Jäger, Schoefer, Young, & Zweimüller (2020): $(1-\gamma)\cdot\left(1-\frac{\partial\hat{\phi}_p}{\partial y}\right)$

[10] for details, see Appendix B: worker groups in equilibrium

[11] see Appendix C: average wage in equilibrium

(3) the labor market tightness θ_p is constant and satisfies the labor demand equation.[12]

3 Predicted average wage effect

In what follows, the model presented in Section 2 is calibrated based on Austrian data originating from social security records in order to compute the predicted effect of a change in the UI indexation parameter $\frac{\partial b_p}{\partial w^r}$ on the average wage both in partial equilibrium and when market equilibrium effects are taken into account. The object of interest throughout this section is the change in the average wage divided by the change in the average UI benefit:[13,14]

$$\frac{\mathbb{E}\left[w|p_1\right] - \mathbb{E}\left[w|p_0\right]}{\mathbb{E}\left[b|p_1\right] - \mathbb{E}\left[b|p_0\right]}$$

The labor market transition rates (at daily frequency) are estimated based on a random sample drawn from the population of individuals aged between 25 and 55 in 2001 with available social security records of employment/unemployment. The corresponding estimates are displayed in Table 3 in Appendix D: Tables and Figures. The parameters of the matching function (μ, η) and the flow vacancy cost parameter κ are set in order to match $\frac{w_p}{y} \approx 0.6$ (corresponding to the labor share) as well as to obtain an implied unemployment amenity a close to zero. The values of parameters are displayed in Table 2.

3.1 Results

The average changes are considered both with and without the market equilibrium effects for two values of the UI expiration rate ξ:

- the case without expiration of benefits ($\xi = 0$);
- the case with the estimated UI benefit expiration rate ($\xi = 0.0047$).

Figure 2 plots the change in the average wage of all workers divided by the change in average benefits of UI-eligibles:

$$\frac{w_{p_1} - w_{p_0}}{b_{p_1} - b_{p_0}}$$

The predicted change in the average wage among all workers is between 5% and 35% of the change in average UI benefits among the UI eligibles. However, this figure includes the wages of UI-ineligibles for whom the wage effect is negative.

When restricting the focus to the change in the average wage of UI-eligible workers divided by the change in average benefits of UI-eligibles plotted in Figure 3:

$$\frac{\mathbb{E}\left[w_{n,p_1}|n>0\right] - \mathbb{E}\left[w_{n,p_0}|n>0\right]}{b_{p_1} - b_{p_0}}$$

[12] The labor demand is given by the employers' free entry condition The free entry condition ($V = 0$): $\frac{\kappa}{m(\theta_p)} = \frac{y-w_p}{\rho+\nu+\delta}$.

[13] This is similar though not equivalent to the average wage-benefit sensitivity used by Jäger, Schoefer, Young, & Zweimüller (2020) to quantify the wage effect of UI.

[14] The procedure for calculating the wage effect involves the following simple steps. First, given the values of the parameters, I compute the unemployment amenity (a) that solves the stationary equilibrium under the benchmark UI indexation parameter $\frac{\partial b_{p_0}}{\partial w^r} = 0.5$. Second, for a grid of alternative values of the UI indexation parameter $\frac{\partial b_{p_1}}{\partial w^r}$, I calculate the implied average wages and average UI benefits necessary for the partial equilibrium. Then for each value of $\frac{\partial b_{p_1}}{\partial w^r}$, I numerically approximate the implied equilibrium job finding rate that solves the stationary equilibrium, and then calculate the average wages and average benefits taking into account the approximate equilibrium job finding rate.

I find that the change in the average wage of UI-eligibles is between 20% and 70% of the change in average UI benefits.

One thing that is common to both averages is the large variation due to benefit expiration. This corroborates the theoretical findings of both Chodorow-Reich, Coglianese, & Karabarbounis (2019) and Jäger, Schoefer, Young, & Zweimüller (2020). The figures in particular are similar in magnitude to the wage-benefit sensitivities predicted by the calibrated simple model of Jäger, Schoefer, Young, & Zweimüller (2020).

4 Empirical test of a predicted discontinuity: the case of the 2001 Austria UI reform

4.1 The 2001 Austrian UI reform

Austria introduced a change to its UI benefit calculation formula progressively starting on the 1st of January 2001:[15]

- For UI claims before the 1st of January 2001, UI benefits were calculated based on gross monthly earnings according to a table defining the basic amount for each income bin.
- For claims starting after the 1st of January 2001, UI benefits were based on net earnings with a 55% (60% below a certain level of earnings) net replacement rate.

The biggest relative increase in benefits concerned workers with gross monthly reference earnings between 10000 and 20000 Austrian Schillings (ATS).[16] Figure 7 plots the gross monthly replacement rate for this group according to the 2000 rule as well as according to the 2001 rule. The replacement rate varies between 0.4 and 0.5.

4.2 Predicted discontinuity

To clarify the idea behind the discontinuity in reemployment wages, consider a UI policy change from p_0 to p_1 at $\mathrm{T_{reform}}$ such that the UI benefits for a UI claim starting at $\mathrm{T_{job\ loss}}$ are:

$$b_{\mathrm{T_{job\ loss}}} = b_{p_0} + \mathbb{1}\left[\mathrm{T_{job\ loss}} > \mathrm{T_{reform}}\right] \cdot (b_{p_1} - b_{p_0})$$

i.e. the policy is introduced progressively.

The wage effect (relative to the counterfactual of no policy change) for an individual if her/his UI claim starts just before $\mathrm{T_{reform}}$ comes exclusively from the change in future benefits (i.e. benefits after reemployment):

$$[\Delta\tilde{\phi}]_{\mathrm{T_{job\ loss}}<\mathrm{T_{reform}}} = \underbrace{\tilde{\phi}_{p_1}(b_{p_0}) - \tilde{\phi}_{p_0}(b_{p_0})}_{\text{future benefits effect}} \ < \ 0$$

where $\tilde{\phi}_p(b)$ is the reemployment wage if the UI policy is p and the individual's current benefits are equal to b.

The wage effect for the same individual if her/his UI claim starts just after $\mathrm{T_{reform}}$ can be written as the

[15] Both before and after the reform, the reference earnings were the average of the previous calendar year for claims starting in the second half of the year and the average of the penultimate calendar year for claims starting in the first half of the year. This means that for workers with sufficient earnings in 1999, there is no change in reference earnings on the 1st of January 2001.

[16] 1 euro is equivalent to 13.7603 Austrian Schillings

sum of the future benefits effect and the current benefits effect and is similar in magnitude to the average effect discussed in Section 3:

$$[\Delta\tilde{\phi}]_{\mathrm{T_{job\ loss}>T_{reform}}} = \tilde{\phi}_{p_1}(b_{p_1}) - \tilde{\phi}_{p_0}(b_{p_0}) = \underbrace{\tilde{\phi}_{p_1}(b_{p_1}) - \tilde{\phi}_{p_1}(b_{p_0})}_{\text{current benefits effect}} + \underbrace{\tilde{\phi}_{p_1}(b_{p_0}) - \tilde{\phi}_{p_0}(b_{p_0})}_{\text{future benefits effect}} \;>\; 0$$

The difference between the two effects is equal to the effect of current benefits on the wage of the individual and given that the future benefits effect is negative, the current benefits effect exceeds the total effect for those losing their job after the reform:

$$[\Delta\tilde{\phi}]_{\mathrm{T_{job\ loss}>T_{reform}}} - [\Delta\tilde{\phi}]_{\mathrm{T_{job\ loss}<T_{reform}}} = \underbrace{\tilde{\phi}_{p_1}(b_{p_1}) - \tilde{\phi}_{p_1}(b_{p_0})}_{\text{current benefits effect}} \;>\; [\Delta\tilde{\phi}]_{\mathrm{T_{job\ loss}>T_{reform}}}$$

4.3 Predicted size of discontinuity

Using the same model as in Section 3, I approximate the predicted difference in reemployment wages between the group of individuals who lose their job just after the reform and the group of workers who lose their job just before the reform by simulating labor market histories of individuals and progressively introducing a change to the UI indexation parameter.[17,18]

Once the simulated data are generated, I compute the ratio of the difference in average wages across the two groups to the difference of average benefits across the two groups:

$$\frac{\mathbb{E}\left[w|\mathrm{T_{job\ loss}} \geq \mathrm{T_{reform}}\right] - \mathbb{E}\left[w|\mathrm{T_{job\ loss}} < \mathrm{T_{reform}}\right]}{\mathbb{E}\left[b|\mathrm{T_{job\ loss}} \geq \mathrm{T_{reform}}\right] - \mathbb{E}\left[b|\mathrm{T_{job\ loss}} < \mathrm{T_{reform}}\right]}$$

Figure 4 plots the predicted values of the above ratio when the calibration is based on the sample drawn from the population, whereas 5 plots the simulation results based when calibration is based on the analysis sample.

Like the average wage effect, the predicted discontinuity varies significantly with the value of the UI expiration rate. I conclude that the discontinuity in the average reemployment wage can be anywhere between 20% and 100% of the discontinuity in average UI benefits.

4.4 Sample selection

The analysis sample for testing the theoretical prediction is restricted to workers with at least one UIB spell starting within the analysis period defined as a symmetric window around the 1st of January with bandwidths ranging from 1 to 50 days.

In order to control for unobserved differences between individuals who start their claim at the end of the year and individuals who start their claim at the beginning of the year, individuals from the surrounding years (1999, 2000, 2002, 2003, 2004), selected based on the same criteria, are used as a sort of

[17] The first step is the same as before: given the parameter values, find the unemployment amenity (a) that solves the stationary equilibrium under policy p_0. But now in addition to calculating the new equilibrium for each value of p_1, I simulate labor market transitions (including wages and benefits) of a a working population of 10k individuals for 1k days. Then I change the policy to p_1 (which is assumed to come as a surprise for the individuals) such that p_1 applies when calculating the benefits of new separators while the benefits of those already on claim are unaffected. I approximate the transition dynamics in the following 1000 days based on two approximation methods.

[18] Method (1) assumes static expectations. This yields a slower convergence to the new equilibrium than rational expectations. In method (2) workers (mistakenly) take the new equilibrium job finding rate as the relevant job finding rate. This method results in a faster convergence to the new equilibrium than rational expectations.

"control" group. The quotation marks are warranted because there are individuals who are present in multiple samples.

Tables 4 and 7 display summary statistics for the treatment and control samples as well as for each year's sample separately. Tables 8 and 9 provide a comparison across the samples by distribution of individuals across the twenty sectors of occupation at reemployment as well as across the seven states of Austria (Bundesländer) at reemployment. Finally, Figure 9 shows the distribution of the UIB claim starting week for the treatment and control samples. All these comparisons reveal a high degree of similarity between the treatment and control samples along various dimensions. This does not come as a surprise given:

- the common sample selection procedure;
- the overlaps across the various samples;
- the likely overrepresentation of seasonal workers among UI claimants (Del Bono & Weber, 2008).[19]

4.5 Discontinuity in benefits

Figure 8 plots the difference in predicted average benefits for the 2001 sample as well as its average. The discontinuity in predicted UI benefits varies significantly with reference earnings and its average is estimated to lie somewhere between 300 and 400 ATS. This figure is taken as the real-world equivalent of the discontinuity in current UI benefits.

4.6 Estimated discontinuity in wages

The empirical specification for estimating the discontinuity in wages resembles the one used in a discrete difference-in-differences analysis:

$$\mathrm{W}_{\text{reemployment}} = \beta_0 + \beta_{\mathrm{P}} \cdot \mathrm{Post}_{\mathrm{T}_{\text{claim start}}(i)} + \beta_{\mathrm{R}} \cdot \mathrm{Reform}_{\mathrm{Sample}(i)} + \beta_{\mathrm{P}\times\mathrm{R}} \cdot \mathrm{Post}_{\mathrm{T}_{\text{claim start}(i)}} \cdot \mathrm{Reform}_{\mathrm{Sample}(i)} + \mathbf{X}_i'\zeta + \epsilon_i \quad \text{(E)}$$

where Post is an indicator for the claim starting on or after the 1st of January of the sample year Y:

$$\mathrm{Post}_{\mathrm{T}_{\text{claim start}}(i)} = \begin{cases} 1 & \text{if } \mathrm{T}_{\text{claim start}}(i) \geq \text{January 1st} \\ 0 & \text{if } \mathrm{T}_{\text{claim start}}(i) < \text{January 1st} \end{cases}$$

and Reform is an indicator for the sample being the 2001 sample:

$$\mathrm{Reform}_{\mathrm{Sample}(i)} = \begin{cases} 1 & \text{if } \mathrm{Sample}(i) = 2001 \\ 0 & \text{if } \mathrm{Sample}(i) \neq 2001 \end{cases}$$

The vector of covariates **X** includes:

- reference earnings used for the prediction of UI benefits (Y-2);
- an indicator for white-collar employment;
- an indicator for Austrian citizenship in the reference year (Y-2);

[19] This is further corroborated by: the high proportion of individuals working in the construction and hospitality sectors that are both characterised by the high degree of seasonality in their yearly employment fluctuations (Del Bono & Weber, 2008); and the low number of displaced workers in the sample when using the definition of job displacement by Schmieder, von Wachter, & Heining (2022) and the method developed by Fink, Segalla, Weber, & Zulehner (2010) to identify establishment entries and exits in the Austrian social security records.

- an indicator for gender interacted with a cubic polynomial of age and a cubic polynomial of the number of employment days during the 18 months preceding the UI benefit claim;
- time-to-entry fixed effects (3 categories);
- sector fixed effects (20 categories);
- state (Bundesland) fixed effects (7 categories).

Equation (E) is estimated using OLS with clustering of standard errors at the individual level given the overlaps across the various samples. Estimates using the full specification for β_{P}, β_{R}, $\beta_{\mathrm{P}\times\mathrm{R}}$, and the coefficient on reference earnings are reported by bandwidth in Table 1. The estimate for $\beta_{\mathrm{P}\times\mathrm{R}}$ by bandwidth is also plotted in Figure 6.

Although the point estimates (≈ 300 ATS) suggest a discontinuity in the average wage that is similar in magnitude to the predicted discontinuity in average benefits, the estimates are very noisy and are only occasionally marginally significant (when the bandwidth is approximately about 20 days). However, even if the identification strategy is valid, I cannot exclude the possibility that the point estimates are due to noise.

The results are robust to using various specifications (Table 5) and do not vary much when leaving out one sample year from the control (Table 6).

I conclude that I do not find evidence that would strongly contradict the theoretical prediction.

4.7 Discussion

The identification strategy is valid only if there are no ongoing differential trends unrelated to the reform in 2001. Put differently, the estimates are meaningful only if there are no systematic Pre/Post differences in the year 2001 that are unrelated to the reform (e.g. related to the business cycle).

There is a concern regarding manipulation or selection into treatment, as both the individual and, to some extent, the UI administration can manipulate the starting day of the UI claim, especially during the days leading up to the 1st of January. Manipulation invalidates the strategy as it is unknown in what way those who self-select themselves differ from those who do not. One may argue that self-selection is made somewhat challenging by the heterogeneous effect of the reform by reference earnings, as it is made clear in Figure 8.

Other potential concerns include worker heterogeneity and labor market effects that are not taken into account in the model and that may affect selection into reemployment for instance. One such element that is completely absent from the model is duration dependence: Schmieder, von Wachter, & Bender (2016) find a positive effect of UI generosity on unemployment duration, which in turn translates into lower reemployment wages due to human capital depreciation. I try to reduce the consequences of duration dependence by the inclusion of indicators for time-to-reemployment bins and restricting the sample to individuals who are reemployed in year Y+1 (the year following the sample year) at the latest.

5 Conclusion

This paper finds that a standard Mortensen-Pissarides model calibrated using Austrian social security data can accommodate both large and small average wage effects induced by changes in UI generosity depending on the rate at which benefit recipients lose their entitlement due to the termination of their potential benefit duration. The change in the average wage of UI benefit recipients is predicted to be between 20% to 70% of the change in the average UI benefit.

The progressive introduction of the 2001 Austrian UI reform offers an *a priori* ideal case for testing the theory. The difference between the average reemployment wage of those starting a UI claim just after the reform and the average reemployment wage of those starting their UI claim just before is predicted to be equivalent to about 20% to 100% of the average difference in current UI benefits across the two groups. Although the point estimates for the average discontinuity in reemployment wages seem to be of a similar magnitude ($\approx$ 200-300 ATS) as the discontinuity in average benefits ($\approx$ 300-400), they come with large standard errors which make them statistically indistinguishable from zero.

Appendix

Appendix A: wage determination

Nash bargaining first-order condition

Given the assumption of free entry ($V = 0$) at equilibrium, the bargained wage solves the following maximisation problem:

$$\phi_p(b) = \arg\max_w \left[J(w)\right]^{1-\gamma} \left[E_p(w) - U_p(b)\right]^{\gamma}$$

The first-order condition of the above maximisation problem is equivalent to:[20]

$$\gamma \cdot \frac{\frac{\partial E_p}{\partial w}(\phi_p(b))}{E_p(\phi_p(b)) - U_p(b)} + (1-\gamma) \cdot \frac{\frac{\partial J}{\partial w}(\phi_p(b))}{J(\phi_p(b))} = 0$$

Given that the expected discounted profits of the employer can simply be written as in the canonical Mortensen-Pissarides model with exogenous separations:

$$J(w) = \frac{y - w}{\rho + \nu + \delta}$$

The Nash bargaining first-order condition becomes:

$$\gamma \cdot \frac{\partial E_p}{\partial w}(\phi_p(b)) \cdot \left[y - \phi_p(b)\right] = (1-\gamma) \cdot \left[E_p(\phi_p(b)) - U_p(b)\right]$$

Given the simplifying assumptions of the model, the functions $\phi_p(.)$, $E_p(.)$, and $U_p(.)$ take on a linearly separable form such that the partial derivatives $\frac{\partial E_p}{\partial w}$, $\frac{\partial E_p}{\partial y}$, $\frac{\partial U_p}{\partial w}$, $\frac{\partial U_p}{\partial y}$, $\frac{\partial \phi_p}{\partial b}$, $\frac{\partial \phi_p}{\partial y}$ are all constant in equilibrium.

Bargained wage and the worker's reservation wage

Let $\hat{\phi}_p(b)$ be the reservation wage of a worker with current (potential) unemployment income b such that the worker is indifferent between being employed and being unemployed:

$$E_p(\hat{\phi}_p(b)) = U_p(b)$$

By linear separability, the Nash bargaining first-order condition can be rearranged to write the bargained wage as a bargaining-power-weighted average of the match productivity and the reservation wage:[21]

$$\phi_p(b) = \gamma \cdot y + (1-\gamma) \cdot \hat{\phi}_p(b) \qquad (\phi_p)$$

Partial effects of income terms

The worker's value of unemployment as a function of benefits b can be rewritten as:

$$\left(\rho + \nu + \xi_p\right) \cdot U_p(b) = a + b + \xi_p \cdot U_p(z) + \theta_p m(\theta_p) \cdot \underbrace{\frac{\partial E_p}{\partial w} \cdot \gamma \cdot \left[y - \hat{\phi}_p(b)\right]}_{=E_p(\phi_p(b)) - U_p(b)}$$

[20] $(1-\gamma) \cdot \left(-\frac{\frac{\partial J}{\partial w}(\phi_p(b))}{\frac{\partial E_p}{\partial w}(\phi_p(b))}\right) \cdot \left[E_p(\phi_p(b)) - U_p(b)\right] = \gamma \cdot J(\phi_p(b))$

[21] Using the reservation wage and linear separability, one can rewrite the worker's net gain as:

$$E_p(w) - U_p(b) = \frac{\partial E_p}{\partial w} \cdot \left[w - \hat{\phi}_p(b)\right]$$

The partial effect of benefits on the worker's value of unemployment:

$$(\rho+\nu+\xi_p)\cdot\frac{\partial U_p}{\partial b}=1-\theta_p m(\theta_p)\cdot\frac{\partial E_p}{\partial w}\cdot\gamma\cdot\frac{\partial\hat{\phi}_p}{\partial b}$$

The worker's value of employment as a function of the wage w can be rewritten as:

$$(\rho+\nu+\delta)\cdot E_p(w)=w+\delta\cdot U_p(b_p(w))$$

The partial effect of the wage w on the worker's value of employment satisfies:

$$(\rho+\nu+\delta)\cdot\frac{\partial E_p}{\partial w}=1+\delta\cdot\frac{\partial U_p}{\partial b}\cdot\frac{\partial b_p}{\partial w^r}=\frac{1}{\Psi_p}=-\frac{\frac{\partial E_p}{\partial w}}{\frac{\partial J}{\partial w}}$$

Implicit differentiation of the indifference condition for the worker's reservation wage $E_p(\hat{\phi}_p(b))=U_p(b)$ with respect to benefits b yields:

$$\frac{\partial E_p}{\partial w}\cdot\frac{\partial\hat{\phi}_p}{\partial b}=\frac{\partial U_p}{\partial b}$$

As result, the partial effect of current benefits of the worker on her/his value of unemployment in closed form becomes:

$$(\rho+\nu+\xi_p)\cdot\frac{\partial U_p}{\partial b}=\frac{\rho+\nu+\xi_p}{\rho+\nu+\xi_p+\theta_p m(\theta_p)\cdot\gamma}$$

such that the relative partial effect of a change in the wage on the employer's expected discounted payoff in terms of the same change on the worker's expected discounted payoff can be written as:

$$\Psi_p=-\frac{\frac{\partial J}{\partial w}}{\frac{\partial E_p}{\partial w}}=\frac{\rho+\nu+\xi_p+\theta_p m(\theta_p)\cdot\gamma}{\rho+\nu+\xi_p+\theta_p m(\theta_p)\cdot\gamma+\delta\cdot\frac{\partial b_p}{\partial w^r}}$$

Partial effects of productivity

The partial effect of productivity y on the worker's value of employment satisfies:

$$\frac{\partial E_p}{\partial y}=\frac{\delta}{\rho+\nu+\delta}\cdot\frac{\partial U_p}{\partial y}$$

The partial effect of productivity on the worker's value of unemployment satisfies:

$$(\rho+\nu)\cdot\frac{\partial U_p}{\partial y}=\frac{\partial E_p}{\partial w}\cdot\theta_p m(\theta_p)\cdot\gamma\cdot\left[1-\frac{\partial\hat{\phi}_p}{\partial y}\right]$$

Implicit differentiation of the indifference condition for the worker's reservation wage $E_p(\hat{\phi}_p(b))=U_p(b)$ with respect to productivity y yields:

$$\frac{\partial E_p}{\partial w}\cdot\frac{\partial\hat{\phi}_p}{\partial y}=\frac{\partial U_p}{\partial y}$$

As a result, the partial effect of productivity on the reservation wage can be written as:

$$\frac{\partial\hat{\phi}_p}{\partial y}=\frac{\theta_p m(\theta_p)\cdot\gamma}{\rho+\nu+\delta+\theta_p m(\theta_p)\cdot\gamma}$$

Closed-form expressions for the worker's reservation wage and the lowest feasible productivity

Evaluating the worker's value of employment at $w = \hat{\phi}_p(b_p(0))$ and using the indifference condition for the worker's reservation wage, one gets:[22]

$$(\rho + \nu) \cdot U_p(b_p(0)) = \frac{\hat{\phi}_p(b_p(0))}{\Psi_p}$$

Rewriting the worker's value of unemployment to get:

$$(\rho + \nu) \cdot U_p(b) = a + b + \xi_p \cdot \left[U_p(z) - U_p(b)\right] + \theta_p m(\theta_p) \cdot \frac{\partial E_p}{\partial w} \cdot \gamma \cdot \left[y - \hat{\phi}_p(b)\right]$$

Then evaluating the above equation at $b = z$ and developing yields the following expression for the difference between the value of unemployment with unemployment income b and the value of unemployment with unemployment income z (following UI benefit exhaustion):

$$\left(\rho + \nu + \xi_p\right) \cdot \left[U_p(b) - U_p(z)\right] = b - z - \theta_p m(\theta_p) \cdot \frac{\partial E_p}{\partial w} \cdot \gamma \cdot \left[\hat{\phi}_p(b) - \hat{\phi}_p(z)\right]$$

After many rearranging steps, one can arrive bring the worker's flow value when unemployed into a more compact form:[23]

$$(\rho + \nu) \cdot U_p(b) = B_p(b) + \frac{\theta_p m(\theta_p) \cdot \gamma}{\rho + \nu + \delta} \cdot \frac{1}{\Psi_p} \cdot \left[y - \hat{\phi}_p(b)\right]$$

where Ω_p is a weight capturing the effect of UI entitlement after benefit exhaustion and $B_p(b)$ is the expected discounted flow value associated with being unemployed (taking into account UI benefit exhaustion):

$$\Omega_p = \frac{\xi_p}{\rho + \nu + \xi_p + \theta_p m(\theta_p) \cdot \gamma} \quad \text{and} \quad B_p(b) = (1 - \Omega_p) \cdot [a + b] + \Omega_p \cdot [a + z]$$

Evaluating at $b = b_p(0)$, then using that $\hat{\phi}_p(b_p(0)) = \Psi_p \cdot (\rho + \nu) \cdot U_p(b_p(0))$ yields:

$$\hat{\phi}_p(b_p(0)) = \frac{\partial \hat{\phi}_p}{\partial y} \cdot y + \left(1 - \frac{\partial \hat{\phi}_p}{\partial y}\right) \cdot \Psi_p \cdot B_p(b_p(0))$$

where $\frac{\partial \hat{\phi}_p}{\partial y} = \frac{\theta_p m(\theta_p) \cdot \gamma}{\rho + \nu + \delta + \theta_p m(\theta_p) \cdot \gamma}$.

Given that $\hat{\phi}_p(b)\Big|_{y = \hat{y}_p(b)} = \hat{y}_p(b)$ by the employer's zero profit condition, the worker's reservation wage can be written as a weighted average of match productivity y and the lowest feasible productivity $\hat{y}_p$:

$$\hat{\phi}_p(b) = \frac{\partial \hat{\phi}_p}{\partial y} \cdot y + \left(1 - \frac{\partial \hat{\phi}_p}{\partial y}\right) \cdot \hat{y}_p(b)$$

And by the same token, when $b = b_p(0)$, then the lowest feasible worker type becomes:

$$\hat{y}_p(b_p(0)) = \Psi_p \cdot B_p(b_p(0))$$

[22] $(\rho + \nu) \cdot U_p(b_p(0)) = \hat{\phi}_p(b_p(0)) + \delta \cdot \left[U_p(b_p(\hat{\phi}_p(b_p(0)))) - U_p(b_p(0))\right]$

[23] $\xi_p \cdot \left[U_p(z) - U_p(b)\right] = \omega_p \cdot [z - b] + \theta_p m(\theta_p) \cdot \frac{\partial E_p}{\partial w} \cdot \gamma \cdot \left[-\omega_p \cdot [\hat{\phi}_p(z) - \hat{\phi}_p(b)]\right]$ where $\omega_p = \frac{\xi_p}{\rho + \nu + \xi_p}$

Furthermore given that the partial effect of unemployment benefits on the lowest feasible worker type is:

$$\frac{\partial \hat{y}_p}{\partial b} = \frac{\frac{\partial \hat{\phi}_p}{\partial b}}{1 - \frac{\partial \hat{\phi}_p}{\partial y}} = \frac{\frac{\partial U_p}{\partial b}}{\frac{\partial E_p}{\partial w} \cdot \left(1 - \frac{\partial \hat{\phi}_p}{\partial y}\right)} = \frac{(1 - \Omega_p) \cdot (1 + \Lambda_p)}{1 + (1 - \Omega_p) \cdot \Lambda_p \cdot \frac{\partial b_p}{\partial w^r}}$$

where:

$$\Lambda_p = \frac{\delta}{\rho + \nu + \theta_p m(\theta_p) \cdot \gamma}$$

The lowest feasible type takes the following form in the most general case (within the present framework):

$$\hat{y}_p(b) = \frac{B_p(b) + (1 - \Omega_p) \cdot \Lambda_p \cdot \left[b - b_p(0)\right]}{1 + (1 - \Omega_p) \cdot \Lambda_p \cdot \frac{\partial b_p}{\partial w^r}}$$

Equivalently, if $\frac{\partial b_p}{\partial w^r} > 0$, then the lowest feasible productivity can be written as a weighted average of the current average flow value of unemployment and the implied pre-separation wage:

$$\hat{y}_p(b) = \Psi_p \cdot B_p(b) + \left(1 - \Psi_p\right) \cdot \underbrace{w_p^r(b)}_{\text{implied pre-separation wage}}$$

where:

$$\Psi_p = -\frac{\frac{\partial J}{\partial w}}{\frac{\partial E_p}{\partial w}} = \frac{1}{1 + (1 - \Omega_p) \cdot \Lambda \cdot \frac{\partial b_p}{\partial w^r}} \quad \text{and} \quad w_p^r(b) = \frac{b - b_p(0)}{\frac{\partial b_p}{\partial w^r}}$$

Appendix B: worker groups in equilibrium

In a stationary equilibrium:

- the inflows into ineligible unemployment equal the outflows from ineligible unemployment:

$$\underbrace{\nu}_{\text{worker entry}} + \underbrace{\xi_p \cdot (u_p - u_{0,p})}_{\text{UI benefit expiry}} = \underbrace{\nu \cdot u_{0,p}}_{\text{worker exit}} + \underbrace{\theta_p m(\theta_p) \cdot u_{0,p}}_{\text{job finding}}$$

- the inflows into UI-eligible unemployment equal the outflows from UI-eligible unemployment:

$$\underbrace{\delta \cdot e_{(n-1),p}}_{\text{separation}} = \underbrace{\nu \cdot u_{n,p}}_{\text{worker exit}} + \underbrace{\theta_p m(\theta_p) \cdot u_{n,p}}_{\text{job finding}} + \underbrace{\xi_p \cdot u_{n,p}}_{\text{UI benefit expiry}}$$

- the inflows into employment equal the outflows from employment:

$$\underbrace{\theta_p m(\theta_p) \cdot u_{n,p}}_{\text{job finding}} = \underbrace{\nu \cdot e_{n,p}}_{\text{worker exit}} + \underbrace{\delta \cdot e_{n,p}}_{\text{separation}}$$

As a result, the unemployment rate is:

$$\frac{u_p}{u_p + e_p} = \frac{\nu + \delta}{\nu + \delta + \theta_p m(\theta_p)}$$

And the share of unemployed in their n-th unemployment spell after gaining eligibility for UI benefits:

$$\frac{u_{n,p}}{u_p} = \left(1 - \Xi_p\right) \cdot \left(\Xi_p\right)^n \quad \text{where} \quad \Xi_p = \frac{\theta_p m(\theta_p) \cdot \delta}{(\nu + \delta) \cdot (\nu + \theta_p m(\theta_p) + \xi_p)}$$

Appendix C: average wage in equilibrium

Wage distribution

Given that match productivity y, unemployment income in case of not receiving UI benefits z, and unemployment amenity a are common to all workers and constant over time, in equilibrium, the wage and UI benefits are determined by n, the number of times a worker has been employed following the last last unemployment spell during which she/he did not receive UI benefits. Let $w_{n,p}$ be the bargained wage obtained immediately after the n-th unemployment spell since being entitled for UI benefit receipt:

$$w_{n,p} = \phi_p(b_p(w_{(n-1),p}))$$

Convergence to ϕ_p^*

Let ϕ_p^* be a fixed point given worker type defined as follows:

$$\phi_p^* = \phi_p(b_p(\phi_p^*))$$

By linear separability, developing yields:

$$\phi_p^*(x) = \frac{\phi_p(b_p(0))}{1 - \Upsilon_p} \quad \text{where} \quad \Upsilon_p = \frac{\partial \phi_p}{\partial b} \cdot \frac{\partial b_p}{\partial w^r}$$

By linear separability, the bargained wage with available benefits b is equal to:

$$\phi_p(b) = \phi_p^* + \frac{\partial \phi_p}{\partial b} \cdot \left[b - \left(b_p(0) + \frac{\partial b_p}{\partial w^r} \cdot \phi_p^* \right) \right]$$

Developing further, the bargained wage can be written as a weighted average of the fixed point wage ϕ_p^* and the virtual reference wage w_p^r implied by the worker's available benefits b:

$$\phi_p(b, x) = \left(1 - \Upsilon_p\right) \cdot \phi_p^* + \Upsilon_p \cdot w_p^r(b) \quad \text{where} \quad w_p^r(b) = \frac{b - b_p(0)}{\frac{\partial b_p}{\partial w^r}}$$

As a result, it is the case that if $n > 0$, then:

$$w_{n,p} = \begin{cases} \left(1 - \Upsilon_p\right) \cdot \phi_p^* + \Upsilon_p \cdot w_{(n-1),p} & \text{if } n > 0 \\ \left(1 - \Upsilon_p\right) \cdot \phi_p^* + \Upsilon_p \cdot w_p^r(z) & \text{if } n = 0 \end{cases}$$

Iterating, one obtains that:

$$w_{n,p} = \left[1 - \left(\Upsilon_p\right)^{(n+1)} \right] \cdot \phi_p^* + \left(\Upsilon_p\right)^{(n+1)} \cdot w_p^r(z)$$

And since $\Upsilon_p < 1$:

$$\lim_{n \to \infty} w_{n,p} = \phi_p^*$$

Average equilibrium wage

The average wage in equilibrium under policy regime p can thus be written as:

$$\begin{aligned} w_p &= \sum_{n=0}^{\infty} \left(\frac{u_{n,p}}{u_p} \right) \cdot w_{n,p} \\ &= \sum_{n=0}^{\infty} \left[\left(1 - \Xi_p\right) \cdot \left(\Xi_p\right)^n \right] \cdot w_{n,p} \\ &= \sum_{n=0}^{\infty} \left[\left(1 - \Xi_p\right) \cdot \left(\Xi_p\right)^n \right] \cdot \left[1 - \left(\Upsilon_p\right)^{(n+1)} \right] \cdot \phi_p^* + \sum_{n=0}^{\infty} \left[\left(1 - \Xi_p\right) \cdot \left(\Xi_p\right)^n \right] \cdot \left(\Upsilon_p\right)^{(n+1)} \cdot w_p^r(z) \end{aligned}$$

The equilibrium average wage can thus be written as the weighted average of the stationary wage ϕ_p^* and the pre-separation wage $w_p^r(z)$ implied by z:

$$w_p = \left(\frac{1-\Upsilon_p}{1-\Upsilon_p\cdot\Xi_p}\right)\cdot\phi_p^* + \left(\frac{\Upsilon_p-\Upsilon_p\cdot\Xi_p}{1-\Upsilon_p\cdot\Xi_p}\right)\cdot w_p^r(z)$$

where:

$$\Xi_p = \frac{\theta_p m(\theta_p)\cdot\delta}{(\mu+\delta)\cdot(\mu+\theta_p m(\theta_p)+\xi_p)}\ ,\ \ \Upsilon_p = \frac{\partial\phi_p}{\partial b}\cdot\frac{\partial b_p}{\partial w^r}\ ,\ \ \phi_p^* = \phi_p(b_p(\phi_p^*))\ ,\ \ b_p(w_p^r(z)) = z$$

Average wage of UI-eligible workers

$$\begin{aligned}
\mathbb{E}\left[w_{n,p}|n>0\right] &= \sum_{n=1}^{\infty}\left(\frac{u_{n,p}}{u_p-u_{0,p}}\right)\cdot w_{n,p} \\
&= \sum_{n=1}^{\infty}\left[\left(1-\Xi_p\right)\cdot\left(\Xi_p\right)^{(n-1)}\right]\cdot w_{n,p} \\
&= \sum_{n=1}^{\infty}\left[\left(1-\Xi_p\right)\cdot\left(\Xi_p\right)^{(n-1)}\right]\cdot\left[1-\left(\Upsilon_p\right)^{(n+1)}\right]\cdot\phi_p^* + \sum_{n=1}^{\infty}\left[\left(1-\Xi_p\right)\cdot\left(\Xi_p\right)^{(n-1)}\right]\cdot\left(\Upsilon_p\right)^{(n+1)}\cdot w_p^r(z) \\
&= \left(\frac{1-(\Upsilon_p)^2}{1-\Upsilon_p\cdot\Xi_p}\right)\cdot\phi_p^* + \left(\frac{(\Upsilon_p)^2-(\Upsilon_p)^2\cdot\Xi_p}{1-\Upsilon_p\cdot\Xi_p}\right)\cdot w_p^r(z)
\end{aligned}$$

Appendix D: Tables and Figures

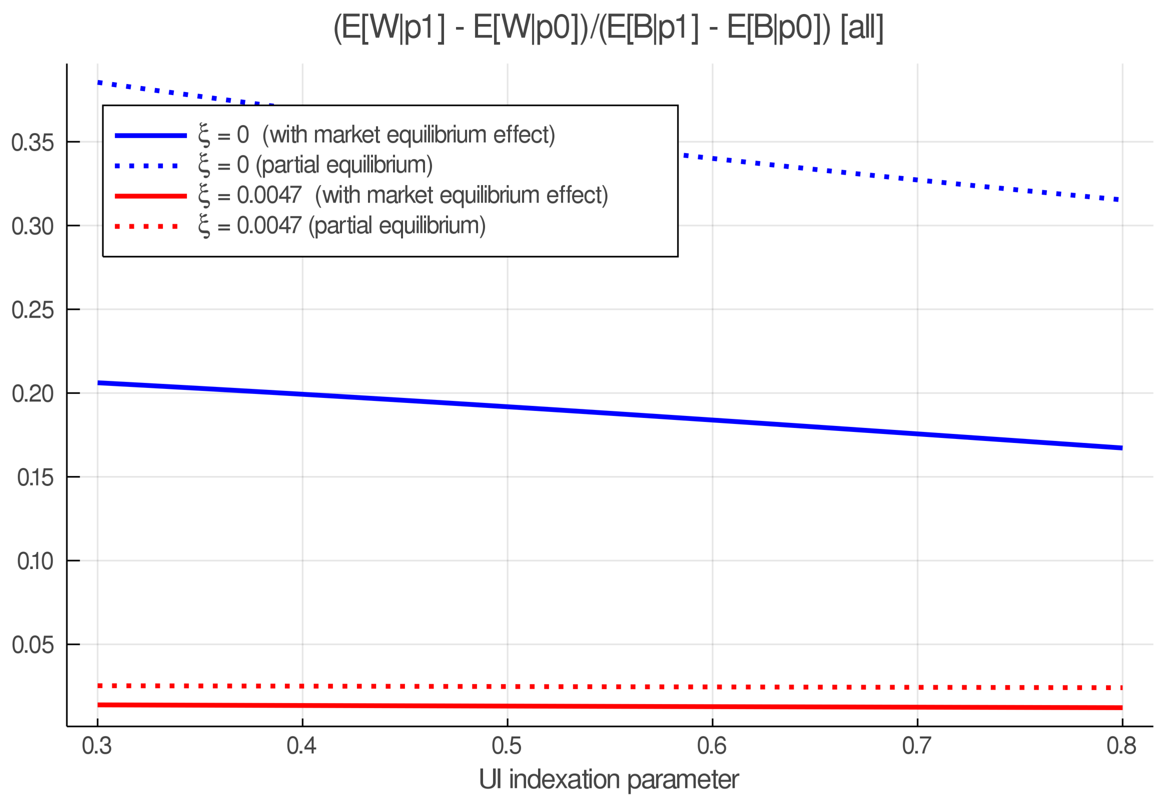

Figure 2: Predicted change in the average wage of all workers in terms of the predicted change in average UI benefits: $\frac{w_{p_1}-w_{p_0}}{b_{p_1}-b_{p_0}}$ where the benchmark indexation parameter is $\frac{\partial b_{p_0}}{\partial w^r}=0.5$.

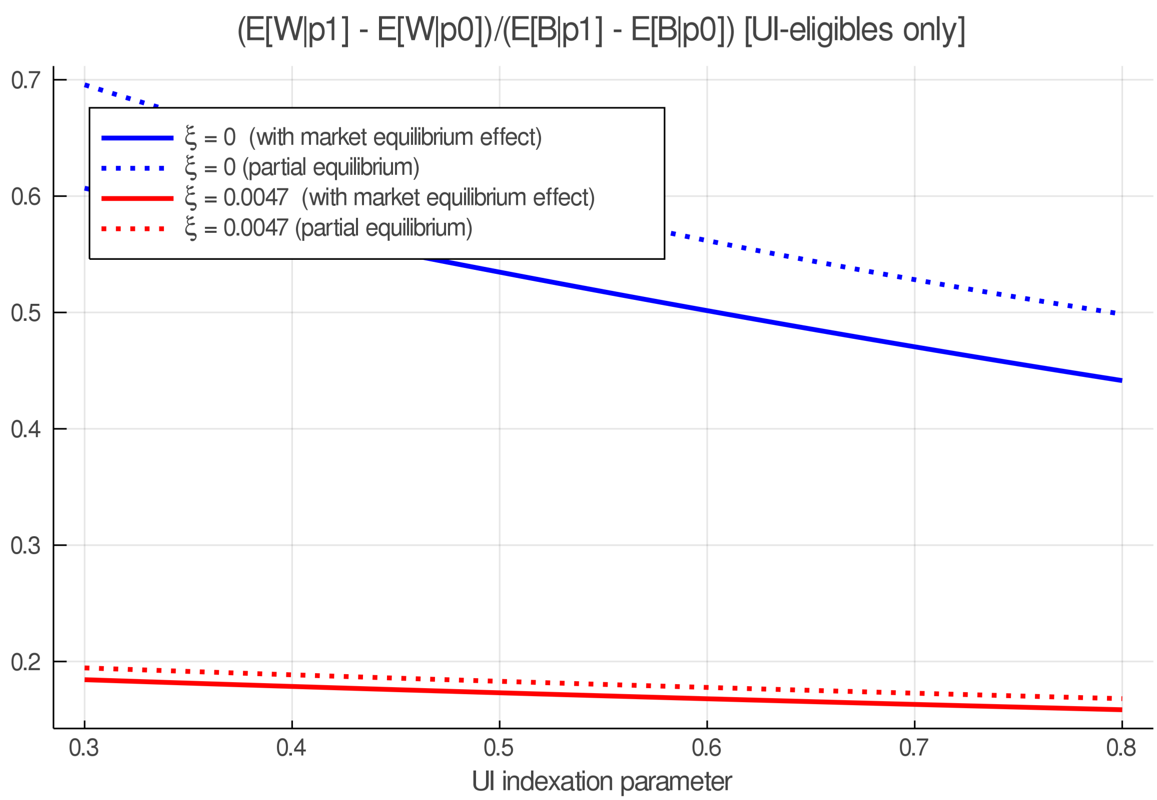

Figure 3: Predicted change in the average wage of UI-eligible workers in terms of the predicted change in average UI benefits: $\frac{\mathbb{E}\left[w_{n,p_1}|n>0\right]-\mathbb{E}\left[w_{n,p_0}|n>0\right]}{b_{p_1}-b_{p_0}}$ where the benchmark indexation parameter is $\frac{\partial b_{p_0}}{\partial w^r} = 0.5$.

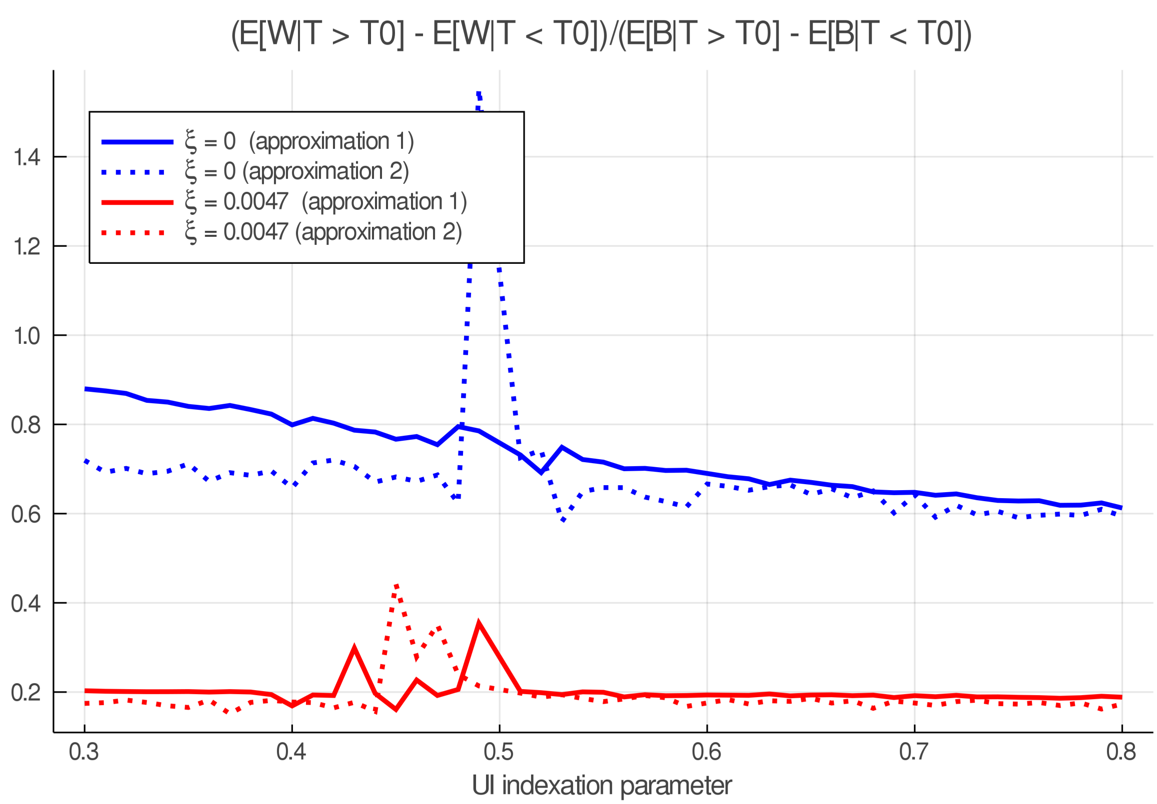

Figure 4: Predicted value of $\frac{\mathbb{E}\left[w|T_{\text{job loss}} \geq T_{\text{reform}}\right] - \mathbb{E}\left[w|T_{\text{job loss}} < T_{\text{reform}}\right]}{\mathbb{E}\left[b|T_{\text{job loss}} \geq T_{\text{reform}}\right] - \mathbb{E}\left[b|T_{\text{job loss}} < T_{\text{reform}}\right]}$ when calibrated for the sample randomly drawn from the population of individuals between 25 and 55 in 2001

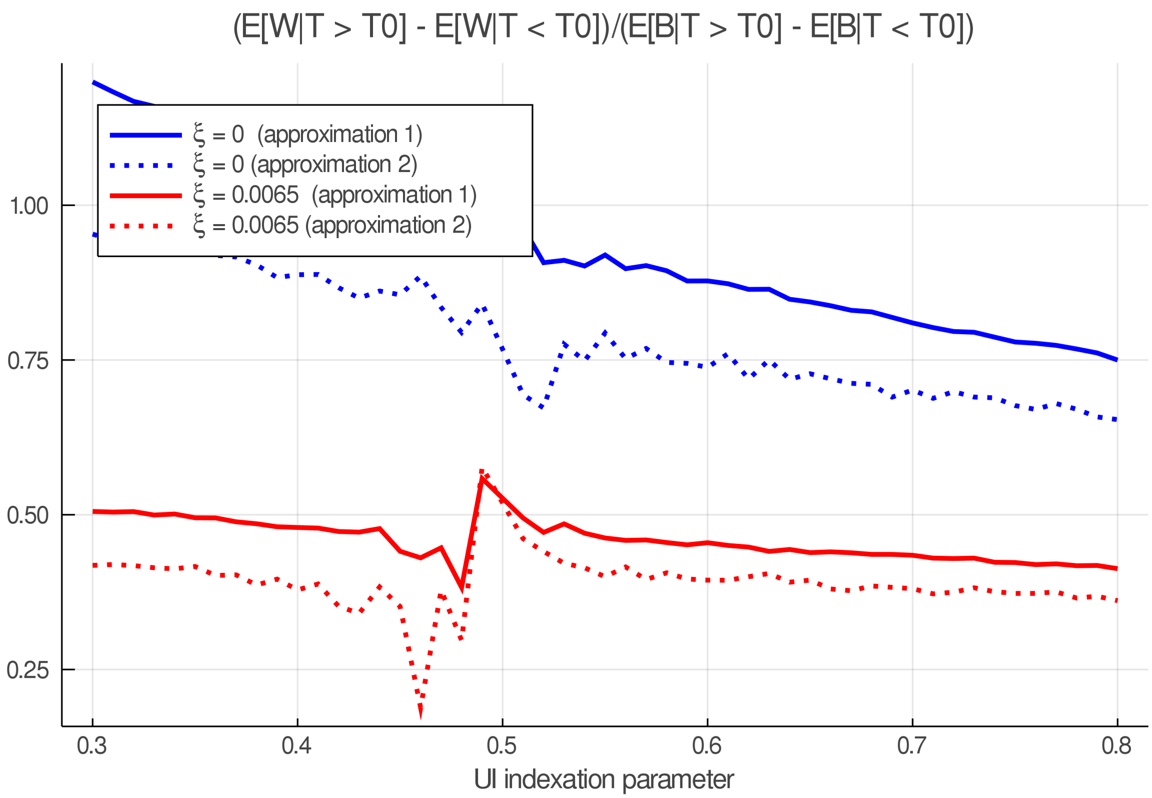

Figure 5: Predicted value of $\frac{\mathbb{E}\left[w|T_{\text{job loss}} \geq T_{\text{reform}}\right] - \mathbb{E}\left[w|T_{\text{job loss}} < T_{\text{reform}}\right]}{\mathbb{E}\left[b|T_{\text{job loss}} \geq T_{\text{reform}}\right] - \mathbb{E}\left[b|T_{\text{job loss}} < T_{\text{reform}}\right]}$ when calibrated for the analysis sample

	Dependent variable: Earnings (reemployment)				
Bandwidth	10 days	20 days	30 days	40 days	50 days
UIB claim starts Post = 0 Post = 1	22 Dec - 31 Dec 1 Jan - 10 Jan	12 Dec - 31 Dec 1 Jan - 20 Jan	2 Dec - 31 Dec 1 Jan - 30 Jan	22 Nov - 31 Dec 1 Jan - 9 Feb	12 Nov - 31 Dec 1 Jan - 19 Feb
Post	−300.94 (251.13)	−249.26 (155.21)	−188.77 (125.72)	−182.73 (104.76)	−88.39 (93.23)
Reform	−84.95 (498.34)	−561.30 (260.61)	−231.59 (193.26)	−205.53 (139.72)	−238.24 (103.87)
Post × Reform	89.88 (575.54)	615.25 (333.04)	296.69 (266.96)	287.93 (212.21)	334.96 (184.41)
Earnings (Y-2)	0.54 (0.05)	0.59 (0.03)	0.60 (0.02)	0.66 (0.02)	0.71 (0.02)
Controls	Yes	Yes	Yes	Yes	Yes
Sector FE	Yes	Yes	Yes	Yes	Yes
Bundesland FE	Yes	Yes	Yes	Yes	Yes
Number of obs.	3,029	6,619	9,747	14,368	19,585
Adjusted R^2	0.26	0.28	0.27	0.28	0.28

Table 1: Estimates using the full specification for different bandwidths

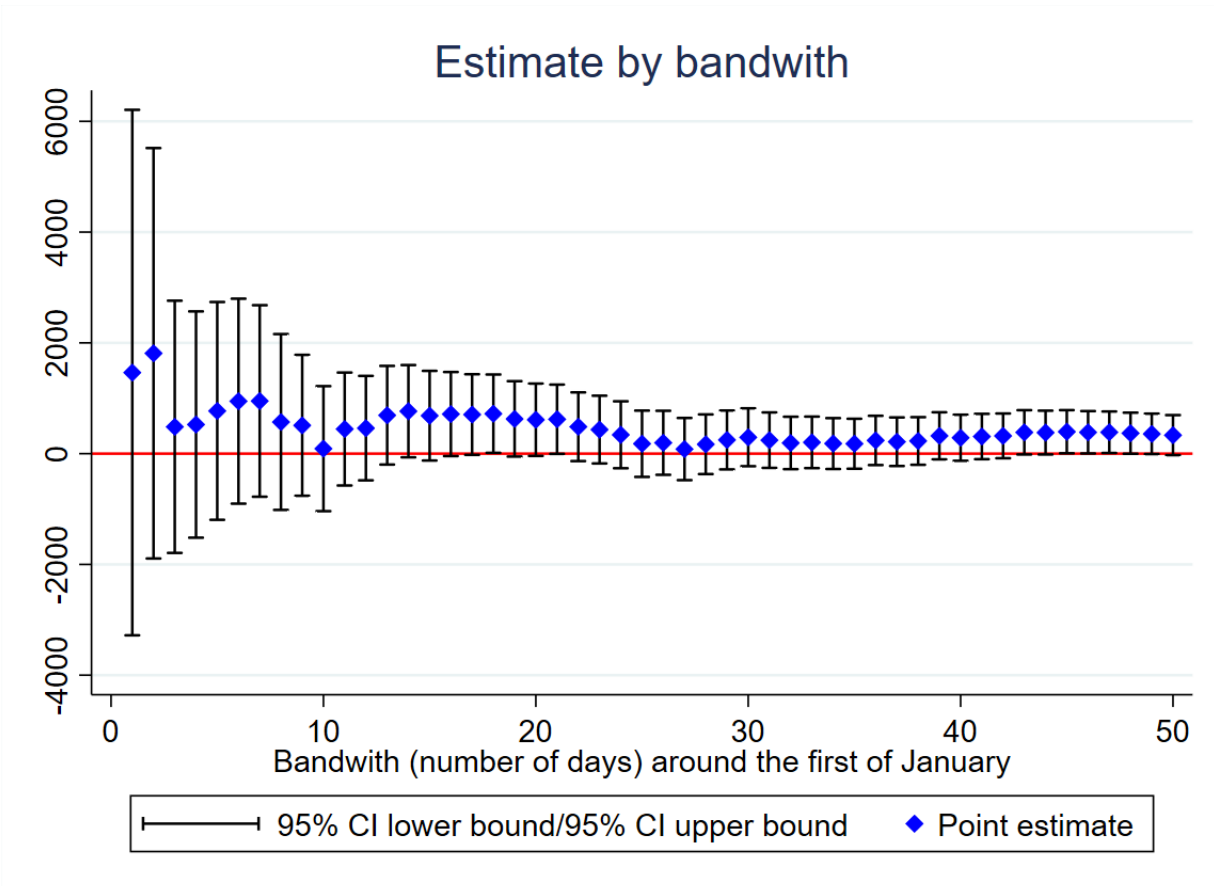

Figure 6: Estimates for $\beta_{P\times R}$ by bandwidth

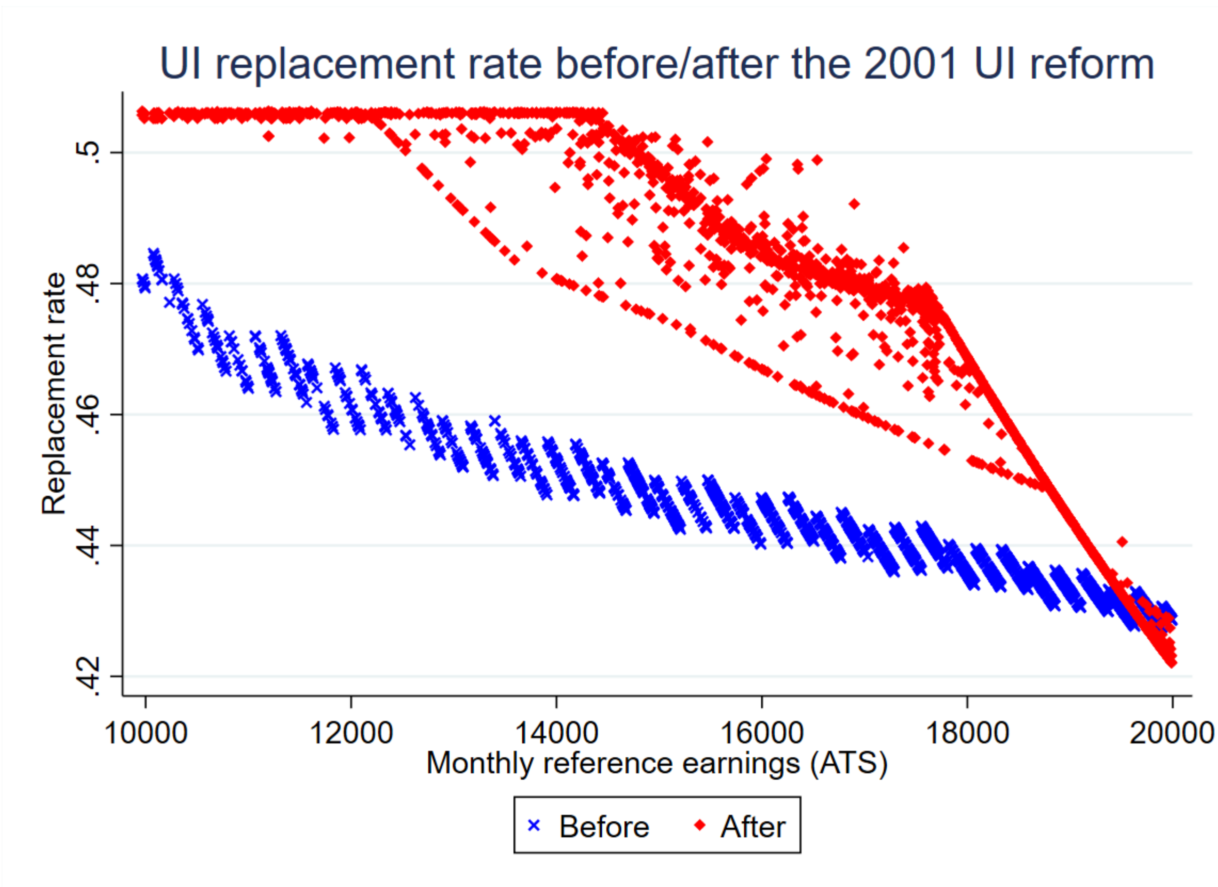

Figure 7: 2001 UI reform sample: effect on the replacement rate

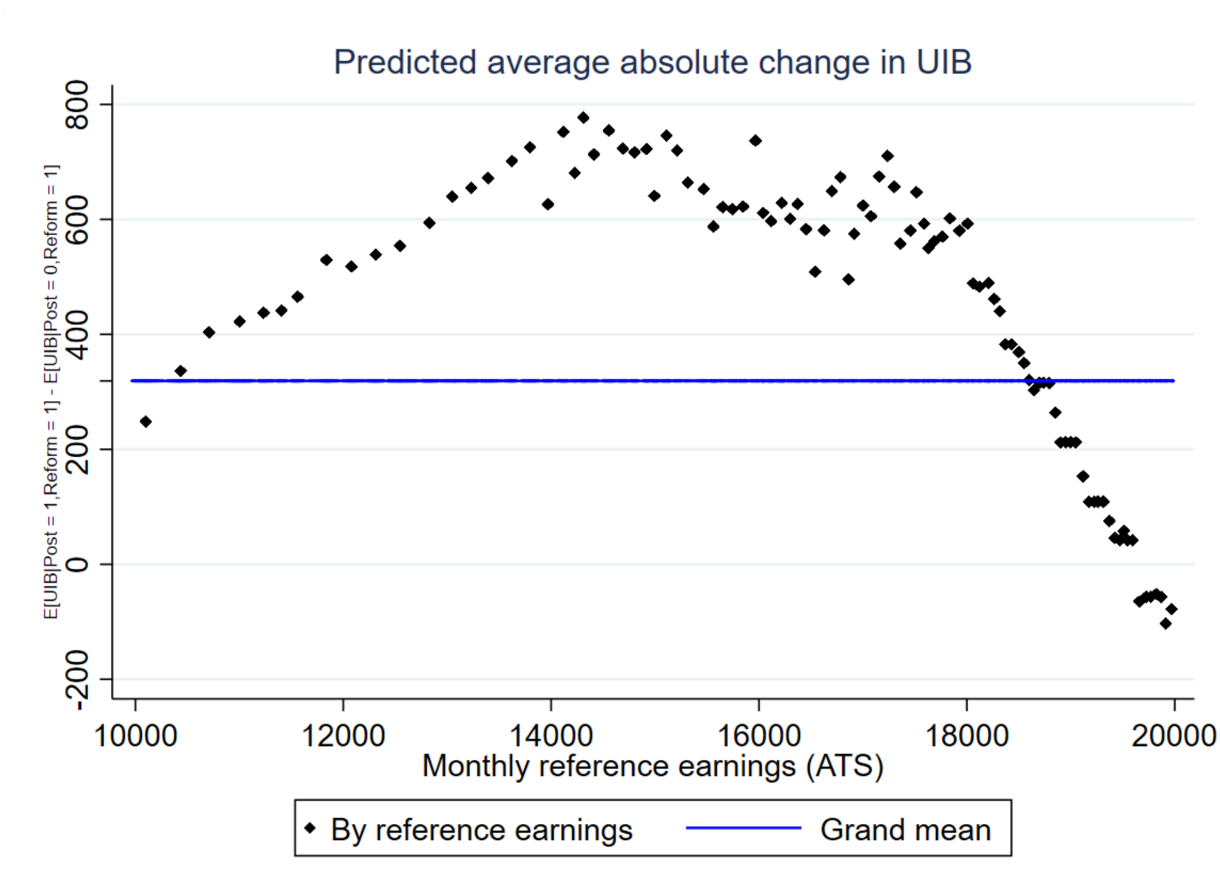

Figure 8: 2001 UI reform sample: predicted average absolute benefit change by reference earnings

symbol	name	value
f_0	daily job finding rate under p_0	0.007
δ	daily job separation rate	0.001
ν	daily working population renewal rate	0.00035
ξ	UI benefit expiration rate	0.0047
$b_p(0)$	UI benefit base amount	0
ρ	daily time discount rate	0.0001
γ	worker bargaining power	0.1
κ	flow vacancy cost	y
μ	matching efficiency scaling parameter	0.005
η	matching elasticity	0.3

Table 2: Calibration for predicting average effects

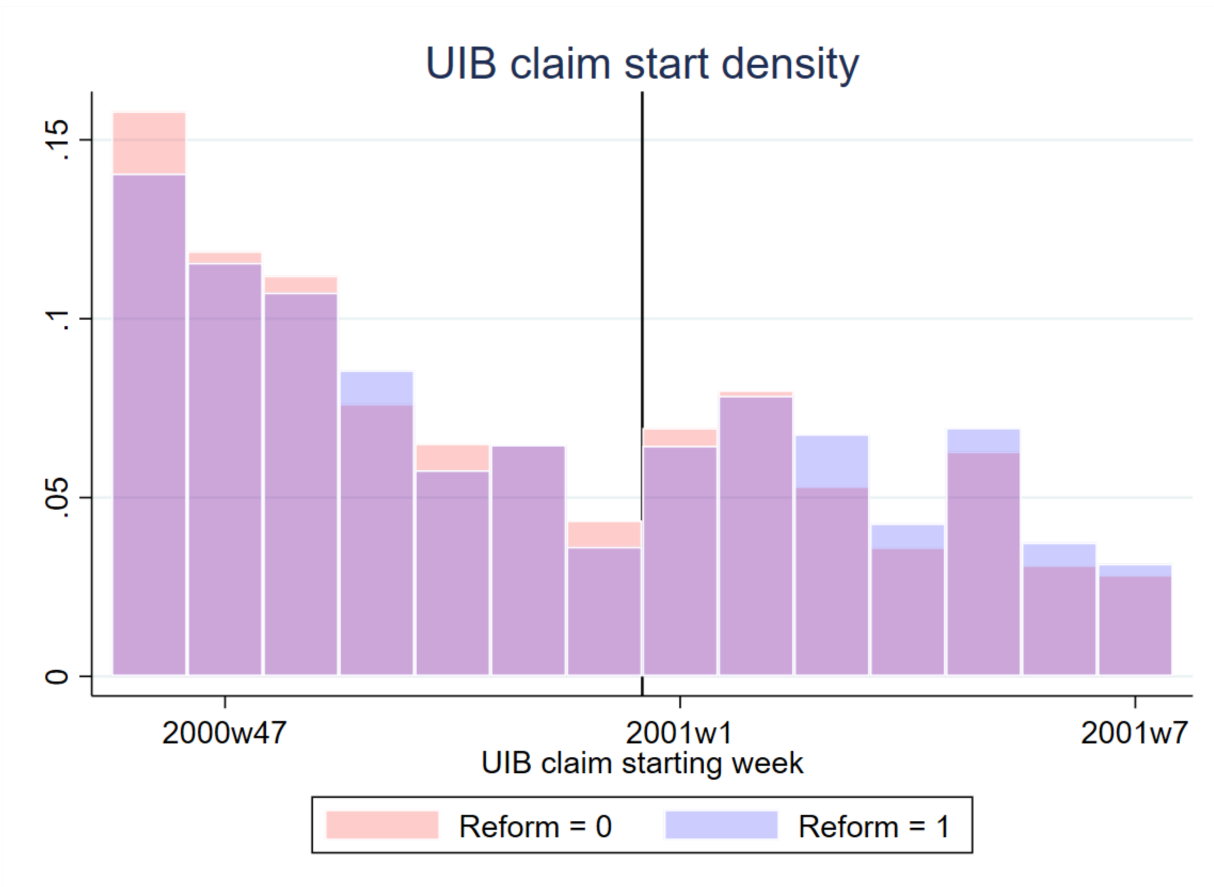

Figure 9: UI benefit claim starting week density

	Sample from the population (*)	Sample used in the analysis (**)
employment outflow rate $(\delta + \nu)$	$.00135$ $(.0012)$	$.00707$ $(.00495)$
job separation lower bound (δ_{min})	$.000427$ $(.000469)$	$.00366$ $(.00323)$
employment inflow rate (f)	$.00716$ $(.00856)$	$.0173$ $(.0188)$
UI benefit expiration rate (ξ)	$.0047$ $(.00288)$	$.0065$ $(.00483)$
Avg. number of obs.	35,607	13,707

(*) Random sample drawn from the population of individuals who are between 25 and 55 in 2001.
(**) Sample used for the analysis about the effect of the 2001 UI reform.

Table 3: Average daily transition rates (based on 1997-2003)

	Reform = 0		Reform = 1	
	Post = 0	Post = 1	Post = 0	Post = 1
Female	.523	.469	.551	.49
	(0.499)	(0.499)	(0.498)	(0.500)
	[0; 1]	[0; 1]	[0; 1]	[0; 1]
Age	38.3	38.9	38.3	39.1
	(8.380)	(8.434)	(8.712)	(8.201)
	[24; 56]	[25; 56]	[24; 56]	[25; 56]
Austrian (Y-2)	.525	.629	.494	.619
	(0.499)	(0.483)	(0.500)	(0.486)
	[0; 1]	[0; 1]	[0; 1]	[0; 1]
Earnings (Y-2)	16,909	16,622	16,697	16,329
	(2,727)	(2,835)	(2,599)	(2,666)
	[10,005; 21,533]	[10,014; 21,523]	[9,963; 19,991]	[9,975; 19,991]
Earnings (reemployment)	18,921	19,090	18,451	18,962
	(5,287)	(6,217)	(5,276)	(6,073)
	[4,469; 53,940]	[4,549; 55,385]	[4,640; 52,496]	[4,755; 47,880]
White-collar job	.0972	.156	.111	.154
	(0.296)	(0.363)	(0.314)	(0.362)
	[0; 1]	[0; 1]	[0; 1]	[0; 1]
Emp. days in 18m before UIB spell	397	416	394	414
	(98.817)	(105.034)	(100.349)	(104.054)
	[0; 549]	[0; 549]	[0; 550]	[0; 550]
Time to entry	78.1	94	79.8	90.7
	(103.576)	(100.024)	(101.641)	(88.620)
	[1; 1885]	[1; 1163]	[1; 1058]	[1; 759]
Number of obs.	10,424	5,953	2,045	1,340

Table 4: Summary statistics

	Dependent variable: Earnings (reemployment)					
	(1)	(2)	(3)	(4)	(5)	(6)
Post	−94.52	50.61	49.64	−313.38	−188.77	−189.87
	(137.49)	(130.14)	(130.34)	(132.23)	(125.72)	(125.81)
Reform	−351.26	−236.74	−259.29	−355.25	−231.59	−253.77
	(214.78)	(211.44)	(211.35)	(196.60)	(193.26)	(193.19)
Post × Reform	293.92	344.16	342.66	263.35	296.69	295.59
	(294.43)	(288.05)	(287.98)	(272.58)	(266.96)	(266.91)
Earnings (Y-2)		0.63			0.60	
		(0.02)			(0.02)	
Log(Earnings (Y-2))			9757.80			9175.99
			(392.00)			(384.84)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Sector FE	No	No	No	Yes	Yes	Yes
Bundesland FE	No	No	No	Yes	Yes	Yes
Number of obs.	9,840	9,840	9,840	9,747	9,747	9,747
Adjusted R^2	0.13	0.20	0.20	0.20	0.27	0.27

Table 5: Estimates for different specifications

Leave-out-year	Dependent variable: Earnings (reemployment) 1999	2000	2002	2003	2004
Post	−225.39	−236.69	−127.47	−158.95	−186.18
	(146.37)	(143.93)	(136.25)	(136.42)	(136.06)
Reform	−405.20	−287.14	−137.75	−158.22	−183.48
	(197.99)	(198.77)	(196.56)	(196.60)	(195.89)
Post × Reform	320.43	362.72	237.54	286.18	290.20
	(274.45)	(274.77)	(272.35)	(271.22)	(271.26)
Earnings (Y-2)	0.58	0.61	0.59	0.59	0.57
	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)
Controls	Yes	Yes	Yes	Yes	Yes
Sector FE	Yes	Yes	Yes	Yes	Yes
Bundesland FE	Yes	Yes	Yes	Yes	Yes
Number of obs.	7,896	7,979	8,176	8,275	8,361
Adjusted R^2	0.27	0.26	0.27	0.27	0.26

Table 6: Leaving out one year from control

Sample year	Y = 1999 (placebo)	Y = 2000 (placebo)	Y = 2001 (reform)	Y = 2002 (placebo)	Y = 2003 (placebo)	Y = 2004 (placebo)
Female	.393 (0.489) [0; 1]	.405 (0.491) [0; 1]	.441 (0.497) [0; 1]	.423 (0.494) [0; 1]	.401 (0.490) [0; 1]	.391 (0.488) [0; 1]
Age	37.8 (8.376) [24; 56]	37.9 (8.354) [24; 56]	38.6 (8.324) [24; 56]	38.9 (8.533) [24; 56]	39.3 (8.485) [24; 56]	39 (8.677) [24; 56]
Austrian (Y-2)	.568 (0.496) [0; 1]	.583 (0.493) [0; 1]	.569 (0.495) [0; 1]	.593 (0.491) [0; 1]	.613 (0.487) [0; 1]	.653 (0.476) [0; 1]
Earnings (Y-2)	16, 274 (2, 384) [10, 288; 19, 382]	16, 213 (2, 575) [10, 005; 19, 618]	16, 550 (2, 599) [9, 965; 19, 989]	16, 872 (2, 635) [10, 192; 20, 355]	17, 330 (2, 909) [10, 148; 21, 010]	17, 779 (3, 043) [10, 187; 21, 533]
Earnings (reemployment)	18, 810 (5, 515) [4, 549; 49, 700]	19, 142 (5, 996) [4, 640; 48, 300]	19, 166 (6, 053) [4, 640; 52, 496]	19, 703 (6, 290) [4, 841; 52, 496]	20, 000 (6, 185) [4, 841; 53, 940]	20, 302 (6, 433) [4, 966; 55, 385]
White-collar job	.114 (0.318) [0; 1]	.117 (0.321) [0; 1]	.128 (0.334) [0; 1]	.128 (0.334) [0; 1]	.128 (0.334) [0; 1]	.143 (0.350) [0; 1]
Emp. days in 18m before UIB spell	403 (105.423) [0; 549]	402 (104.901) [0; 549]	402 (104.764) [0; 550]	403 (106.490) [0; 549]	406 (104.231) [0; 549]	403 (107.979) [0; 549]
Time to entry	93.4 (106.692) [1; 1018]	86.8 (95.816) [1; 903]	90.4 (103.037) [1; 1058]	94.5 (113.882) [1; 1150]	91.1 (107.824) [1; 1521]	89.8 (108.138) [1; 1885]
Number of obs.	1,863	1,783	1,722	1,584	1,485	1,403

Table 7: Summary statistics by year

	Reform = 0		Reform = 1	
	Post = 0	Post = 1	Post = 0	Post = 1
Accommodation and food service activities	28.3%	25.8%	31.4%	24.3%
Activities of extraterritorial organisations and bodies	0.0%	0.0%	0.0%	0.0%
Activities of households as employers; undifferentiated goods - and services - producing activities of households for own use	0.1%	0.3%	0.2%	0.0%
Administrative and support service activities	17.6%	14.0%	17.8%	14.5%
Agriculture, forestry and fishing	4.3%	2.6%	2.3%	2.9%
Arts, entertainment and recreation	1.1%	1.2%	1.1%	0.9%
Construction	12.9%	17.2%	11.6%	20.2%
Education	4.0%	1.2%	3.9%	0.9%
Electricity, gas, steam and air conditioning supply	0.0%	0.1%	0.0%	0.0%
Financial and insurance activities	0.2%	0.1%	0.0%	0.5%
Human health and social work activities	1.0%	0.7%	1.2%	1.0%
Information and communication	0.5%	0.5%	0.5%	0.2%
Manufacturing	6.0%	9.2%	5.1%	9.0%
Mining and quarrying	0.2%	0.4%	0.0%	0.3%
Other services activities	1.2%	1.3%	0.5%	1.7%
Professional, scientific and technical activities	1.2%	1.2%	0.6%	1.5%
Public administration and defence; compulsory social security	4.3%	4.8%	4.6%	4.2%
Real estate activities	0.5%	0.6%	0.4%	0.6%
Transporting and storage	11.9%	9.6%	13.3%	10.1%
Water supply; sewerage; waste managment and remediation activities	0.2%	0.3%	0.5%	0.3%
Wholesale and retail trade; repair of motor vehicles and motorcycles	4.5%	8.6%	4.9%	6.9%
Number of obs.	4,076	4,042	822	900

Table 8: Sector of reemployment

	Reform = 0		Reform = 1	
	Post = 0	Post = 1	Post = 0	Post = 1
Unknown	0.7%	0.6%	0.9%	0.2%
Burgenland	2.4%	4.5%	2.1%	4.7%
Kärnten	11.1%	14.5%	10.5%	14.3%
Niederösterreich	11.7%	17.0%	9.4%	17.4%
Oberösterreich	13.6%	16.4%	14.2%	18.8%
Salzburg	12.9%	7.1%	14.4%	7.0%
Steiermark	10.7%	16.6%	10.3%	15.6%
Tirol	22.9%	11.2%	22.4%	10.0%
Vorarlberg	3.2%	1.4%	3.9%	1.6%
Wien	10.8%	10.8%	12.0%	10.4%
Number of obs.	4,076	4,042	822	900

Table 9: State (Bundesland) of reemployment

Appendix E: institutional context and data

UI benefits

Workers in Austria are eligible to receive UI benefits after having been employed subject to UI contributions for at least 52 weeks in the last two years at baseline.

The basic amount of UI benefits is calculated based on previous earnings (subject to unemployment insurance). The replacement rate is around 40-50% of gross earnings for earners below the benefit ceiling corresponding to the maximum contribution basis. Depending on the number of dependents in the household, UI-claimants may also be eligible for family allowance up to a cap. The potential benefit duration of UI benefits is a function of age and tenure within some period before the claim is made and varies between 20 weeks and 78 weeks. The Austrian unemployment insurance scheme allows for partial UI receipt in case the earnings of the unemployed individual are below a certain threshold with such earnings being deducted from the UI benefits of the UI benefit recipient.

After the exhaustion of UI benefits, unemployed individuals may apply for means-tested unemployment assistance benefits that are about 90% of previous UI benefits.

Wage setting

In Austria, most workers of the private sector are covered by sectoral wage agreements resulting from centralised collective bargaining and determining sectoral wage floors. However, wages exhibit large variation across individuals working in the same sector and individual-level bargaining is prevalent.

Data

The data used in the present paper are from the Austrian Labor Market Database (https://arbeitsmarktdatenbank.at/) originating from matched employer-employee social security records collected for administrative purposes.

Variables on individuals include gross yearly earnings (contribution bases used to calculate basic benefit amounts) and associated employment duration for each establishment, labor market/ life-cycle spells that are relevant for social insurance (e.g. unemployment, health, parental leave, maternity leave, pension etc.), and a restricted set of demographic attributes (nationality, birth year, gender etc.). No information is reported on marital status, number of dependents, education levels, hours of work etc.

Information on establishments includes location and industry code.

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