Unemployment Insurance and Learning: Evidence from Reservation Wages*

Patrick Arni Yanos Zylberberg

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Abstract

Some job seekers have uncertain prospects at the onset of unemployment; insurance may offer an opportunity to learn. We develop a stylized model in which individuals have imprecise priors and learn along the unemployment spell, and we quantify the learning value of unemployment insurance. The reservation wage initially increases with benefits, but learning and dynamic selection induce a strong, negative duration-dependence in this effect. The magnitude of the previous response depends on the precision of initial priors, leading to heterogeneous effects of benefits on unemployment duration and match quality. Combining register data with a survey reporting reservation wages, we provide support for these theoretical predictions.

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*Arni: University of Bristol, IZA, CESifo; patrick.arni@bristol.ac.uk.; Zylberberg: University of Bristol, CESifo, Alan Turing Institute; yanos.zylberberg@bristol.ac.uk. We are grateful to Steffen Altmann, Pierre Cahuc, Bart Cockx, Bernd Fitzenberger, Dylan Glover, Simon Jaeger, Camille Landais, Andreas Mueller, Barbara Petrongolo, Imran Rasul, Roland Rathelot and Gerard Van den Berg for useful discussions and comments. We also thank participants at CBS and in the 6th AMSE-BdF Labor Market Conference (2017), the Bristol Workshop on Economic Policy Interventions and Behaviour (2018), the CEPR/IZA Annual Labour Economics Symposium (2018), SOLE Toronto (2018) and the Workshop on Wages and the Labor Market (Helsinki, 2017) for helpful comments. The usual disclaimer applies.

Job seekers may have imprecise priors about their employment prospects. These priors shape their search behavior: the intensity at which they look for new job opportunities, or the probability to decline them. This observation has motivated early, influential contributions studying the role of information and learning during job search (McCall, 1970; Burdett and Vishwanath, 1988). Experimenting in the early stages of unemployment should be valuable to a job seeker with imprecise priors. Unemployment insurance may offer the opportunity to experiment and learn.

In this paper, we evaluate the learning value of unemployment insurance across heterogeneous job seekers with different initial priors about their prospects. We develop a model à la Burdett and Vishwanath (1988) where the job seeker has imprecise beliefs about her job prospects.[1] Unemployment insurance allows her to learn, a process during which she initially rejects offers, then gradually updates her priors and revises downward the probability to receive dream job offers. Unemployment insurance is valuable to a job seeker with imprecise priors, as reflected by the marked adjustment of the initial reservation wage to benefits, but its impact on search outcomes may be ambiguous: the job seeker remains longer unemployed, which may lead to low-quality matches. We exploit a survey of reservation earnings in Switzerland, and provide empirical support for the theoretical predictions about the relationship between the generosity of insurance, reservation wages along the unemployment spell, and search outcomes.

The model generates negative duration-dependence, as in Burdett and Vishwanath (1988), but also, and most importantly, implies that the gradient in reservation wages further decreases with the generosity of unemployment insurance. In response to an increase in insurance coverage, the uninformed job seeker strongly adjusts her initial reservation wage; she then refines her priors and appears to markedly lower her reservation wage over time. Two effects explain this sharp revision of beliefs: (i) a "precision" effect and (ii) a "dynamic selection" effect. The precision effect derives from a gradual reduction in the dispersion of expected wages and an inherent asymmetry. The reservation wage is indeed asymmetrically affected by the tails of the distribution, because a dream job would make it worth waiting for such an opportunity while expectations would not be pulled down by the left tail, as these offers would remain below any reasonable reservation wage and would be rejected anyway. The dynamic selection effect derives from a composition effect: remaining job seekers are more likely to have received negatively-selected wage offers and to become pessimistic about their prospects. Both effects induce a large duration

[1] We augment the stylized model of Burdett and Vishwanath (1988) by explicitly allowing for a duration-dependence in wage offers and by modeling imperfect access to borrowing, in order to derive credible quantitative insight about the learning value of unemployment insurance.

effect of unemployment insurance, with an ambiguous impact on match quality: the uninformed job seeker rationally experiments, at the expense of unemployment duration—and also potentially of future match quality. By contrast, an informed job seeker does not respond much to insurance on the onset of unemployment and does not need to adjust her reservation earnings so markedly afterwards.

In order to derive reasonable quantitative predictions about the (heterogeneous) response to unemployment insurance, we calibrate the model to match key moments of the data. We consider two distinct worker types, an uninformed worker and a well-informed worker, and we predict the causal effect of an increase in the generosity of unemployment insurance on: the initial adjustment of reservation wages, its gradual revision among remaining job seekers, unemployment duration, and match quality.

Our empirical analysis exploits a unique survey of reservation earnings (collected at the onset of unemployment, and after 3 months) linked with individual register data.[2] In order to identify the causal impact of unemployment insurance, we rely on two sources of exogenous variation: (i) a sharp discontinuity in insurance coverage around age 25, which we use to measure the average impact of unemployment insurance;[3] (ii) a fuzzy eligibility criterion based on the mapping between contributed months and months of entitled benefits, which we use to study treatment heterogeneity. The average effect of insurance on reservation earnings is non-negligible: an additional month of coverage increases the reservation earnings, as reported at the onset of unemployment, by about 0.5–1.2%. This adjustment in search behavior has implications for search outcomes: non-employment spells are between 1.5 and 2.5 days longer and the hiring wage increases by about 0.3–0.5%. This average effect however masks large treatment heterogeneity. The response of reservation earnings sharply differs along past unemployment experience, which we use as a proxy for the precision of priors about job prospects. Inexperienced job seekers, with noisy priors, strongly adjust their initial reservation earnings with unemployment insurance. By contrast, experienced job seekers—with at least one unemployment spell over the past three years and fairly precise priors—do not respond much to the length of the insurance coverage period. This differential adjustment in search behavior is reflected in search outcomes: inexperienced job seekers end up accepting lower wage

[2]The information on reservation earnings was collected in the Canton of Fribourg, Switzerland, and combined with register data covering the full population of unemployed in the country. The combined data allows us to observe the dynamics of reservation earnings along the unemployment spell, but also non-employment duration and measures of match quality.

[3]This empirical setting allows us to run a sharp regression discontinuity design within the sample of potentially-treated individuals, but also within a placebo sample where the age discontinuity should be irrelevant. One major limit of this strategy—used in most of the literature—is that the elasticity of search outcomes to insurance is only locally estimated around a narrow age interval.

offers than experienced ones, in spite of being *initially* choosier. This heterogeneity could explain the ambiguous findings of the literature, with estimated wage effects of unemployment insurance ranging from positive (Nekoei and Weber, 2017) to insignificant (Card et al., 2007; Lalive, 2007; Van Ours and Vodopivec, 2008), or even negative (Schmieder et al., 2016).

The main contribution of this paper is to document the heterogeneous effect of unemployment insurance in the presence of uncertainty. Our quantitative analysis provides a quantitative extension of the seminal theory developed in Burdett and Vishwanath (1988). This quantification is particularly useful to isolate (i) a "precision" effect from (ii) a "dynamic selection" effect in the revision of beliefs. The closest papers to ours are part of a recent strand of research motivated by the observation of job seekers' behavior (Spinnewijn, 2015; Conlon et al., 2018; Mueller et al., 2018; Potter, 2020). We closely relate to Spinnewijn (2015), who studies optimal unemployment insurance when job seekers hold biased beliefs—instead of imprecise beliefs, and Conlon et al. (2018), who use high-quality data on labor market expectations and rejected offers in order to identify learning and discipline a theoretical model of job search in the presence of information frictions. In our model, we assume that agents use Bayesian updating, as in Burdett and Vishwanath (1988) or Potter (2020) for instance, and that beliefs are (heterogeneously) imprecise rather than (heterogeneously) biased. The empirical findings of Conlon et al. (2018) and Mueller et al. (2018) partly challenge these theoretical assumptions: Conlon et al. (2018) find that agents learn too much—the update of labor market expectations is too substantial to be rationalized by Bayesian updating, while Mueller et al. (2018) provide evidence of *biased* initial beliefs and limited adjustments of reservation wages over the unemployment spell.

The paper relates to the literature evaluating the impact of unemployment insurance on labor market outcomes. The heterogeneous adjustment in the profile of reservation earnings may provide an explanation for the ambiguous findings of the literature, and the heterogeneity in the estimated elasticity of match quality (see, for instance, Card et al., 2007; Lalive, 2007; Van Ours and Vodopivec, 2008; Schmieder et al., 2016; Nekoei and Weber, 2017) or unemployment duration (see, for instance, Schmieder et al., 2012; Card et al., 2015) to unemployment benefits. Crucial insight could be gained by observing the intermediary role of search behaviors, and whether job seekers modify their investment in search with unemployment insurance, or accept fewer offers. The evidence on such changes is thin. To our knowledge, only one study has estimated the causal impact of insurance on reservation wages (Le Bar-

banchon et al., 2017).[4] A key empirical finding of the present study, documenting a positive elasticity of reservation wage to unemployment insurance, is remarkably different from Le Barbanchon et al. (2017) who find no effects using French data. Treatment heterogeneity, and the difference between the average unemployed worker in France and in Switzerland, may be an explanation for these differences.

The theoretical framework is a model of sequential job offers in partial equilibrium, as standard in studies of optimal unemployment insurance (Shavell and Weiss, 1979; Hopenhayn and Nicolini, 1997; Shimer and Werning, 2008; Chetty, 2008). The model thus features the well-known trade-off between consumption-smoothing and moral hazard. Unemployment insurance helps stabilize income along and across the different prospective unemployment spells. It may however undermine the incentives to exit unemployment. Our empirical finding about the (heterogeneous) elasticity of reservation earnings to insurance coverage also speaks to this literature. For instance, Shimer and Werning (2007) show that this elasticity is informative about the optimality of the insurance scheme. In their stationary model, the reservation wage is indeed a mapping of worker's utility; a large increase in reservation earnings would thus indicate large gains of additional insurance coverage.

The remainder of the paper is organized as follows. Section 1 develops a model in which job seekers with imprecise priors about their job prospects receive sequential job offers; it then derives quantitative predictions about the heterogeneous effect of unemployment insurance in such a framework. Section 2 describes the institutional context, our main data sources, the empirical methodology and documents the average and heterogeneous effect of unemployment insurance on search behavior and search outcomes. Finally, Section 3 briefly concludes.

1 Model

This section develops a model in which a job seeker receives job offers in a sequential manner and updates her beliefs about job prospects along this process. The model is used to provide a quantitative assessment of the (heterogeneous) learning value of unemployment insurance.

1.1 Environment

We start by describing the environment of the model.

Time is discrete, and we consider the standard problem of a potential worker

[4] A more observational study by Krueger and Mueller (2010), in which search effort is measured by time use survey, finds that search intensity does seem to respond to insurance.

facing a sequence of wage offers (à la McCall, 1970). The agent lives for infinitely many periods and maximizes expected discounted utility. Let c_t denote consumption in period t and $\beta < 1$ the discount factor. The expected lifetime utility in period 0 is:

$$U_0 = E_0 \sum_{t=0}^{\infty} \beta^t u(c_t),$$

where $u(\cdot)$ is the period utility, which satisfies $u'(\cdot) > 0$ and $u''(\cdot) < 0$.

The agent can be in two states, employed or unemployed. In period 0, the agent starts unemployed. When unemployed in a certain period, the agent exogenously receives a wage offer with probability f. Conditional on receiving an offer, the agent can accept or reject. For simplicity, we assume that employment is an absorbing state such that—upon acceptance—the agent remains indefinitely employed under the same contractual terms. If the offer were to be rejected, the agent remains unemployed and loses all ties with the previously matched employer.

The most important element of the model is the distribution of potential wage offers and the priors of the agent about such distribution. We rely on a framework à la Burdett and Vishwanath (1988). The *actual* distribution of potential wages is $G(\cdot) = N(1, \nu)$, such that the average wage offer is normalized and equal to 1. The agent knows the variance of wage offers, ν, but does not observe its mean. In period 0, the agent has normally-distributed priors about this mean such that, from the agent's viewpoint, the possible wage offer in period 0 follows a Normal distribution $N(\mu_0, \sigma_0)$ with $\sigma_0 > \nu$.[5]

The underlying distribution of wage offers is assumed stationary along the unemployment spell. However, a number of recent contributions have documented a negative duration-dependence in job opportunities (Kroft et al., 2013; Oberholzer-Gee, 2008; Eriksson and Rooth, 2014), which may reflect a depreciation of human capital, stigma or (negative) signaling. As we will see later, a negative duration-dependence in accepted wages is a built-in feature of the model, and will arise endogenously from the interaction of learning and selection. In order to introduce *exogenous* duration-dependence in job opportunities, we assume that there is a time-varying depreciation factor which acts like an 'iceberg' cost between the offered wage and the received labor income.[6] A wage offer x received at period t would provide a flow of labor income, $(1 - \delta_t)x$, if it were to be accepted. For the sake of parsimony, we assume

[5]The (initial) normally-distributed priors about the mean of the actual distribution are distributed along $N(\mu_0, \sigma_0 - \nu)$.

[6]This assumption implies, as standard in the literature, that home production does not follow a similar duration-dependent process, maybe illustrating that the depreciation of human capital or the stigma associated with long-term unemployment is mostly relevant on formal labor markets.

that the agent starts the unemployment spell as high-skilled, i.e., with $\delta_0 = 0$, and there is an idiosyncratic draw at each period determining if the discount remains at 0 or jumps to an absorbing state $\delta > 0$ (with probability p_h).

The income flow upon unemployment consists of home production h, which we assume to be constant, and unemployment insurance $\{b_t\}$. In order to model the existing duration-dependence in eligibility to unemployment insurance, we consider that the agent is initially eligible to benefits, i.e., $b_0 = \bar{b}$, and there is a period-specific draw determining if the eligibility expires and the agent ends up in an absorbing state, $b = \underline{b}$ (with probability p_b).

We suppose that there exist no other assets that are contingent on the employment status of the individual, as standard in the literature. For instance, this assumes away the existence of a private market for unemployment insurance.[7]

We also assume that access to credit is imperfect, in contrast with Shimer and Werning (2008) for instance. The agent starts with initial (liquid) assets, a_0, and needs to ensure in each period that assets are positive, i.e., $a_t \geq 0$. One implication is that the desire to stabilize consumption over time will shape the choice of a sequence of reservation wages.

Note that we shut down any effect potentially arising from adjustments in search efforts. Specifically, we suppose that search efforts are inelastic, and the agent cannot actively learn and "fish" for wage offers. We also assume that the distribution of wages is unknown, but the interview arrival rate is perfectly known (in stark contrast with Potter, 2020). Both assumptions come from one important limitation of the empirical application: while we do observe reservation wages, data on search behavior along the unemployment spell is limited.

1.2 The worker program

The agent can be in two states, employed or unemployed. Upon forming a match, a worker draws a wage x and, since employment is an absorbing state, the present discounted value of being employed is $W(a', \delta, x) = u\left(x(1-\delta) + ra'\right)/r$ for a worker with assets a' and human capital depreciation δ upon hiring. By contrast, the value of being unemployed depends on unemployment duration through the depletion of assets and human capital, but also through the revision of priors and the eligibility to unemployment benefits. Let $U(a, \mu, \sigma, \delta, b)$ denote the value of being unemployed in a given period for an individual with priors $N(\mu, \sigma)$ and assets a at the beginning of

[7] The absence of a private market for unemployment insurance may relate to the large unobserved heterogeneity across job seekers (Hendren, 2017), making it difficult to design unemployment insurance contracts that are contingent on the risk of becoming long-term unemployed (Barnichon and Zylberberg, 2019).

the period. The value of being unemployed, $U(a, \mu, \sigma, 0, \bar{b})$, for a high-skill individual eligible to unemployment benefits, can be written as,[8]

$$U(a, \mu, \sigma, 0, \bar{b}) = \max_{\{c, a', \omega\}} \quad u(c) + \beta f \left[\int_{\omega}^{\infty} W(a', 0, x) dG_{\mu,\sigma}(x) + \int_{-\infty}^{\omega} V(x) dG_{\mu,\sigma}(x) \right] + \beta(1-f)V$$

where $V(x)$, the value of being unemployed after having received offer x, and before the idiosyncratic depreciation/eligibility draws, is,

$$\begin{aligned} V(x) = \quad & (1-p_b)(1-p_h)U(a', \mu', \sigma', 0, \bar{b}) + p_b(1-p_h)U(a', \mu', \sigma', 0, \underline{b}) \\ & + (1-p_b)p_h U(a', \mu', \sigma', \delta, \bar{b}) + p_b p_h U(a', \mu', \sigma', \delta, \underline{b}) \end{aligned}$$

and V, the value of being unemployed after having received no job offers is,

$$\begin{aligned} V = \quad & (1-p_b)(1-p_h)U(a', \mu, \sigma, 0, \bar{b}) + p_b(1-p_h)U(a', \mu, \sigma, 0, \underline{b}) \\ & + (1-p_b)p_h U(a', \mu, \sigma, \delta, \bar{b}) + p_b p_h U(a', \mu, \sigma, \delta, \underline{b}) \end{aligned}$$

The worker is subject to a budget constraint, $c + qa' = a + \bar{b} + h$, and a borrowing constraint, $a' \geq 0$, and (μ', σ') are the revised priors about the wage distribution after the observation of the wage offer x. The Bayesian update rule is as follows:

$$\begin{cases} \mu' = \dfrac{\sigma - \nu}{\sigma} x + \dfrac{\nu}{\sigma} \mu \\ \sigma' = \nu + \dfrac{(\sigma - \nu)\nu}{\sigma} \end{cases} \tag{1}$$

where $\frac{\sigma-\nu}{\sigma}$ can be interpreted as the relative weight that is given to the signal versus priors. With diffuse priors, the agent would sharply revise expectations upon receiving generous offers.

The value of being unemployed in other cases, $(\delta = 0, b = \underline{b})$, $(\delta = \delta, b = \bar{b})$, or $(\delta = \delta, b = \underline{b})$, follow similar equations, except that either eligibility, or human capital depreciation, or both, will be in their respective absorbing state. These maximization programs will give rise to Euler equations equating the present returns to consumption to the expected future marginal gains, accounting for the possibility that the credit constraint binds in some future states of the world.

A match is preferable to unemployment and the worker ends up with a job whenever $W(a', \delta, x) \geq U(a', \mu', \sigma', \delta, b)$, i.e., whenever the surplus of the match is larger than the outside option of breaking the newly-formed match. This condition

[8] The value functions depend on the initial state, most notably on $\mu, \sigma, 0, \bar{b}$, and on future assets a', but we omit these variables in the following equations for the sake of exposure.

helps determine the reservation wage, which verifies:

$$W\left(a',\delta,\omega\right)=U\left(a',\frac{\sigma-\nu}{\sigma}\omega+\frac{\nu}{\sigma}\mu\ ,\ \nu+\frac{(\sigma-\nu)\nu}{\sigma},\delta,b\right) \tag{2}$$

Simple comparative statics about this expression provide the following insights. First, higher wage offers lead to a higher likelihood of acceptance, but this channel is partly tempered by diffuse priors. Upon receiving an offer close to the reservation wage, the agent also revises beliefs about the wage distribution. Depending on whether the reservation wage is higher or lower than the agent's expectation, the revision may be upward—thereby raising his future prospects of remaining unemployed—or downward. In the former case, the agent remains longer unemployed when he has diffuse priors because just-acceptable offers make him more optimistic. In the latter case, the agent remains longer unemployed when he has diffuse priors because just-acceptable offers make him more pessimistic. This effect is an *ex-ante learning* channel. Second, optimistic priors, i.e., a high μ, lead to more rejection until the Bayesian process converges to the true distribution.

1.3 Learning, dynamic selection and the role of unemployment insurance

This section provides a quantitative assessment of the (heterogeneous) learning value of unemployment insurance relying on the previous model.

Calibration While the previous model does not feature any heterogeneity, the quantitative analysis will compare different types of agents, along the precision of their initial priors, and will allow for some heterogeneity within each broader type. A crucial input of the quantitative model is the distribution of priors, which will be characterized by an initial variance σ_0 and mean $\mu_0 = 1$.[9] This initial variance defines an agent type, as all other characteristics are assumed similar across the different types. The quantitative predictions will be σ_0-specific; it will however be based on average outcomes, across spells for a given individual, but also across individuals within a type.

We set the preference parameters to be independent of σ_0, and as standard in models of sequential job offers. A period is a month; the monthly discount factor, β, corresponds to a yearly interest rate of 10%. The agent enjoys consumption following a Constant-Relative-Risk-Aversion utility function with parameter $s = 2$.

[9] In stark contrast with Spinnewijn (2015), we will ignore the existence of an ex-ante bias in the perception of job prospects: all spells of the quantitative model will start with a 'centered' distribution of wage expectations, around the actual mean.

The initial assets and income flows under unemployment are set to match basic moments of our empirical application. Initial assets are allowed to differ across agents. The distribution of initial assets is extracted from the actual distribution of liquid assets, as recorded in the Swiss Household Panel, and is calibrated independently of type σ_0. We assume that home production is constant over time and represents 20% of the *average* wage offer, while unemployment benefits are constant and uniformly set at a replacement rate of 70%, i.e., $\bar{b} = 0.7$, as long as the job seeker is eligible to benefits. With monthly probability $p_b = 0.1$, unemployment benefits however drop to a replacement rate of 50%, i.e., $\underline{b} = 0.5$, reflecting the existence of other schemes insuring the job seeker after the expiration of unemployment benefits.

The job finding rate is set at $f = 0.2$, while the actual standard deviation of the wage distribution is set at $\sqrt{\nu} = 0.06$. With monthly probability $p_h = 0.1$, human capital depreciates and wage offers are discounted by a factor, i.e., $\delta = 0.08$.

In order to solve the model, we discretize the analysis and create grids for the state variables $\{a, \sigma, \mu\}$, while we account for the state variables $\{\delta, b\}$ by considering four different value functions corresponding to each one of the four different combinations of these binary variables (labeled with τ). We solve numerically the model as a fixed point problem. The agent takes her future choices as given when deciding on the optimal contemporary choices. We iterate and find the fixed point as follows: we choose initial values for policy functions $(a, \mu, \sigma) \mapsto U_\tau(a, \mu, \sigma)$; we construct $U_\tau(a, \mu, \sigma)$ by setting the *future* valuations equal to these initial policy functions in the previous maximization program. We then update the agent's policy function and iterate the previous procedure until we converge to the fixed point.

Learning and dynamic selection We first use the quantitative model to gain some insight about two main channels generating a negative duration-dependence in reservation wages: learning and dynamic selection.

The update of beliefs with job offer arrivals both affects the precision of priors and their location—see Equation (1). With duration, the average unemployed worker is more likely to have received some offers, and his priors are more precise. However, he is also more likely to have received disappointing offers; he would have otherwise exited the unemployment pool. The first effect is the learning effect; the variance of priors about wage offers decreases with duration. This increased precision of beliefs implies that very promising offers are less likely, which reduces the reservation wage. The increased precision of beliefs also implies that very unattractive offers are less likely. This symmetric force is however unlikely to affect the reservation wage in any significant way, as left-tail offers end up being rejected. For this reason,

a thinner right tail decreases more the reservation wage than a thinner left tail increases it. The second effect is the dynamic selection effect; the mean of expected wage offers decreases with duration as only unlucky, pessimistic individuals remain in the unemployment pool.

We illustrate these effects and their implications for job finding and employment outcomes for a given level of insurance in Figure 1, where we simulate 100,000 unemployment spells for a job seeker with imprecise priors (type-1 in blue) and a job seeker with infinitely precise priors (type-2 in red). We report the duration-dependence in the average hiring wage (wage conditional on having been recruited at duration t), the job finding rate and the two quantities characterizing the Bayesian revision process, i.e., the mean and variance of the worker's priors. The bottom panel of Figure 1 shows that that the learning effect dominates in the early stages of unemployment: the variance of priors decreases substantially. This induces an initial overshooting in the reservation wage of the job seeker with imprecise priors, compared to the one with infinitely precise priors, hence the very low job finding rate and high hiring wage for the few lucky individuals having been offered very attractive offers. By contrast, the dynamic selection dominates at later stages when a sufficient number of lucky individuals have exited the unemployment pool: the variance has stabilized while remaining individuals are now very pessimistic. This pessimism implies that remaining individuals are now ready to accept any offer coming their way, as illustrated by the relatively high job finding rate and low hiring wage. Both effects induce a very steep duration-dependence in hiring wages: with duration, the job seeker learns that dream job opportunities (far in the right tail of wage offers) are very unlikely—learning effect—and they become more pessimistic in general—dynamic selection effect. These two effects generate contrasting predictions for the relative behavior of reservation wages compared to individuals with precise priors. The learning effect makes uncertain individuals initially too optimistic; they overestimate the likelihood of dream job opportunities due to their dispersed priors. Uncertainty makes the job seeker initially choosy, leading to longer unemployment spells, and ending up accepting low wage offers.

The effect of unemployment insurance The previous mechanism describes the average unemployment spell across types with different priors. The marginal effect of unemployment insurance follows the same patterns, as we now show.

We simulate the model for the same different individuals with different priors, under two different specifications for unemployment insurance: one with a low monthly probability of losing benefits, $p_b = 0.1$, one with a higher monthly probability,

$p_b = 0.15$, and we display the difference in the average outcomes of the simulations between the two settings (see Figure 2 in which earnings are reported in CHF with the average wage offer set at CHF 4,000 and duration is reported in days). More specifically, we look at the differential effect of unemployment insurance on the initial reservation earnings, the revision in reservation earnings after 3 months for the remaining job seekers, the duration of unemployment and the average hiring wage. We see that a more generous unemployment insurance leads to a marked increase in the reservation wage for those individuals with imprecise priors; the increase is very moderate for individuals with the most precise priors. This however leads to a larger revision in the reservation wage after 3 months, and a higher length in the duration of the unemployment spell. Table 2 reports the percentage change in reservation earnings, their adjustment after 3 months of unemployment and the hiring wage for the previous type-1 (a job seeker with imprecise priors) and type-2 (a job seeker with infinitely precise priors)—corresponding to the two extremes in Figure 2.

Unemployment insurance appears to be detrimental to match quality when the job seeker has very imprecise priors. Her behavioral response is however rational—given her beliefs, and more generous unemployment insurance increases her ex-ante welfare at the onset of unemployment. Indeed, unemployment insurance provides a cushion which allows the job seeker to wait and experiment: the job seeker may initially reject tempting offers, because (i) there is insufficient information to discard the possibility of a dream job offer coming her way, (ii) a rather tempting offer may even make the job seeker more optimistic about such a possibility. This learning value of unemployment insurance is not reflected in job search outcomes.

The adjustment to the generosity of unemployment insurance varies with the uncertainty about job prospects. This observation could explain the wide range described by the estimated wage effects of unemployment insurance in the literature (see, for instance, Schmieder et al., 2016; Nekoei and Weber, 2017). Schmieder et al. (2016), in particular, interpret their findings by the existence of two opposing forces. An increase in the coverage of unemployment insurance raises reservation earnings for given unemployment duration (selectivity effect): job seekers accept fewer low-wage offers, especially so at the onset of unemployment. However, individuals remain unemployed longer and are more likely to exit unemployment when job offers are less generous (Kroft et al., 2013; Oberholzer-Gee, 2008; Eriksson and Rooth, 2014), or when these (initially choosy) individuals have revised their expectations and rapidly readjusted reservation earnings downward (duration effect).[10]

[10]We formalize this decomposition in Appendix C, where we analyze the marginal impact of unemployment insurance on match quality.

Our theory speaks to these different effects: the uninformed job seeker becomes more reluctant to accept offers at the onset of her unemployment spell in order to experiment, a learning process which reveals costly at later stages, once the actual distribution of wage offers becomes better known. The heterogeneous wage effects of unemployment insurance could relate to the heterogeneous population on which these effects are estimated. For instance, the sample selection used in Schmieder et al. (2016)—excluding job seekers with past unemployment experience in the previous years, before the unemployment spell of interest—may not be innocuous: this is a population where we would expect the duration effect to be particularly high according to our theory. Conversely, the sample of job seekers studied in Le Barbanchon et al. (2017) may include very experienced job seekers, given the very unequal incidence of unemployment spells across workers in France. These experienced job seekers should not respond too strongly to unemployment insurance, even during the first meeting with a caseworker.

We provide in the next section more direct empirical evidence about the causal effect of unemployment insurance on job search behavior (through the observation of reservation earnings during the first meeting with a caseworker, and three months later), and its subsequent impact on unemployment duration and match quality.

2 Empirical evidence

This section provides empirical evidence about the causal effect of unemployment insurance on job search behavior and describes: (i) the institutional context and the data sources, (ii) the empirical strategy, (iii) estimates of the learning value of unemployment insurance.

2.1 Context and data sources

This section briefly describes unemployment insurance in Switzerland and provides a detailed account of our data sources.

Context and variation in entitlement to unemployment insurance Our theory shows that the causal effect of unemployment insurance on job search behavior depends on the job seeker's 'type', most notably the precision of priors upon registration. For this reason, it is important to provide some insight about the profile of the average job seeker in our context.

The survey of reservation earnings covers individuals registering for unemployment insurance in the Canton of Fribourg (Switzerland) between September 2012–

March 2014.[11] Unemployment rates in Switzerland were fluctuating between 3 and 4% over this period. The profile of the average job seeker appears more representative of the average worker than in other European economies; for instance, many registered job seekers are experiencing their first unemployment spell. Along other dimensions, the labor market dynamics is closer to European economies than to the United States: the low unemployment rate in Switzerland derives from very low separation rates and low job finding rates, as compared to the United States. The low incidence of unemployment allows the government to provide generous unemployment insurance, also motivated by (and possibly contributing to) lengthy unemployment spells. The median unemployment duration is between 4 and 6 months—versus 1 and 2 months in the United States; full entitlement to benefits provides insurance coverage for 400 working days or almost two years, against 6 months in the United States.[12] The average job seeker in Switzerland is carefully monitored and accompanied by caseworkers. From registration to exit, the job seeker is invited to regular caseworker meetings, approximately once a month. The monitoring system notably involves a monthly check of search effort, the job seeker being subject to sanctions in the worst case. Job centers also provide numerous active labor market policies including training schemes.

Unemployment insurance coverage depends on various observable characteristics of the job seeker, including the age, the number of dependents, and the number of contributed months over the past two years. Our empirical analysis relies on variation in the eligibility for unemployment compensation benefits, based on (i) age at registration and (ii) previous contribution over the past 2 years before registration. First, we exploit a discontinuity in the mapping between age at registration and the length of unemployment insurance coverage in order to estimate its impact on reservation wages, unemployment durations and realized hiring wages. There is indeed a sharp discontinuity in benefit entitlement around age 25: job seekers (i) having contributed more than 18 months and (ii) without dependent children are only entitled for 200 days of potential benefit duration (PBD) if they enter unemployment insurance below age 25 against 400 working days of PBD for their older peers.[13] The condition on dependent children is important: job seekers (i) having contributed more than 18 months and (ii) *with* dependent children are entitled to full

[11]This canton has similar labor dynamics than Switzerland as a whole, covers two language regions (German-, and French-speaking) and includes both urban and rural areas.

[12]The average replacement rate is around 70%, depending on household characteristics (presence of children) and on an income ceiling. Non-eligible job seekers may claim social assistance, which is means-tested and provides a cushion for job seekers whose benefits have expired.

[13]We ignore a similar discontinuity in benefit entitlement around age 25 due to the small sample of registered individuals around this threshold.

insurance coverage (400 working days) irrespective of their age. These individuals will constitute a placebo sample for the age discontinuity. This quasi-experimental variation is comparable to the empirical variation used in similar studies (Schmieder et al., 2016; Nekoei and Weber, 2017), and provides a clean discontinuity along a characteristic which cannot be manipulated or adjusted. However, this variation in the generosity of unemployment insurance only allows to estimate the response of search behaviors among a very specific sample of individuals.

Second, there is a complex mapping between employment during the contribution period prior to entering unemployment and the length of unemployment insurance coverage. To be conditionally eligible for 400 working days of benefit duration, a prime-aged individual (25–55) must have paid at least 18 months of unemployment insurance contributions out of the 24 months prior to entering unemployment. Below 18 months of contribution, the job seeker is only entitled to 260 working days of benefits.[14] This assignment criterion may interfere with other, less observable criteria, and the discontinuous assignment at 18 months is fuzzy. The noise in the observed assignment is also related to administrative reasons. Data on entitlement to benefits is extracted from the register at the beginning of the unemployment spell, in order to ensure that the information is predetermined. In practice, however, the assessment of the individual's status takes time and some assignments may be updated compared to the original allocation. Exploiting the contribution criterion provides a crucial advantage, compared to existing literature: it allows us to estimate the effect on a broader cross-section of prime-aged job seekers. Unlike existing literature, this analysis is not specifically tied to local treatment effects on particular age groups of older or younger job seekers.

A survey about reservation earnings The empirical analysis exploits a survey of reservation earnings and expected earnings collected during the evaluation of a profiling system in the canton of Fribourg. All registered job seekers between September 2012–March 2014 were asked a series of questions, including their own estimates about their reservation earnings and expected earnings, during their first meeting with a caseworker—usually taking place within two to three weeks after formal registration. The structure of the survey is similar to that of the German Socio-Economic Panel for instance: the respondent is asked what he/she expects in terms of monthly earnings for the (full-time) job he/she is looking for; and what would be the minimum level of offered monthly earnings that he/she was willing to

[14]Note that, besides the mentioned criteria, entitlement to unemployment benefits in Switzerland requires that the individual is employable and immediately available to take up new employment.

accept. This information is clearly presented as being collected in the context of a survey/experiment, and does not commit the job seeker to any future behavior that could be later monitored. The drawback is that these reported earnings could be noisy, and an easy response for respondents could be to refer to the previous wage (DellaVigna et al., 2017).[15] If the registered job seeker is still unemployed three months later, a new meeting leads to the collection of updated reservation earnings. The subsequent observation of reservation earnings among this selected sub-group of individuals is important to assess the duration-dependence in search behavior—partly driven by a revision of beliefs as shown in Section 1.

The survey of reservation earnings is matched with register data covering the full population of unemployed individuals in Switzerland and linking information from the unemployment insurance register with the social security register. The unemployment insurance register is updated at a daily level and includes a rich set of socio-demographic covariates—age, gender, education, last occupation, nationality, marital status, function in last job, household size—and benefit-related covariates—replacement ratio, benefit duration, contribution duration and insured income. The social security register contains monthly information on earnings and employment, which provides pre-unemployment covariates and post-unemployment outcomes up to two years after exit from unemployment.

Selection into the final sample is based on three criteria. First, a unit of observation (individual $\times$ unemployment spell) needs to fulfill basic eligibility criteria for unemployment insurance, as previously described. Second, the job seeker must have had at least one meeting with the caseworker. Third, we condition the analysis on individuals who had non-zero social security earnings in the previous two years before unemployment insurance registration.

2.2 Empirical strategy

This section describes two empirical specifications used to estimate the causal effect of unemployment insurance on search behavior and outcomes, and provides descriptive statistics across job seekers with different unemployment experience.

Empirical strategy The first empirical specification exploits the age threshold at 25, below which the potential benefit duration (PBD) amounts to 200 working days,

[15] Appendix Figure A1 displays the distribution of (i) reservation earnings and (ii) the ratio of reservations earnings to past earnings in our final sample. There is a clear bunching observed at the level of past earnings: numerous job seekers report a reservation wage exactly at the level of their previous wage or few percent lower. This empirical observation turns out to be very similar to the ones found in earlier literature (Feldstein and Poterba, 1984; Krueger and Mueller, 2016).

as against 400 days above. We apply the following sharp regression discontinuity estimation strategy using local polynomial regression and bandwidth selection (as estimated in Calonico et al., 2014):

$$y_{it} = \alpha + \beta \mathbb{1}_{a_i \geq 25} + f(a_i) + \varepsilon_{it} \tag{S1}$$

where subscript i denotes an individual $\times$ unemployment spell, t is time, and $f(.)$ is a polynomial in the forcing variable (age). The dependent variable, y_{it}, will be: the reported reservation earning(s), the hiring wage, unemployment duration, depending on the specification.

The second specification is estimated on the broader range of prime-aged job seekers (ages 25–55). We use the difference in entitlement levels predicted by the length of the previous contribution period. As described previously, the data on this assignment criterion is noisy. We thus estimate the following equation,

$$y_{it} = \alpha + \beta d_i + \gamma \mathbf{X}_{it} + \eta_t + \varepsilon_{it} \tag{S2}$$

where d_i is the potential benefit duration in months. The vector of controls, $\mathbf{X}_{it}$, includes a large set of dummies for past occupation, education, skills, past unemployment experience and age groups. We also add month $\times$ year dummies, η_t. The variable d_i is instrumented in a first stage by $\mathbb{1}_{m_i \geq 18}$, i.e., a dummy equal to one for individuals having contributed at least 18 months to unemployment insurance over the past two years. This contribution criterion applies to the full population of prime-aged job seekers; the present empirical strategy thus allows to identify treatment heterogeneity across sub-groups of job seekers.

In both specifications, standard errors are clustered at the caseworker-level, in order to account for possible covariation in assignment to benefits and covariation in data collection (a caseworker is also a 'surveyor').

Precision of priors The previous framework allows us to estimate the treatment effect of unemployment insurance. The quantitative predictions of Section 1 however pertain to treatment *heterogeneity*, most notably along the precision of priors at the onset of unemployment.

The survey of reservation earnings does not provide a direct assessment of second-order moments of the expected wage distribution. We proxy uncertainty about job prospects with an imperfect measure: the recent unemployment experience, which is precisely constructed from the unemployment insurance and social security registers. The rationale for the use of such a proxy is that a job seeker learns about

employment prospects while actively searching, and that this knowledge depreciates during periods of less intense search (e.g., while inactive or searching on the job). This depreciation could relate to secular or cyclical changes of the labor market since the last unemployment spell, or to changes in the worker profile and the associated suitable opportunities. Between two unemployment spells (e.g., in 2006 and in 2012), labor market conditions would have changed; an employed worker would have gained six years of experience and would be fishing for job opportunities in different ponds. We thus consider two distinct categories of job seekers: inexperienced job seekers without any unemployment spells—thus involving active search for a job—during the previous three years, and experienced job seekers with at least one such unemployment spell.[16]

Inexperienced and experienced job seekers differ along their initial priors. While they have similar reservation earnings on average (about 3% lower than their previous earnings, see Table 3), the dispersion of reservation earnings normalized by previous earnings is 25% higher among inexperienced job seekers. The distribution of reservation earnings has *much* fatter tails for inexperienced job seekers (see Figure 3). Another measure of job prospects is the expected earnings, as reported by job seekers during the first interview with the caseworker. Expected earnings might be a more direct measure of priors, reservation earnings also reflecting home production and the capacity to smooth consumption along the unemployment spell. Job seekers with different unemployment experience report fairly similar expected earnings on average (about 4-5% higher than their previous earnings, see Table 3), but the dispersion is 30% higher among inexperienced job seekers.[17] Inexperienced and experienced job seekers also slightly differ along ex-ante characteristics (see Table 3): experienced job seekers are more likely to be attached to the labor force (e.g., male) and are slightly negatively selected along skills, as measured by past earnings or education. These differences are however not very large.

2.3 The (heterogeneous) effect of unemployment insurance

Average treatment effect We first quantify the average effect of unemployment insurance coverage. Table 4 presents the estimation of Equations (S1) and (S2)

[16]One limitation with using past unemployment experience to isolate different types of job seekers is that this variation may correlate with the treatment assignment. Indeed, in our second empirical specification (S2), treatment assignment depends on the number of contributed months in the past two years. An inexperienced job seeker, with fewer than 18 contributed months but no unemployment experience, would have had a period of inactivity during the past two years.

[17]Note that the average hiring wage is lower than the initial reservation wage. This pattern may illustrate biased beliefs upon unemployment, or be related to a duration-dependence in reservation wages and possibly wage offers.

on the whole sample of individuals and using the following dependent variables: the reservation wage at period t_0 (at the onset of unemployment), the difference between the reservation wage at period t_1 (after 3 months of unemployment) and the reservation wage at period t_0, the expected wage as declared at period t_0.

Panel A reports robust estimates accounting for bandwidth selection at the age-25 cut-off, following the methodology developed in Calonico et al. (2014). We find that reservation earnings are about 11% higher for respondents just above the age-25 cut-off compared to their younger peers, which correspond to a marginal effect on reservation earnings of more than 1% for each additional month of coverage. This effect is substantial, and statistically significant. We provide visual evidence of the relationship between the length of the unemployment insurance coverage and reservation wages at the onset of unemployment in panel (a) of Figure 4.[18] Figure 4 shows a large discontinuity at the cut-off: Individuals just above the cut-off, and thus entitled to full coverage, declare reservation earnings about CHF 200 larger than individuals just below the cut-off.[19] There are no major concurrent changes in policies at age 25 which could explain this sharp discontinuity. We do however provide a placebo check by plotting the exact same relationship within the sample of respondents *with* dependents—for whom the age cut-off is irrelevant. Panel (a) of Appendix Figure A4 illustrates that there is no discontinuity at the cut-off within the placebo sample. The initial effect on reservation earnings seems to fade away after 3 months, as shown by the difference between the reservation earnings at the late and early stages of unemployment (see column 2). Unemployment insurance coverage raises the prospects of job seekers about future match quality: the reported expected earnings upon future employment increase by a similar amount as reservation earnings (see column 3, and see Appendix Figure A3 for graphical evidence).

We find qualitatively similar results using specification (S2), in which actual unemployment insurance coverage is instrumented by the contribution cut-off (see Panel B of Table 4). Each additional month of coverage increases reservation earnings by about 0.5% and expected earnings by about 0.4%, consistently with the visual evidence provided in Figures 4 and A3.[20] The fuzzier relationship between contribution to social security and eligibility for insurance does not allow for a clean visualization of a local discontinuity. The discontinuity at the 18-month cut-off is noisy, but remains visible (see panel b of Figure 4). Individuals above the 18-month

[18] We restrict the sample to individuals without dependents. Individuals who are more than 25 years old at registration are thus eligible for 400 working days of benefits while younger individuals are eligible for 200 days.

[19] See Appendix Figure A3 for a log specification muting possible outliers.

[20] These estimates correspond to an elasticity of reservation wages to the length of unemployment insurance of about 0.10 (specification S1) and 0.05 (specification S2).

threshold, and thus supposedly entitled to full coverage, declare reservation earnings about CHF 200 larger than individuals just below the threshold. While this effect appears to be similar as the one found in panel (a) of Figure 4, it is in fact larger. Indeed, the 18-month cut-off adds 140 working days of benefits to the marginal job seeker against 200 days for the age cut-off. A differential of CHF 200 in the reservation wage would correspond to a marginal effect of about 0.30% for each additional month of coverage. Besides, the relationship between months of contribution and full entitlement to benefits is fuzzy and there are numerous respondents with various insurance coverages on both sides of the 18-month cut-off, which should bias downward this estimate.

The impact of unemployment insurance on reservation earnings should be reflected in search outcomes. Table 5 presents the estimation of Equation (S1) in Panel A and Equation (S2) in Panel B for three different outcomes: the duration of non-employment, the hiring wage and the probability to be employed after 6 months. Non-employment spells are found to last between 1.5 and 2.5 days longer with each additional month of coverage.[21] Interestingly, the hiring wage increases on average by about 0.3–0.5%, consistent with Nekoei and Weber (2017), but in stark contrast with Schmieder et al. (2016).

The existence of a positive effect of unemployment insurance on reservation earnings is not a theoretical puzzle. Any model of sequential offers where the job seeker can adjust her reservation wage would predict an upward adjustment whose magnitude would depend—among other elements—on the underlying distribution of wage offers (see Shimer and Werning, 2008, for instance). Nonetheless, this finding contradicts previous evidence on the elasticity of reservation earning to unemployment benefits (see Le Barbanchon et al., 2017, using a similar empirical approach). The purpose of the next section is to reconcile these findings, and to highlight the importance of a neglected dimension of heterogeneity.

Uncertainty and heterogeneous treatment effects The effect of unemployment insurance theoretically depends on the precision of initial priors.

Table 6 analyzes this heterogeneity in the data. We rely on specification (S2), in which insurance coverage and its interaction with an *Experience* dummy are instru-

[21]The effect of unemployment insurance on search duration is made apparent in Figure 5: non-employment duration increases by about 20 days at the cut-off where insurance coverage is supposedly extended by 200 working days. As with reservation earnings, one concern could be that other policies may differentially affect job seekers on either side of the cut-off. We provide a placebo check by plotting the relationship between age at entry and non-employment duration for respondents *with* dependents in Panel (b) of Appendix Figure A4. Again, there is no discontinuity at the cut-off.

mented by months of contribution and the interaction with the *Experience* dummy.[22] The results are striking. Inexperienced job seekers adjust their initial reservation and expected earnings by about 1.1-1.4% for each additional month of insurance coverage (column 1). This strong adjustment from inexperienced agents is in stark contrast with the response of experienced agents: their reservation and expected earnings are not significantly affected by a marginal adjustment of insurance coverage. This adjustment in reservation earnings however appears short-lived: the reservation wage after three months decreases among the selected group of inexperienced individuals still employed at this stage (column 2). Additional insurance is thus associated with a much steeper schedule of reservation earnings for inexperienced job seekers. Individuals with uncertain prospects seem to overshoot in the early stages of unemployment, and there is a rapid and very strong downward adjustment after a few months. By contrast, experienced job seekers do not adjust so markedly their initial reservation wage, and reservation earnings do not display the same duration-dependence. Finally, this adjustment in reservation earnings reflects rosier expectations about job prospects, as illustrated in column 3 where we report estimates of the treatment effect on *expected* earnings.

The heterogeneous adjustment of reservation earnings has implications for search outcomes. As inexperienced job seekers are initially choosier, they remain longer unemployed (see column 4) and we find that insurance coverage is then negatively related to their hiring wage (as in Schmieder et al., 2016, see column 5). The search outcomes of the two types markedly differ: match quality increases much more for experienced job seekers. Experienced job seekers do not respond much to the additional insurance coverage, and they do not experience the same drop in match quality. If anything, additional insurance coverage allows them to select better job offers. The previous theoretical framework explains this puzzling adjustment of reservation earnings: job seekers with uncertain priors are so much more selective in early stages, when it visibly affects their later outcomes, because there is a value in learning about job prospects and learning requires to be initially selective.

We interpret the marked heterogeneity between the attitudes of experienced and inexperienced job seekers as indicative of differences in the initial precision of prospects. We run robustness checks for these results in Appendix Table A3 by controlling for other dimensions of heterogeneity, notably education and gender. The heterogeneity along past experience is robust to this sensitivity analysis.

[22]We cannot use the regression discontinuity design for the heterogeneity analysis. Indeed, most job seekers on either side of the age cut-off are "inexperienced" almost by construction: they should have contributed to social security, which involves a lengthy employment spell, and this employment spell is very often their first job.

3 Conclusion

For many job seekers, job search may be an unusual, or forgotten, activity, for which they hold blurry expectations. We develop a simple model of sequential job offers arriving on the desk of a job seeker with imprecise priors, and we show that unemployment insurance may offer the opportunity for the job seeker to learn. Along this learning process, the job seeker may ignore acceptable jobs and remain long unemployed, with non-negligible consequences on match quality.

A unique combination of (i) data on reservation earnings and (ii) natural experiments on the generosity of unemployment insurance allows us to provide supporting evidence for this learning effect of unemployment insurance. The empirical analysis relies on a dichotomy between job seekers with recent unemployment experience and job seekers without any such experience.

These results suggest that heterogeneity in the initial priors about employment prospects may rationalize ambiguous findings of the empirical literature on the duration and match quality effects of unemployment insurance. This insight may also be valuable for the design of unemployment policies, a question which we leave for future research.

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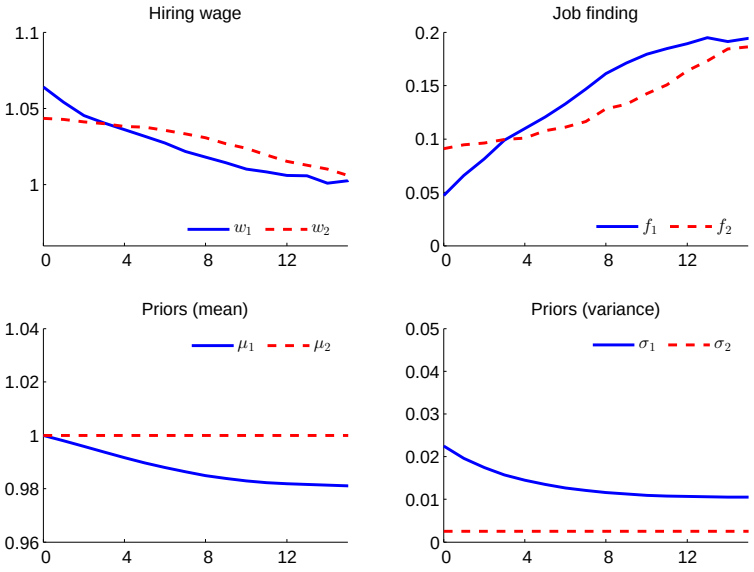
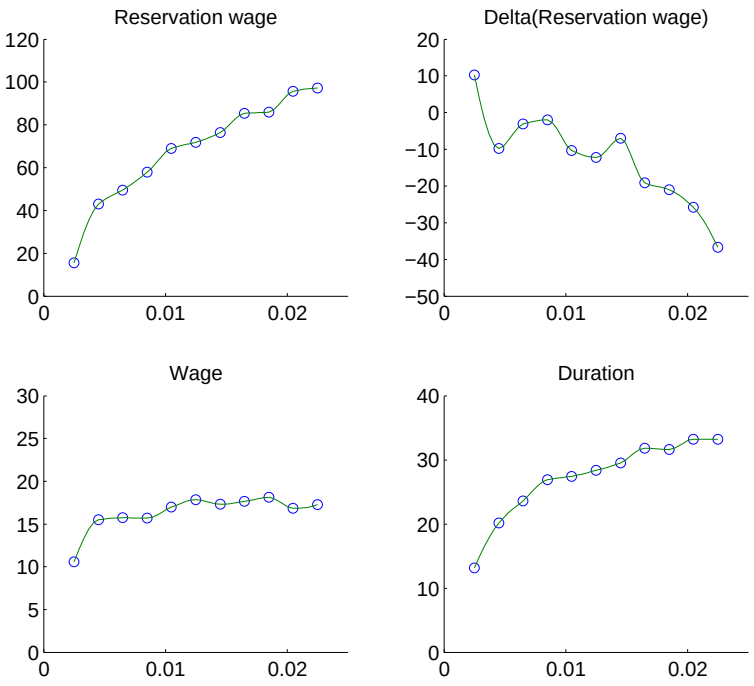
Figures and tables

Figure 1. Simulated duration-dependence in search outcomes and priors.



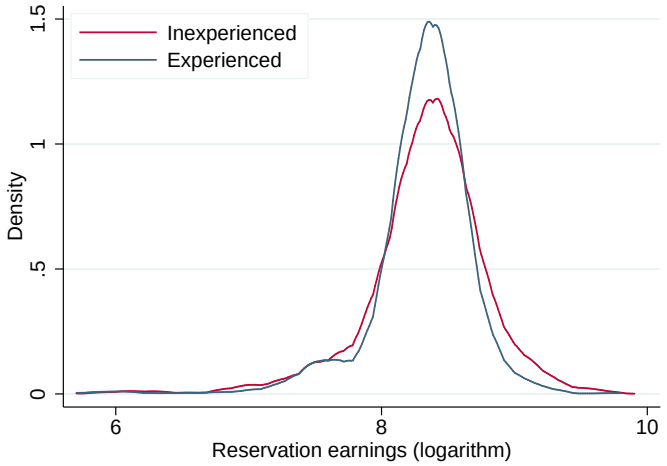
Notes: The Figure represents the duration-dependence in the average hiring wage (wage conditional on having been recruited at duration d), the job finding rate and the two quantities characterizing the Bayesian revision process, i.e., the mean and variance of the worker's priors. Blue lines are for the uninformed job seeker with relatively large initial variance in priors. Dashed red lines are for the informed job seeker with relatively low initial variance in priors. The figure displays averages over 100,000 simulated unemployment spells for each type.

Figure 2. Simulated effect of an extension of the unemployment insurance for various initial priors (x-axis).



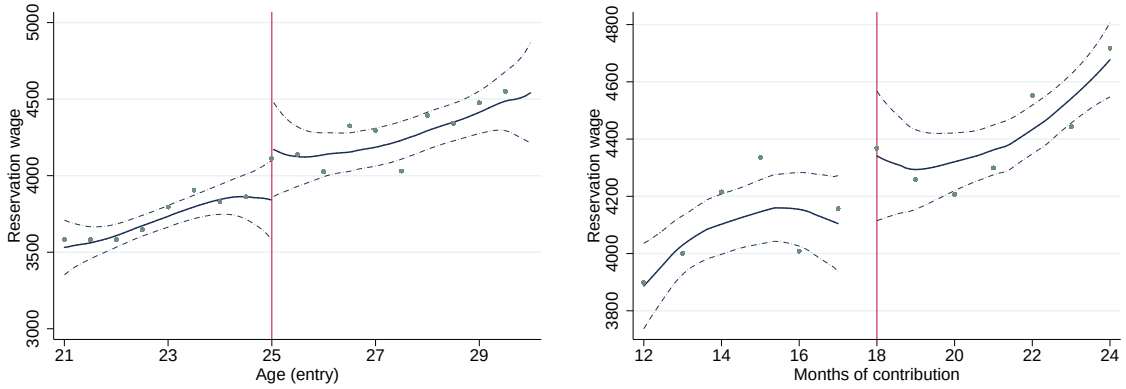
Notes: The Figure represents the effect of an extension of the unemployment insurance as a function of initial priors (variance of initial priors, x-axis). Each dot is computed using 100,000 simulated unemployment spells.

Figure 3. Distribution of reservation earnings along past unemployment experience.



Notes: The Figure represents the empirical distribution of reservation earnings for two different types of job seekers with different past unemployment experience (Source: Survey of reservation earnings, Switzerland, 2012–2014).

Figure 4. Eligibility to unemployment insurance and reservation earnings.

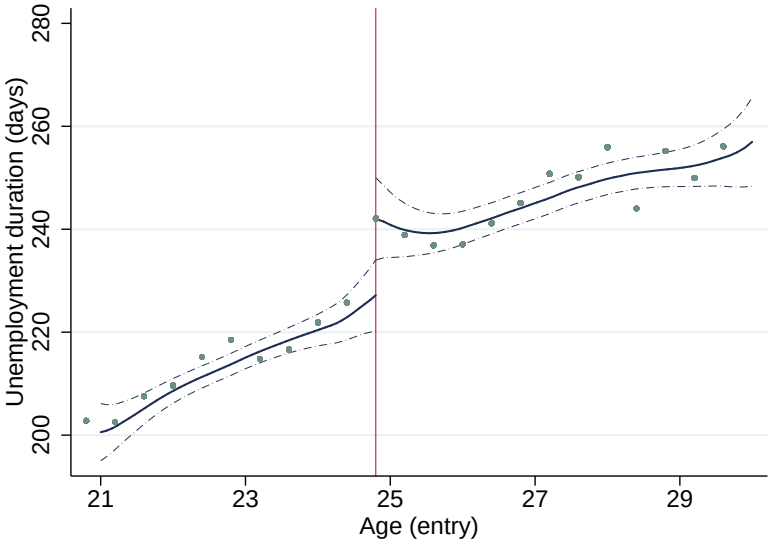


(a) Age threshold.

(b) Months of contribution.

Notes: Panel (a) represents the relationship between reservation earnings and age for job seekers without children. Panel (b) represents the relationship between reservation earnings and months of contribution for all job seekers. We create bins of respondents along their age (resp. months of contribution) when registering with the job center and the dots represent the average reservation wage within each bin. The lines are locally weighted regressions estimated on both sides of the threshold(s).

Figure 5. Eligibility to unemployment insurance (age threshold) and unemployment duration.



Notes: The Figure represents the relationship between unemployment duration and age for job seekers without children. We create bins of respondents along their age when registering with the job center and the dots represent the average reservation wage within each bin. The lines are locally weighted regressions estimated on both sides of the threshold.

Table 1. Calibration parameters.

Parameter		Value	Rationale
A. Preferences			
Discount factor	β	0.99	Shimer and Werning (2008)
Risk-aversion (CRRA)	$u(.)$	2	Shimer and Werning (2008)
B. Home production and benefits			
Replacement rate (eligible)	$\bar{b}$	0.70	Swiss Unemployment Insurance
Replacement rate (expired)	$\underline{b}$	0.50	Swiss Unemployment Insurance
Expiration	p_b	0.10	Swiss Unemployment Insurance
Home production	$h(.)$	0.20	Exit rate/Reservation wage
Human capital depreciation	δ	0.08	Duration dependence in wages
Human capital depreciation	p_h	0.10	Duration dependence in wages
Assets	a_0	-	Swiss Household Panel
C. Wage offers			
Arrival rate	f	0.20	Exit rate
Variance	σ_w	0.05^2	Variance of accepted wages

Table 2. Simulated effect of an extension of the unemployment insurance.

VARIABLES	Res. wage (1)	Δ Res. wage (2)	Hiring wage (3)	Duration (4)
Imprecise priors	0.0239	-0.0058	0.0042	33.65
Precise priors	0.0042	0.0018	0.0020	13.27

Notes: The Table reports the effect of an extension of the unemployment insurance as a function of initial priors (inexperienced and experienced). The results are obtained from 100,000 simulated unemployment spells.

Table 3. Descriptive statistics.

		Unemployment experience	
	All	Experienced	Inexperienced
Ex-ante characteristics			
Age	37.9	37.9	37.9
Female	.419	.364	.457
Married	.505	.492	.514
Education (>high school)	.151	.126	.168
Language (local)	.245	.250	.242
Language (English)	.259	.245	.269
Citizenship (Swiss)	.483	.418	.528
UE Experience (last 3 years)	122.9	270.3	0.4
Past earnings (CHF)	4569	4444	4656
Priors			
Reservation earnings (CHF)	4336	4250	4396
Ratio reservation/past earnings (log)			
mean	-.034	-.035	-.033
standard deviation	.325	.283	.351
Expected earnings (CHF)	4688	4566	4773
Ratio expected/past earnings (log)			
mean	.046	.041	.050
standard deviation	.274	.231	.300
Search outcomes			
Unemployment duration	218	210	224
Hiring wage (CHF)	3878	3811	3925
Observations	4,631	1,878	2,753

Notes: We define experienced job seekers as those with one unemployment spell (active search) in the last three years.

Table 4. Effect of an extension of the unemployment insurance on reservation earnings.

VARIABLES	Res. wage (t_0)	Δ Res. wage (t_1/t_0)	Expected wage
	(1)	(2)	(3)
Panel A: Age threshold (RD)			
Age> 25	.1135	-.1110	.0903
	(.0451)	(.0898)	(.0449)
	[.0123]	[-.0120]	[.0097]
Observations	3,630	1,091	3,630
Mean(outcome)	8.171	.0229	8.257
Panel B: Contribution threshold (IV)			
Insured period (months)	.0052	.0009	.0042
	(.0019)	(.0041)	(.0013)
Observations	4,996	1,759	5,028
Mean(outcome)	8.305	-.0057	8.392

Standard errors are reported between parentheses and are clustered at the caseworker-level. Standardized effects (of an additional month of coverage) are reported between square brackets. The unit of observation is an unemployment spell. In Panel A, we report nonparametric confidence intervals for regression-discontinuity designs, as developed in Calonico et al. (2014). In Panel B, controls include a large set of dummies for past occupation, region, education, skills, past experience and age groups. The instrument is a dummy equal to one above the contribution eligibility threshold (at least 18 month-equivalent of contributed work over the past two years).

Table 5. Effect of an extension of the unemployment insurance on search outcomes.

VARIABLES	Duration (days)	Hiring wage	Emp. (6 months)
	(1)	(2)	(3)
Panel A: Age threshold (RD)			
Age> 25	13.40	.0324	.0232
	(5.361)	(.0169)	(.0064)
	[1.453]	[.0035]	[.0025]
Observations	68,001	53,876	54,225
Mean(outcome)	225.7	8.154	.9098
Panel B: Contribution threshold (IV)			
Insured period (months)	2.245	.0049	.0033
	(.2157)	(.0007)	(.0002)
Observations	241,096	163,710	164,694
Mean(outcome)	286.8	8.316	.9193

Standard errors are reported between parentheses and are clustered at the caseworker-level. Standardized effects (of an additional month of coverage) are reported between square brackets. The unit of observation is an unemployment spell. In Panel A, we report nonparametric confidence intervals for regression-discontinuity designs, as developed in Calonico et al. (2014). In Panel B, controls include a large set of dummies for past occupation, region, education, skills, past experience and age groups. The instrument is a dummy equal to one above the contribution eligibility threshold (at least 18 month-equivalent of contributed work over the past two years).

Table 6. Effect of an extension of the unemployment insurance—heterogeneity along unemployment experience.

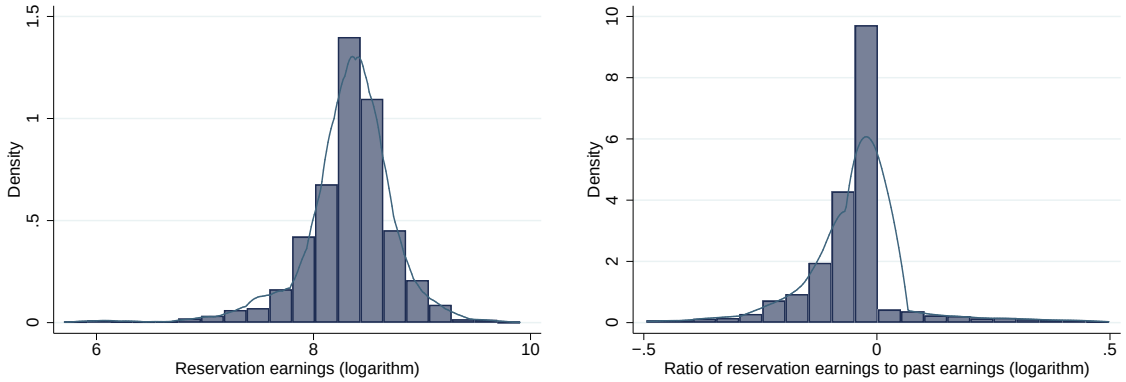
VARIABLES	Res. wage (t_0)	Res. wage (t_1)	Exp. wage
	(1)	(2)	(3)
Insured period (months)	.0144	-.0108	.0111
	(.0038)	(.0089)	(.0025)
Insured period (months)	-.0143	.0162	-.0107
× Experience	(.0054)	(.0108)	(.0038)
Observations	5,041	1,777	5,029
	Duration (days)	Hiring wage	Emp. (6 months)
	(4)	(5)	(6)
Insured period (months)	3.641	-.0031	.0009
	(.2449)	(.0008)	(.0003)
Insured period (months)	-3.068	.0103	.0022
× Experience	(.3074)	(.0009)	(.0004)
Observations	241,096	163,710	164,694

Standard errors are reported between parentheses and are clustered at the caseworker-level. The unit of observation is an unemployment spell. Controls include a large set of dummies for past occupation, region, education, skills, past experience and age groups. The instruments are a dummy equal to one above the contribution eligibility threshold (at least 18 month-equivalent of contributed work over the past two years) and its interaction with a past unemployment experience dummy.

ONLINE APPENDIX—not for publication

A Additional figures and tables

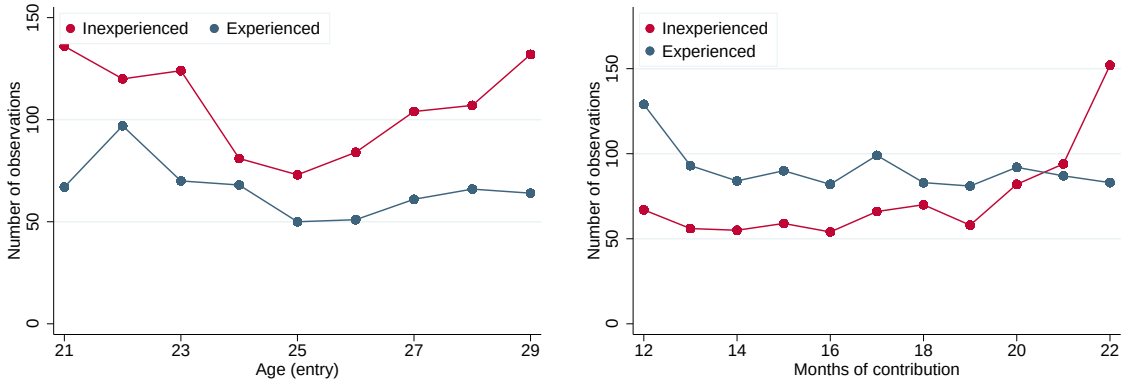
Figure A1. Distribution of reservation earnings.



(a) Reservation earnings. (b) Ratio to last earnings.

Notes: The left panel represents the distribution of reservation earnings (first meeting, 4,996 observations). Some statistics: CHF 4336 (mean), 1744 (standard deviation), 4000 (median). The right panel represents the ratio to past earning. The patterns are close to those found in Feldstein and Poterba (1984) and Krueger and Mueller (2016).

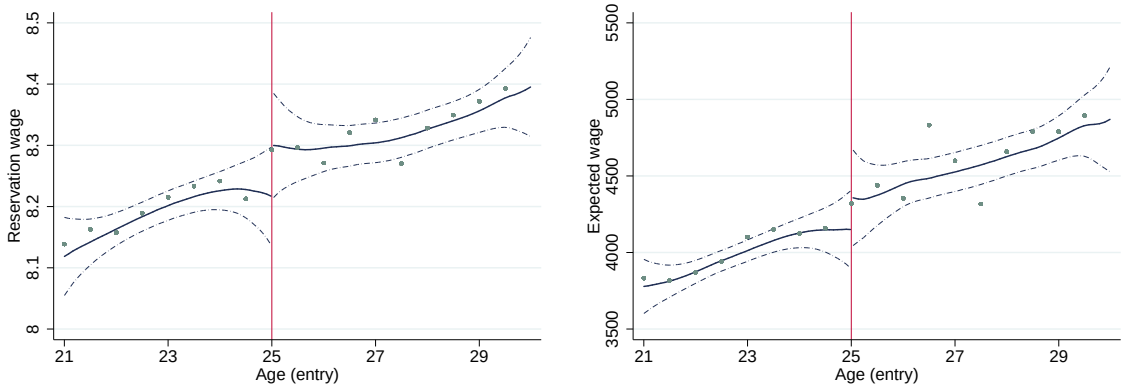
Figure A2. Number of respondents as a function of age at registration (left panel) and months of contribution over the past two years (right panel).



(a) Age. (b) Months of contribution.

Notes: These Figures display the number of respondents as a function of age at registration (left panel) and months of contribution over the past two years (right panel). Blue dots are for job seekers with relatively low unemployment experience, red dots are for job seekers with relatively high unemployment experience.

Figure A3. Eligibility to unemployment insurance (age threshold)—robustness checks.

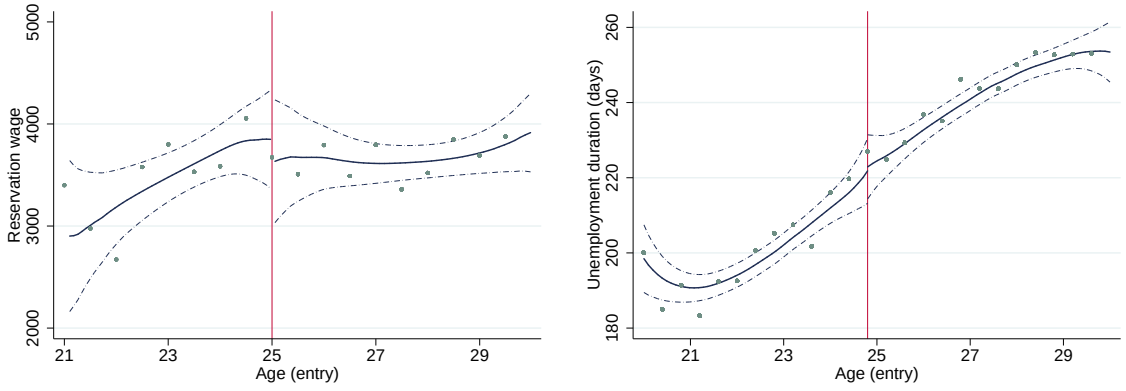


(a) Log reservation earnings

(b) Expected earnings.

Notes: Panel (a) (resp. b) represents the relationship between the logarithm of reservation earnings (resp. expected earnings) and age for job seekers without children. We create bins of respondents along their age when registering with the job center and the dots represent the average reservation wage within each bin. The lines are locally weighted regressions estimated on both sides of the threshold.

Figure A4. Eligibility to unemployment insurance and reservation earnings/unemployment duration—placebo.



(a) Reservation earnings.

(b) Unemployment duration.

Notes: The Figure represents the relationship between reservation earnings (left panel) or unemployment duration (right panel) and age for job seekers *with* children. We create bins of respondents along their age when registering with the job center and the dots represent the average outcome within each bin. The lines are locally weighted regressions estimated on both sides of the threshold.

Table A1. Simulated effect of an extension of the unemployment insurance—robustness with randomly-drawn priors.

VARIABLES	Res. wage	Δ Res. wage	Hiring wage	Duration
	(1)	(2)	(3)	(4)
Inexperienced job seekers	0.0189	-0.0005	0.0038	33.01
Experienced job seekers	0.0042	0.0018	0.0020	13.27

Notes: The Table reports the effect of an extension of the unemployment insurance as a function of initial priors (inexperienced and experienced). The results are obtained from 100,000 simulated unemployment spells.

Table A2. Heterogeneous effects of an extension of the unemployment insurance—robustness with additional outcomes.

VARIABLES	P(duration> 400)	P(wage<res. wage)	P(wage<exp. wage)
	(1)	(2)	(3)
Insured period (months)	.0181	.0269	.0246
	(.0039)	(.0069)	(.0083)
Insured period (months)	-.0119	-.0147	-.0132
× Experience	(.0058)	(.0071)	(.0059)
Observations	5,319	5,319	5,319

Standard errors are reported between parentheses and are clustered at the caseworker-level. The unit of observation is an unemployment spell. Controls include a large set of dummies for past occupation, region, education, skills, past experience and age groups. The instruments are a dummy equal to one above the contribution eligibility threshold (at least 18 month-equivalent of contributed work over the past two years) and its interaction with a past unemployment experience dummy.

Table A3. Heterogeneous effects of an extension of the unemployment insurance—robustness with controls for additional interactions.

VARIABLES	Res. wage (t_0)	Res. wage (t_0)	Res. wage (t_0)
	(1)	(2)	(3)
Insured period (months)	.0139	.0135	.0211
	(.0033)	(.0032)	(.0035)
Insured period (months)	-.0134	-.0134	-.0148
× Experience	(.0041)	(.0041)	(.0039)
Controls (× Insured period)	Education	Citizenship	Gender
Observations	5,259	5,259	5,259

Standard errors are reported between parentheses and are clustered at the caseworker-level. The unit of observation is an unemployment spell. Controls include a large set of dummies for past occupation, region, education, skills, past experience and age groups. The instruments are a dummy equal to one above the contribution eligibility threshold (at least 18 month-equivalent of contributed work over the past two years) and its interaction with a past unemployment experience dummy.

B Test for the optimality of unemployment insurance

This Appendix performs a simple test for the optimality of unemployment insurance based on two sufficient statistics, the elasticities of (i) reservation earnings and (ii) insurance *payments* to unemployment insurance.

The analysis is based on the sequential search model of Shimer and Werning (2007), where job seekers have access to perfect inter-temporal consumption smoothing. We assume that time is continuous; the agent is infinitely-lived and maximizes expected discounted utility. Letting c_t denote consumption at time t, the expected lifetime utility in period 0 is:

$$U_0 = E_0 \int_{t=0}^{\infty} e^{-\rho t} u(c_t),$$

where $u(c) = -e^{-\alpha c}$ is the period utility with constant absolute risk aversion α and $\rho > 0$ is the discount rate.

The agent can be either employed or unemployed. We assume that the agent starts unemployed and that employment is an absorbing state, such that time t coincides with unemployment duration as long as the agent is unemployed. An unemployed worker produces h and receives b from the unemployment agency. When unemployed, the agent receives job offers at rate f. The job offer provides an exogenous wage flow w drawn from a distribution $G(\cdot)$. Conditional on accepting the offer, the agent stays forever employed. Upon rejection, the agent loses contact with the employer.

Asset markets are incomplete. The agent has access to a competitive market for non-contingent bonds—the return of such bonds is assumed to be equal to the discount rate ρ. The agent cannot however insure against unemployment risk; the unemployment agency does it on her behalf. The unemployment agency finances itself through lump-sum taxes: the agent pays a flow of lump-sum taxes τ independently of her employment status.

In such framework, the program of the unemployment agency reduces to a simple static program for two reasons. First, it is easy to show that there exists a reservation wage ω in each period, and such reservation wage is independent of unemployment duration. Consequently, the exit rate from the unemployment pool is also constant, equal to $f(1 - G(\omega))$. Second, the initial welfare of the agent is equal to $U_0 = u\left(\rho a + \omega - \tau\right)/\rho$ where a is the initial holding of bonds, because the agent sets her reservation wage such as to be indifferent with remaining unemployed and being employed provides a constant flow of utility equal to $u\left(\rho a + \omega - \tau\right)$. There is a correspondence between initial welfare and the initial reservation wage. See

Barnichon and Zylberberg (2019) for a detailed proof.

The unemployment agency minimizes the cost of unemployment insurance (b, τ) delivering utility $\bar{U}$ to the worker:[23]

$$\min_{b,\tau} \left\{ \frac{b}{\rho + f\left(1 - G(\omega)\right)} - \tau/\rho \right\}$$

subject to $u\left(\rho a + \omega - \tau\right)/\rho \geq \bar{U}$. We assume for simplicity that the discount rate ρ is negligible compared to f; the program can be written as:

$$C(U) = \min_{b,\tau} \left\{ P(b) - \tau/\rho \right\}$$

subject to $\omega - \tau \geq u^{-1}\left(\rho U\right) - \rho a$, where $P(b)$ is the expected payment of benefits.

The optimal insurance verifies the equivalent of a Baily-Chetty formula:

$$\rho P^{'}(b) = \omega^{'}(b) \tag{3}$$

The left-hand side of Equation (3) is the discounted cost of increasing unemployment insurance. This cost includes the mechanical effect of increasing benefits on the cost of the unemployment insurance policy and a behavioral response coming from the longer unemployment duration (or, equivalently, the lower exit rate). The right-hand side of Equation (3) is the welfare gain of insurance, which is captured by the increase in reservation earnings.

Using the estimates from Table 4 and Equation (S1), we find that the increase in reservation earnings induced by a longer insurance coverage is around $\Delta\omega =$ 379 CHF. We construct, for each job seeker, the total benefits received during the unemployment spell, and estimate Equation (S1): we find that the total cost of increasing unemployment insurance is equal to $\Delta P = 1499$ CHF. For any reasonable value of ρ (proxied by the "monthly" discount rate), we have that $\Delta\omega >> \rho\Delta P$, which indicates that optimal insurance is too low (as in Shimer and Werning, 2007).

These findings rely on very strong assumptions (perfect inter-temporal smoothing, perfect information). We relax these assumptions in Section 1 where the large elasticity of reservation earnings to unemployment insurance is shown to have different welfare implications.

[23] The reservation wage depends on unemployment insurance as follows:

$$\alpha\left(\omega - b\right) = \frac{f}{\rho}\left(1 - G(\omega) + \int_{\omega}^{\infty} u(x - \omega) dG(x)\right)$$

C Selectivity and duration effects on match quality

The effect of unemployment insurance on match quality is possibly ambiguous in the presence of duration-dependence in the quality of job offers (Kroft et al., 2013; Oberholzer-Gee, 2008; Eriksson and Rooth, 2014). There is a selectivity effect: job seekers may sample job offers more carefully and accept fewer low-wage offers at the onset of unemployment. There is also a duration effect: individuals remain unemployed longer on average and duration-dependence in job offers implies that these offers will become less generous. The relative size of the two effects crucially depends on the elasticity of unemployment duration to unemployment insurance and the extent to which wage offers decrease with unemployment duration. This Appendix formalizes this intuition by providing a decomposition of the impact of unemployment insurance on match quality.

We assume that time is discrete and, in each period, one job offer is drawn from a duration-dependent distribution $G_t(\cdot)$ with probability f. Let ω_t denote the optimally-chosen reservation wage in period t. In period t, the exit probability is $f\left(1-G_t(\omega_t)\right)$ while the period-specific average match quality is:

$$w_t = \frac{\int_{\omega_t}^{+\infty} x dG_t(x)}{1-G_t(\omega_t)}$$

The number of job seekers exiting in period t is:

$$n_t = \Pi_{\tau=0}^{t-1}\left[1-f+fG_\tau(\omega_\tau)\right] f\left(1-G_t(\omega_t)\right)$$

The average match quality, upon hiring, is thus:

$$w = \sum_{t=0}^{+\infty} n_t w_t$$

We vary marginally the level of unemployment insurance from b to $b+db$. At first order, we have that:

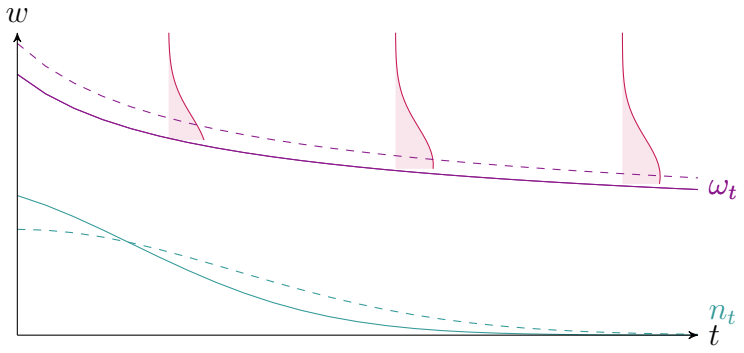
$$w(b+db)-w(b) = \sum_{t=0}^{+\infty} n_t(b)\left[w_t(b+db)-w_t(b)\right] + \sum_{t=0}^{+\infty} w_t(b)\left[n_t(b+db)-n_t(b)\right]$$

The first term on the right-hand side of the equation is the selectivity effect: for a given allocation of hires across time, job seekers tend to accept better offers when insurance is more generous. The second term is a duration effect: with higher unemployment insurance, more workers will be recruited after a long unemployment

spell, i.e., when wages are drawn from a less generous distribution of offers. We represent these two effects in Appendix Figure A5.

The duration effect depends on (i) the degree to which the distribution of unemployment duration shifts to the right, and (ii) the duration-dependence in wage offers. Indeed, with flat average match quality, this term disappears. If there is duration-dependence in match quality, i.e., the average match quality $w_t(b)$ is decreasing with time t, a larger shift in the distribution of unemployment duration induces a larger decrease in match quality across periods.

Figure A5. Duration dependence in match quality and unemployment insurance—an illustration of the selectivity and duration effects.



Notes: The Figure represents the duration-dependence in reservation wages (purple), the distribution of wage offers (red), and exit probability (teal). Dashed lines illustrate the change with more generous unemployment insurance.

In the empirical analysis of Section 2, one can think of the elasticity of reservation earnings to unemployment benefits as a proxy for the magnitude of the selectivity effect, while the duration effect can be bounded by the elasticity of unemployment duration to unemployment benefits. As we find the latter to be small, we would expect match quality to increase with unemployment duration. This is exactly what we find and report in Table 4.