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Experiments on unemployment benefit sanctions and job search behavior

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ABSTRACT

This paper presents the results of an experimental study on unemployment benefit sanctions. The experimental set-up allows us to distinguish between the effect of benefit sanctions once they are imposed (the ex post effect) and the threat of getting a benefit sanction imposed (the ex ante effect). We find that both effects matter. Moreover, the ex ante effect turns out to be substantial and bigger than the ex post effect. Benefits sanctions stimulate the outflow from unemployment.

1. Introduction

Despite the fact that over the past decades unemployment went down in many OECD countries it is still high in most of these countries. This is mainly caused by the long duration of unemployment. Governments face the problem of how to design policies that bring the unemployed back to work more quickly. It turns out that many of the active labor market policies that are used (training, subsidized jobs etc.) have insufficient effects on overall unemployment (Martin and Grubb, 2001). One of the problems is that in many countries for those who lose their jobs there are substantial unemployment benefits that are provided for a long period.

We show that benefit sanctions[1] can help to reduce unemployment even if the expected benefit (over time) remains constant. That is, the uncertainty of the level of the benefit is an effective instrument to induce unemployed to accept jobs. In particular, compare two benefit systems. First, a constant benefit system that always pays a benefit equal to 60. Second, a sanction system which pays a benefit equal to 70 in 60% of the periods and 45 in the other periods (where $0.6 * 70 + 0.4 * 45 = 60$; we interpret the difference between 70 and 45 as a benefit sanction). In the sanction system, the job acceptance probability turns out to be substantially higher.

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[1] A benefit sanction is a temporary reduction of unemployment benefits that is imposed for example because the unemployed worker did not search hard enough to find a job or because a job offer was rejected. See Fredriksson and Holmlund (2006) for an overview of research on unemployment benefits including benefit sanctions and Grubb (1999) for an overview of the situation on monitoring and benefit sanctions across the OECD.

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To illustrate, at a wage equal to 125 (out of a uniform distribution on [90, 200]; see below for details), the (simulated) acceptance probability under the constant benefit system equals 9.4%. Under the sanction system it equals (on average) 23.5%. Note that this increase in acceptance probability is achieved without making the unemployed financially worse off on average. Further, our design allows us to quantify the so-called ex ante and ex post effects of the sanction system compared to the constant benefit system. The *ex post effect* is the change in job acceptance probability once a benefit sanction is imposed. The *ex ante effect* refers to the increased outflow from unemployment even before a benefit sanction is imposed. The mere threat of receiving a benefit sanction affects job acceptance behavior. In the example, the ex ante effect of introducing the sanction system equals (23.5 − 9.4 =) 14.1 percentage points while the ex post effect—the difference between acceptance probabilities at benefit levels 70 and 45—equals 10 percentage points in this case. This suggests that evaluating a sanction system on the ex post effect only leads to an underestimation of the effects of such a system.

The current evidence on the effectiveness of a sanction system is partly based on empirical research in which micro data about unemployment durations and benefit sanctions are used. Abbring et al. (2005) and Van den Berg et al. (2004) provide empirical evidence for the Netherlands. Jensen et al. (1999) does the same for Denmark and Lalive et al. (2005) presents an analysis for Switzerland. These micro econometric studies typically compare unemployed with and unemployed without benefit sanctions, taking into account that the process by which sanctions are imposed may have been selective. Therefore these studies provide estimates of the ex post effect.[2]

In contrast to our paper, these studies do not provide information on the ex ante effect. This effect can be formalized in a number of different ways. In papers like Boone and Van Ours (2006) and Boone et al. (2007) the ex ante effect appears because by searching harder the unemployed can reduce the probability of being sanctioned. The idea is that government officials monitor search effort. When the effort is (perceived to be) high, they conclude that someone did not get a job, because none were available, not because he did not try to find a job. Using this set up Boone et al. (2007) shows that it is optimal from a welfare point of view to introduce a system of benefit sanctions. Boone and Van Ours (2006) shows that the strengths of the ex ante effect and the ex post effect depend on the monitoring intensity. If this intensity is low, the ex post effect is more important, but if the monitoring intensity is high, the ex ante effect is more important. In the model presented in this paper, the unemployed cannot affect the probability of being sanctioned, except by accepting the current wage offer. This leads to slightly different results as explained below.

As mentioned, this paper reports a laboratory experiment to analyze the effects of unemployment benefit sanctions. Previous experimental investigations of search models are reported in Braunstein and Schotter (1981, 1982), Hey (1982, 1987), Cox and Oaxaca (1989, 1992), and Sonnemans (1998). In general, all authors conclude that observed behavior is close to, but not fully consistent with, optimal search behavior. Braunstein and Schotter (1981, 1982) test the theoretical implications of numerous variants of an infinite horizon sequential job search model. They observe that individuals react to variations of the environment as predicted by theory, even though the duration of search often falls short of the theoretically predicted duration. Additionally, they find reservation wages to drop over time, even though theory predicts constant reservation wages in the infinite horizon models that they use as benchmarks.

Cox and Oaxaca (1989, 1992) report job search experiments in a finite horizon model. They argue that the individuals in Braunstein and Schotter's (1981, 1982) experiments had not actually believed in the infinite horizon and had rather played a finite horizon game, in which optimal reservation wages fall over time. While they find search duration and income to be very close to the theoretical predictions with risk-neutral individuals (Cox and Oaxaca, 1989), they also find the directly elicited reservation wages to be lower than predicted (Cox and Oaxaca, 1992). They conclude that a model with risk aversion explains their observations best.

Sonnemans (1998), however, shows that a fully rational model of risk-averse search is not consistent with the search strategies that participants choose in a finite search model experiment. Most individuals in his experiment use search heuristics that combine the rational marginal net benefit aspect with some satisfying rule that is applied to total income (i.e. they do not ignore the sunk cost of search). This observation is well in line with the results of Hey's (1982, 1987) research on consumer search heuristics.

Our paper contributes to the experimental literature on job search in three important ways. First, the model we use is especially suited for an experimental implementation, because it provides a constant reservation wage benchmark in a finite horizon setting.[3] The models implemented so far had either the one or the other advantage, but not both.[4] Second, we present the first experimental analysis of the effect of random benefit sanctions on job acceptance

[2] An exception is Lalive et al. (2005) who estimate the ex ante effect using cross sectional variation in the sanction rate. They compare the magnitude of the ex ante and ex post effect finding that both effects are quantitatively important. Black et al. (2003) and Rosholm and Svarer (2008) show that a threat effect also occurs when unemployed workers are assigned to training programs. To avoid entering such programs they leave unemployment more quickly than without the assignment. Meyer (1995) gives an overview of empirical evidence on compliance with UI rules in the US using data from randomized field experiments. He shows that cash bonuses, increased enforcement of work search rules, and a strengthening of the work test influence the speed by which people leave unemployment. Note, however, that the field experiments measure the overall effect and do not distinguish between an ex ante and an ex post effect.

[3] The optimal reservation wage in our model does decrease in the last few periods of the 100 period game. But, these last few periods can be omitted from the statistical analysis without a serious loss of information.

[4] The advantage of a finite horizon game in the laboratory seems self evident. The advantage of having a constant reservation wage benchmark is two-fold. First, when optimal behavior is constant, we can expect individuals to "learn" much more effectively within the duration of the experiment. Second, the estimates of the job acceptance rates from the sequences of responses are much more reliable, when optimal behavior is constant over time.

behavior.[5] Finally, this study presents the first attempt to assess the relative importance of unemployment benefits in determining job acceptance as compared to the wage.

We find that observed acceptance probabilities are lower than the theoretically optimal ones for a risk-neutral individual. This suggests that individuals are risk-seeking more than risk-neutral. Moreover, this effect is most pronounced in the treatment with constant unemployment benefit levels. Again this suggests that a system with constant unemployment benefits over time raises unemployment. While the combination of a positive ex ante effect with reservation wages that lie above the optimal risk-neutral reservation wages cannot be simply explained with uniform risk preferences in a classical decision-making model, more complex models such as Prospect Theory (Kahneman and Tversky, 1979) may organize the data better. Assuming that the current wage offer is the reference point, an individual who is risk-seeking in gains and losses, but also feels a strong disutility from benefit sanctions (loss aversion), theoretically may exhibit behavior that is consistent with the observed behavior. Finally, we find that individuals react as predicted to financial incentives in the form of wages offered or unemployment benefits provided.

The set-up of the paper is as follows. In Section 2 we present the theoretical model underlying our experiments. Section 3 describes the experimental set-up. Section 4 presents the results of the experiments. Section 5 concludes. The appendices give the instructions used in the experiment and provide more details on prospect theory in our search context.

2. Job search and benefit sanctions—theory

The job search model that we analyze, is an extension of the simple one-player search games that were presented in the late 1960s and early 1970s.[6] Using the basic model in discrete time and with a finite horizon T, we add the feature that the job search does not end with the first employment contract, but is a recurring problem. The individual in our model lives an entire working life, with stretches of employment and unemployment. In each period $t = 1, \ldots, T$ of the hypothetical life time, the individual receives a single job offer. The job offer in period t is a contract that offers a wage w_t in each of the periods $t, \ldots, \min\{t + \bar{\tau} - 1, T\}$, where the tenure $\bar{\tau}$ is the duration of the employment unless the game ends before the tenure. We assume that the wage w_t is drawn independently from the same distribution every period. We denote the distribution function of this wage distribution by $F(w)$.

At the outset of the game in period 1, the individual is *uncommitted*, i.e. currently has no job, but has not yet rejected that period's incoming job offer. An individual who accepts the job offer receives the wage w_t in every period for the duration of the employment and cannot quit the job or switch to different employment. During the employment phase, the worker is informed of all job offers that arrive, even though these offers cannot be accepted. After the employment phase, as long as the game has not ended, the individual is back in the uncommitted state, i.e. has lost the previously held job, but has not yet rejected the incoming new job offer.

An uncommitted individual who does not accept the incoming job offer receives the full amount of the unemployment benefit for the current period. This is consistent with the practice in most (if not all) OECD countries where the unemployed receives full benefits for an initial period. However, after rejecting a wage offer, the uncommitted individual becomes unemployed and may face a benefit sanction, that is the individual may receive a low benefit instead of a high benefit.

An unemployed worker is first told whether he will receive the normal unemployment benefit b^h or the reduced benefit $b^l \le b^h$ in case he does not accept the incoming job offer that period.[7] The probability of receiving the high benefit equals p and the probability of getting a benefit sanction imposed and receiving a low benefit equals $(1 - p)$. This lottery is played out independently in every period before the unemployed individual gets a new job offer. This timing assumption allows us to identify the ex post effect (see below).

In characterizing the optimal decision rule for a risk-neutral individual, we use the following notation. Let $E(V_t^{u,h})$ $[E(V_t^{u,l})]$ denote the expected continuation payoff for a worker who rejects a wage offer in period t, knowing that he gets the high [low] benefit level in period t. Using backward induction, we start the analysis at period T.

At period T a worker with unemployment benefit level b^i $(i = h, l)$ should accept any job with $w \ge b^i$. Hence his reservation wage and expected payoff in the period equal

$$\bar{w}_T^i = b^i$$
$$E(V_T^{u,i}) = F(\bar{w}_T^i)b^i + (1 - F(\bar{w}_T^i))E(w|w > \bar{w}_T^i)$$

where $i = l, h$ and $E(w|w > \bar{w}_T^i)$ denotes the expected wage conditional on this wage exceeding the reservation wage $\bar{w}_T^i$. Now before the individual knows the realization of b, his expected payoff in period T equals

$$E(V_T^u) = pE(V_T^{u,h}) + (1 - p)E(V_T^{u,l})$$

[5] We know of no other experimental study on benefit sanctions. No previous study has examined the effects of introducing and varying a random search cost. Braunstein and Schotter (1981, 1982) study the effect of varying the probability distribution of wages offers. Cox and Oaxaca (1989, 1992) study the effect of varying the probability of wage offer arrivals.

[6] See Lippman and McCall (1976a, b) for overviews.

[7] A special case here is $b^l = b^h = b$, that is the case where an unemployed workers receives the same benefit b every period.

Now we move back to $t = T - 1$ where the worker gets unemployment benefit b^i if he rejects the job offer. In the latter case, his expected pay off equals

$$b^i + \delta E(V_T^u)$$

where δ is the discount factor. If he accepts the job, he gets $w(1+\delta)$. Hence his reservation wage and expected payoffs equal

$$\bar{w}_{T-1}^i = \frac{b^i + \delta E(V_T^u)}{1+\delta}$$
$$E(V_{T-1}^{u,i}) = F(\bar{w}_{T-1}^i)(b^i + \delta E(V_T^u)) + (1 - F(\bar{w}_{T-1}^i))(1+\delta)E(w|w > \bar{w}_{T-1}^i)$$

Before he knows the realization of b, the worker's expected pay off equals

$$E(V_{T-1}^u) = pE(V_{T-1}^{u,h}) + (1-p)E(V_{T-1}^{u,l})$$

Similarly we find for $\tau \leq \bar{\tau} - 1$ that

$$\bar{w}_{T-\tau}^i = \frac{b^i + \delta E(V_{T-\tau+1}^u)}{\sum_{s=0}^{\tau} \delta^s}$$
$$E(V_{T-\tau}^{U,i}) = F(\bar{w}_{T-\tau}^i)[b^i + \delta E(V_{T-\tau+1}^U)] + (1 - F(\bar{w}_{T-\tau}^i))\left(\sum_{s=0}^{\tau} \delta^s\right) E(w|w > \bar{w}_{T-\tau}^i)$$
$$E(V_{T-\tau}^u) = pE(V_{T-\tau}^{u,h}) + (1-p)E(V_{T-\tau}^{u,l})$$

For $\tau \geq \bar{\tau}$ we get an additional effect. If an individual accepts the current job offer, he knows that after $\bar{\tau}$ periods (when his job ends) he will get the high benefit for sure for one period (if he chooses to reject the job offer then). This prospect of receiving b^h in $\bar{\tau}$ periods time lowers his reservation wage today. This is a version of Mortensen's (1977) entitlement effect. By accepting a job now, the agent becomes entitled to receiving the high unemployment benefit in the future (with probability 1). This makes the unemployed more eager to accept current wage offers. Hence we get the following equations for the reservation wage, the expected value of being unemployed once you know whether you get a sanction or not this period and the expected value of being unemployed before you know whether or not you are sanctioned this period.

$$\bar{w}_{T-\tau}^i = \frac{b^i + \delta E(V_{T-\tau+1}^U) - \delta^{\bar{\tau}} E(V_{T-\tau+\bar{\tau}}^{U,h})}{\sum_{s=0}^{\bar{\tau}-1} \delta^s} \tag{1}$$

$$E(V_{T-\tau}^{U,i}) = F(\bar{w}_{T-\tau}^i)[b^i + \delta E(V_{T-\tau+1}^U)] + (1 - F(\bar{w}_{T-\tau}^i))\left[\left(\sum_{s=0}^{\bar{\tau}-1} \delta^s\right) E(w|w > \bar{w}_{T-\tau}^i) + \delta^{\bar{\tau}} E(V_{T-\tau+4}^{U,h})\right]$$

$$E(V_{T-\tau}^u) = pE(V_{T-\tau}^{u,h}) + (1-p)E(V_{T-\tau}^{u,l})$$

Using these equations we can derive the optimal decision rules for risk-neutral agents in our experiment. First, we describe the experimental set up.

3. Experimental setup

Our experiment consists of three random benefit sanction treatments and a sure benefit control treatment. The sanction probability (i.e. the probability of a benefit reduction $1-p$) equals 0.4 in the three corresponding treatments. The expected value of the unemployment benefit is constant across all four treatments, but the (mean preserving) spread is increased systematically. Table 1 summarizes the parameters of our treatments.

A total of 62 individuals participated in the experiment, with 16 participants in the "spread 75" and "spread 50" treatments and 15 participants in the other two treatments. All treatments were run on the same day at the CentER*lab*, Tilburg University with software based on the experimental software toolbox RatImage (Abbink and Sadrieh, 1995). As the participants randomly arrived at the location, they were assigned to one of the four treatments in an alternating sequence. This guaranteed the randomization of participants across treatments with almost equal numbers in each treatment.

Upon arrival, each participant was seated in a cubical and received written instructions (see Appendix A). If there were any questions, these were answered privately at the cubicle. Each participant played a single 100-period job search game. The participants could leave the laboratory as soon as they had completed their task. Including the time for waiting and reading the instructions, no one needed more than 1 h for participation.

All participants were undergraduate economics students in their second year and the experiment was part of their labor economics course. Prior knowledge of—the second-year undergraduate—students about search theory is limited. Intermediate Labor Economics is taught in the third year of undergraduate studies. The search experiment is intended as an introduction to a lecture about search theory, which is given after the search experiment. Instead of providing financial incentives, we provided the students with the possibility to "earn" about 20% of their course grade by participating in the experiment. The higher a participant's absolute score in the experiment, the better was the grade received. The grading

Table 1
Experimental treatments.

Treatment	Full benefit	Reduced benefit	Sanction benefit	EV of benefit	Number of participants
No spread	60	–	–	60	15
Spread 25	70	45	0.4	60	15
Spread 50	80	30	0.4	60	16
Spread 75	90	15	0.4	60	16

Table 2
Optimal job acceptance probabilities π.[a]

Treatment	Full benefit	Reduced benefit	Unconditional probability π	Ex ante effect	Ex post effect
No spread	–	–	0.65	0.00	–
Spread 25	0.63	0.68	0.65	0.00	0.05
Spread 50	0.60	0.72	0.65	0.00	0.12
Spread 75	0.58	0.75	0.65	0.00	0.17

[a] Optimal in all periods in which the optimal reservation wage is constant.

scheme was known to the students from the outset of the experiment and the instructions (see Appendix A) included a table translating scores into grades.[8] The incentive compatible grading of student participants is a well-established method in experimental economics.[9]

For each of the treatments we have derived the optimal decision rules using the reservation wages in the previous section. The parameter values are as follows. The tenure length equals $\bar{\tau} = 4$, the discount factor $\delta = 1$ and the wage distribution is assumed to be uniform on the interval [90, 200]. For the no spread treatment we have $b^h = b^l = 60$, for the spread 25 treatment we have $b^h = 70$ and $b^l = 45$, for the spread 50 treatment we have $b^h = 80$ and $b^l = 30$ and for the spread 75 treatment we have $b^h = 90$ and $b^l = 15$. In each case the probability of receiving the high benefit equals $p = 0.6$.

As indicated in the theoretical section, the optimal reservation wage is conditional on the realization of the unemployment benefit in the current period. Given a specific level of the unemployment benefit, the optimal reservation wage is basically constant for most part of the game, only declining sharply towards the benefit level in the last 10 rounds. Hence, the optimal reservation wage provides a simple benchmark for the analysis of the observed behavior.

Over this range where reservation wages are constant (roughly, period 1–90) we find the following values: $rw15 = 117.2$ ($rw15$ denotes the reservation wage when the individual's unemployment benefit equals 15 in that period, etc.), $rw30 = 121.0$, $rw45 = 124.9$, $rw60 = 128.9$, $rw70 = 131.2$, $rw80 = 133.5$ and $rw90 = 136.0$. With the assumed uniform distribution of wage offers on [90,200] we can translate the reservation wages into probabilities to accept a job offer, $\pi = (200 - rw)/(200 - 90)$. Table 2 shows these probabilities in the first two columns.

So conditional on having a low benefit in the spread 25 treatment, the probability of accepting a job equals 0.68, etc. The unconditional probability of accepting a job in the spread 25 treatment equals $0.6 * 0.63 + 0.4 * 0.68 = 0.65$ (where $p = 0.6$ equals the probability of receiving the high benefit). We define the *ex ante effect* of benefit sanctions as the difference between the unconditional acceptance probability under a positive spread treatment and the acceptance probability under the no spread treatment. The idea is that the expected benefit is the same under both treatments[10] and hence the acceptance probabilities can be meaningfully compared.

In the theoretical outcome with risk-neutral agents, the ex ante effect turns out to be zero. The higher reservation wage (compared to the no spread reservation wage) at the high unemployment benefit cancels the lower reservation wage at the low unemployment benefit. Hence, theoretically, we find no effect on the job acceptance rate of increasing the spread (for a given expected unemployment benefit level). This result crucially depends on the assumption of risk neutrality. The ex ante effect, for example, will be strictly positive, if we assume that the individuals weigh losses higher than gains of the same magnitude (in the spirit of Kahneman and Tversky, 1979). Clearly, risk aversion instead of loss aversion will also lead to a positive ex ante effect. However, as described later, we find that the participants in our experiment exhibit behavior that seems more in line with a loss aversion model than with a fixed risk attitude model.

[8] The score table we used was based on the optimal reservation wage strategy for risk-neutral individuals. Since these strategies lead to expected payoffs of about 150–155 per period in all treatments, we used the same score table for all participants.

[9] Two examples of the grade payment experiments can be found in Selten et al. (1997, 2003). See Friedman and Sunder (1994) for a discussion of the method.

[10] Strictly speaking this is not true since the individual always receives the high benefit for sure in the first period after an employment spell. Taking this into account would make the theoretical ex ante effect slightly negative. Our observations, however, show that the effect is in fact positive.

The *ex post effect* is the difference between the acceptance probability before and after the sanction is imposed. It is reported in the fifth column of Table 2. This effect is positive and increasing in the spread. This is what we find in the experiment as well.[11]

4. Results

4.1. Non-parametric tests

Reservation wage choices are not directly observable. We, therefore, will concentrate on observed acceptance rates for most of our data analysis. Instead of using the data of all 100 rounds of play, we restrict our analysis to the acceptance rates in the rounds 11–90. We drop the first 10 rounds from the analysis, because experiment participants generally need some time (i.e. some rounds of play) before they have adapted to the experimental decision situation. We drop the last 10 rounds from the analysis, because optimal acceptance probabilities increase in the last 5–10 periods of our finite search game.

Table 3 displays the mean observed acceptance rates of the individuals in our experiment for each of the possible levels of unemployment benefits. Remember that when an individual is committed (i.e. is on a job and the tenure has not ended), this individual cannot accept a new wage offer. Therefore, the job acceptance rate is defined as the ratio of accepted wage offers to all received offers in uncommitted periods (i.e. the sum of accepted plus rejected wage offers). As a benchmark we consider the *conditionally optimal acceptance rate* for each individual: For each period t in which the individual was free to accept or to reject the received wage offer (i.e. the individual was not committed), we compare the wage offer to the optimal reservation wage at the given benefit level for a game starting in t and lasting another $T-t$ periods.[12] The acceptance rates are calculated and displayed both including and excluding the first periods after an employment spell.

Obviously, the optimal acceptance rate decreases monotonically with the benefit level (see Table 2), because the opportunity cost of waiting for a better job offer next period is lower when benefits are lower. The fact that the conditionally optimal rates shown in Table 3 do not perfectly follow this pattern is due to the different realizations of the stochastic variables. To avoid misinterpretations based on the differences in the realizations, we compare the differences of the mean observed to the conditionally rational acceptance rates across benefit levels.

Comparing the optimal to the observed acceptance rates in the top part of Table 3, we find that in all seven cases, the mean observed acceptance rate is smaller than the conditionally optimal rate. The differences, however, are not significant for the two lowest and the two highest levels. It seems that observed behavior is closest to the conditionally optimal benchmark in the cases with extreme benefits, while it is furthest away in the case with no benefit sanctions.

Since there is no benefit sanction in a period immediately following employment, the results may be affected in a systematic way by including those periods. But, as the lower part of Table 3 shows, our main observations remain basically unchanged when we calculate the acceptance rates excluding the first period after each employment phase.[13] Excluding the first period after employment, the differences between the observed and conditionally optimal acceptance rates slightly increase for the benefit level 80, while they slightly decrease for the benefit levels 70 and 90. This, however, does not change the general picture substantially.

Although in most cases the observed average acceptance rates in the high benefit settings (70, 80, 90) seem closer to the conditionally optimal rates than in the corresponding low benefit settings (45, 30, 15), the differences are not significant in any treatment. Comparing the six benefit sanction settings to the no sanction treatment (with a benefit level of 60), we find no significant differences between the low benefit settings and the no sanction setting. We do, however, find significant differences in all but one case (the case in which we compare the benefit 70 to the benefit 60 setting and consider all periods in which an offer could have been accepted) between the high benefit and the no sanction settings.

Table 4 shows the mean optimal and mean observed acceptance rates aggregated over both benefit levels of each benefit sanction treatment. The conditionally optimal acceptance rate is 12% greater than the aggregate observed level in the spread 25 treatment. It is 6% greater in the spread 50 and 6% greater in the spread 75 treatment. Although the observed acceptance levels are too low compared to the corresponding optimal level in all three cases, this distance is significantly smaller in almost all cases with benefit sanctions than it is when benefits are fixed at 60. The fact that the aggregate rate of acceptance is significantly closer to optimum in the benefit sanction treatments indicates that there is a positive ex ante effect of introducing benefit sanctions. The one to the last column of Table 4 shows the difference in differences (between observed and optimal acceptance rates) as a measure of the ex ante effect. Put differently, it compares the observed ex ante

[11] Whereas the ex ante effect is always zero (with risk neutral workers), the ex post effect varies with the tenure period. In particular, the ex post effect decreases as the tenure period becomes longer (focussing on the spread 75 treatment—with the biggest ex post effect—reducing the tenure period to 3, increases the ex post effect to 0.22, while for tenure periods of 5 and 6, the ex post effect equals resp. 0.14 and 0.11). Acceptance probabilities (with full and reduced benefits) decrease with the length of the tenure period, but the fall in acceptance probability with low benefits is bigger.

[12] This is conditionally optimal in the following sense. Given that the individual has a choice at time t, we assume that optimal choices are made from t onwards, no matter whether the decisions before period t were optimal or not. Note that if the individual had followed a fully optimal decision path, he may have been committed in t and not have had the choice he is given under conditional optimality. In this manner, conditional optimality provides us with a rational benchmark that allows for non-optimal histories of play and is, thus, better comparable to the observed behavior than the fully optimal decision path.

[13] Notice that there can be no difference between the top and the bottom half of Table 3 for the low benefit levels (15, 30, 45), because these benefit levels do not occur immediately following employment.

Table 3
Observed and conditionally optimal acceptance rates.

Benefit level	15	30	45	60	70	80	90
All periods in which an offer could have been accepted							
Conditionally optimal rate	0.71	0.72	0.75	0.67	0.66	0.60	0.60
Mean observed rate	0.64	0.64	0.64	0.50	0.53	0.57	0.56
Observed SD	0.26	0.28	0.11	0.08	0.11	0.12	0.15
Number of individuals	16	16	15	15	15	16	16
Observed-optimal	−0.07	−0.08	−0.11	−0.18	−0.13	−0.04	−0.04
Significance level[a]	n.s.	n.s.	0.05	0.001	0.01	n.s.	n.s.
Excluding the first period after each employment							
Conditionally optimal rate	0.71	0.72	0.75	0.67	0.73	0.71	0.65
Mean observed rate	0.64	0.64	0.64	0.50	0.66	0.65	0.62
Observed SD	0.26	0.28	0.11	0.08	0.15	0.21	0.20
Number of individuals	16	16	15	15	15	16	16
Observed-optimal rate	−0.07	−0.08	−0.11	−0.18	−0.07	−0.06	−0.03
Significance level[a]	n.s.	n.s.	0.05	0.001	0.05	0.10	n.s.

[a] Wilcoxon signed-ranks test, one-tailed ("n.s." = "not significant at 0.10").

Table 4
Job acceptance rates and the ex ante effect.

Treatment	Mean observed rate	Conditionally optimal rate	Difference	Ex ante effect	Significance level[a]
No spread	0.50	0.67	−0.18	–	–
All periods in which an offer could have been accepted					
Spread 25	0.59	0.70	−0.12	0.06	0.01
Spread 50	0.61	0.66	−0.06	0.12	0.05
Spread 75	0.60	0.65	−0.06	0.12	n.s.
Excluding the first period after each employment					
Spread 25	0.65	0.74	−0.09	0.09	0.01
Spread 50	0.65	0.72	−0.07	0.11	0.02
Spread 75	0.63	0.68	−0.05	0.13	0.01

[a] Comparing the distributions of the acceptance rate differences to the no spread treatment with the Mann–Whitney *U*-test, one-tailed ("n.s." = "not significant at 0.10").

effect with the conditionally optimal ex ante effect (which is not equal to zero).[14] The ex ante effect is positive in all cases. It appears especially significant and strong (9–13%) when we consider only those periods in which a benefit sanction was possible.

Furthermore, the levels of the ex ante effect displayed in Table 4 seem to increase with the spread. This increase, however, is rather small and in all cases insignificant. So we conclude that a substantial ex ante effect exists that is not very sensitive to the size of the benefit sanction.

So far we have derived two main observations from our experimental observations:

- *Observation* (1): The experimentally observed rate of job offer acceptance is generally smaller than the optimal risk-neutral rate.
- *Observation* (2): The experimentally observed rate of job offer acceptance comes significantly closer to the optimal risk-neutral rate when benefit sanctions are introduced.

Observation 1 seems to imply that individuals are risk-seeking, because instead of accepting jobs at the same rate as risk-neutral optimization prescribes, they tend to wait longer, hoping for higher wage offers to come. On first sight, however, observation 2 seems to contradict this, because increased risk due to benefit sanctions does not reduce observed job offer acceptance probabilities as would be predicted by risk-seeking behavior. Instead, when benefit sanctions increase the risk,

[14] Recall that the ex ante effect in Table 2 (which is equal to zero) is calculated as an expectation over wages. The conditionally optimal ex ante effect in Table 4 is calculated for the particular wage sequence used in the experiment.

individuals react by increasing their acceptance probabilities, indicating that they would rather avoid the risk of a benefit sanction.

One way to reconcile the two observations is to model individuals behavior in the spirit of Kahneman and Tversky's Prospect Theory (1979), which allows individuals to weigh gains and losses separately.[15] A typical Prospect Theory valuation function consists of three outcome weighting and at least one probability weighting parameter. We will ignore the probability weighting aspect, because its influence on the valuation is relatively small in the context of our game, in which each decision in an early stage leads to a plethora of later stage outcomes, all of which have similarly small probabilities.[16] Omitting the probability weighting, leaves us with the following valuation function:

$$u(x) = \begin{cases} x^{\alpha} & \text{if } x \geq 0 \\ -\lambda(-x)^{\beta} & \text{if } x < 0 \end{cases} \tag{2}$$

where $x > 0 (< 0)$ denotes a gain (loss) compared to the reference point that is assumed to have a value of zero.

The parameters α and β describe the curvature of the valuation function for gains and losses, respectively (i.e. α and β describe the individuals risk attitude). The parameter λ describes an overproportional disutility from incurring losses (loss-aversion). It is usually assumed that individuals are risk-averse in gains ($\alpha < 1$), risk-seeking in losses ($\beta > 1$), and loss-averse ($\lambda > 1$).

Assuming the reference point for the employment decision an individual in our model is the current wage offer w_t, then a higher accepted wage offer in the next period $w_{t+1} > w_t$ is a gain valued as $(w_{t+1} - w_t)^{\alpha}$. In contrast, lower wage offers $w_{t+1} < w_t$ that are accepted and benefit payments $b < w_t$ are losses and are valued as $-\lambda(w_t - x)^{\beta}$.

It is straightforward to see that risk-seeking behavior in gains ($\alpha > 1$) can explain our observation 1. Since risk-seeking individuals evaluate possible future gains higher than in the risk-neutral benchmark ($\alpha = 1$), they tend to decrease the probability of accepting a job offer. In the case of the evaluation of the losses things are more complicated, because the curvature of the valuation function and the loss-aversion parameter may drive results in opposite directions. Since the model is not pre-determined in this point and since our experimental results are not rich enough to allow for a joint estimation of all the parameters, we can only speculate about the relationship between β and λ.[17]

Our guess concerning β and λ is that individuals are likely to be risk-seeking in losses ($\beta > 1$) and strongly loss-averse ($\lambda > 1$) at the same time. Not only are both parts of this hypothesis in line with the original observations by numerous authors (see Camerer, 1995), but assuming risk-seeking behavior in losses also parallels the risk-seeking behavior that we observe in gains. Measuring gains and losses from the reference point of the current wage offer, the assumptions $\alpha > 1$, $\beta > 1$, and $\lambda > 1$ can explain why we observe individuals, who on the one hand exhibit a lower job acceptance rate than a risk-neutral individual would (risk-seeking both in gain and losses), but on the other hand exhibit a greater acceptance rate when substantial losses are possible, due to a benefit sanction (strong loss-aversion).

4.2. Parametric analysis

Observing the behavior of 62 individuals over 100 time periods generates 6200 observations. However, in many periods the individuals do not have a choice because they have a job from which they are not allowed to quit. And, as in the previous subsection we base the analysis on the behavior of individuals from period 10–90. This leaves us with 1928 observations relevant for an analysis of unemployment behavior because they concern periods in which the individual decides on whether or not to accept a wage offer. In total there are 871 rejections of wage offers and 1057 acceptances. Of the 1928 observations 1057 refer to the first period after unemployment (or the first period of the game) during which the individual is not liable for a benefit sanction. The remaining 871 observations concern periods when the individual was potentially confronted with a benefit sanction.

For the parametric analysis of the behavior of the participants in the experiments we use the fixed effects logit model

$$\Pr(y_{it} = 1) = \frac{e^{\alpha_i + \beta x_{it}}}{1 + e^{\alpha_i + \beta x_{it}}}$$

where y equals 1(0) if a wage offer is accepted (rejected), i refers to participant $(1, \ldots, 62)$, t refers to the period $(11, \ldots, 90)$. Furthermore, x is a vector of explanatory variables, the α_i represent individual fixed effects and β is a vector of parameters. The explanatory variables are the wage offer (*wage*) unemployment benefits (*benefits*) and the period of the game (*time*). The parameters of the fixed effects logit model are estimated using Chamberlain's conditional likelihood method. The results are shown in Table 5.

[15] For an overview of the empirical evidence on Prospect Theory see Camerer (1995).

[16] In the final period T of a game with risky benefits, the number of outcome states is already 222. This number grows exponentially as we move forward to earlier periods.

[17] Note that as far as we can tell, no study yet has applied Prospect Theory to a dynamic decision setting such as ours, in which individuals must optimize a series of sequential decisions. In such a setting, it remains unclear which reference point should be used in evaluating own future decisions. Appendix B presents an attempt to adapt Prospect Theory to our case, by assuming that the decision-maker will use the current wage as a reference point for the decisions in the following four periods, i.e. in those periods in which the wage is guaranteed (if he accepts the offer today).

Table 5
Parameter estimates fixed effects logit model.[a]

	Potential sanction period		First period[b]	All
	(1)	(2)	(3)	(4)
Wage	0.157 (11.1)	0.159 (11.3)	0.156 (13.0)	0.152 (19.1)
Benefit	−0.040 (5.5)	−0.039 (5.5)	–	−0.045 (9.1)
Time	−0.005 (0.6)	–	–	–
Hausman χ^2	18.3	17.8	34.8	104.2
−Loglikelihood	102.3	102.4	135.6	304.4
	871		1057	1928

[a] Absolute *t*-values in parentheses.
[b] In the first period after job loss the unemployed is not liable for a sanction.

Table 6
Parameter estimates fixed effects logit model—subgroups[a].

	Spread 0	Spread 25	Spread 50	Spread 75
Wage	0.164 (6.1)	0.174 (5.0)	0.152 (5.3)	0.155 (5.7)
Benefit	–	−0.078 (2.6)	−0.045 (3.2)	−0.032 (3.3)
−Loglikelihood	29.7	20.0	25.4	25.7
Hausman χ^2	3.5	1.4	5.4	6.5
N	251	204	200	216

[a] Absolute *t*-values in parentheses.

The first column shows the parameters for the potential sanction periods. It is clear that conditional on differences between individuals, high wage offers have a positive effect and high benefits have a negative effect on the acceptance probability. Time does not seem to affect the acceptance probability. Apparently individuals do not change their behavior over the game, which is in line with the claim in the theoretical section that the optimal reservation wage is approximately constant between periods 1 and 90. The χ^2-statistic of the Hausman test for homogeneity ($\alpha_i = \alpha$) indicates that we cannot accept the absence of heterogeneity in the intercepts.[18] The second column of Table 5 shows the parameter estimates if we omit *time* as an explanatory variable. Indeed, the parameter estimates hardly change. The third column shows the estimation results if we use the information collected in the first period after unemployment when individuals were never confronted with a benefit reduction. Then, since the benefits are always the same, we cannot identify the benefit effect because this is absorbed by the individual fixed effects. The estimated wage effect is almost the same as the one shown in the second column of Table 5. Finally, the fourth column shows the parameter estimates if we pool across periods.[19] In all estimates we find that the effect of a change in the wage is approximately four times as big as the effect of a change in the benefit level. Using Eq. (1), we see that an offer w should be accepted if

$$(1+\delta+\delta^2+\delta^3)w - b > \delta E(V^U_{T-\tau+1}) - \delta^{\bar{\tau}} E(V^{U,h}_{T-\tau+\bar{\tau}})$$

Hence with $\delta = 1$ (which is reasonable in an experiment lasting less than an hour) we indeed find that the effect of w on the acceptance probability is four times the effect of b.[20]

Because from the first period after unemployment we cannot derive information about (ex post) sanction effects we focus the remaining analysis on the periods when individuals were sometimes exposed to benefit sanctions. To check the robustness of our parameter estimates we split up the sample according to the four groups of treatments and estimated the fixed effects logit model for each of the groups separately. The results are shown in Table 6.

For all groups we again find that a higher wage offer increases the probability of acceptance. And for groups with non-constant benefits we again find a negative effect of the benefit level. A likelihood ratio test for the restriction that the parameter estimates of all explanatory variables are the same across the four groups equals 3.20. Since at a 5% significance level the critical χ^2 with 5 degrees of freedom equals 11.1 we cannot reject the hypothesis that conditional on the fixed effects the parameters are the same for every group in the sample. Or, in other words if we allow for individual fixed effects

[18] The Hausman tests compares Chamberlain's conditional maximum likelihood estimator (CMLE) and the usual maximum likelihood estimator of the binomial logit (ML). H_0 is that the difference in coefficients is not systematic and is based on the chi-squared statistic (See Green, 2000):

$$\chi^2 = (\widehat{\beta}_{CML} - \widehat{\beta}_{ML})'(Var[CML] - Var[ML])^{-1}(\widehat{\beta}_{CML} - \widehat{\beta}_{ML})$$

The critical χ^2-value (5% level) for 3 degrees of freedom is equal to 7.8, for 2 degrees this is 6.0, for 1 degree of freedom it is 3.84.

[19] The likelihood-ratio statistic for pooling across the different periods equals 132.8, indicating that pooling across the first periods and later periods is rejected by the data.

[20] We thank a referee for pointing this out.

Table 7
Parameter estimates binomial logit model.[a]

	(1) Spread 0	(2) Spread 25	(3) Spread 50	(4) Spread 75
Wage	0.125 (7.2)	0.147 (6.1)	0.104 (6.8)	0.098 (7.1)
Benefit	–	−0.058 (2.4)	−0.023(2.2)	−0.015 (2.4)
−Loglikelihood	63.9	46.6	62.3	69.3
N	251	204	200	216
	(5)	(6)	(7)	
Wage	0.111 (13.8)	0.115 (13.8)	0.114 (13.7)	
Benefit	−0.023 (4.4)	−0.022 (4.2)	−0.022 (4.2)	
Spread = 25	–	1.02 (3.1)	–	
Spread = 50	–	1.24 (3.8)	–	
Spread = 75	–	0.96 (3.0)	–	
Spread = 0	–	–	1.07 (4.1)	
−Loglikelihood	254.4	245.1	245.5	
N		871		

[a] Absolute t-values in parentheses.

pooling across the four groups is allowed. For the first three groups in Table 6 the Hausman tests indicate that the hypothesis of no heterogeneity in the intercepts cannot be rejected. For the fourth group the Hausman test is only insignificant at a 10% level. Nevertheless these results in comparison to those in Table 5 suggest that within the separate groups intercepts are the same while between groups the intercepts are different.

Our estimation results clearly indicate that individuals respond to financial incentives, both through the wage offer and the benefit reduction. The parameter estimates concerning the benefits refer to the so called ex post effect. Once a benefit is reduced the individual is more likely to accept a wage offer. In the set-up of the experiment it is possible to investigate the ex post effect for each of the individuals participating in the experiment. We are also interested in the so called ex ante effect. This is the effect that individuals who are confronted with the possibility of benefit reduction will change their behavior even before this reduction is actually imposed. To get an idea of this effect we have to compare behavior across individuals because the same individual was not exposed to different sanction regimes. Therefore, if there is an ex ante effect this is picked up by the fixed effects. In order to identify the ex ante effect we have to compare the behavior of individuals from different groups correcting for the effects of wages and benefits. Since we do not find (a lot of) heterogeneity in the intercept of the logit model for the separate groups the identification of the ex ante effect is straightforward. Using a binomial logit model we establish whether conditional on wages and benefits there is a difference between the four groups. If there is, this is due to the ex ante effect.

Columns 1–4 of Table 7 show the parameter estimates of the binomial logit model for the four groups of individuals. Column 5 shows the parameter estimates if we would simply pool across the four groups and ignore the ex ante effect. The value of the LR-test is equal to 12.3 which indicates that we cannot simply pool across the four groups. Column 6 shows the parameter estimates if we allow the intercept to differ between the groups by introducing dummy variables for the three groups with a positive spread in benefits.

Indeed, conditional on benefits and wage offers those that are subject to possible benefit sanctions have a higher acceptance probability than the reference group. This represents the ex ante effect. The seventh column of Table 7 shows the parameter estimates if we impose the ex ante effect to be the same across all groups. As shown the estimation results hardly change so we cannot reject the hypothesis that the ex ante effect is constant across the three groups.[21]

To give an impression about the size of the effects we use the parameters in the seventh column of Table 7 to perform some simulations of which the results are shown in Table 8.

Table 8 shows that with a wage offer of 125 and fixed benefits of 60 the acceptance probability is equal to 9.4%. With benefits of 70 but in a situation where the individual may be confronted with a benefit sanction later on the acceptance probability would be 19.5%. The fact that this acceptance probability is higher than with a fixed benefit of 60 is due to the fact that the ex post effect is smaller than the ex ante effect. With benefits of 45 the acceptance probability is 29.5%. The difference between 29.5% and 19.5% is due to the ex post effect of a benefit sanction. The weighted average acceptance probability for a 45–70 combination is 23.5%. The difference between 23.5%—with an expected benefit level of 60—and 9.4%—with a fixed benefit level of 60—is the ex ante effect, equal to 14.1%.

Table 8 shows calculated ex post effects and ex ante effects for other combinations of wage offers and benefit levels. For example if the wage offer increases to 150 the ex post effect declines to 7.2% while the ex ante effect increases to 19.5%. The ex post effect is smaller because the acceptance probability with a high benefit is already as high as 80.7%. If the wage offer

[21] The LR test statistic is equal to 0.3, the critical χ^2-*value* = 6.0. Note that pooling across the four groups is not rejected by the data once we account for the ex ante effect. The LR test statistic is 6.8, the critical χ^2-*value* = 7.8.

Table 8
Simulation results; acceptance probabilities in %.[a]

Spread	0	25		Avg.	25		50		75	
Benefit	60	70	45	60	Ex post	Ex ante	Ex post	Ex ante	Ex post	Ex ante
Wage	(1)	(2)	(3)	(4)[b]	(3)–(2)	(4)–(1)				
125	9.4	19.5	29.5	23.5	10.0	14.1	20.6	15.1	31.3	16.6
150	64.1	80.7	87.9	83.6	7.2	19.5	13.9	18.5	20.4	17.0
175	96.9	98.6	99.2	98.9	0.6	2.0	1.1	1.9	1.7	1.7

[a] Based on the parameter estimates of Table 7, column 3.
[b] $0.6*(2)+0.4*(3)$.

is equal to 175 the ex post effect is equal to 0.6% and the ex ante effect is equal to 2.0%. Both effects are small because the acceptance probability is high irrespective of the (expected) benefit level.

Table 8 also shows ex post effects and ex ante effects for other combinations of benefit levels that have the same expected benefit of 60. Of course if the spread increases the ex post effect increases as well. At low wage levels, where acceptance probabilities are low the ex ante effect increases with the spread. At higher wage levels and low benefit levels the acceptance probabilities are close to 1 and therefore the ex ante effect decreases with the spread in the benefit levels.

What do the numbers in Table 8 tell us about an optimal unemployment benefit system? Note that for the government, the benefit b is a transfer which does not raise social welfare. Hence a social planner solves the optimal acceptance problem with $b = 0$.[22] It turns out that the socially optimal acceptance behavior is to accept every wage offer above 110. Hence, the bigger the ex ante effect in Table 8, the better it is from a social point of view. Since high offers tend to be accepted anyway, this effect is most important at low wage offers, like $w = 125$. This implies that from an efficiency point of view, higher spread is better. Since the spreads are defined in such a way that expected benefits are the same across treatments and because a worker receives the high benefit in the period after losing his job, there are no strong distributional arguments that would work against this conclusion.[23]

5. Conclusions

In this paper we analyze job search behavior in the presence of unemployment benefits and unemployment benefit sanctions. Our analysis is based on laboratory experiments in which the arrival of job offers is exogenous. We focus on wage offer acceptance behavior. In theory the job search behavior of an unemployed worker is influenced by a system of benefit sanctions in two distinct ways. First, if confronted with a reduction of the benefits, an unemployed worker will be more likely to accept a given job offer. This is the so called ex post effect. Second, due to the threat of receiving a benefit sanction a worker will be more likely to accept a given wage offer than he would be if his benefits would be constant and no system of benefit sanctions existed. This is the so called ex ante effect.

Our experiments show that both ex post effect and ex ante effect are relevant. The magnitude of both effects depends on the structure of the system of benefit sanctions and on the specific wage offers. In most cases the ex ante effect (which is hard to estimate using econometric techniques on real world data) is larger than the ex post effect. In the experiment, we compare two unemployment benefit systems where one system has the same benefit every period and the other a lottery over a high and a low benefit. In both cases the expected unemployment benefit per period is the same but the outflow out of unemployment is far higher for the lottery scheme. The policy implication is that introducing the uncertainty associated with benefit sanctions can reduce unemployment even when the expected unemployment benefit level is unchanged.

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Appendix A. Instructions

A.1. The "no spread" treatment

Department of Economics, Tilburg University

[22] If b is financed using distortionary taxation, the social value when rejecting a wage offer may even be negative.
[23] Note, however, that a positive ex ante effect implies that the worker feels worse off under the sanction system; this drives the worker to lower the reservation wage. Hence increasing the spread may at some point become welfare reducing.

330071: Sociaal economisch beleid

Instructions for the Job Search Experiment

Welcome to our job search experiment!

Please, read these instructions carefully. If you should have any questions, please, raise your hand and wait for an experimenter to come to your cubicle. Once you have completed the experiment, you may leave the laboratory.

Please, remain quiet and do not communicate with the other participants.

The decision task you face in this experiment resembles job market decision making, but is simplified in a number of ways. Thus, although job market terminology is used, you are asked to focus only on the decisions and payoffs that are actually part of the experimental setting. Your goal in the experiment should be to maximize payoffs.

The experiment consists of 100 rounds. In each round, you are offered a contract to work for four consecutive rounds at a specified wage.

The offered wage is always in the range of (and including) 90–200 Taler, where Taler is the name of the experimental currency unit.

If you accept the job offer, you will receive the offered wage in the current round and in each of the next three rounds. You cannot break the contract and quit the job prematurely. To be able to accept a different job offer, you will have to wait until the employment has terminated. The duration of employment is displayed on your screen in the field labeled "Tenure". It remains constant throughout the entire experiment.

If you reject a job offer, you will receive an unemployment benefit in the current round and will be free to accept or reject the job offer in the next round. The amount of unemployment benefit that you will receive is 60 Taler.

After the experiment, the part of your course grade that depends on this experiment will be determined as follows:

Average payoff	0–14	15–29	30–44	45–59	60–74	75–89	90–104	105–119	120–134	>135
Grade	1	2	3	4	5	6	7	8	9	10

Thank you for participating.

A.2. *Instructions for the "spread 25" treatment*[24]

Department of Economics, Tilburg University

330071: Sociaal economisch beleid

Instructions for the Job Search Experiment

Welcome to our job search experiment!

Please, read these instructions carefully. If you should have any questions, please, raise your hand and wait for an experimenter to come to your cubicle. Once you have completed the experiment, you may leave the laboratory.

Please, remain quiet and do not communicate with the other participants.

The decision task you face in this experiment resembles job market decision making, but is simplified in a number of ways. Thus, although job market terminology is used, you are asked to focus only on the decisions and payoffs that are actually part of the experimental setting. Your goal in the experiment should be to maximize payoffs. The experiment consists of 100 rounds. In each round, you are offered a contract to work for four consecutive rounds at a specified wage. The offered wage is always in the range of (and including) 90–200 Taler, where Taler is the name of the experimental currency unit.

If you accept the job offer, you will receive the offered wage in the current round and in each of the next three rounds. You cannot break the contract and quit the job prematurely. To be able to accept a different job offer, you will have to wait until the employment has terminated. The duration of employment is displayed on your screen in the field labeled "Tenure". It remains constant throughout the entire experiment.

If you reject a job offer, you will receive an unemployment benefit in the current round and will be free to accept or reject the job offer in the next round. The amount of unemployment benefit that you will receive may be "full" or "reduced". The full benefit is 70 Taler, while the reduced benefit is 45 Taler.

You are certain to receive the full unemployment benefit when you are unemployed:

- in the very first round of the experiment and
- in any first round of unemployment immediately following a round of employment.

In all other rounds, there will be a lottery determining whether you will receive the full or the reduced benefit. The probability of receiving the full benefit is 60% and the probability of receiving the reduced benefit is 40%. The lottery takes

[24] The "spread 50" and "spread 75" treatments are similar. Replace "70" by "80" and "45" by "30" for spread 50 treatment. Replace "70" by "90" and "45" by "15" for the spread 75 treatment.

place at the beginning of the round, which means that you will know the outcome of the lottery before you make a decision on the current job offer. All parameters concerning the unemployment benefit remain constant throughout the entire experiment.

After the experiment, the part of your course grade that depends on this experiment will be determined as follows:

Average payoff	0–14	15–29	30–44	45–59	60–74	75–89	90–104	105–119	120–134	>135
Grade	1	2	3	4	5	6	7	8	9	10

Thank you for participating.

Appendix B. Can prospect theory explain our results?

Prospect Theory (PT) combines a number of choice phenomena in the framework of a single model (Kahneman and Tversky, 1979; Tversky and Kahnenman, 1992). In the paper, we describe how PT relates to our results. Applying PT to the decision situation that we consider, however, is not straightforward. Two main difficulties arise. First, the number of parameters in a full PT model is so large (three parameters in the value function and at least one in the probability weighting function) that both field and experimental data sets, in general, will not be large enough for valid estimations. Second, none of the specifications of PT that are available in the literature can cope with dynamic settings such as ours, with a sequence of decisions and a corresponding flow of information. Such dynamic settings, which are characteristic for search problems, require an enhancement of PT to allow for a systematic adjustment of the reference point and (possibly) of the outcome ranks.

In this appendix, we present an adapted version of PT that allows us to deal with these difficulties in our dynamic game. Since probability weighting has little impact when prospects have rich outcome sets with flat probability distributions, we leave probability distortion aside and concentrate only on the value function (Eq. (2)):

$$u(x) = \begin{cases} x^{\alpha} & \text{if } x \geq 0 \\ -\lambda(-x)^{\beta} & \text{if } x<0 \end{cases}$$

where α (β) measures the curvature of the utility function for gains (losses) and λ captures loss aversion.

Before being able to apply the value function, we must clarify which outcomes are to be considered gains and which losses. Assuming that the wage offer w_t is the worker's reference point for the decision at time t, it is neither clear that $w_{t+1} > w_t$ belongs to a gain state nor that $w_{t+1} < w_t$ belongs to a loss state, because decisions and random draws in the subsequent periods may drive the final outcome in either direction.

One possibility to deal with this problem is to assume that the game has an expected discounted (continuation) value V that the worker receives starting any period that immediately follows the job tenure.[25] Suppose the worker has an offer w today. If he accepts, he receives w for four periods (job tenure) and V after that. The benchmark w against which he weighs future gains and losses only makes sense for the four periods with tenure. After that, there is no need to regret the rejection of w, because w is paid for only four periods anyway.[26]

Table B1 specifies the wage and benefits paths for periods 0 (now) to 7. The first row contains the realizations, if the offer w is accepted (i.e. the worker receives w for four periods and the continuation payoff V thereafter). If the current offer is rejected, but the next period's offer is accepted (which happens with probability $(1 - F(\bar{w}))$, where $\bar{w}$ is the reservation wage, i.e. the lowest wage that the worker accepts), the worker receives b today, the new offer w in the periods 1–4, and V thereafter. Similarly, the following rows show the cases where the offers in periods two, three, or four are rejected.

The loss V_l of rejecting w in any period can be written as follows:

$$V_l = \lambda(w-b)^{\beta}(1 + F(\bar{w})\delta + (F(\bar{w})\delta)^2 + (F(\bar{w})\delta)^3) \\ + \int_{\bar{w}}^{w} \lambda(w-t)^{\beta}\, dF(\delta + \delta^2 + \delta^3 + F(\bar{w})(\delta^2 + \delta^3) + F(\bar{w})^2\delta^3) + \delta^4 V$$

The first term is the loss that the worker incurs, if he turns down w and finds the wage offers that follow to be below his reservation wage $\bar{w}$. Since he does not accept such offers, he receives the benefit b in each period. The probability of receiving such a low wage offer is $F(\bar{w})$. The second term is the loss incurred, if w is rejected and the wage offers t that follow are above $\bar{w}$, but below w. Finally, by rejecting the current offer the worker loses the continuation payoff V for the time after the current tenure.

[25] To simplify notation, we assume here that the game has an infinite horizon.

[26] The worker knows that rejecting now, leads to a new reference point tomorrow. A hyper-rational decision-maker may take this updating of his own reference point into account. Doing so, however, does not seem plausible, since an anticipated modification of the reference point introduces time-inconsistency and, thus, makes the decision-maker both hyper-rational and boundedly rational at the same time.

Table B1
Possible payoff paths.

	0	1	2	3	4	5	6	7
	w	w	w	w	V			
$(1-F(\bar{w}))$	b	w	w	w	w	V		
$(1-F(\bar{w}))F(\bar{w})$	b	b	w	w	w	w	V	
$(1-F(\bar{w}))F(\bar{w})^2$	b	b	b	w	w	w	w	V
$F(\bar{w})^3$	b	b	b	b	V			

The gain from rejecting the current offer w is given by the following expression:

$$\begin{aligned} V_g = & \int_w^{w_1} (t-w)^\alpha \, dF(t)(\delta + \delta^2 + \delta^3 + F(\bar{w})(\delta^2 + \delta^3) + F(\bar{w})^2 \delta^3) \\ & + \int_{\bar{w}}^{w_1} t \, dF(t)(\delta^4 + F(\bar{w})(\delta^4 + \delta^5) + F(\bar{w})^2(\delta^4 + \delta^5 + \delta^6)) \\ & + V((1-F(\bar{w}))\delta^5 + (1-F(\bar{w}))F(\bar{w})\delta^6 + (1-F(\bar{w}))F(\bar{w})^2\delta^7 + F(\bar{w})^3\delta^4) \end{aligned}$$

Defining the reservation wage $\bar{w}$ as the solution to $V_g = V_l$, the continuation value V is simply:

$$V = F(\bar{w})[b + \delta V] + \int_{\bar{w}}^{w_1} w \, dF(w)(1 + \delta + \delta^2 + \delta^3) + (1 - F(\bar{w}))\delta^4 V$$

Solving for V and $\bar{w}$ as explicit functions of α, β, and λ is not possible. This, however, is not necessary for our purpose, because we can estimate the probability of acceptance using a logit model. We start by noting that:

$$\begin{aligned} & \int_{\bar{w}}^{w} \lambda(w-t)^\beta \, dF(t) = \frac{(w-\bar{w})^{1+\beta}}{1+\beta} \\ & \int_w^{w_1} (t-w)^\alpha \, dF(t) = \frac{(200-w)^{1+\alpha}}{1+\alpha} \\ & \int_{\bar{w}}^{w_1} t \, dF(t) = \frac{2000}{11} - \frac{\bar{w}^2}{220} \end{aligned}$$

Since the $(2000/11 - \bar{w}^2/220)$ term in V_g disappears in the constant as it does not depend on the current offer w, we can write:

$$\begin{aligned} & V_l = \lambda_0 + \lambda_1 (w-b)^\beta + \lambda_2 \frac{(w-\bar{w})^{1+\beta}}{1+\beta} \\ & V_g = \gamma_0 + \gamma_1 \frac{(200-w)^{1+\alpha}}{1+\alpha} \end{aligned}$$

We need a few more simplifications and approximations to come to an equation that we can actually estimate. First, note that under a logit model the probability of acceptance is given by $e^{V_g}/e^{V_g} + e^{V_l}$. Hence w.l.o.g. we can choose $\lambda_0 = 0$. Further, we can divide both V_g and V_l by γ_1 and hence normalize $\gamma_1 = 1$.

Next, using a first order Taylor approximation around $\bar{w} = b$, we can write

$$\frac{(w-\bar{w})^{1+\beta}}{1+\beta} = \frac{(w-b)^{1+\beta}}{1+\beta} - (w-b)^\beta (\tilde{w} - b)$$

for some $\tilde{w} \in \langle b, \bar{w} \rangle$. Now we argue that $(\tilde{w} - b)$ does not vary with w and "hardly" varies with b (intuitively, $\bar{w}$ is a fixed mark-up on b). Hence we view $(\tilde{w} - b)$ as a constant. The relevant equations can now be written as follows:

$$\begin{aligned} & V_l = \lambda_1 (w-b)^\beta + \lambda_2 (w-b)^{1+\beta} \\ & V_g = \gamma_0 + \frac{(200-w)^{1+\alpha}}{1+\alpha} \end{aligned}$$

Because we only have 871 observations, we need to impose more (admittedly, ad hoc) restrictions to be able to identify α, β. We assume $\lambda_1 = \lambda_2$ and $\gamma_0 = 0$. When estimating this logit model, we cannot reject the null hypothesis that $\beta = 1$. However, we do find that $\alpha = 4.5$ (t-value equal to 8.8).

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