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ABSTRACT

How Changes in Financial Incentives Affect the Duration of Unemployment*

This paper studies how changes in the two key parameters of unemployment insurance – the benefit replacement rate (RR) and the potential duration of benefits (PBD) – affect the duration of unemployment. In 1989, the Austrian government made unemployment insurance more generous by changing, simultaneously, the maximum duration of regular unemployment benefits and the earnings replacement ratio. We find that increasing the replacement ratio has much weaker disincentive effects than increasing the maximum duration of benefits. We use these results to split up the total costs to unemployment insurance funds into costs due to changes in the unemployment insurance system and costs due to behavioral responses of unemployed workers. Results indicate that costs due to behavioral responses are substantial.

JEL Classification: C41, J64, J65

Keywords: maximum benefit duration, replacement rate, unemployment duration, unemployment insurance, policy change

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1 Introduction

This paper studies how *changes* that make unemployment systems more generous affect the duration of unemployment. Most unemployment insurance systems are characterized by two major parameters: the *level of unemployment benefits* (in relation to previous earnings); and the *maximum duration* that an unemployed worker can draw such benefits. Reliable empirical evidence on how these parameters affect the search behavior of unemployed workers is crucial for designing appropriate policies. Most previous empirical studies identify such incentive effects from 'exogenous' variation, separately, either in a change in benefit levels or a change in the potential duration of benefits. While the ceteris paribus effects of changes in such parameters are clearly interesting per se, it does not allow to address potentially important questions of the appropriate *design* of unemployment insurance.

There are mainly three issues that will be addressed in this paper and that have not been studies in previous papers. First, our study allows us to *compare the magnitude* by which either of these two parameters affects the transition rates of workers from unemployment to a new job. This is very important, as it gives immediate evidence of the relative effectiveness of the two policy parameters. Second, by focusing on a major policy change that, simultaneously, increased the generosity of unemployment benefits along the level- and the duration-dimension of unemployment benefits, we are able to study whether there are possible *interaction effects* between these two key-parameters. In other words, we study whether the combined effect of a simultaneous increase benefit-levels and benefit-duration is larger, smaller, or equal in size, than the sum of effects resulting from separate changes in these two parameters. Third, our paper proposes a new and insightful simulation method that calculates the financial costs for the unemployment insurance funds of changes in these two key parameters. And it splits these costs into *direct costs* - given the same distribution of unemployment durations an increase in benefit levels - and into *indirect costs* - resulting from behavioral responses of unemployment individuals. This sheds new light on the role of two key policy parameters in affecting the costs to unemployment insurance funds.

At a more general level, there is considerable interest on the issue of disincentives effects of unemployment insurance systems, both from the point of view of economic policy, and from a more theoretical perspective. The role of unemployment insurance parameters is of considerable interest in the current *economic policy* debate. Facing persistently high unemployment rates, a number of (European) countries are discussing and/or implementing new unemployment insurance rules. An important part of those new rules concern changes both in the benefit-levels and benefit-durations. Hence it is interesting to know what effects one can expect from such changes. There is a considerable *theoretical literature* regarding the extent to which such changes affect the optimal job search strategy of workers. Job search theory offers sharp predictions on how changes in the key parameters in unemployment insurance will affect the exit rate. However, whereas there is considerable evidence regarding the impact of potential benefit duration on the one hand and on the impact of replacement ratio on the other hand, we are not aware of studies that contrasts the effects of changes to both unemployment insurance parameters.

The present paper identifies the causal effect of benefit duration on the willingness of individuals to accept jobs using a policy change that took place in Austria in 1989. This policy change provides a *nice empirical design*. Access to extended benefit duration was contingent upon age and previous work experience whereas access to higher benefit levels was contingent upon previous earnings. The increase in potential benefit duration was considerable and was itself contingent on age. It extended benefits for workers of ages 40-49 from 30 weeks before the policy change to 39 weeks after the change - a 33 % increase in potential benefit duration; and for workers above age 50 from 30 weeks before to 52 weeks after the policy change - a 73 % increase in benefit duration. Furthermore, the policy change took place in 1989 which, in Austria, was quite a stable macroeconomic environment. This implies that our study is less subject to endogenous policy bias than other studies. Endogenous policy bias arises when more generous unemployment insurance rules are implemented in anticipation of a deteriorating labor market. Such a policy bias has been found important in several recent studies (Card and Levine, 2000, Lalive and Zweimüller, 2004a). To assess the effect of these changes in unemployment insurance rules, we use a large and informative data set that allows us to trace workers' unemployment histories over an extended period of time. We compare the *entire unemployment inflow* that took place two years before the policy change to the entire inflow two years after the change. This leaves us with a rather large data-set and allows us to estimate the interesting policy parameters quite precisely.

The paper is organized as follows. The following section discusses the relevant theoretical arguments and also provides a discussion of previous empirical evidence regarding the effects of the two key parameters of unemployment insurance. Section 3 gives the relevant institutional background on the changes to UI in Austria that are used to identify the effects of benefit parameters on unemployment duration. Section 4 provides a first descriptive analysis of the effects of UI on unemployment duration. Section 5 presents the econometric analysis regarding the effects on the unemployment exit rate, and section 6 concludes with a summary of the results.

2 Theory and previous studies

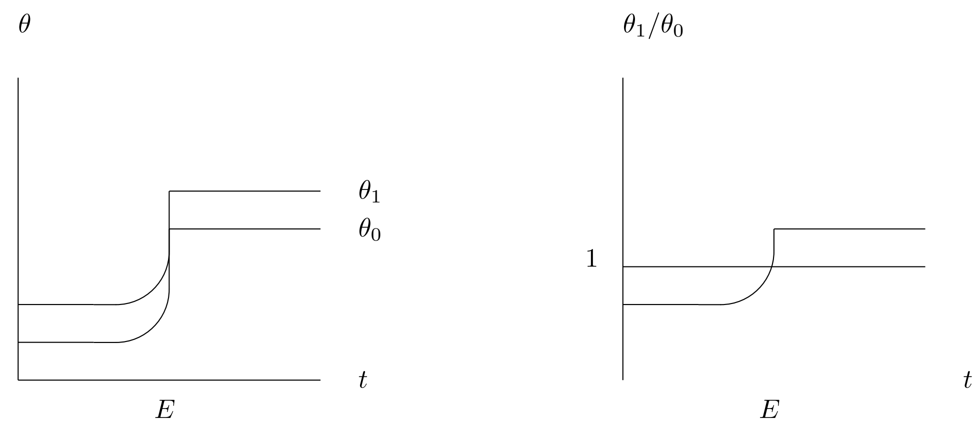
2.1 Theory

Job search theory generates sharp predictions regarding the effects of PBD and RR on the unemployment exit rate (Burdett 1979, Mortensen 1977, Mortensen 1990, Van den Berg 1990). These predictions are summarized in Figure 1.

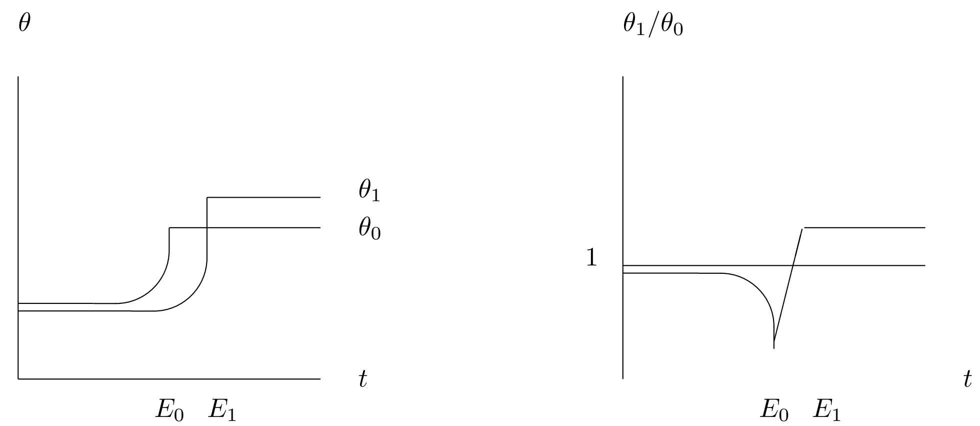
The upper panel in Figure 1 shows how an increase in the RR may affect the unemployment exit rate (θ). Two effects are stressed in the literature. On one hand, increasing RR leads to a strong disincentive effect at the beginning of the unemployment spell because benefit payments increase immediately (period 0 to benefit exhaustion E). On the other hand, because renewal of benefits depends on working, after benefits have been exhausted, the unemployment exit rate may be higher than in the system with a low RR. Thus, the unemployment exit hazard will be lower in the beginning and possibly higher after benefits have been exhausted.

In contrast, an extension of PBD does entail only small immediate disincentive effects for workers at the beginning of the unemployment spell. Most of the action will be just before benefit exhaustion in the old system until just after benefit exhaustion in the new system. This is because prolonged PBD delays the period of rapid increase in the unemployment exit rate that is characteristic of a system with limited unemployment benefit receipt. Thus, the ratio between the exit rate in the new system

Figure 1: Changes to RR and PBD and the Unemployment Exit Hazard



A. Increasing the Replacement Rate



B. Increasing the Potential Benefit Duration (E)

(θ_1) and the exit rate in the old system (θ_0) will be less than 1 in the time period covered by regular unemployment benefits in the old system (0 to E_0). Second, this ratio is expected to increase strongly and eventually exceed 1 in the period between old benefit exhaustion and new benefit exhaustion (from E_0 to E_1).

2.2 Previous empirical studies

There are several US studies concerning potential benefit duration and its effect on the *exit rate from unemployment*.[1] Grossman (1989), Moffitt and Nicholson (1982), and Moffitt (1985) for example study the effects of extended PBD that take place in the US during recessionary periods. Meyer (1990) and Katz and Meyer (1990) find for US data that the exit rate from unemployment rises sharply just before benefits are exhausted. Such sharp increases are absent for nonrecipients. For benefit recipients they find spikes around exhaustion points in both the new job finding rates and the recall rates. This suggest that unemployed search harder just before the expiration of benefits or they return to pre-arranged jobs just before they loose their benefits. However, Meyer (1990) shows that even if workers are entitled to longer benefits the 'spike' still occurs at the same place as before the benefit extension. Katz and Meyer (1990) also conclude that the adverse incentive effect of extended benefit periods is larger than the negative incentive effect of reduced benefit levels. Card and Levine (2000) argue that US research on the effect of longer UI benefits on the duration of UI spells is based on differences across states. The differences are partly related to recessions and related endogenous policy responses. Therefore, research may lead to an overstatement of the effect of longer UI-benefits on the duration of UI-spells. Furthermore, US studies, often focus on a public finance question since they study the impact of maximum benefit duration on compensated unemployment spell lengths and not on total unemployment. Nevertheless, Card and Levine (2000) themselves find similar results as before in their analysis of the New Jersey extended benefit program. Card and Levine (2000) report a disincentive effect of .07 weeks per additional week of PBD. Furthermore, they suggest that the 'traditional spike' may have to do with factors other than the strategic timing of job starting dates. They suggest that workers are conditioned to become less selective around the time UI typically expires. An alternative explanation is that there is an implicit contract between unemployed workers and their previous employers to be hired around the traditional time of benefit expiration. They attribute the fact that the implicit contract does not adjust to the new expiration date to the fact that the extended benefit program was a short-term policy. In both cases a longer-term policy may have a bigger effect. A recent US study by Addison and Portugal (2004) confirms the earlier results. Prior to the benefit exhaustion the exit rate out of unemployment declines but at and around benefit exhaustion there is a sharp increase in the exit rate.

Evidence on the effect of PBD in European studies is mixed. Hunt (1995) finds substantial disincentive effects of extended benefit entitlement periods for Germany. Carling, Edin, Harkman and Holmlund (1996) investigated whether there is an end-of-benefit-period effect in Sweden where there is a job guarantee for workers that run out of benefits. Here too an increase in the exit rate to employment is found around the time when benefits run out although the increase is substantially smaller than in

[1]Fredriksson and Holmlund (2003) give a recent overview of empirical research related to incentives in unemployment insurance. See Green and Riddell (1993, 1997), and Ham and Rea (1987) for studies that focus on Canada.

the US. Furthermore, at benefit exhaustion there is a big increase in the outflow from unemployment to labor market programs. Lubyova and Van Ours (1997) investigate the effects of changes in PBD in Slovakia. They find that exits out of unemployment increased when the benefit period was reduced and decreased when the benefit period were lengthened. However, the changes in the exit rates concern exit to destination other than regular jobs. The job finding rate was not affected by changes in the benefit period. Winter-Ebmer (1998) analyzing Austrian data finds that males react to an extended benefit period but females do not. Furthermore, he finds that the impact of benefit extension is larger for long unemployment spells than it is for short spells. Stancanelli (1999) does not find evidence of a significant benefit exhaustion effect for Britain. Adamchik (1999) finds for Polish unemployed a large increase in the employment hazard as the benefit expiration moment approaches. Puhani (2000) on the contrary does not find such an effect for Poland. He concludes that the change from unlimited unemployment benefits to a one year benefit period that was introduced in 1991 did not affect the exit rates out of unemployment. Bratberg and Vaage (2000) investigate the effects of a fixed unemployment benefit period for Norway. They do not find a significant rise in the employment hazard before benefit expiration. They explain this from the attractiveness of labor market programs. They do find a spike in the exit out of unemployment suggesting that some workers stay unemployed only until their benefits expire. After that they withdraw from the labor force. When the unemployment benefit period was extended to more than 3 years the employment hazard was significantly reduced in the first year of unemployment. This suggest that disincentive effects materialize mostly among short-term unemployed workers. Roed and Zhang (2003) find for Norwegian unemployed that the exit rate out of unemployment increases sharply in the months just prior to benefit exhaustion where the effect is larger for females than for males. Cockx and Ries (2004) study Belgian unemployment insurance where benefits are not limited in time except for partners with income (usually women). Also in this study exhaustion of unemployment benefits has an important significant positive impact on the job finding rate. Finally, Fitzenberger and Wilke (2004) investigate the effects of extended PBD for elderly workers in West-Germany during the mid 1980s. They find an increase in the duration of unemployment which they attribute to the behavior of many firms and workers which used the extended PBD a part of early retirement packages.[2]

The effects of RR on unemployment durations has been studied frequently. The bulk of the early literature focuses on differences in the benefit replacement rate between individuals. This literature is problematic due to the possibility of unobserved heterogeneity distorting identification in the cross-section. There are several estimates on the elasticity of unemployment duration with respect to benefits in the early literature ranging from 0.1 to 1.0 (Atkinson and Micklewright, 1991). In some recent European studies even bigger elasticities are found. Carling et al. (2001), studying the effects of a reduction in the RR from 80% to 75% in Sweden in 1995, find that this policy change increased the job finding rate by roughly 10%, implying an elasticity of around 1.7. Bennmarker et al. (2004) that deals with changes in the Swedish UB system in the early 1990s find a smaller elasticity of around 0.6. Roed and Zhang (2003), in a study for Norway, estimate elasticities of around 0.95 for males and around 0.35 for females. All in all, in many European labor markets the effect of changes in the RR on the job finding rate are substantial.

[2]Steiner (1997) studying extensions of PBD in West-Germany in the 1980s finds that these increased unemployment durations of males but not of females.

3 Unemployment insurance and the Austrian labor market

3.1 The System Before The Policy Change

Like in a number of other countries the Austrian unemployment insurance system is characterized by a limited period over which unemployed individuals can draw 'regular' unemployment benefits (UB). Unemployment benefits depend on previous earnings and, compared to other European countries, the replacement ratio (UB relative to *gross* monthly earnings) is rather low. Figure 2 shows that, before August 1989, the replacement ratio declined strongly from a maximum of about 63 % (monthly income is below 2,210 AS) to 41 % in the income range of between 3,000 to 5,000 AS previous monthly earnings.[3] The benefit replacement ratio then stays just below 41 % for incomes up to the cap of 27,430 AS previous monthly earnings. Individuals earning more than 27,430 AS get UB of 11,233 AS per month irrespective of their income. Thus, the benefit replacement rate decreases monotonically in previous monthly income for the high-income group.

Figure 2 about here

On top of UB, family allowances are paid. UB payments are not taxed and not means-tested. Voluntary quitters and workers discharged for misconduct cannot claim benefits until a waiting period of 4 weeks has passed. UB recipients are expected to search actively for a new job that should be within the scope of the claimant's qualifications, at least during the first months of the unemployment spell. Non-compliance with the eligibility rules is subject to benefit sanctions that can lead to the withdrawal of benefits for up to 4 weeks.

Before August 1989, an unemployed person could draw regular unemployment benefits (UB) for a maximum period of 20 weeks provided that he or she had paid unemployment insurance contributions for at least 52 weeks within the last 2 years. Individuals who had contributed to UI for at least 156 weeks in the last 5 years were eligible for 30 weeks of regular unemployment benefits.[4]

Once the period of regular unemployment benefits has expired, individuals can apply for 'transfer payments for those in need' ("Notstandshilfe").[5] As the name indicates, these transfers are means-tested and the job seeker is considered eligible only if she or he is in trouble. These payments depend on the income and wealth situation of other family members and close relatives and may, in principle, last for an indefinite time period. These transfers are granted for successive periods of 39 weeks after which eligibility requirements are recurrently checked. These post-UB transfers are lower than UB and can at most be 92 % of UB. In 1990, the median post-UB transfer payment was about 70 % of the median UB. Note however, that individuals who are eligible for such transfers may not be comparable to individuals who collect UB because not all individuals who exhaust UB pass the means test.

This system applies to all of Austria except for regions with a dominant steel industry. In these steel regions, a regional extended benefit program was introduced in June 1988, that entails a dramatically

[3] The median monthly income was about 16,400 AS in the unemployment inflow from regular jobs in 1988.

[4] UB duration was 12 weeks for job-seekers who did not meet either previous contribution requirement. In order to guarantee a minimum degree of homogeneity, this paper focuses on workers that have contributed for at least 52 weeks to UI in the 2 years prior to unemployment. Thus, all workers are eligible for at least 20 weeks of UB before the policy change.

[5] This implies that job seekers who do not meet UB eligibility criteria can apply at the beginning of their spell.

different UI system for workers aged 50 or older. In order to focus attention on the policy change in August 1989, we focus on the non-steel regions that were never entitled to the regional extended benefit program. See Lalive and Zweimüller (2004a) and Lalive and Zweimüller (2004b) for analyses of this program.

3.2 The 1989-Changes in Policy Parameters

As of August 1, 1989 the Austrian government enacted a series of important changes to so-called 'unemployment insurance law' (Arbeitslosenversicherungsgesetz, AlVG). The first important change was that the potential duration of UB payments became dependent not only on previous contributions but also on age at the beginning of the unemployment spell. Benefit duration for the age group 40-49 was increased to 39 weeks if the unemployed has been employed 312 weeks of employment within the last 10 years prior to the current spell. For the age group 50 and older, UB-duration was increased to 52 weeks if the unemployed has been employed for at least 468 weeks within the last 15 years.

The second important change was that the benefit replacement rate was increased from about 41 % to roughly 47 % in the previous income bracket between 5,000 AS and 10,000 AS (Figure 2). After the income threshold of 10,000 AS has been crossed, the benefit replacement rate is faded out quickly to reach the former level of 41 % at 12,610 AS previous monthly income. These changes affect all job seekers as of August 1, 1989.

In the period that we study, there was a further slight increase to the benefit replacement rate. As of June 1, 1990, the Austrian government enacted an increase to the benefit replacement rate for those with previous income exceeding 12,610 but below 27,000 AS. This change essentially ensures that the gross replacement rate is faded out from a level of 47 % to a level of 41 % over the income range 10,000 AS to 27,000 AS instead of the range from 10,000 AS to 12,610 AS.

In this paper, we focus on the effect of the increase in PBD and the increase in RR in August 1989. We do not estimate also the effect of the increase in RR in July 1990, for two reasons. First, this policy change entails a much weaker change to the benefit replacement rate than the policy change in August 1989.[6] Second, the July 1990 change to the RR occurs rather shortly after the August 1989 change. This implies that the unemployment exit rate in the period before the July 1990 change but after the August 1989 change is not identified in the period 48 weeks after entry and beyond. This time period is, however, of substantial interest in the present analysis.

The fact that we do not account for the July 1990 change implies that the estimated treatment effects refer to treatments relative to a control treatment that does not leave unaffected all parameters of the unemployment insurance system. Thus, not accounting for the July 1990 policy changes the interpretation of the effects we report but it does not affect the internal validity of these effects. Moreover, since we evaluate the effects of these policy changes relative to a slight increase in benefits, our results give a *lower bound* on the effects relative to no change.

[6]The average increase in the benefit replacement rate is almost 6 percentage points for the August 1989 change. In contrast, the replacement rate increases by a mere 1.3 percentage points due to the second policy change (Table 3).

3.3 The situation on the Austrian labor market 1987-1991

Before we go into the details of data and statistical analysis, it is instructive to look at the situation on the Austrian labor market during the period 1987 to 1991. This is the period on which the empirical analysis below will be concentrated.

Table 1 about here

Table 1 shows that in 1987 the economy was at the end of a recession and started to improve. Real GDP growth was 1.7 % in 1987 and then started to grow to as much as 4.7 % in 1990. The favorable situation of the business cycle lead to strong employment growth throughout the period under consideration. However, it did not show up in decreasing unemployment rates. The reason was primarily a strong increase in labor supply (a strong increase in immigration and rising female labor force participation). That is why unemployment rose slightly despite a strong employment growth.

It is worth noting that this situation is favorable for our empirical strategy. Employment growth during the treatment period was stronger than before. Hence it is unlikely that our results from a comparison of the labor market experiences of older workers between the period prior to the policy change to the post-policy period is strongly driven by a deteriorating labor market.

4 Descriptive Analysis

4.1 Data

To assess the impact of changes to financial incentives on transition rates out of unemployment, we use longitudinal individual data from two different sources: (i) the *Austrian social security database* which contains detailed information on the individuals' employment, unemployment and earnings history since the year 1972, and some information on the employer like region and industry affiliation; and (ii) the *Austrian unemployment register* from which we get information on the relevant socio-economic characteristics. From these data we extract a sample that contains all unemployment entrants in the period between August 1, 1987 (2 years before the policy change) and July 31, 1991 (2 years after the policy change). We concentrate on job seekers in the age bracket 35-54, who have at least 52 weeks within the last 2 years, and with residence in regions that were never eligible for a special regional extended benefit program. Furthermore, in order to isolate the effects of changes in PBD, we concentrate on workers who either fulfill both previous contribution requirements[7] or neither. We end up with 225,821 unemployment spells. The median duration of unemployment is 12 weeks. More than 85 % of spells end in a job, 14 % of spells in a non-job exit destination (long-term sickness, pension, unknown). Since spells are observed until May 1999, only 1 % of spells are right censored.

4.2 Construction of Groups

Table 2 summarizes the changes to unemployment insurance that were enacted in August 1989. Eligibility depends on three criteria: previous gross monthly income, age, and previous work experience.

[7]That is, at least 312 weeks contributions in the previous 10 years and at least 512 weeks contributions in the previous 15 years.

Thus, in the data it is possible to distinguish four groups of job seekers. The first group comprises job seekers with monthly income exceeding 12,610 AS who are aged 40 or older with much previous work experience (6 out of previous 10 years and 9 out of previous 15 years). This group is eligible for the change to the potential duration of benefits ($ePBD$ group). The second group consists of job seekers with income exceeding 12,610 AS and age less than 40 years or age exceeding 40 years but with little work experience. This group benefits from the increase in the gross replacement rate (eRR group). The third group contains job seekers with income lower than 12,610 AS and aged 40 or older with much previous work experience. This group is affected by both, the increase in the benefit replacement rate and the increase in the potential benefit duration ($ePBD_RR$ group). The fourth group contains job seekers with income exceeding 12,610 AS who are young or older job seekers with little work experience. For those individuals there was no change in the two central parameters of the unemployment insurance system (Control group).

Table 2 about here

Table 3 reports the means of the RR and of the PBD together with the number of spells in the respective groups both before August 1989 and after August 1989. The first row in Table 3 shows that almost all job seekers entering unemployment before August 1989 in the *ePBD* group were eligible for the maximum duration of regular benefits of 30 weeks.[8] In contrast, the PBD was almost 43 weeks for spells in the ePBD group after the policy change. Thus, this group experienced an increase by 13.5 weeks in the PBD. The second row in Table 3 shows that there is a slight increase in the benefit replacement rate. This increase is due to the fact that there is a second policy change in June 1990 affecting the high income workers in the ePBD group. The third row in Table 3 shows that this group is the largest in size, and that the number of spells in the ePBD group increases. However, note that this probably reflects the fact that eligibility to the change in the RR depends on previous income in nominal terms rather than the fact that more individuals register to collect unemployment insurance because benefits are more generous. In line with economic growth over the period 1987-1991 (Table 1), the total number of spells is almost identical before and after the policy change.

Table 3 about here

The second set of rows in Table 3 refers to the *eRR group*. PBD is lower on average in the RR group than in the PBD group. This reflects the fact that many spells in the RR group do not fulfill the 30 week requirement that at least 60 % out of the previous 5 years have to be spent working. While there is virtually no change to PBD, the benefit replacement rate increases strongly, from 41 % to 47 %. This group is smaller than the first group reflecting the fact that median income in the unemployment inflow is higher than the nominal income threshold of 12,610 AS. The decrease in the number of spells in the group is due to the fact that previous income must be below a nominally fixed income threshold in order to be a member of the RR group.

The third set of rows in Table 3 refers to the *ePBD_RR* group. This group very much resembles a combination of the ePBD and of the eRR group exhibiting long potential benefit duration as in the

[8]The empirical analysis below accounts for the fact that the all unemployment insurance parameters may vary due to the fact that the changes enacted in August 1989 pertain to *all* spells, not just to those started after August 1989.

ePBD group, and a rather high replacement rate of 41 % as in the eRR group. Interestingly, this group experiences an increase in the PBD and in the RR in exactly the same magnitude as both previously discussed groups. This is the smallest group. Again, the number of spells allocated to this group declines since all individuals must have earned less than the nominal income threshold of 12,610 AS in order to be allocated to the ePBD_RR group.

The fourth set of rows in Table 3 refers to the *control group*. This second largest group has rather long PBD and relatively low RR before the policy change. There is a slight decrease in the PBD over time, and a slight increase in the RR (reflecting the policy change in June 1990) over time.

The last column in Table 3 reports diff-in-diff estimates of the effect of the policy change on both parameters of the unemployment compensation system. This column shows that a corresponding diff-in-diff calculation for some outcome, identifies the effect of extending the PBD by 14 weeks (starting from 30 weeks), the effect of increasing the RR by 4.6 percentage points (starting from 41 %), and the effect of increasing both PBD by 14 weeks and increasing the RR by 4.4 percentage points. Thus, this design allows for an exhaustive analysis of how financial incentives affect the duration of unemployment.

4.3 Unemployment Duration

Table 4 reports average unemployment duration in the first 104 weeks by program implementation status and by group.[9] Let t_u denote the realized duration of unemployment measured in weeks. Unemployment duration in the first two years is $t_u^{104} \equiv \min(t_u, 104)$.

Table 4 about here

The first column in Table 4 shows that average unemployment duration is longest in the ePBD_RR group and shortest in the Control group in spells that started before August 1989. The second column in Table 4 shows average unemployment duration after August 1989. The third column in Table 4 shows that unemployment duration increases in all groups. However, as column four in Table 4 shows, the change in unemployment stronger in groups which are eligible for either the change to PBD or RR or both. For instance, unemployment duration increases by 1.13 weeks more strongly in the ePBD group that is eligible for the extension of PBD but not for the increase in RR. There is a slightly weaker increase by .96 weeks in unemployment duration in the eRR group which is eligible for the increase in RR but not for the extension of PBD. The strongest effect is in the group that is eligible for both RR and PBD. In the ePBD_RR group, unemployment duration increases by 3.25 weeks more strongly than in the Control group. Furthermore, there appears to be an excess increase of 1.16 weeks (=3.25-1.13-0.96) in unemployment duration in the sense that this effect exceeds the sum of the effects reported in the ePBD and in the eRR groups.

4.4 Survivor Functions

Job search theory predicts that financial incentives in UI affect the shape of the unemployment exit hazard depending on the time to benefit exhaustion. In order to study this prediction, it is useful to

[9]We report average unemployment in the first 104 weeks for two reasons. First, we will calculate the contribution to the total change as a function of elapsed unemployment duration. Second, right-censoring is not an issue in the first 104 weeks. Moreover, note that results referring to total unemployment duration are very similar.

decompose the effect on average unemployment duration reported in Table 4 as follows. It is well known that expected unemployment duration in the first two years is given by $E(T_u^{104}) = \int_0^{104} S(z)dz$ where $S(z) = \exp(-\int_0^z \theta(x)dx)$ is the survivor function, that is, the probability that unemployment spells are longer than z weeks, and where $\theta(x)$ is the unemployment exit hazard, i.e. $\theta(x) = \frac{f(x)}{S(x)}$ where $f(x)$ is the density of unemployment spells (Lancaster, 1990). This says, for instance, that the increase in average unemployment duration in the ePBD group by 2.42 weeks is due to the fact that the survivor function in the ePBD group after August 1989 was higher than the corresponding survivor function in the ePBD group based on spells that started before August 1989. Moreover, the difference in these survivor functions integrates to 2.42 weeks. Thus, analyzing the effect of the policy change on survivor functions allows decomposing the total change in unemployment duration into contributions to this change as a function of duration.[10]

Figure 3 shows the Kaplan-Meier survivor functions for the four groups. The top left subfigure contrasts the survivor function after the policy change with the survivor before the policy change in the ePBD group. Clearly, after 15 weeks of elapsed unemployment duration, the survivor function after the policy change starts to diverge from the corresponding function before the policy change. The difference widens until about 40 weeks have elapsed. After this point the difference becomes smaller again and stays constant at a low level after 65 weeks of elapsed duration. Thus, extending the PBD appears to create a 'lens' that starts 15 weeks before benefit exhaustion in the old system and that ends about 15 weeks after benefit exhaustion takes place in the new system.

Figure 3 about here

The top right subfigure in Figure 3 reports the difference in the survivor functions in the eRR group. In contrast to the previous findings, we note an ever so slight increase in the survivor function that takes place almost from the start of the unemployment spell. The difference between the survivor functions becomes larger after 20 weeks of unemployment duration have elapsed, and again after 30 weeks have elapsed. The survivor function remains at a higher level than before the policy change even in the period when benefits have been exhausted, after week 30.

The bottom left subfigure in Figure 3 reports the survivor function analysis for the ePBD_RR group. This figure very clearly combines aspects of both policy changes. On one hand, we note a relatively strong increase in the survivor function right from the start of the unemployment spell. Again, there a 'lens' starts to appear after 15 weeks of unemployment duration which disappears only after 65 weeks of unemployment duration have elapsed.

The bottom right panel reports the survivor functions in the 'control' group. There is no difference at all in the survivor functions up to 20 weeks of unemployment duration. Thereafter we note a slight upward shift in the survivor function. Thus, in order to isolate the effects of the changes to the unemployment compensation system in August 1989, it is necessary to net out the change occurring over time from the raw effects on the survivor functions in the previous three subfigures.

[10] Note that elapsed unemployment duration is not time to benefit exhaustion. However, recall that in the old system, only two levels of the PBD prevailed, i.e. 20 weeks and 30 weeks. Thus, elapsed duration is very closely related to time to benefit exhaustion.

4.5 Exit Hazards

Figure 4 reports the Kaplan-Meier estimates of the unemployment exit hazard by period and group. The top, left subfigure refers to the *ePBD* group. The unemployment exit rate before the policy change (dashed line) is very low at the start of the unemployment spell, reaches a maximum of .1 per week after 20 weeks of unemployment have elapsed and declines gradually to a very low level. Interestingly, there is an important spike in the unemployment exit rate in week 30 – the week when regular unemployment benefits are exhausted for almost all individuals in this group. This replicates the important findings in Meyer (1990). There are two important differences between the unemployment exit rate before August 1989 and the corresponding rate after August 1989. First, the spike that was observed in week 30 ”moves” to weeks 39 and 52. Second, the unemployment exit rate is strongly depressed in the period from week 20 and ending in week 40. This is the period just before exhaustion in the old system and in between old and new exhaustion weeks.

Figure 4 about here

The exit rate in the *eRR* group is characterized by two spikes in the old system in week 20 and in week 30 (top, right subfigure). In the new system, the exit rate appears to be slightly depressed from the start of the unemployment spell. Thus, an important difference between changes to PBD and to RR emerges. Whereas the exit rate in the first part of the unemployment spell appears to be unaffected with changes to PBD, the exit rate is depressed from the start with changes to RR.

The combined effects of RR and PBD can potentially be studied in the bottom, left subfigure (*ePBD_RR* group). In the old system, the unemployment exit rate is rather low until 30 weeks of regular benefits have elapsed. In the new system, we observe a depressed hazard from the start of the spell. Moreover, whereas the unemployment exit rate shoots upward between week 30 and week 40 in the old system, the exit rate is strongly depressed in the corresponding period in the new system. Furthermore, there are two notable spikes centered after 39 weeks and 52 weeks in the new system.

The remaining subfigure shows the unemployment exit rate for the group that was not affected in August 1989. We note that even though there was no change to unemployment insurance parameters in this group, the exit rate after August 1989 appears to be lower from 10 weeks until 65 weeks of elapsed unemployment duration. There are at least two reasons for this reduction in the exit rate. First, real GDP growth was lower in 1991 than in 1990 (Table 1). Second, in June 1990 this group was affected by a slight increase in the benefit level. Both factors may have contributed to a lower unemployment exit hazard after August 1989 compared to the period before August 1989.

This descriptive analysis already provides important insights into the mechanism by which financial incentives in UI affect unemployment duration. However, a number of important aspects were not accommodated so far. First, job search theory models the unemployment exit hazard for homogeneous workers. We, however, have discussed unemployment exit rates that refer to very heterogeneous groups of job seekers. It has been show that failure to account for heterogeneity biases the duration dependence of the unemployment exit hazard and, potentially, the effects of financial incentives on unemployment. Second, the change to PBD is heterogeneous: PBD increases by 9 weeks for workers aged 40-49 years, and by 22 weeks for workers aged 50 years and older. These problems will be addressed in the context of an econometric model of the unemployment exit rate in the following section.

5 Results

5.1 Statistical model

To estimate how financial incentives affect the unemployment exit hazard, we apply a proportional hazard model.[11] The proportional hazard model posits the following specification for the exit rate $\theta(t_u|x) = \lambda(t_u)\exp(x\beta)$, where $\lambda(t_u)$ captures the baseline duration dependence of the hazard (in weeks), and x are the observed characteristics of the individuals.[12] The baseline duration dependence is of central interest in this paper because it refers to the exit rate for a homogeneous group of workers. We specify the duration dependence of the hazard as a piece-wise constant function of elapsed duration as follows

$$\lambda(t_u) = \exp(\sum_{l=0}^{14} \lambda_l I(4l < t_u \leq 4(l+1)) + \lambda_{15} I(t_u > 60)) \tag{1}$$

Thus, the hazard rate shifts every 4 weeks interval. Because there are very few transitions beyond week 60 the last time interval covers the entire remaining duration of the spell as of week 60 .

The treatment effect can be identified in a (log) difference-in-difference setting. Denote eligibility for the extension of PBD from 30 weeks to 39 weeks by $eP39 = I(ePBD = 1, age < 50)$, eligibility for an extension to 52 weeks is denoted by $eP52 = I(ePBD = 1, age \geq 50)$. Second, introduce the calendar time varying function $A89(t_c) = I(t_c \geq mdy(8, 1, 1989))$ where t_c measures calendar time in days since Jan 1, 1960, and $mdy(x, y, z)$ gives the number of days since Jan 1, 1960 of day y in month x and year z. The function $A89(t_c)$ records the moment a spell enters the period after the policy change has taken place. Thus, the interaction term $eP39 * A89(t_c)$ indicates that an individual satisfying all eligibility criteria for the extension to 39 weeks has entered the period when this policy change has been enacted. The duration dependence of the hazard rate is specified as follows[13]

$$\begin{aligned}
\lambda_l &= \beta_{0l} + \beta_{1l} eP39 + \beta_{2l} eP52 + \beta_{3l} eRR + \\
&+ \beta_{4l}(eP39 + eP52) * eRR + \beta_{5l} A89 + \\
&+ \delta_{1l} eP39 * A89 + \delta_{2l} eP52 * A89 + \delta_{3l} eRR * A89 + \\
&+ \delta_{4l} eP39 * eRR * A89 + \delta_{5l} eP52 * eRR * A89 \\
l &= 0..15
\end{aligned} \tag{2}$$

The set of β parameters captures ex ante differences between groups $(\beta_{1l}, ..., \beta_{4l})$, and changes to duration dependence occurring over time (β_{5l}). Note that we assume that there are no ex ante differences

[11] See Van den Berg (2001) for a recent survey of the properties of the mixed proportional hazard model and for applications of this model to duration data.

[12] These are age, marital status, female, education, log(previous monthly income), recall status, blue collar, seasonal industry, manufacturing industry, time spent non-employed, tenure, and quarter of inflow. Use of the exp() function guarantees that the hazard rate is non-negative in the entire domain of $x\beta$.

[13] For ease of exposition, we suppress dependence of $A89(t_c)$ on calendar time t_c and write $A89$.

between those individuals who are eligible for the change to RR and an extension of PBD from 30 to 39 weeks compared to individuals eligible for the change to RR and the change to PBD from 30 to 52 weeks. The set of δ parameters measure the change in the duration dependence of the hazard rate due to changes in financial incentives. There are five sets of δ parameters because the policy change entails 5 interventions (P39, P52, RR, and combinations). δ_{1l} and δ_{2l} capture the effect of extending PBD, δ_{3l} captures the effect of increasing the gross replacement rate. The parameters δ_{4l} and δ_{5l} test whether changes to both dimensions of unemployment insurance affect the unemployment exit rate in a way that would not be expected from two separate changes to one dimension only. Thus, these parameters address the issue whether increasing the liberality of the unemployment insurance system simultaneously along the benefit level and the benefit duration dimension generates disincentive effects beyond the effects that are expected from two uni-dimensional change.

Estimation of the above model follows standard procedure (Lancaster 1990). The conditional hazard estimates address two important issues. First, the model allows for the differences across treatments. Second, the hazard rate is identified conditional on important differences across individuals captured by x. However, unobserved heterogeneity may potentially be important in estimating the effects of financial incentives on the unemployment exit rate. We discuss unobserved heterogeneity below.

5.2 Main Results

Figure 5 presents the main results concerning the effect of financial incentives on the unemployment exit hazard. The figure reports the effects of changes in the UI parameters on the log exit rate (see Table A1 for all parameter estimates, standard errors, and z-values). Thus, a reduction in the exit rate is represented by a negative number, an increase in the exit rate corresponds to a positive number. The numbers on the x-axis give the midpoint of the respective four week duration interval.

Figure 5 about here

The top left subfigure reports the effects of extending the PBD from 30 to 39 weeks. Increasing potential benefit duration tends to leave unaffected the unemployment exit rate until 16 weeks of unemployment duration have elapsed. In week 30 (the old exhaustion period), the hazard rate in the new system is much lower than the hazard rate in the old system. Thereafter the hazard rate in the new system increases strongly compared to the corresponding rate in the old system. In weeks 42-50 – when benefits have expired also in the new system – the unemployment exit hazard is much higher than before the policy change. This can be taken as evidence for the entitlement effect discussed in Figure 1. From week 54 onwards, there is no effect of extending potential benefit duration on the unemployment exit rate. Thus, the entitlement effect is a transitory phenomenon.

In contrast, extending benefits from 30 to 52 weeks reduces the exit hazard already early on in the unemployment spell (top, right subfigure). With the exception of week 1, the unemployment exit rate is lower in the new system compared with the old system. The largest reduction occurs, again, in week 30 – the period when benefits expired in the old system. In the period 30 - 54 weeks we observe a rapid increase of the unemployment exit rate. The unemployment exit rate is much higher in the new system in week 54 – the period when benefits expire in the new system. Again, the unemployment exit rate is higher compared to the old system not only in the exhaustion week (54) but also in the week that follows (58) – in line with the entitlement effect. In week 62 (which covers the entire period from week 60 to the end of the spell) there is no effect of extending the potential benefit duration.

Increasing the benefit replacement rate tends to depress the unemployment exit rate much less strongly than changing the potential benefit duration (middle subfigure). Individuals with access to more generous unemployment benefits tend to leave unemployment less rapidly in the covered period (weeks 2 to 30, exceptions are weeks 22 and 26). After benefits have expired for all individuals, there is no effect on the unemployment exit rate (with the exception of weeks 50 and 62).

Does it matter whether individuals are affected by a combined change instead of two separate changes to financial incentives? The bottom left subfigure answers this question by looking at the *incremental* effect of RR for the group that experienced a PBD increase of 9 weeks (i.e. in addition to the PBD-effect shown in the top-left subfigure). Results suggest that the hazard rate is slightly (yet insignificantly) lower in the first four week interval. Thereafter, all coefficients that reflect the incremental effect of a combined intervention turn out to be insignificant (with the exception of the coefficient for week 18). The bottom right subfigure shows the incremental effect of RR for the group which experienced a 22 week in increase in PBD (i.e. in addition to the PBD-effect shown in the top-right subfigure). Results indicate that combining a 22-week benefit extension with an increase in the replacement rate decreases the exit rate in the early period of the spell (weeks 2 and 6). Thereafter, the effects are insignificant (except for weeks 18 and 26). Thus, the overall impression from the hazard rate estimates is that there are no additional disincentive effects arising from a two-dimensional intervention compared to two separate changes to just one dimension of UI benefits. However, note that the small downward shifts in the hazard rate in the early period of the spell may imply strong effects on the population survivor function and on expected duration – a point we discuss below in detail.

Summarizing our hazard rate results, we find that the effect of increasing potential benefit duration by 9 or by 22 weeks are in line with predictions from job search theory. The unemployment exit hazard is affected in a non-monotonic way by increases in potential benefit duration. In the first part of the unemployment spell, there is a weak reduction in the exit hazard. The strongest negative effects arise around the period when unemployment benefits used to be exhausted in the old system. The intermittent period – from the old exhaustion week until the new exhaustion week – is characterized by a rapid increase of the hazard. The exit hazard is significantly higher than the counterfactual without benefit extension for some weeks before but also for additional weeks after benefits have been exhausted in the new system. In contrast, with few exceptions, increasing the benefit replacement rate tends to reduce the unemployment exit hazard throughout the unemployment spell.

So far we have discussed hazard rate estimates. These are important because job search theory offers sharp predictions regarding the impact of unemployment insurance parameters on the exit hazard. However, labor market policy is more interested in the implied effects on unemployment durations or – equivalently – effects on survivor functions. Figure 6 reports the difference in the factual survivor function with treatment to the counterfactual survivor function without treatment. Specifically, in the first step we estimate the survivor function with treatment for each individual as implied by the hazard rate estimates $\widehat{S}_{1i}(t_u|x_i) = exp(-\int_0^t \widehat{\theta}_1(z|x_i)dz)$ with $t_u = 0, 4, .., 56, 60, 100$. The corresponding survivor function without treatment is $\widehat{S}_{0i}(t_u|x_i) = exp(-\int_0^t \widehat{\theta}_0(z|x_i)dz)$. The counterfactual hazard rate without treatment is obtained by imposing all treatment effects δ to be zero. This gives the change to the survivor function in the treated group at the individual level. In the second step, we average this change with respect to the distribution of individual characteristics x_i in the population receiving the treatment. This gives the change in the population survivor function reported in Figure 6.

Figure 6 about here

Extending potential benefit duration by 9 weeks entails a positive contribution to the change in expected unemployment duration in the time period between 20 weeks and 50 weeks (top, left subfigure). Both, the periods before 20 weeks of elapsed duration, and the period after 50 weeks of duration have elapsed do not contribute to increasing expected duration. The maximum contribution arises in week 35 – exactly in between the old benefit exhaustion week (30) and the new benefit exhaustion week (40).

Results are similar in qualitative respects but different in quantitative respects for an increase of PBD by 22 weeks (top, right subfigure). Again, the unemployment spell can be divided in three periods. From week 0 to week 12, the contribution to expected unemployment duration is slightly negative, from week 12 to week 60, the contribution is strongly positive, and from week 60 onwards, the contribution to expected unemployment duration is positive but small. Again, the maximum contribution occurs at week 40 which is roughly in between the old exhaustion week (30) and the new exhaustion week (52). However, the strongest difference lies in the magnitude of the contribution. Whereas extending duration by 9 weeks generates a maximum contribution on the order of 2.5 percentage points, the corresponding maximum contribution due to a 22 week increase exceeds 5 percentage points.

In contrast to benefit duration extensions, an increase in the benefit replacement rate generates a positive contribution to expected unemployment duration right from the start of the unemployment spell (middle subfigure). Most of the prolonging contribution occurs in the covered period of the unemployment spell (weeks 0 to 30). There is also a positive but much less strong contribution to expected unemployment duration in the period that is no longer covered by regular unemployment benefits (week 30 onwards).

The bottom two subfigures report results for interventions that increase PBD as well as RR. Two interesting results emerge in comparison with the solitary change to potential benefit duration (top two subfigures). First, the contribution to expected unemployment duration is positive from the start of the unemployment spell. This is clearly the impact of the replacement rate on top of the potential benefit duration effect. Second, the maximum contribution to expected unemployment duration increases strongly from 2.5 percentage points to more than 4 percentage points (PBD 30-39 weeks), and from 6 percentage points to almost 14 percentage points (PBD 30-52 weeks).

Table 5 about here

To indicate the effects of the changes in financial incentives Table 5 shows the average unemployment duration in the first 104 weeks of the unemployment spell.[14] The first column in Table 5 gives the factual

[14]We report expected unemployment duration in the first 104 weeks because, in order to estimate total expected unemployment duration we need to know the survivor function until infinity. Since inference on the survivor function tends to become ever more unreliable as we extend the duration of the unemployment spell, we arbitrarily limit our

expected unemployment duration with treatment for the five treated groups and the group that is not affected by an intervention in August 1989.[15] The second column in Table 5 gives the counterfactual expected unemployment duration without treatment for the five treated groups. The third column gives the effect of the interventions on expected unemployment duration.[16]

Extending the potential benefit duration by 9 weeks tends to increase expected unemployment duration by .45 weeks or by .05 weeks per additional week of PBD (second row). Increasing PBD by 22 weeks generates about 2.3 additional weeks of unemployment (third row). Thus, the second PBD extension produces twice as many weeks of unemployment per additional week of PBD (.10). As discussed in Section 2, this result is in line with previous findings regarding the effect of PBD on unemployment duration and similar to for example Lalive and Zweimueller (2004a) who find a disincentive effect of .05 weeks per additional week of PBD. In contrast, increasing RR by 6 percentage points tends to prolong unemployment duration by .38 weeks (fourth row). This implies an elasticity of unemployment duration with respect to the RR of about 0.15, which is small compared to the results of other studies discussed in Section 2.

Individuals who are targeted with a combined 9 week increase to PBD and a 6 percentage point increase in RR are unemployed for .86 weeks longer than in the counterfactual situation without this combined intervention (fifth row). Interestingly, this change to unemployment duration equals almost exactly to the prediction obtained from two separate changes, i.e. .38+.45=.83. Individuals who get both a 22 week increase in PBD and a 6 percentage point increase in RR are unemployed much longer than in the counterfactual situation of no intervention (5.7 weeks, sixth row). Note that the 'adding up result' no longer obtains for this group of individuals, i.e. 2.27+.38=2.65 weeks instead of 5.7 weeks. This result manifests itself already in Figure 6. Whereas the survivor curve difference in the case 'PBD 30-39 weeks and RR Increase' is approximately the sum of 'PBD 30-39 weeks' and 'RR Increase', this is not true for the case 'PBD 30-52 weeks and RR Increase'. Thus, the excess effect of combined interventions on unemployment duration appears to originate predominantly from a generous increase in PBD with a generous increase in RR.

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discussion to the first 104 weeks which are quite well identified in our large dataset. Expected unemployment duration is obtained by integrating the population survivor function with respect to time up to 104 weeks.

[15]Recall that average unemployment duration in the control group is 16.5 weeks in the period after 1989 (Table 4). The corresponding number implied by the econometric model is 16.9 weeks (top, left cell). This is strong evidence that the econometric model fits the data well. The resulting difference is due to the fact that average unemployment duration treats spells which are right-censored in the first 104 weeks as completed whereas the econometric model accounts for right-censoring.

[16]Note that the simulation results in Table 5 give the 'effect of treatment on the treated'. A concern with these simulations is that the treated groups differ very strongly from the average unemployed individual. We can discuss this concern by using the effects identified in the treated group to forecast potential effects of each treatment on all individuals. This results in *slightly weaker* effects than those reported in Table 6 (results are available upon request from the authors). This is due to the fact that the large group of 'non-treated' individuals is characterized by rapid exit from unemployment. Note, however, that using the effects identified in the treated group to forecast effects for the entire population is valid if and only if the job search environment is similar across groups.

5.3 Sensitivity Analysis

Table 6 discusses unobserved heterogeneity, seasonal workers, and exits to jobs. Because the model allows for effects on the entire duration dependence of the unemployment exit rate, comparing hazard rate coefficient estimates is not informative. Therefore, we base our discussion of the sensitivity of the main result on a time average of the change in the population survivor function reported in Figure 6. Specifically, we calculate the average with respect to time of the change in the population survivor function after 0, 4, ..., 60 weeks of unemployment duration.[17] Table 6 reports the time and population average difference of the survivor function with treatment and the survivor function without treatment.

Table 6 about here

The results suggest that the survivor function is .63 percentage points higher with additional 9 weeks of PBD, it is higher by 3.17 percentage points with an additional 22 weeks of PBD, it is .56 percentage points higher with more benefits, and 1.28 percentage points higher in the combined intervention plus 9 weeks PBD plus 6 percentage points RR, and it increases strongest, by 8.17 percentage points, in the combined intervention that adds 22 weeks to PBD and 6 percentage points to RR.

The second column in Table 6 discusses the sensitivity of our results with respect to unobserved heterogeneity.[18] We deal with unobserved heterogeneity by allowing for a discrete distribution of unobserved heterogeneity with two masspoints (Heckman and Singer 1984). This approach can be thought of as an approximation to the true distribution of unobservables across individuals. The estimates suggest that unobserved heterogeneity is relevant as indicated by the strong change in the log Likelihood. Nevertheless, the implied changes of the population survivor function are quite similar to those displayed in our main results. For instance, whereas the main results suggest that the average change to the survivor function is on the order of .63 percentage points, the results that allow for unobserved heterogeneity indicate an average change of .62 percentage points. The results are not as similar for the other four interventions. However, in all cases results that allow for unobserved heterogeneity imply a stronger effect of changes in financial incentives on the population survivor function. Thus, our main results can be interpreted as giving the *lower bound* of the true effects of financial incentives on unemployment duration.

In Austria, the construction sector and the tourism sector – two sectors characterized by strongly seasonal employment – contribute disproportionately to the inflow into unemployment. Whereas almost 50 % of the unemployment inflow belongs to these two sectors, the corresponding proportion in employment is on the order of only 15 %. This suggests performing our main analysis in a sub-sample that excludes seasonal workers in order to see their impact on estimated results. The third column in Table 6 indicates that the presence of seasonal workers has a more important effect on results than unobserved heterogeneity. Interestingly, changes to potential benefit duration seem to have stronger disincentive effects on non-seasonal workers than changes to the benefit replacement rate. This can be seen in two ways. First, when comparing solitary interventions this conclusion arises directly (PBD

[17]We average with respect to the value of the survivor function in the first 60 weeks because in this period the difference in the survivor function is largest. Thus, if there are differences in results, we expect to see these differences more strongly in a time average containing the first 60 weeks compared to a time average containing the entire real axis.

[18]Coefficient estimates for all sensitivity analyzes are available from the authors upon request.

30-39 weeks and PBD 30-52 weeks effects almost double compared to main results, RR has positive effect in the main results but zero effect in non-seasonal results). Second, the additional change to the population survivor function generated by increasing RR in addition to the PBD intervention is much stronger in our main results than in the non-seasonal worker sample (compare first row with fourth row, and second row with fifth row). This suggests that seasonal workers are less sensitive to changes in potential benefit duration but more sensitive to changes in the level of benefits than non-seasonal workers. A potential explanation for this finding builds on our findings above. We have shown above that changes to potential benefit duration only weakly depress the exit hazard in the beginning whereas changes to the replacement rate immediately reduce the exit rate. Thus, lower sensitivity to PBD and higher sensitivity to RR for seasonal workers is in line with a priori reasoning since unemployment spells are much shorter for seasonal workers. We nevertheless believe that it is important to work with our main results because over-representation of seasonal workers in unemployment holds for many countries not only for Austria.

Job search theory derives predictions in a world where individuals choose between accepting a job or remaining unemployed for an additional period (Mortensen, 1977). In Austrian reality, however, job seekers have additional options that lead out of unemployment, such as the illness insurance system, training, leaving registered unemployment. These options are taken up by roughly 14 % of job seekers in our sample. Thus, it is important to investigate the extent to which our main results are driven by the process that refers to non-job exits. We do this by estimating the transition rate from unemployment to regular jobs. We then report the change to the (purely hypothetical) population survivor function that would prevail if non-job exits did not exist, i.e. disregarding entirely the non-job exits. Again, we report the (time) average change in this job survivor function. Results in Column 4 of Table 6 show that non-job exits are not driving our main result (with the exception of the 'PBD 30-39 weeks plus RR' intervention).

5.4 Disincentive Effects

This final sub-section compares the disincentive effects of changes in PBD and changes in RR. Since such a comparison needs a common denominator we study the effects in terms of average benefit payments. In this comparison our line of reasoning is the following. Suppose a policy maker proposes to increase the benefit replacement rate. This will directly increase expected benefit payments in the time period covered by regular unemployment insurance even if individuals do not change their job search behavior. We denote the expected benefit payments in the new system that do not reflect behavioral changes the ex ante expected benefit payment. As we have shown so far, actual expenditures of unemployment insurance will be higher than expected since individuals have lower exit rates due to higher benefit payments. We denote the expected benefit payment that reflects both, the direct financial effect and the indirect behavioral effect, the ex post benefit payment. An intuitively appealing measure relates the difference between ex post and ex ante payments to the difference between ex ante payments and payments before the policy change. This measure gives the behavioral effect of changes to unemployment insurance in relation to the pure financing effects of changes to unemployment insurance.

Specifically, we estimate expected cost at the individual level in the old system as the product of unemployment benefit b_{0i} times expected duration of unemployment in the covered period $\int_0^{E_{0i}} S_{0i}(t)dt$, where $S_{0i}(t) \equiv S_0(t|x_i$ is the counterfactual survivor function without the policy change.[19] The ex ante expected benefit payment is $b_{1i} \int_0^{E_{1i}} S_{0i}(t)dt$. Note first that ex ante benefit payments do not reflect behavioral changes because we work with the counterfactual survivor function without treatment $S_{0i}(t)$ to estimate expected duration, and second that $E_{1i} > E_{0i}$ and $b_{1i} = b_{0i}$ in the *ePBD* group, and $E_{1i} = E_{0i}$ and $b_{1i} > b_{0i}$ in the *eRR* group. The ex post expected benefit payment is $b_{1i} \int_0^{E_{1i}} S_{1i}(t)dt$. Thus, ex post benefit payments reflect both the financial effects and the behavioral effects of changes to unemployment insurance parameters. The disincentive measure we report in Table 7 is the difference between ex post and ex ante payments relative to the difference between ex ante payments and payments in the old system (averaged in the sub-population receiving treatment). Formally, this is

$$D = \frac{E_{x_i}\left[b_{1i}\int_0^{E_{1i}} S_{1i}(t)dt - b_{1i}\int_0^{E_{1i}} S_{0i}(t)dt\right]}{E_{x_i}\left[b_{1i}\int_0^{E_{1i}} S_{0i}(t)dt - b_{0i}\int_0^{E_{0i}} S_{0i}(t)dt\right]} = \frac{E_{x_i}\left[b_{1i}\int_0^{E_{1i}} (S_{1i} - S_{0i})(t)dt\right]}{E_{x_i}\left[b_{1i}\int_0^{E_{1i}} S_{0i}(t)dt - b_{0i}\int_0^{E_{0i}} S_{0i}(t)dt\right]} \quad (3)$$

This measure gives the additional cost to unemployment insurance solely due to behavioral changes $((S_{1i} - S_{0i})(t))$ per unit of increase in the unemployment insurance without behavioral changes.

Table 7 gives the increase in benefit payments due to changes in UI parameters in percent of expected benefit payments in the old system (Column A); the increase in benefit payments due to behavior (Column B), and the disincentive effect (Column C).

Table 7

Increasing the covered period of the unemployment spell by 9 weeks would have generated an average increase in cost of about 9.5 percent without behavioral effects. However, because job seekers adjust their behavior, there is a second, behavioral effect on total costs on the order of 2.1 percent of the original payments. Thus, the disincentive effect due to a 33 percent increase in PBD is roughly 22 %.

The direct financial consequence of extending PBD by 22 weeks is about 17 percent of the original payments. This is slightly less than the direct effect of the smaller benefit extension because the contribution to expected benefit payments decreases with elapsed duration. Again, there is a second effect on expected costs due to changes in behavior on the order of 14 percent of original payments. This generates a disincentive effect of 82 %. Clearly, the disincentive effect of a generous extension of potential benefit duration is much larger than the disincentive effect due to a moderate extension of benefit duration. This result arises, primarily, due to a disproportionate change in the behavioral effect – this effect is 7 times larger for the 22 week extension compared to the 9 week extension.

In contrast, increasing the benefit replacement rate does not entail strong disincentive effects. Additional payments due to behavioral changes amount to merely 11 % of the increase in payments due to UI parameters (Row 3, Column C).

[19] Note that $b = Bw$ where B is the gross replacement rate and w is gross weekly income. Moreover, this ex ante expected cost measure does not account for unemployment assistance payments which are available after unemployment benefits have run out. The data do not contain information on unemployment assistance. Also, results are qualitatively not sensitive to using imputed unemployment assistance payments.

Rows 4 and 5 in Table 7 discuss the disincentive effects from combined interventions. Again, a moderate combined intervention generates much weaker disincentive effects than a combined strong benefit extension (18 % vs. 96 %). Second, there are no excess effects due to a combination of higher benefit replacement rates with a moderate 9 week extension. This result holds because the disincentive effect of the combined intervention, 18 %, is only slightly higher than the disincentive effect generated by the summing the RR with the PBD extension of 16 % (=(2.1+1.6)/(9.5+13.9)*100).[20] In contrast, combining a strong extension of benefits with an increase in benefit payments leads to excess disincentive effects. The disincentive effect obtained by adding the two separate changes is 50 % (=(13.9+1.6)/(16.8+13.9)*100). The actual disincentive effect is almost twice as strong.

Summarizing these simulations, we note that changes to potential benefit duration appear to generate stronger disincentive effects than comparable changes to the benefit replacement rate. Second, combining a strong PBD extension with an increase in the replacement rate generates strong excess disincentive effects.

6 Conclusions

This paper addresses the issue of how financial incentives embedded in the unemployment insurance system affect the duration of unemployment. This issue is important for a number of reasons. On the one hand, the years since the turn of the century have witnessed important reforms to unemployment insurance in many (particularly European) countries. On the other hand, studies of how *simultaneous changes* of UI parameters affect the unemployment exit rate are lacking. Hence it is difficult to compare the relative effects of changes in the policy instruments.

This paper relies on a change to unemployment insurance in the late 1980s in Austria. This reform lead both to extensions of the potential duration (PBD) of regular unemployment benefits for a first group of individuals; to an increase in the gross replacement rate (RR) for a second group of individuals; to both extended PBD and higher RR for a third group of individuals; and to no changes for a final group of individuals. This means that it is not only possible to study the relative magnitudes of two key parameters determining the generosity of unemployment compensation but also to analyze whether there are excess effects from combined changes in PBD and RR.

Our results indicate first that extending the potential duration of benefits and increasing the benefit replacement rate both tend to reduce unemployment exits in the period that is covered by unemployment benefits, i.e. before benefit exhaustion. Second, we find that the effects of an extension of the potential duration of unemployment benefits are more detrimental to unemployment duration than the effect of an increase in the benefit replacement rate. Finally, we compare the effect of a combined increase in PBD and RR to an isolated increase in PBD. It turns out that whereas there is an excess effect of a combined intervention on unemployment duration for generous PBD extensions, there is no corresponding excess

[20]Note that this "expected disincentive" effect is valid if and only if the effects identified in the groups affected by only one policy change also hold for the group affected by two policy changes. This condition may be satisfied because the group with two changes is very similar to the group affected by a change in the RR with respect to previous earnings, and the combined intervention group is similar to the group affected by a PBD extension with respect to the previous work history.

effect for moderate PBD extensions.

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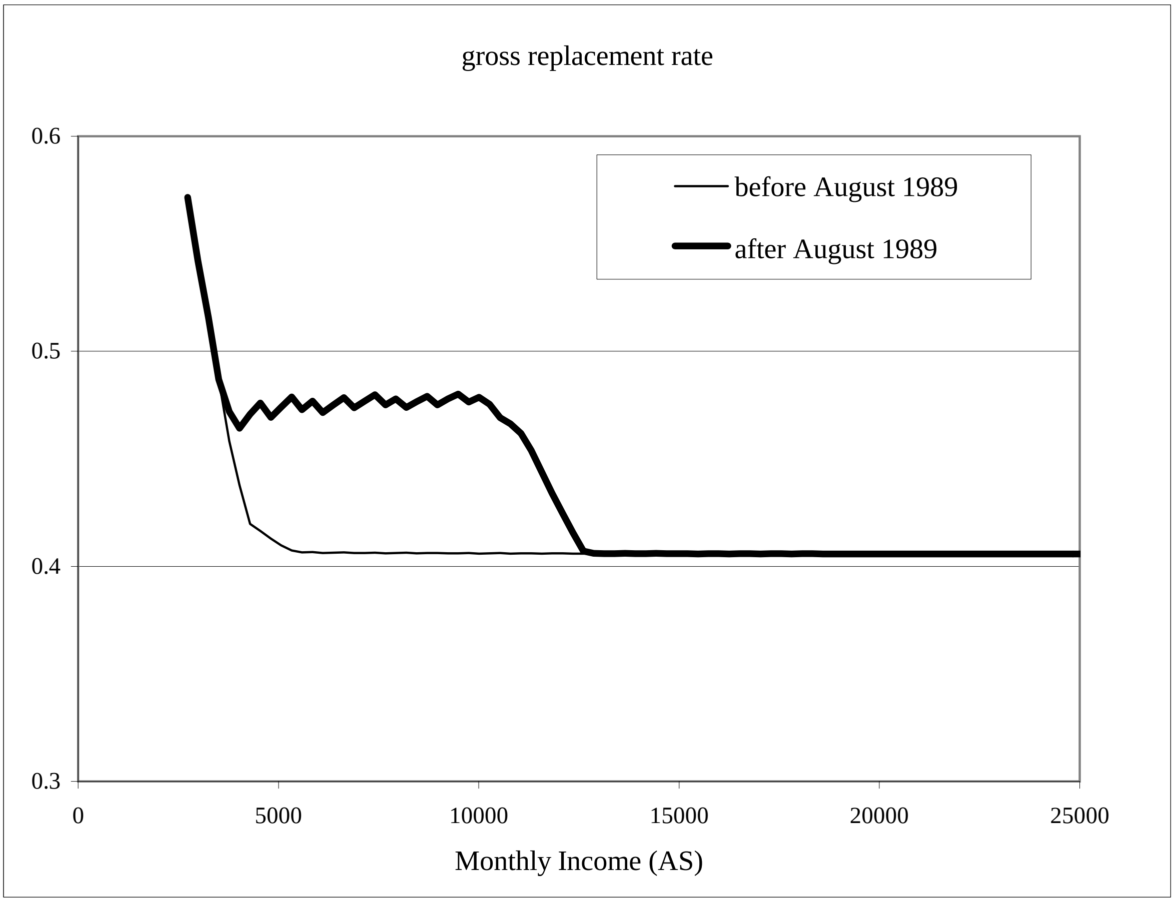
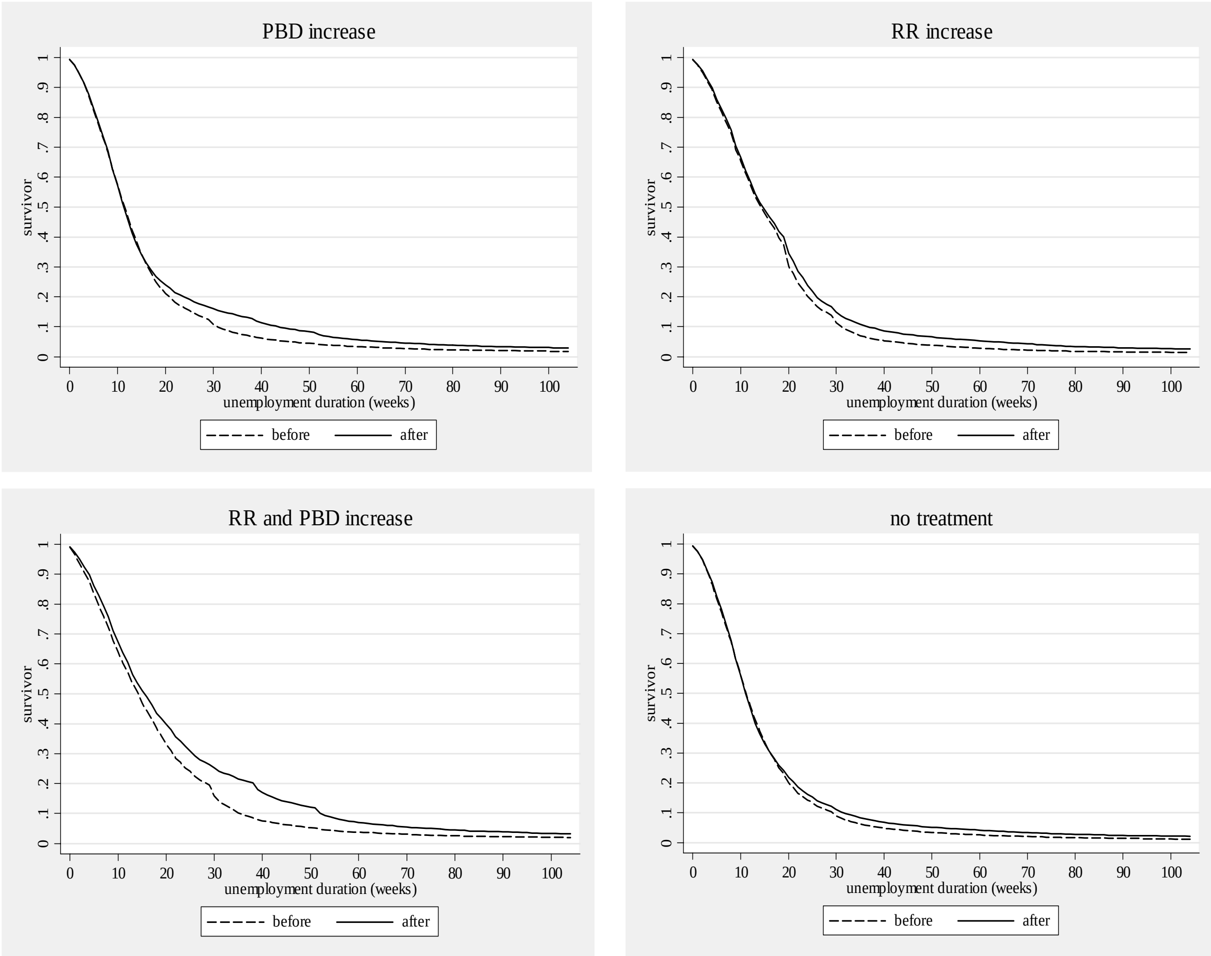
Figure 2:
The Change to the Benefit Replacement Rate in August 1989



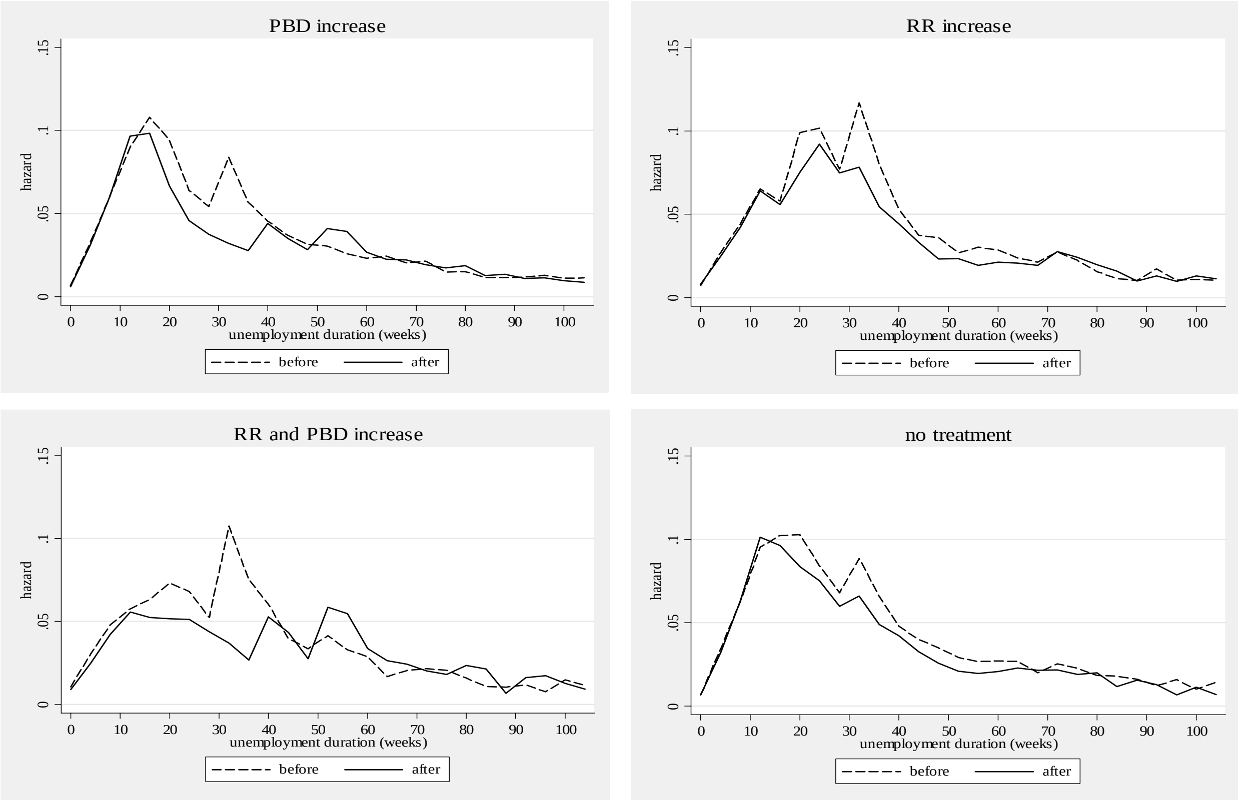
Source: Austrian federal laws (Bundesgesetzblätter) no. 594/1983, 364/1989.

Figure 3:
Kaplan-Meier Survivor Functions



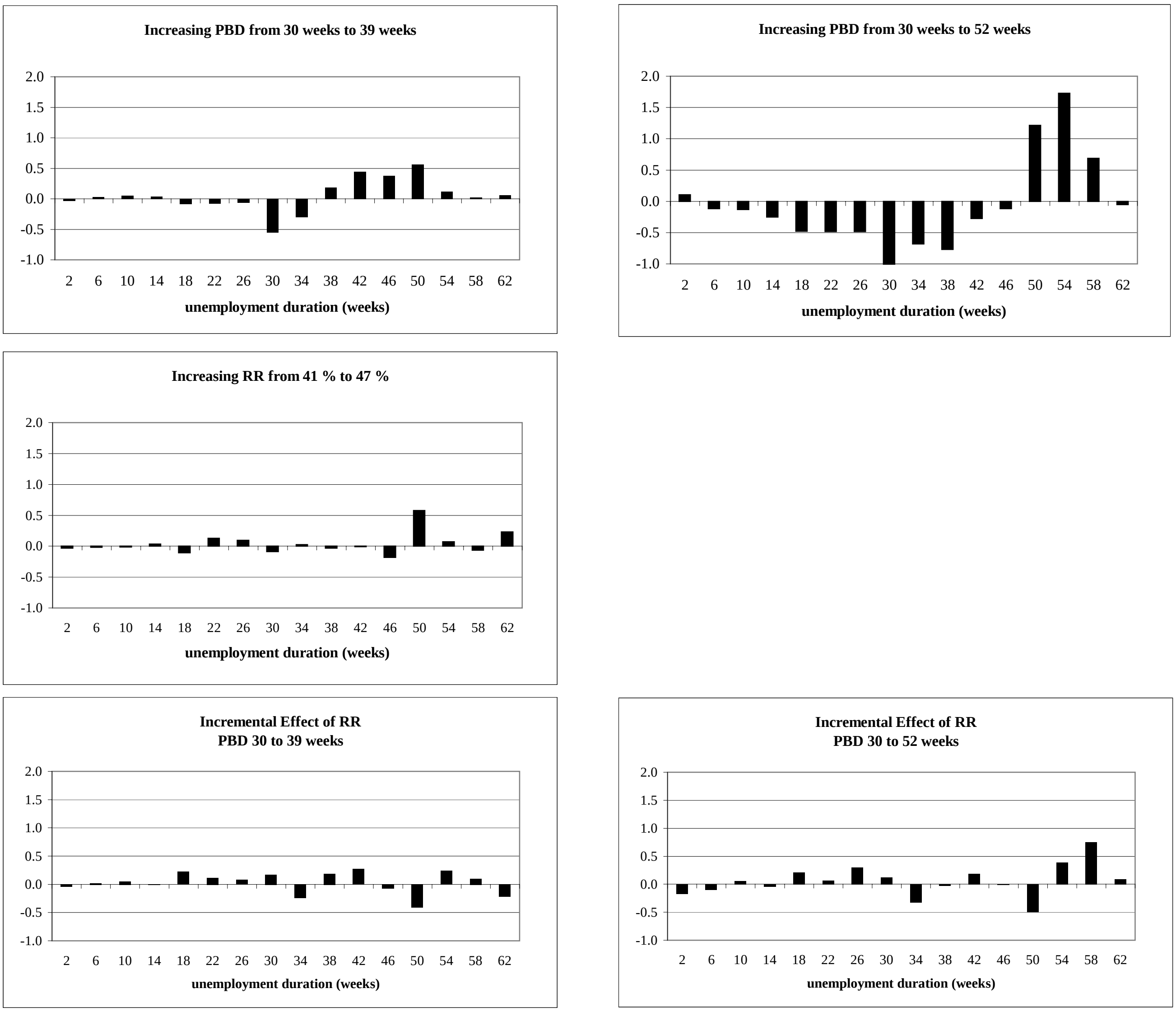
Notes: before = spell starts before August 1989, after=spell starts after August 1989
Source: Own calculations, based on Austrian Social Security Data.

Figure 4:
Kaplan-Meier Unemployment Exit Rate



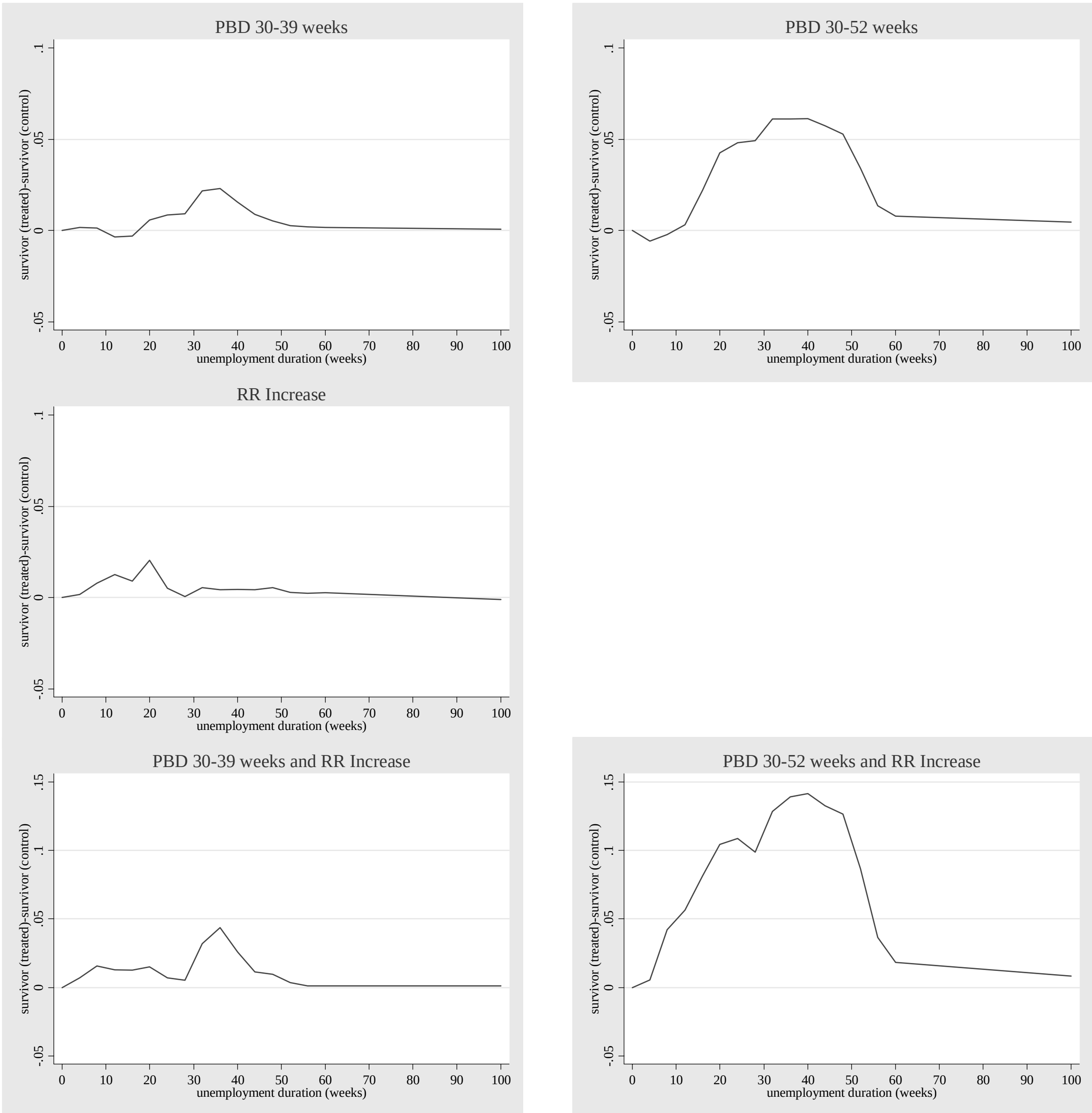
Notes: before = spell starts before August 1989, after=spell starts after August 1989
Source: Own calculations, based on Austrian Social Security Data.

Figure 5:
Effects on log Unemployment Exit Rate (Based on Table A1)



Notes: x-axis gives the midpoint of the duration interval.

Figure 6:
Simulations: Difference between Survivor function with treatment and Survivor function without treatment (control)



Notes: x-axis gives the end of the duration interval. Difference refers to the end of the duration interval.
Source: Own calculations, based on Austrian Social Security Data.

Table 1:
The Austrian labor market 1987-1991

	Real GDP Growth	Employment Growth	Unemployment Rate
1987	1.7	0.6	5.6
1988	3.2	0.7	5.3
1989	4.2	1.4	5
1990	4.7	2.8	5.4
1991	3.3	2.8	5.8

Source: Statistics Austria.

Table 2:
Eligibility (e) for Change to the Replacement Rate (RR) and for Change to Potential Benefit Duration (PBD)

		Age			
		younger than 40 years		40 years or older	
		worked		worked	
		little	much	little	much
Monthly income	<= 12,610 AS	eRR	eRR	eRR	ePBD_RR
	> 12,610 AS	Control	Control	Control	ePBD

Notes: Worked "little" refers to less than 6 out of previous 10 years and less than 9 out of previous 15 years work experience. Worked "much" refers to worked more than 6 out of previous 10 and worked more than 9 out of previous 15 years.

Table 3:
The changes to unemployment insurance in August 1989

		before August 1989	after August 1989	change (After-Before)	Diff-in-Diff (change compared to 'Control')
ePBD group					
	PBD (weeks)	29.5	42.5	13.0	13.5
	RR (%)	40.0	40.9	0.9	-0.3
	N	48294	51110		
eRR group					
	PBD (weeks)	25.1	24.6	-0.5	0.0
	RR (%)	41.4	47.3	5.9	4.6
	N	17160	15310		
ePBD_RR group					
	PBD (weeks)	29.0	42.6	13.6	14.1
	RR (%)	41.3	47.0	5.7	4.4
	N	11992	9182		
Control group					
	PBD (weeks)	27.4	26.9	-0.5	--
	RR (%)	40.2	41.5	1.3	--
	N	33815	38958		
Total					
	PBD (weeks)	28.1	34.8	6.7	--
	RR (%)	40.4	42.5	2.0	--
	N	111261	114560		

Notes: PBD=potential benefit duration. RR=benefit replacement rate. ePBD=eligible for increase in potential benefit duration; eRR=eligible for increase in benefit replacement rate. ePBD_RR=eligible for both.

Source: Own calculations, based on Austrian Social Security Data.

Table 4:

Average Unemployment Duration in First 104 Weeks
(measured in weeks)

	before August 1989	after August 1989	change (After-Before)	Diff-in-Diff (change compared to 'Control')
ePBD group	16.25	18.67	2.42	1.13
	(0.08)	(0.09)	(0.12)	(0.18)
	48294	51110		
eRR group	17.79	20.03	2.24	0.96
	(0.12)	(0.16)	(0.20)	(0.24)
	17160	15310		
ePBD_RR group	19.01	23.55	4.53	3.25
	(0.17)	(0.24)	(0.29)	(0.32)
	11992	9182		
Control group	15.24	16.52	1.29	--
	(0.08)	(0.09)	(0.13)	
	33815	38958		

Notes: Standard errors in parentheses.
Source: Own calculations, based on Austrian Social Security Data.

Table 5:
Simulated Effects on Expected Duration in First 104 Weeks

	Treated	Control	Effect
No treatment	16.91	16.91	0.00
Change to One Parameter			
PBD 30-39 weeks	17.53	17.08	0.45
PBD 30-52 weeks	20.62	18.35	2.27
RR increase	20.97	20.60	0.38
Change to Two Parameters			
PBD 30-39 and RR increase	21.95	21.09	0.86
PBD 30-52 and RR increase	29.43	23.70	5.72

Notes: Based on population receiving the treatment in the period after the policy change.
Source: Own calculations, based on Austrian Social Security Data.

Table 6:

Survivor Curve with Treatment - Survivor Curve without Treatment in First 60 Weeks
(Average; Percentage Points)

	Main Results	Unobserved Heterogeneity	Excluding Seasonal Workers	Regular Jobs
PBD 30-39 weeks	0.63	0.62	1.24	0.68
PBD 30-52 weeks	3.17	3.51	5.18	3.29
RR Increase	0.56	0.73	-0.08	0.43
PBD 30-39 weeks and RR Increase	1.28	1.84	1.75	0.83
PBD 30-52 weeks and RR Increase	8.17	9.48	8.55	8.30
-log Likelihood	792903	789558	464322	700449
Number of Observations	225821	225821	123756	225821

Notes: Based on population receiving the treatment in the period after the policy change.
Source: Own calculations, based on Austrian Social Security Data.

Table 7:
Simulated Effects on Average Benefit Payments
(In Percent of Payments in Old System)

	Increase In Cost Due To		
	A. UI Parameters	B. Behavior of Job Seekers	C. Disincentive Effect (=B/A)
Change to One Parameter			
PBD 30-39 weeks	9.5	2.1	22.0
PBD 30-52 weeks	16.8	13.9	82.4
RR increase	13.9	1.6	11.2
Change to Two Parameters			
PBD 30-39 and RR increase	24.0	4.5	18.6
PBD 30-52 and RR increase	34.7	33.2	95.8

Notes: Based on population receiving the treatment in the period after the policy change.
Source: Own calculations, based on Austrian Social Security Data.

Table A1:
Coefficient Estimates for Main Results

	Coeff.	Std.Err.	z-Value
Age (years)	-0.014	0.001	-23.719
Family situation (other)			
single	0.156	0.016	9.564
married	0.014	0.017	0.807
divorced	-0.107	0.018	-6.048
Female	-0.029	0.022	-1.284
female * married	-0.084	0.023	-3.639
female * single	0.136	0.025	5.551
female * divorced	0.055	0.025	2.201
Education (compulsory)			
apprenticeship	-0.053	0.005	-11.605
upper secondary	-0.157	0.011	-14.740
tertiary	-0.243	0.012	-20.205
Job promised	0.355	0.005	76.984
Previous job characteristics			
Blue collar worker	0.395	0.006	64.709
log wage rate	0.116	0.008	15.168
tenure (years, since 1972)	-0.006	0.000	-12.031
time not employed / total (previous 10 years)	-0.101	0.012	-8.755
Industry (other)			
seasonal	0.352	0.005	70.996
manufacturing	-0.094	0.006	-15.496
Inflow year (1987)			
1988	0.015	0.008	1.853
1989	0.030	0.011	2.810
1990	-0.007	0.014	-0.506
1991	-0.061	0.016	-3.732
Inflow quarter (I)			
II	0.014	0.006	2.552
III	-0.212	0.007	-29.981
IV	-0.233	0.007	-35.064
Duration dependence (weeks)			
Constant	-4.185	0.061	-68.794
4-7	0.692	0.018	38.784
8-11	1.207	0.017	69.278
12-15	1.406	0.019	74.514
16-19	1.491	0.022	69.172
20-23	1.453	0.026	55.947
24-27	1.269	0.033	37.884
28-31	1.503	0.036	41.871
32-35	1.233	0.050	24.673
36-39	0.856	0.070	12.175
40-43	0.790	0.083	9.480
44-47	0.517	0.108	4.798
48-51	0.423	0.125	3.396
52-55	0.434	0.135	3.218
56-59	0.280	0.164	1.702
60-	-0.380	0.047	-8.132
Duration dependence * Eligible for RR Increase			
0-3	-0.175	0.033	-5.305
4-7	-0.261	0.032	-8.180
8-11	-0.474	0.035	-13.635
12-15	-0.013	0.036	-0.373

16-19	0.155	0.040	3.842
20-23	0.163	0.051	3.200
24-27	0.317	0.053	5.929
28-31	0.156	0.077	2.013
32-35	0.135	0.110	1.232
36-39	-0.062	0.138	-0.451
40-43	0.142	0.167	0.851
44-47	-0.411	0.234	-1.756
48-51	-0.032	0.222	-0.142
52-55	0.114	0.254	0.449
56-59	-0.251	0.077	-3.271
60-			
Duration dependence * Eligible for PBD Increase 30-39			
0-3	0.088	0.018	4.853
4-7	-0.030	0.024	-1.244
8-11	-0.060	0.024	-2.522
12-15	0.030	0.025	1.166
16-19	-0.042	0.029	-1.427
20-23	-0.323	0.037	-8.776
24-27	-0.245	0.046	-5.305
28-31	0.075	0.046	1.636
32-35	-0.009	0.065	-0.145
36-39	0.168	0.089	1.895
40-43	-0.032	0.110	-0.290
44-47	0.052	0.137	0.378
48-51	-0.193	0.169	-1.137
52-55	0.110	0.171	0.642
56-59	0.092	0.207	0.442
60-	-0.142	0.063	-2.247
Duration dependence * Eligible for PBD Increase 30-52			
0-3	-0.090	0.026	-3.459
4-7	0.111	0.034	3.270
8-11	0.105	0.033	3.194
12-15	0.328	0.034	9.553
16-19	0.304	0.039	7.805
20-23	0.043	0.049	0.885
24-27	-0.028	0.063	-0.451
28-31	0.237	0.060	3.939
32-35	-0.091	0.091	-0.995
36-39	0.102	0.122	0.840
40-43	-0.256	0.158	-1.618
44-47	-0.123	0.196	-0.627
48-51	-0.153	0.221	-0.692
52-55	-0.457	0.273	-1.673
56-59	-0.104	0.277	-0.376
60-	-0.028	0.070	-0.398
Duration dependence * Eligible for PBD and RR increase			
0-3	0.139	0.034	4.122
4-7	-0.028	0.048	-0.586
8-11	-0.207	0.048	-4.338
12-15	-0.163	0.051	-3.216
16-19	-0.434	0.053	-8.185
20-23	-0.320	0.061	-5.210
24-27	-0.356	0.076	-4.663
28-31	-0.264	0.073	-3.635
32-35	0.032	0.104	0.308
36-39	-0.122	0.145	-0.842
40-43	-0.058	0.191	-0.306

44-47	-0.022	0.225	-0.098
48-51	0.487	0.306	1.594
52-55	-0.123	0.309	-0.398
56-59	-0.341	0.359	-0.951
60-	0.126	0.109	1.157
Duration dependence * After August 1989			
0-3	0.002	0.016	0.150
4-7	-0.035	0.022	-1.585
8-11	0.031	0.021	1.478
12-15	-0.101	0.023	-4.322
16-19	-0.286	0.028	-10.355
20-23	-0.295	0.033	-8.962
24-27	-0.325	0.042	-7.688
28-31	-0.408	0.045	-9.101
32-35	-0.386	0.061	-6.365
36-39	-0.240	0.082	-2.919
40-43	-0.383	0.098	-3.905
44-47	-0.361	0.124	-2.906
48-51	-0.551	0.145	-3.792
52-55	-0.444	0.154	-2.893
56-59	-0.310	0.182	-1.705
60-	-0.297	0.050	-5.976
Treatment Effects			
RR Increase (=Eligible for RR Increase * After August 1989)			
0-3	-0.030	0.024	-1.281
4-7	-0.016	0.041	-0.392
8-11	-0.012	0.038	-0.322
12-15	0.035	0.043	0.828
16-19	-0.105	0.045	-2.361
20-23	0.128	0.049	2.598
24-27	0.093	0.063	1.475
28-31	-0.089	0.067	-1.333
32-35	0.024	0.094	0.254
36-39	-0.032	0.130	-0.249
40-43	-0.009	0.164	-0.056
44-47	-0.179	0.198	-0.906
48-51	0.576	0.263	2.190
52-55	0.074	0.253	0.291
56-59	-0.063	0.285	-0.222
60-	0.231	0.082	2.819
PBD Increase 30-39 (=Eligible for PBD 30-39 * After August 1989)			
0-3	-0.030	0.019	-1.551
4-7	0.030	0.030	0.991
8-11	0.053	0.029	1.835
12-15	0.039	0.032	1.216
16-19	-0.083	0.038	-2.157
20-23	-0.077	0.048	-1.593
24-27	-0.064	0.060	-1.065
28-31	-0.551	0.061	-8.975
32-35	-0.293	0.081	-3.609
36-39	0.185	0.103	1.795
40-43	0.445	0.127	3.514
44-47	0.380	0.157	2.423
48-51	0.559	0.193	2.891
52-55	0.120	0.195	0.616
56-59	0.026	0.232	0.111
60-	0.063	0.067	0.949
PBD Increase 30-52 (=Eligible for PBD 30-52 * After August 1989)			

0-3	0.104	0.026	4.006
4-7	-0.118	0.042	-2.827
8-11	-0.129	0.040	-3.261
12-15	-0.249	0.043	-5.857
16-19	-0.477	0.052	-9.194
20-23	-0.481	0.065	-7.348
24-27	-0.483	0.083	-5.788
28-31	-1.007	0.085	-11.907
32-35	-0.683	0.116	-5.901
36-39	-0.770	0.146	-5.260
40-43	-0.276	0.182	-1.514
44-47	-0.117	0.219	-0.532
48-51	1.215	0.238	5.113
52-55	1.726	0.286	6.037
56-59	0.687	0.296	2.326
60-	-0.051	0.073	-0.700
PBD 30-39 and RR Increase (=Eligible for PBD 30-39 and RR * After August 1989)			
0-3	-0.039	0.037	-1.055
4-7	0.018	0.065	0.285
8-11	0.051	0.061	0.827
12-15	0.001	0.067	0.016
16-19	0.222	0.073	3.047
20-23	0.118	0.082	1.434
24-27	0.081	0.102	0.798
28-31	0.172	0.102	1.683
32-35	-0.235	0.137	-1.716
36-39	0.188	0.172	1.095
40-43	0.269	0.223	1.209
44-47	-0.071	0.268	-0.265
48-51	-0.408	0.347	-1.177
52-55	0.238	0.355	0.672
56-59	0.101	0.414	0.244
60-	-0.215	0.117	-1.831
PBD 30-52 and RR Increase (=Eligible for PBD 30-52 and RR * After August 1989)			
0-3	-0.161	0.050	-3.224
4-7	-0.092	0.090	-1.026
8-11	0.056	0.083	0.679
12-15	-0.035	0.089	-0.393
16-19	0.209	0.097	2.150
20-23	0.066	0.107	0.619
24-27	0.298	0.128	2.327
28-31	0.123	0.137	0.893
32-35	-0.325	0.180	-1.801
36-39	-0.018	0.218	-0.083
40-43	0.182	0.259	0.701
44-47	-0.001	0.295	-0.375
48-51	-0.490	0.342	-1.434
52-55	0.387	0.343	1.128
56-59	0.749	0.402	1.863
60-	0.090	0.121	0.750
-log Likelihood		792902.635	
Number of Observations		225821	

Source: Own calculations, based on Austrian Social Security Data.