How do Extended Benefits and Early Retirement Rules affect Unemployment Duration? A Regression Discontinuity Approach

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Abstract

This paper studies a program that extends the maximum duration of unemployment benefits from 30 weeks to 209 weeks. Interestingly, this program is targeted to individuals aged 50 years or older, living in certain eligible regions in Austria. In the evaluation, I use sharp discontinuities in treatment assignment at age 50 and at the border between eligible regions and control regions to identify the effect of extended benefits on unemployment duration. Results indicate that the duration of job search is prolonged by at least .08 weeks per additional week of benefits among men, whereas unemployment duration increases by at least .28 weeks per additional week of benefits among women. The salient differences between men and women are consistent with the lower minimum age for early retirement applying to women.

JEL-Classification: C41, J64, J65

Keywords: benefit duration, unemployment duration, early retirement, regression discontinuity

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1 Introduction

Structural unemployment differs tremendously among countries at relatively similar stages of economic development. For instance, the 20 OECD member countries analyzed by Nickell and Layard (1999) are characterized by an average unemployment rate over the period 1983 to 1996 of about 8 %; but the standard deviation in unemployment rates across these countries amounts to more than 4 %. The literature on labor market institutions documents tremendous differences in policies that appear to contribute to unemployment with unemployment insurance being one of the most important candidate explanations. In particular, the potential duration of unemployment benefits is strongly correlated with structural unemployment (Nickell and Layard, 1999). The idea is that extended benefit duration discourages job search and thus leads to prolonged unemployment duration.

The causal effect of potential benefit duration on unemployment duration can be estimated more convincingly using information on one country rather than on several countries. Understanding the reasons for differences in policy is crucial in isolating the causal effects of these policies (Besley and Case, 2000). Arguably, understanding the motivation behind one policy change is a more straightforward task than understanding the complex reasons for differences in unemployment insurance across multiple countries. Furthermore, studying a change within one country allows isolating the contribution of the potential duration of benefits on unemployment duration more cleanly than in a cross country study which can be affected by tremendous differences in other labor market institutions.

This paper proposes to identify the effect of extending benefits on the duration of job search using information on a unique policy change in Austria. In June 1988, the Austrian government extended the potential duration of unemployment benefits from 30 weeks to 209 weeks for job seekers aged 50 or older when entering unemployment, living for at least 6 months in certain regions of Austria, who satisfy a previous work requirement. There are several interesting aspects of this regional extended benefit program (REBP). *First,* the REBP provides a unique opportunity to study the effect of a strong increase in the potential benefit duration by almost 3.5 years. The existing literature on the effects of potential benefit duration on unemployment duration are primarily based on extensions of benefit duration by one or two quarters.[1]

Second, the program is strictly targeted with respect to age at entry into unemployment and place of residence – two dimensions that can be readily observed in the available data. The age based identification strategy compares job seekers who are aged 50 years to job seekers who just fail the age requirement. This strategy is intuitively appealing because both groups

[1]For instance, Katz and Meyer (1990) use state variation in federal supplementation of potential benefit duration by one quarter (13 week) triggered by high unemployment. Lalive *et al.* (2006) study changes in potential benefit duration in Austria by 9, and 22 weeks respectively.

of job seekers are basically of the same age. However, since the program was strictly applied conditional on having completed the 50^{th} year of age, the slightly older group of job seekers has access to REBP whereas the slightly younger group of job seekers does not have access to REBP. Thus assignment to treatment takes place in a so-called "sharp" regression discontinuity design (Hahn *et al.*, 2001). One potentially important concern with this strategy is that firms and workers could try to manipulate age at entry into unemployment. In particular, firms might be willing to offer to their employees not to lay them off until they just satisfy the age requirement.[2] The paper therefore proposes to focus on the second threshold, the border between treated and control regions, to identify the effect of REBP on unemployment duration. This geography based strategy contrasts individuals living close to both sides of the border between treated and control regions. This contrast is appealing because labor market conditions are quite similar within a tightly defined geographical area. Moreover, in contrast to age at entry into unemployment, region of residence can not be readily manipulated because workers have to move from control to treated regions well in advance of the eventual layoff.

Third, Austrian social insurance legislation allows for early retirement at a much lower age for women compared to men. Women satisfying the REBP criteria are eligible for early retirement at age 55 years, whereas men have access to early retirement only at age 60 years. Moreover, women satisfying the REBP criteria also have access to a program of special income support (*Sonderunterstützung*) upon completing the 54^{th} year of age, whereas men have to turn 59 years old before becoming eligible for special income support. Special income support benefits are quite generous – they are 25 % higher than unemployment benefits provided the benefit level does not exceed the expected old age pension – and these benefits are provided for one year. This means that REBP can also be used to study the interactions between unemployment insurance provisions and early retirement rules. Specifically, by performing separate analyses for women and men, this paper can discuss the likely impacts of having an early retirement option after exhausting unemployment benefits among women compared to not having this option among men.

This paper contributes to two strands of the literature. The first strand is concerned with measuring the effects of potential benefit duration on unemployment duration. A selective list of contributions includes Card and Levine (2000), Hunt (1995), Katz and Meyer (1990), Lalive and Zweimüller (2004b), Moffitt (1985), Moffitt and Nicholson (1982), Winter-Ebmer (1998) and Van Ours and Vodopivec (2006). These contributions to the literature are primarily based on differences-in-differences approaches.[3] The present paper goes beyond the existing

[2]Such a reaction can invalidate the regression discontinuity assumption that average unemployment duration for individuals just missing the age threshold is informative on the counterfactual duration without treatment for individuals who have just turned 50 years.

[3]In the static labor supply literature, Lemieux and Milligan (2005) study the incentive effects of social

literature in proposing to use the regression discontinuity approach. This design is appealing. Berger *et al.* (2005) find that the regression discontinuity design very robustly identifies the effect that would be found in a randomized experiment. Moreover, the regression discontinuity approach can be superior to the differences-in-differences strategy because it allows to identify the causal effect of potential benefit duration using cross section information. Thus, it is not necessary to assume that time trends in unemployment are identical in the treated and control groups – the primary identifying assumption in the differences-in-differences approach. The smaller second strand of the literature discusses interactions between unemployment insurance and early retirement. Heyma and Van Ours (2006) study how the early retirement option affects job finding rates among older workers in the Netherlands. Riphahn (1997) compares the determinants of transitions into unemployment and disability among older workers in German data. She concludes that critical variables such as individual health or aggregate unemployment have clearly different effects on the two forms of exit from employment. Dahl *et al.* (1999) reach a similar conclusion using Norwegian data.

The main contributions of this paper are the following. *First,* the paper studies a very strong change in potential benefit duration. This is appealing from an economic viewpoint because it provides evidence on the maximum extent to which changing the potential benefit duration contributes to unemployment. Moreover, because the treatment dose is so large, a graphical analysis of the treatment effect is quite informative. *Second,* this paper identifies the effects of the same change in potential benefit duration at two thresholds – the age threshold and the border threshold. This is useful because the regression discontinuity assumption may be satisfied for the geographic analysis but not necessarily for the age based strategy. Moreover, because the effect of treatment may depend on the characteristics of individuals, this paper illustrates that the effects identified at two thresholds need not agree. *Third,* the analysis uses rich, high quality, comprehensive data from two administrative sources, the Austrian social security database, and the Austrian unemployment insurance register. These data provide a comprehensive account of the entire work history of individuals since the year 1972. Moreover, the data record very accurately both the age at entry into unemployment and the place of residence of job seekers. These two pieces of information are crucial in implementing a convincing regression discontinuity identification strategy. *Fourth,* the data cover the universe of all unemployment spells. This allows concentrating on unemployment spells that are fairly close to the age and border thresholds thus limiting the possible biases due to misspecification. Indeed, results indicate that the effects of both age and distance border on average unemploy-

assistance on the decision to work in a regression discontinuity design (RDD) and discuss the relationship between the RDD and the differences-in-differences approach. Moreover, Chetty (2005) and Autor and Duggan (2006) discuss the likely reasons for the effects of generous employment assistance programs on labor force participation.

ment duration can be captured in a relatively simple manner – a model with a linear trend on both sides of the threshold. This means that the empirical analysis convincingly identifies the effect of extended benefits and early retirement rules on unemployment duration. *Fifth,* many countries are developing strategies for their pension systems to be able to cope with rapidly ageing populations. This paper argues that it may be important to focus on pathways to retirement that are generated by social assistance programs outside the pension system.

The outline of this paper is as follows. Section 2 provides background on the unemployment insurance system, on the regional extended benefit program, and on the early retirement rules in Austria. Section 3 discusses the dataset and provides descriptive statistics on the subsamples of eligible and ineligible job seekers used in the main analysis. Section 4 provides descriptive evidence on the effects of REBP on unemployment duration, on the composition of the unemployment inflow, and on the size of the unemployment inflow. Section 5 discusses identification and estimation of treatment effects in the regression discontinuity design. Section 6 provides the regression analysis of the effects of REBP on unemployment duration, and section 7 concludes this paper with a summary of our findings.

2 Background

This section discusses the Austrian unemployment insurance and early retirement rules and it provides background on the REBP. Moreover, the section discusses why the REBP may affect women differently from men.

2.1 Unemployment insurance

Before August 1989, an unemployed person could draw regular unemployment benefits (UB) for a maximum period of 30 weeks provided that he or she had paid unemployment insurance contributions for at least 156 weeks within the last 5 years.[4] In August 1989 the potential duration of UB payments became dependent not only on previous experience 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 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.

Voluntary quitters and workers discharged for misconduct can not 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

[4]UB duration was 20 weeks for job-seekers who did not meet this requirement. This paper focuses on individuals who were entitled to at least 30 weeks of benefits.

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.

Compared to other European countries, the replacement ratio (UB relative to *gross* monthly earnings) is rather low. The amount of UB payments depends on previous earnings and, in 1990, the replacement ratio was 40.4 % for the median income earner; 48.2 % for a low-wage worker who earned half the median; and 29.6 % for a high-wage worker earning twice the median. On top, family allowances are paid. UB payments are not taxed implying that net-replacement rates are substantially higher than 40 %, and there is no experience rating of firms.

After UB payments have been exhausted, job seekers can apply for 'transfer payments for those in need' (*Notstandshilfe*).[5] As the name indicates, these social assistance transfers are means-tested. Social assistance 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. The social assistance 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 among job seekers who were eligible for social assistance. 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. The majority of the unemployed (59 %) received UB whereas 26 % received social assistance transfers.

2.2 The Regional Extended Benefits Program

The background of the REBP is strongly tied to the history of the Austrian steel sector. To protect its assets after World War II from Soviet appropriation and to provide the capital needed for reconstruction, Austria nationalized its iron, steel, and oil industries, large segments of the heavy engineering and electrical industries, most of the coal mines, and the nonferrous metals industries. State owned firms in manufacturing were part of a large holding company, the *Oesterreichische Industrie AG*, OeIAG. By the mid-1970s this holding company was running into serious problems related to shrinking markets, overstaffing, too heavy concentration on outmoded smokestack industries, insufficient research and development, and low productivity. Initially, the Austrian government covered the losses by subsidies. But in 1986, after the steel industry was hit by an oil speculation scandal and failure of a U.S. steel plant project, this protectionist policy was abolished. A new management was appointed and a strict restructuring plan was implemented. This plan aimed at focusing on the holdings' core competencies.

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

The result were layoffs due to plant closures and downsizing, particularly in the steel industry.

To mitigate the labor market problems in the concerned regions the Austrian government enacted a law that extended UB-entitlement to *209 weeks* for a specific subgroup. An unemployed worker became eligible to 209 weeks of UB if he or she satisfied, *at the beginning* of his or her unemployment spell, each of the following criteria: (i) age 50 or older; (ii) a continuous work history (780 employment weeks during the last 25 years prior to the current unemployment spell); (iii) location of residence in one of 28 selected labor market districts since at least 6 months prior to the claim; and (iv) start of a new unemployment spell after June 1988 or spell in progress in June 1988. The REBP was initially expected to be in effect until December 1991. However, the Austrian parliament decided at the end of 1991 to extend the program until August 1993 when it was eventually abolished.

The minister for social affairs, a member of the ruling party SPÖ, was in charge of selecting those regions that became eligible to the program. Records of the meetings in which the set of regions eligible to the program was decided are not open to the public. However, two facts emerge when comparing the eligible regions and the ineligible regions. On the one hand, the eligible regions were characterized by a strong concentration of employment in the steel sector. In the REBP regions, roughly 17 % of workers were employed in the steel industry firm before REBP was introduced, whereas in the non-REBP regions the corresponding figure was below 5 % (Lalive and Zweimüller, 2004a). On the other hand, it is not possible to detect any important differences between treated and non-treated regions in terms of the unemployment rate or the fraction of long-term unemployed before the REBP starts. These two facts support the idea that the program was targeted towards regions with a relatively high share of employment in the steel sector rather than towards regions with high structural unemployment.

This discussion implies, first, that it might be difficult to draw reliable evidence on the effect of REBP from a global comparison of treated and control regions because these regions are characterized by a different industry structure. However, a local comparison at the border between treated and control regions can be quite informative if communities located on both sides of the border are similar in terms of industry and age structure. Second, it is clear that individuals entering unemployment from a job in the steel industry were not only facing a different unemployment insurance regime but were affected by the restructuring of the steel sector. Thus it is very difficult to isolate the effects of extended benefits on unemployment duration in the non-steel inflow. This paper therefore proposes to focus on the non-steel inflow. Note that more than 80 % of all job seekers were not previously employed in the steel sector. This means that concentrating on the non-steel inflow allows identifying the effects of extended benefits on an important sub-sample of the entire unemployment inflow.

2.3 Early Retirement

Austrian social security legislation provides for regular old age pensions at age 65 for men and age 60 for women. Pension benefits depend on contributions to the pension system in the 156 months (13 years) prior to leaving the labor force, and on the total number of months contributed to the pension system.

There are two early retirement pathways available at age 60 for men and at age 55 for women. The first is provided for individuals who have a long contribution history, that is, worked for at least 420 months (35 years) prior to claiming early retirement. Also, individuals applying for this early retirement option must have worked for at least 2 out of the previous 3 years before entering early retirement. The second early retirement option is available to individuals who have spent at least 12 out of the previous 15 months claiming unemployment benefits, post-UB transfers, or special income support.

A third measure affecting older workers is *Sonderunterstützung* (special income support). This measure was originally created in January 1974 to support individuals in the mining sector who were permanently displaced just prior to becoming eligible for early retirement. The special income support program provides benefits for at most one year; benefits are 25 % higher than unemployment benefits capped from above by the pension benefit the individual is expected to receive from the pension system. In 1979, the system was extended to cover all men aged 59 years or older and women aged 54 years or older, provided they had contributed to the pension system for at least 15 out of the previous 25 years. Note that the previous contribution requirement for the special income support is identical to the contribution requirement for REBP.

2.4 Hypotheses

The effects of the REBP for men can be analyzed in the standard job search framework where job seekers receive unemployment benefits as long as they have not exhausted the potential benefit duration. Thereafter job seekers are eligible for reduced social assistance transfers. Mortensen (1977) argues that extending the potential benefit duration in such a system tends to reduce the transition rate to regular jobs because it postpones the exhaustion of regular unemployment benefits.[6] This reduction in the unemployment exit rate leads to prolonged unemployment duration.

In contrast to men, women have access to special income support once unemployment benefits have been exhausted. This means that in contrast to the standard job search model, eligible women are facing an upward sloping time path of benefits discouraging job search

[6] Lalive *et al.* (2006) find that this is indeed the case for small benefit extensions.

strongly.[7] Thus, REBP is expected to prolong unemployment duration much more strongly for women than for men.

Moreover, firms and workers may even use REBP to change their early retirement strategies. Laying off an older worker who is unproductive but has been employed with the firm for a long period damages the reputation of the firm. In contrast, offering this worker an early retirement option is a way to end the employment relationship without damaging one's reputation among on-going jobs. Thus, providing early retirement is an attractive option for firms who want to keep a reputation as a long-term employer but also desire to end employment relationships that are marginally unproductive. In general, financing early retirement is costly. However, since REBP replaces at least 40 % of previous income, this strategy becomes attractive for firms who expect significant savings from ending an employment relationship but do not want to be perceived as reneging on a promise of long-term employment. They merely need to provide severance pay to top off unemployment benefits in order to reach the level of a regular old age pension. Analyzing unemployment duration is informative on the extent to which such agreements may have taken place. Women with access to an early retirement package are certain not to leave unemployment until they reach age 54 (special income support program starts; income while unemployed is lower than special income support) or age 55 (regular early retirement program starts; income while unemployed is higher than special income support). This means that the duration of unemployment among eligible women with an early retirement option is a monotonically decreasing function of the time from age at entry into unemployment to age 54/55 years.

3 Data

To assess the impact of benefit duration and early retirement rules on the duration of unemployment spells, I use longitudinal individual data from two different sources: (i) the Austrian social security database (ASSD) which contains detailed information on the individuals' age, 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 (AUR) from which I get information on the place of residence (community) and relevant socio-economic characteristics (see Table A1 for descriptive statistics on these characteristics). The data cover the universe of the unemployment inflow over the period 1986 to 1995. The corresponding spells are followed up until the end of 1998.

The empirical analysis extracts information on individuals entering unemployment from a job in the non-steel sector in the time period 1/1986 until 12/1987 (before REBP) and in the

[7] These predictions have been recently developed in the standard job search model (Hairault *et al.*, 2006).

time period 8/1989 until 7/1991 (during REBP). The first time period covers the situation before REBP was introduced. We restrict attention to the period after January 1986 because the Austrian unemployment register only started in 1986. Moreover, we do not include information on the period 1/1988 until 5/1988 because spells starting in this time period may already be affected by REBP.[8] The 'during REBP' time period covers the longest possible time period where REBP is introduced but no other changes in benefit entitlement take place. (Recall that the maximum unemployment duration was changed as of August 1989.) Furthermore, the analysis disregards the fourth quarter inflow into unemployment in the year 1991 because Lalive and Zweimüller (2004a) show that the inflow into unemployment was very strongly affected just prior to the end of 1991.[9]

The analysis furthermore focuses on individuals with a 'continuous' work history. Eligibility for REBP (and special income support) requires 780 employment weeks (15 years) within the last 25 years – an actual-to-potential experience ratio of at least 0.6. Since the Austrian social security database only contains information as of January 1, 1972, we can observe at most 19.5 years prior to entry into unemployment on average. In order to keep possible misclassification low, a continuous work history is defined as a career with a ratio of actual to potential work experience (henceforth previous experience) since the year 1972 of at least 0.7. This ensures that only workers who satisfy the work experience requirement with a very high probability are included in the sample.[10]

The data contain information on the month and year of birth, and month and year of entry into unemployment. This allows calculating the age at entry into unemployment by counting the number of years and months of a persons life completed before entering unemployment. For instance, a job seeker born in June 1940 who is entering unemployment in May 1990 is aged 49 years and 11 months. In contrast, a job seeker born in the same month but entering unemployment in June 1990 is aged 50 years and 0 months.[11] The empirical analysis restricts

[8] Note that ongoing spells are affected by REBP. However, once a job seeker has exhausted regular unemployment benefits he or she is no longer eligible for REBP. Since the potential benefit duration was at most 30 weeks prior to REBP, this sample selection ensures that REBP does not affect the 'before REBP' analysis strongly.

[9] Arguably, this can be rationalized by the fact that it was not certain whether REBP would be extended. Firms and workers therefore had a strong incentive to make use of the generous unemployment insurance rules provided by REBP.

[10] The data contain information on employment dating back to the late 1940s for about 30 % of all individuals (*REV Daten*). This information can be used to assess the quality of the threshold rule used in the empirical analysis. Findings indicate that 61 % of all job seekers with an actual to potential experience ratio of .6 to .7 actually fulfill the 15 out of 25 years requirement. The corresponding figure is 81 % for job seekers with a ratio of .7 to .8, it is 94 % for job seekers with a ratio of .8 to .9, and it is 99 % for job seekers with a ratio of .9 to 1. This suggests that the .7 threshold is successful in identifying eligible individuals (the average probability of being eligible exceeds 94 %). Note, however, that we can not concentrate on the sub-sample of individuals with *REV* information since this sub-sample is not a random draw from the unemployment inflow.

[11] Note that this job seeker may have been born on June 30, 1940 but entered unemployment on June 1, 1990 missing almost one month to her or his 50^{th} birthday. Results strongly suggest that this person was nevertheless eligible for REBP (see Figure 2). Arguably, this can be explained by the fact that the caseworkers in the unemployment insurance office only consider month and year of birth and unemployment entry when

attention to individuals aged 46 years to 53 years (and 11 months) at the beginning of the unemployment spell. This is the only age bracket where both women and men do not have access to early retirement on the first day of the unemployment spell. Second, because age is only recorded up to a precision of one month, we allow for clustering of the regression errors at the age cell level to account for possible specification error as suggested in Card and Lee (2006).

The second identification strategy identifies the effect of REBP at the border between treated and control regions.[12] Figure 1 shows the distribution of REBP across the 2361 communities in Austria. Interestingly, the treated regions (communities with blue shading) were all located on a contiguous area located in the Eastern part of Austria and stretching from the Northern border to the Southern border. The program covers parts of the provinces Burgenland, Carinthia (Kärnten), Lower Austria (Niederösterreich), Upper Austria (Oberösterreich), and Styria (Steiermark).

It is crucial to measure the distance of each community to the border between treated and control regions. Figure 1 shows that communities which appear to be located close to the border on the map need to be close in economic terms because they are separated by mountainous terrain (for instance in the Alpine center of Austria). We therefore use a measure that reflects travel time – an economically more relevant measure of distance between locations than air distance. Specifically, the distance to the border of community A is the number of minutes it takes to drive a car from a community across the border, i.e. to the closest community that is located on the other side of the border.[13] This travel distance measure is superior to using air distance between communities because it accounts for possible geographic barriers (mountains, rivers) between communities that look adjacent on a map. The minimal distance from a community in the treated region to the nearest control region community is 5 minutes. We normalize travel distance from this treated community to the border to be zero because this community is, effectively, located exactly on the border between treated and control communities.[14]

For control region communities we perform the same calculation with the only difference that we record the negative of the travel distance by car. Thus non-negative values of the

assessing a claimant's eligibility status.

[12] See Holmes (2005) and Hoxby (2000) for important geography based analyses in urban economics and the economics of education.

[13] The distance measure reflects the time required to drive from the center of community A to the center of the community on the other side of the border using the fastest road connection between these two communities under normal conditions. We obtained this information in 2000 from a commercial provider of rout planning software in Austria (DDS Digital Services). Note that the travel distance by car measured in this paper may not properly reflect the travel distance at the beginning of the 1990s. Nevertheless, we believe that this measure of travel distance is likely to contain important information on the geographic distance between communities because there were no major changes to road infrastructure.

[14] Specifically, we subtract 5 minutes travel distance from each treated region community's distance to the border between regions.

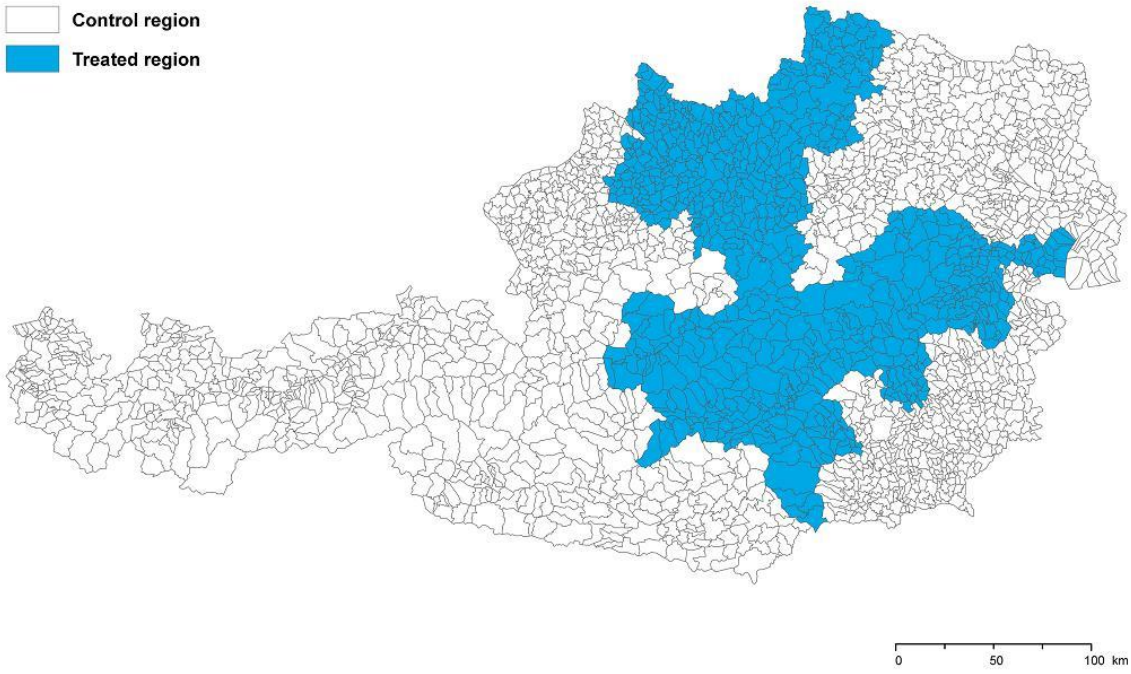


Figure 1: Regional distribution of REBP

distance to border variable refer to treated communities. Negative values of the distance to border refer to control communities. The analysis identifies the effect of REBP on unemployment duration at the border between treated and control communities, i.e. at zero minutes distance to border.

The empirical analysis restricts attention to individuals living no farther than a 70 minutes car drive from the border because the density of the inflow into unemployment is very low in communities located further than 70 minutes car distance from the border. Furthermore, we also exclude unemployment spells that start in Vienna (a control region city located at 33 minutes from the border between treated and control regions) because Vienna is a very dominant community characterized by long unemployment duration.

The key issue in terms of identification is the location of steel plants in terms of distance

Table 1: Selected Descriptive Statistics (means)

Column	(1)	(2)	(3)
Living in	Treated region	Treated region	Control region
Age bracket	50-53 years	46-49 years	50-53 years
	A. Men		
Age (years)	51.7	48.0	51.7
Distance to border (minutes)	28.2	27.2	-39.2
Married (share)	.828	.785	.821
Construction (share)	.481	.492	.600
Number of spells	4759	4975	8537
	B. Women		
Age (years)	51.5	48.1	51.9
Distance to border (minutes)	27.1	26.6	-37.1
Married (share)	.780	.696	.721
Construction (share)	.030	.027	.034
Number of spells	3466	2193	3625

Source: Own calculations, based on ASSD.

to the border between treated and control regions. Even though the analysis focuses on the non-steel inflow, the steel restructuring operations may spill over to other industries. There are two main channels for spillovers. First, industries that are supplying materials to the steel industry can be affected. Second, the reduction in steel worker incomes may spill over to other industries via reduced demand for goods. The national steel holding's two largest plants are located in the city of Linz (Upper Austria), and Donawitz, located near the city of Leoben (Styria). Our data indicates that it takes 24 minutes to drive from the city of Linz to the border between treated and control regions. The distance from Donawitz to the border is even longer – 34 minutes. Arguably, this suggests that spillovers from steel do not affect estimates of the effect of REBP at the border between treated and control regions.[15]

Table 1 reports key background statistics on the job seekers entering unemployment from a job in the non-steel sector in the time during REBP (8/1989-7/1991), by gender, age and region of residence.[16]

Table 1 indicates that there are 4759 treated male individuals, that is individuals aged 50-53 years, living in treated regions (Panel A, Column 1). Average age is slightly lower than 52 years reflecting the fact that the inflow is concentrated somewhat among individuals closer to the 50 year threshold. On average, treated individuals live about a 28 minutes car drive from the

[15]Note that spillovers from steel are unlikely to bias the identification strategy at the age 50 years threshold because these spillovers affect both job seekers similarly on both sides of the threshold.

[16]These control variables are used in the empirical analysis. In addition, the empirical analysis uses information on family situation, education, nationality, wage in previous job, skill level (white collar vs. blue collar), and previous industry to control for possible differences between treated and control spells. See Table A1 in the appendix for descriptive statistics on all variables.

border between treated and control regions. About 83 % of all men who enter unemployment are married, and about 48 % of the job seekers were previously employed in construction.[17]

Table 1 shows that there are 4975 men starting an unemployment spell also in treated regions but aged 46-49 years (Panel A, Column 2). Clearly, average age (48 years) in this group is lower than in the group of treated individuals. However, this first control group appears to be living at roughly similar distance to the border between treated and control regions. The average car drive to the border takes 27 minutes for the younger individuals compared to 28 minutes for the older individuals. The younger group of job seekers living in treated regions is quite comparable to the eligible older group of job seekers in terms of the family situation (79 % are married) and the share previously employed in construction (50 %).

In the control communities, there are 8537 men aged 50-53 entering unemployment in the age group 50-53 years (Table 1, Panel A, Column 3). The inflow into unemployment is larger in the control regions than in treated regions because more people live and work in control region communities than in treated regions. Average age is 51.7 years; this figure is identical to treated individuals suggesting that there is no concentration of the inflow close to age 50 that could be attributed to REBP. However, these individuals are living on average 39 minutes from the border between treated and control regions. This indicates that the average control individual is living in a community that could be quite different due to geographic location from the community of the average treated individual. Indeed, the construction sector inflow is much larger in control regions (60 %) than in treated regions (48 %). This suggests paying particular attention to how the construction share changes when approaching the border between treated and control regions. Finding a discontinuous drop in the construction sector inflow at the border would invalidate the regression discontinuity design. With respect to the family situation job seekers in control regions (82 % are married) are similar to job seekers in treated regions (83 % are married).

There are 3466 women entering unemployment who satisfy both the age and region of residence requirement for REBP (Table 1 Panel B Column 1). The average age among women is 51.5 years; about .3 years lower than the average age among treated men. This could be due to the fact that REBP might have been more relevant among women near the age 50 threshold compared to men. Second, about 78 % of all eligible women are married and about 3 % of these women were previously employed in the construction sector.

Table 1 reports descriptive statistics on the two control groups for women (Panel B Columns 2 and 3). There are 2193 women entering unemployment in the age bracket 46-49 years in the period with REBP in treated regions (Panel B Column 2). Note that the ratio of the number

[17]Note that the high share of construction workers in the unemployment inflow reflects strong seasonal unemployment in the construction sector rather than the relative size of this sector compared to other sectors.

of treated spells relative to the number of control spells is 1.58 among women (3466/2193); the corresponding ratio is only 0.96 among men (4749/4975). This suggests that REBP might have affected the inflow into unemployment more strongly among women than among men. (This hypothesis will be investigated more thoroughly in the following section.) Importantly, the family situation of the job seekers who fail the age requirement is quite different from the eligible group of job seekers. Whereas 78 % of the eligible women are married, only 70 % of the women below the age 50 threshold are married. In terms of identification, it is important to see whether this difference occurs at the age threshold. The second control group comprises the 3625 women who do not live in treated regions but satisfy the age requirement (Panel B Column 3). Note that average age in this group is 51.9 years whereas the average age in the treated group is 51.5 years. This confirms the impression that REBP seems to not only have increased the number of spells but also the number of unemployment spells near the age 50 threshold. Moreover, the fraction married in the control group is again somewhat lower (72 %) than in the treated group (78 %).[18].

4 Descriptive Evidence on the Effects of REBP

This section reports descriptive evidence on the effects of REBP on unemployment duration, on the effects of age and distance to border before REBP was introduced, and on the effects of REBP on inflow composition and on inflow size.

4.1 Results for Men

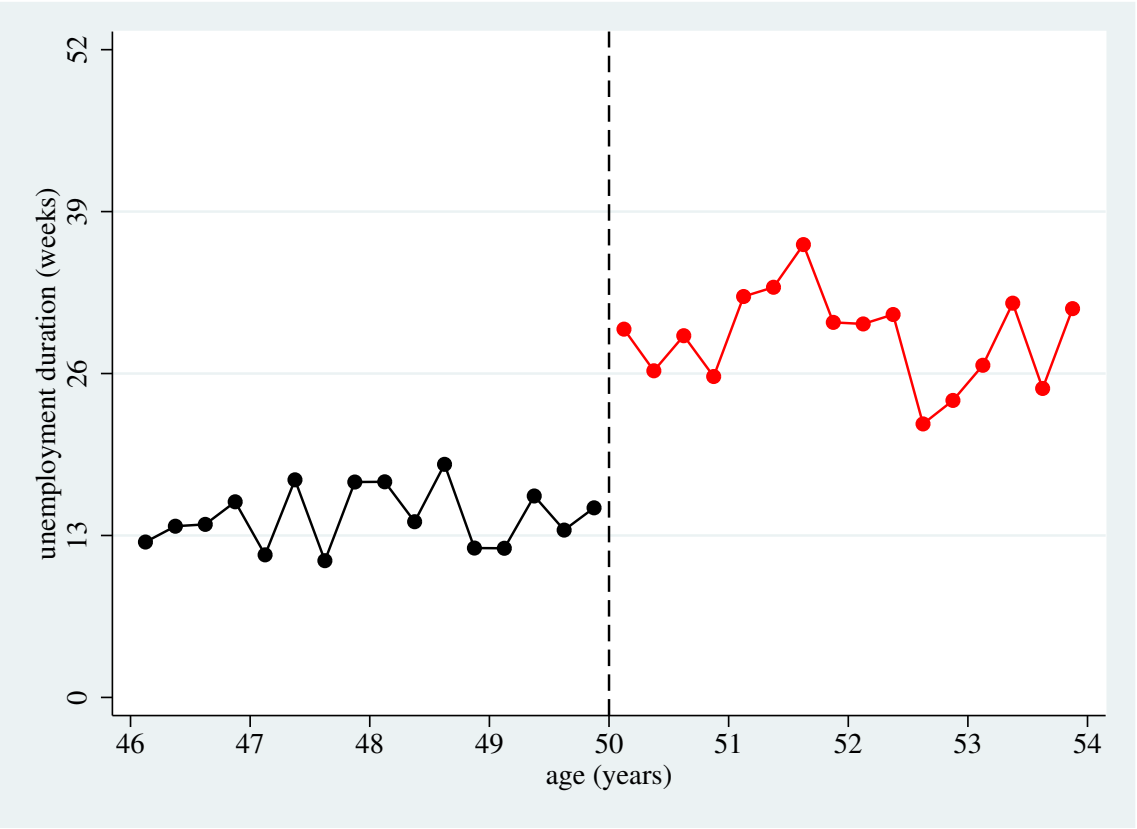
Figure 2 reports descriptive evidence on the effect of REBP on average unemployment duration (measured in weeks) among men. Note that average unemployment duration is not affected by right censoring because spells are observed until the end of 1998.[19]

Figure 2 reports average unemployment duration by age at entry into unemployment for each age quarter from 46 years and 1 quarter to 53 years and 4 quarters. The evidence is based on 9734 individuals living in treated regions, i.e. 4759 treated individuals aged 50 years and older and 4975 control individuals aged 46 to 49 years. Control individuals remain unemployed for 13 weeks on average. In contrast, average unemployment duration exceeds 26 weeks in almost all age cells for individuals aged 50 years or older. There is a discrete jump in average unemployment duration that occurs between individuals aged 49 years and 4 quarters and individuals aged 50 years and 1 quarter. This suggests that there is a strong effect of REBP on the average duration of unemployment spells.

[18]The groups do not differ with respect to construction. Moreover, there are no strong differences with respect to previous industry (see Table A1)

[19]Fewer than 1% of all unemployment spells are right censored in the data.

Figure 2: The effect of REBP on unemployment duration for men: age threshold

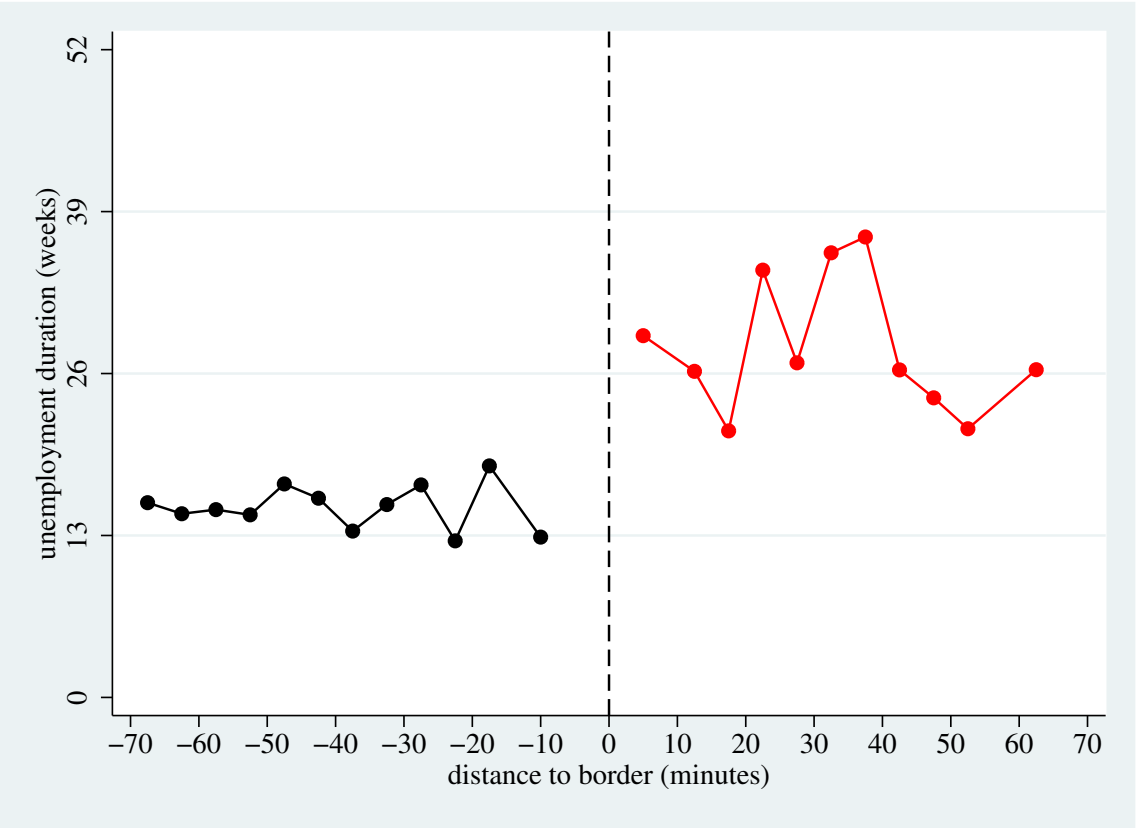


Notes: Sample restricted to inflow into unemployment the period 8/1989 until 7/1991 (during REBP). Sample restricted to individuals living in treated region.
Source: Own calculations, based on Austrian Social Security Database.

Figure 3 identifies the effect of REBP by comparing individuals living on both sides of the border between treated and control regions. This figure is based on 13296 individuals who are 50 years or older at the beginning of their unemployment spell, i.e. the 4759 treated individuals (who live in treated regions) and the 8537 control individuals (who live in control regions).[20] Average unemployment duration is roughly 13 weeks in the control regions (negative values of distance to border). Furthermore, unemployment duration appears to decrease slightly when approaching the border between treated and control regions. In contrast, as soon as we enter the the treated region, average unemployment duration increases to more than 26 weeks. This suggests, again, that REBP strongly increases average unemployment duration among men living close to the border between treated and control regions. In line with control regions, there is a negative relationship between average unemployment duration and distance to border

[20]The figure reports average unemployment duration for each distance to border cell of width 5 minutes, i.e. the first cell reporting average unemployment duration in communities located 65-69 minutes from the border between treated and control regions (-67.6 minutes), the second cell reporting evidence for communities at 60-64 minutes distance (-62.5 minutes), ..., and the last cell reporting evidence for the community located 55 to 69 minutes from the border (62.5 minutes). Note that the cells at distance 10 to 14 minutes, 5 to 9 minutes to the border from the control region side, and the cells 0 to 4 minutes, and 5 to 9 minutes distance to the border on the treated region side are aggregated because the cells close to the border are based on fewer than 150 spells. For the same reason, the descriptive analysis aggregates the cells 55-59 minutes, 60-64 minutes, and 65-69 minutes distance to border into one cell. Note, however, that the econometric analysis is based on the continuous distance to border measure.

Figure 3: The effect of REBP on unemployment duration for men: border threshold



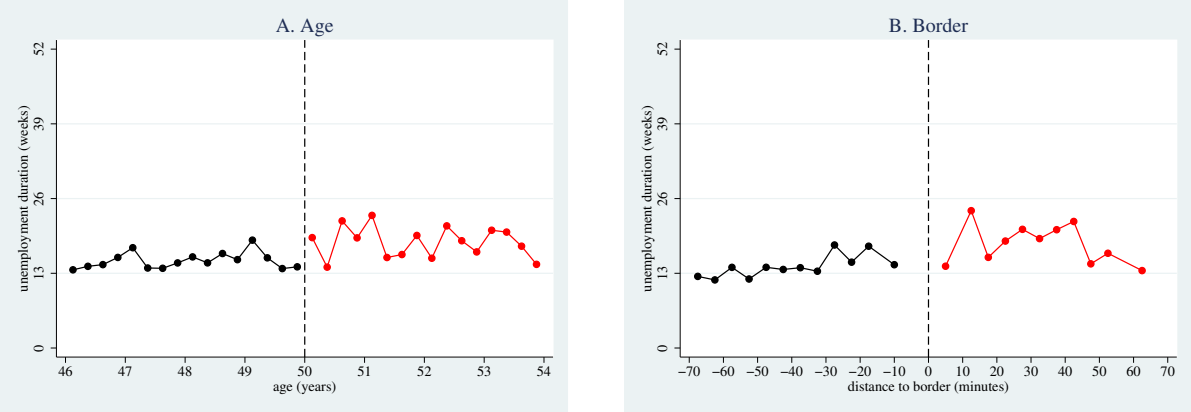
Notes: Sample restricted to inflow into unemployment the period 8/1989 until 7/1991 (during REBP). Sample is restricted to individuals aged 50 years or older.
Source: Own calculations, based on Austrian Social Security Database.

in treated regions.

The evidence in Figures 2 and 3 suggest that there are important discontinuities in the duration of unemployment at age 50 and at the border between treated and control regions. Have these discontinuities been caused by REBP? This is true only if the counterfactual average duration without REBP varies smoothly with age and distance to border. In particular, jumps in unemployment duration at age 50 and at the border that occur for reasons other than benefit eligibility have to be ruled out. I therefore investigate whether average duration of unemployment varies smoothly before REBP was introduced. Figure 4 reports average unemployment duration as a function of age and distance to border in the period from 1/1986 until 12/1987, i.e. 2.5 years to .5 years before REBP was introduced.

Figure 4A reports the effects of age on unemployment duration. Men who are 46 years old remain unemployed for about 13 weeks on average. As age increases, so does average unemployment duration. Men who are 53 years old when registering at the unemployment office are expected to be unemployed for about 16 weeks. Importantly, there are some differences in terms of average unemployment duration at the age 50 threshold. Men who are in the age bracket 49 years and 4 quarters are unemployed for roughly 14 weeks. In contrast, men who have just celebrated their 50^{th} birthday remain unemployed for 16 weeks on average. This

Figure 4: The effects of age and distance before REBP: men



Notes: Sample restricted to inflow into unemployment in the period 1/1986 until 12/1987 (before REBP). Sample for age identification is restricted to treated region. Sample for border identification is restricted to individuals aged 50 years or older.
Source: Own calculations, based on Austrian Social Security Database.

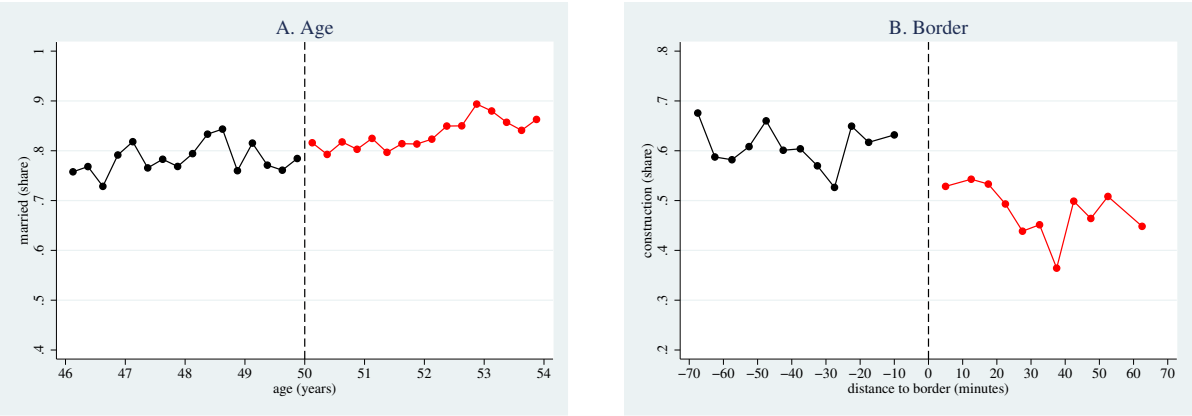
evidence thus suggests that it may be important to account for pre-existing differences in average unemployment duration at the age 50 years threshold.

Figure 4B assesses how average unemployment duration varies with distance to border. Before REBP, average unemployment duration is about 13 weeks in control region communities at 70 minutes distance to the border. Duration of job search increases monotonically from less than 13 weeks to about 20 weeks when approaching the border between treated and control regions. Importantly, there is no difference in average unemployment duration on both sides of the border. The evidence in Figure 4B thus suggests that identifying the effect of REBP by contrasting average unemployment duration in communities located at both sides of the border is a meaningful identification strategy.

For this identification strategy to be valid, however, the composition of the inflow pool needs to be balanced at the age and border threshold in the period with REBP. Two important characteristics are marital status and previous employment in construction. *Marital status* is important primarily because it is related to the potential level of the social assistance transfers. The idea is that married individuals are more likely to live with a working spouse. Since means testing focuses on household rather than individual income, the likelihood that married individuals will receive social assistance is lower. This suggests that married individuals remain unemployed shorter than non-married individuals all else equal. *Construction* employment is important because it proxies for seasonal unemployment which reflects unemployment due to a temporary rather than a permanent layoff. Table 1 presents descriptive statistics on these important background characteristics and shows that the share married is not balanced with respect to age and the construction share is not balanced between treated and control regions. Figure 5 therefore assesses how the composition of the inflow into unemployment varies with age and distance to border.

Focusing on men entering unemployment in treated regions in the age bracket 45-53 years,

Figure 5: The Composition of the Unemployment Inflow: men



Notes: Sample restricted to inflow into unemployment in the period 8/1989 until 7/1991 (during REBP). Sample for age identification is restricted to treated region. Sample for border identification is restricted to individuals aged 50 years or older.
Source: Own calculations, based on Austrian Social Security Database.

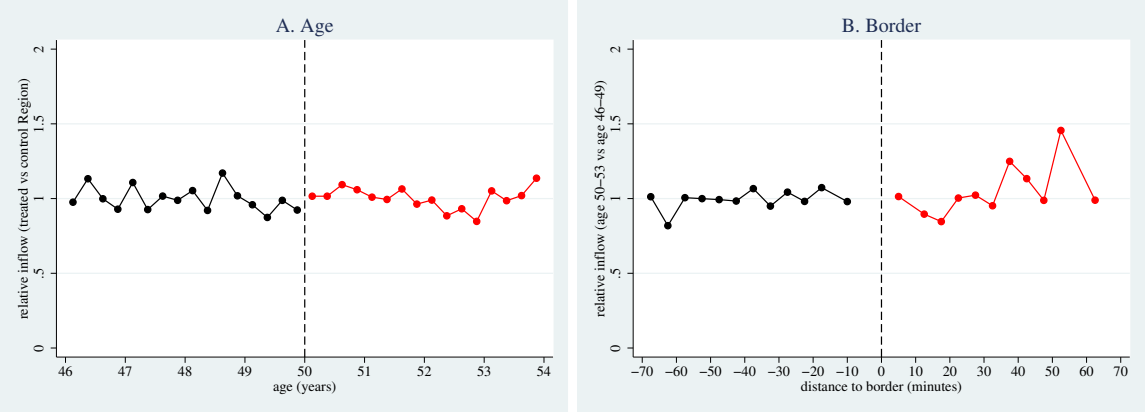
Figure 5A reveals that marital status indeed appears to be correlated with age. In the age bracket 46-48 years, the share married increases from about 75 % to about 80 %. Importantly, there is no discontinuity at the age 50 threshold. Roughly 80 % of all job seekers who are aged 50 years and 1 quarter are married. The share married increases from 80 % to about 86 % in the age bracket 50 to 53.

Figure 5B discusses inflow composition with respect to previous employment in construction as a function of distance to border. In control regions, the share previously employed in construction is about 60 % irrespective of distance to the border between treated and control regions. Just on the other side of the border, the share previously employed in construction decreases quite strongly to 53 %. The share previously employed in construction decreases further as distance to border increases and reaches a level of less than 40 % in communities located at distance 40 minutes to the border. Moving further away from the border, we find that the construction share increases again to about 50 %. The important message from Figure 5B ist that there is a discontinuous change in the previous industry structure that confounds the raw regression discontinuity estimate of the effect of extended benefits on unemployment duration.

A final concern with the identification strategy refers to how likely it is that firms and individuals manipulate their location on either side of the threshold. While it is clearly difficult to manipulate one's age, it is very well possible that firms and individuals can manipulate the *age at entry into unemployment*. Figure 6 therefore assesses whether the relative size of the inflow into unemployment is affected by the REBP.[21]

[21] It would be desirable to report the unemployment inflow rate, that is, the number of spells entering unemployment relative to employment. Our employment data, however, are based on the location of the previous employer rather than of the location of the individual's residence. This means that it is not possible to calculate unemployment risk appropriately. Note that relative inflow is, however, informative on inflow risk (unemployment inflow divided by employment) if the age structure of employment is identical in treated and control regions up to a constant.

Figure 6: Inflow effects due to REBP: men



Notes: Age: relative inflow is the ratio of the density of age in the treated region to the density of age in the control region. Border: relative inflow is the ratio of the density of distance to border in the age bracket 50-53 years to the corresponding density in the age bracket 46-49 years. Sample restricted to inflow into unemployment in the period 8/1989 until 7/1991 (during REBP).
Source: Own calculations, based on Austrian Social Security Database.

Figure 6A reports relative inflow for the age based identification strategy among men. Relative inflow is the likelihood ratio of age, i.e. the ratio of the density of age in treated regions to the density of age in control regions.[22] Figure 6A indicates that the likelihood ratio is close to 1 throughout the entire support suggesting that there is no concentration of the inflow at a particular age bracket. This suggests that manipulation of the age at entry into unemployment does not occur among men.

Figure 6B reports relative inflow for the border based identification strategy. Relative inflow is the likelihood ratio of distance to border, i.e. the ratio between the density of distance to border in the age bracket 50-53 years to the density of distance to border in the age bracket 46-49 years. In control communities, relative inflow is 1 indicating that the number of older workers entering unemployment is almost identical to the number of younger workers. Relative inflow is also close to 1 in treated communities located no farther than 30 minutes from the border. Relative inflow becomes more noisy in communities located 35 minutes and more from the border reflecting the fact that these distance to border cells are relatively small. Again, there appears to be no manipulation of location of residence.

4.2 Results for Women

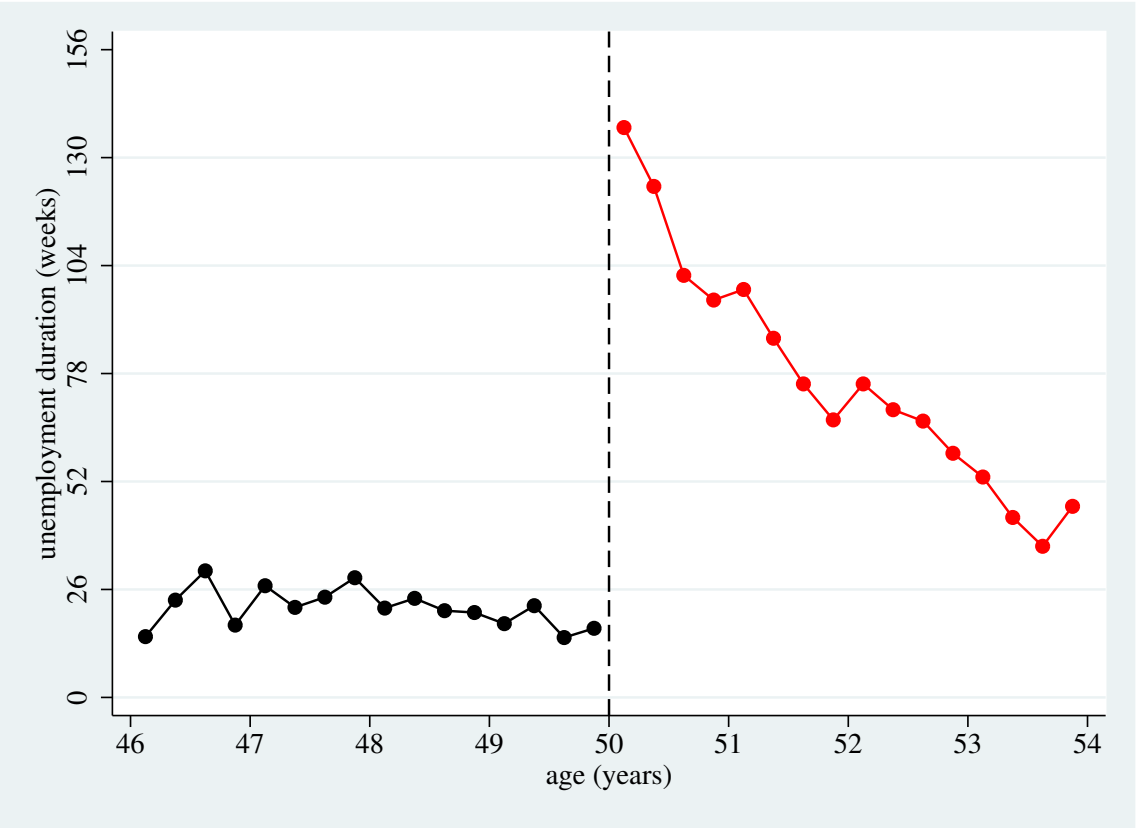
This subsection reports descriptive evidence on the effects of REBP among women. Recall that the early retirement rules provide for a continuous exit path from the labor force for women who are eligible for REBP.

Figure 7 concentrates on women entering unemployment in treated regions in the age bracket 46 to 53 years and it identifies three striking facts.[23] First, there is a very salient

[22] Specifically, the density in treated (control) regions is the ratio of the number of spells observed in each age bracket relative to the total number of spells in treated (control) regions. Each point in Figure 6A is the ratio between these two densities.

[23] Note that the y-axis for women covers the first three years in an unemployment spell rather than merely

Figure 7: The effect of REBP on unemployment duration for women: age threshold



Notes: Sample restricted to inflow into unemployment the period 8/1989 until 7/1991 (during REBP). Sample is restricted to individuals living in treated region.
Source: Own calculations, based on Austrian Social Security Database.

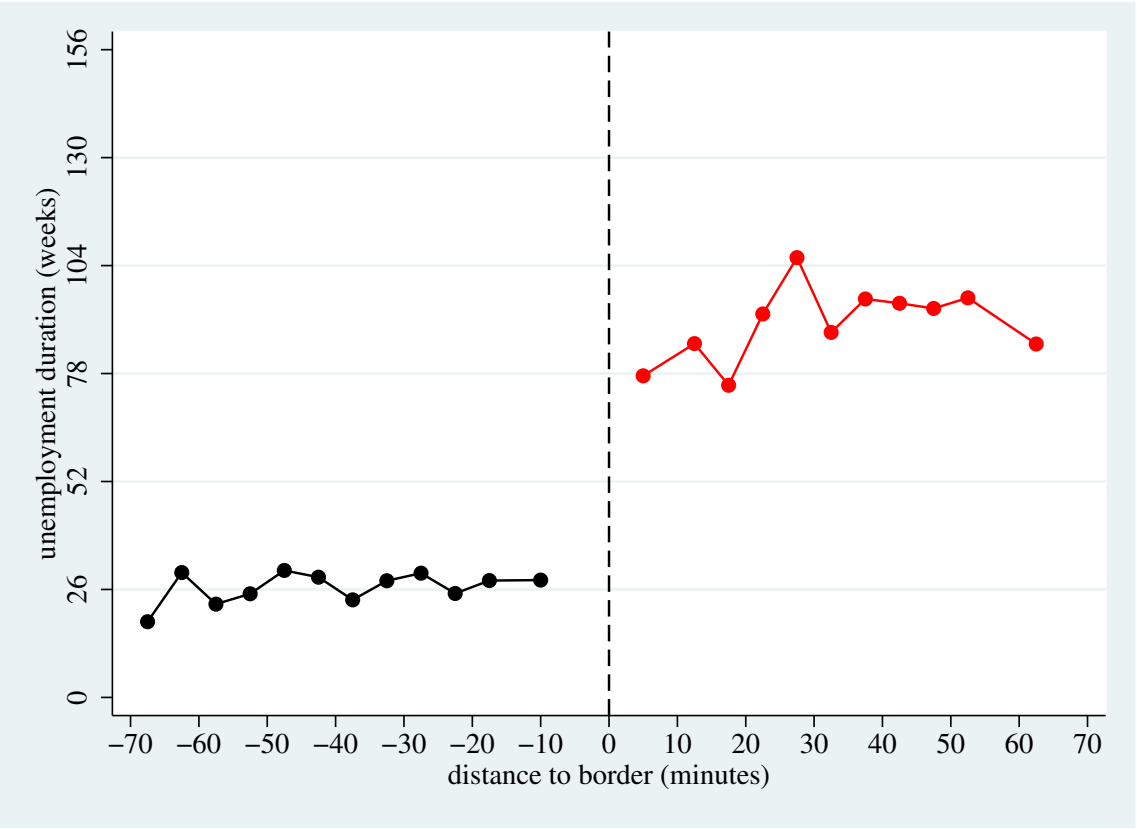
increase in unemployment duration at the age 50 threshold. Whereas the women who are slightly younger than the threshold leave unemployment on average after about 16 weeks, women who are slightly older than the threshold do not exit unemployment for more than 130 weeks on average. Thus, there appears to be an increase in unemployment duration by more than 110 weeks. Second, in the age bracket 50 to 53 years, there is a very strong decrease in average unemployment duration from more than 130 weeks (age 50 years and 1 quarter) to less than 52 weeks (age 53 years and 4 quarters). This evidence is consistent with an interpretation that a substantial fraction of eligible women remain unemployed until they turn 54, the minimum age required in the special income support program.[24] Third, in contrast to men, there appears to be a decline in average unemployment duration from about 26 weeks at age 48 to about 16 weeks at age 49.

Figure 8 uses variation in distance to border among women aged 50 years or older to identify the effect of REBP. There is hardly any variation in the duration of job search as

the first year as for men. Women who are 46 years old remain unemployed for about 20 weeks on average; this is somewhat longer than average unemployment duration among men in the same age bracket (see Figure 2). This can be explained by seasonal (construction sector) unemployment being much more relevant for men than for women.

[24]Note, however, that it it is not true that all women at the age 50 threshold are using REBP as an early retirement pathway. If this were the case the average duration of unemployment would have to exceed 200 weeks for women entering unemployment at age 50 instead of reaching a level of 141 weeks.

Figure 8: The effect of REBP on unemployment duration for women: border threshold

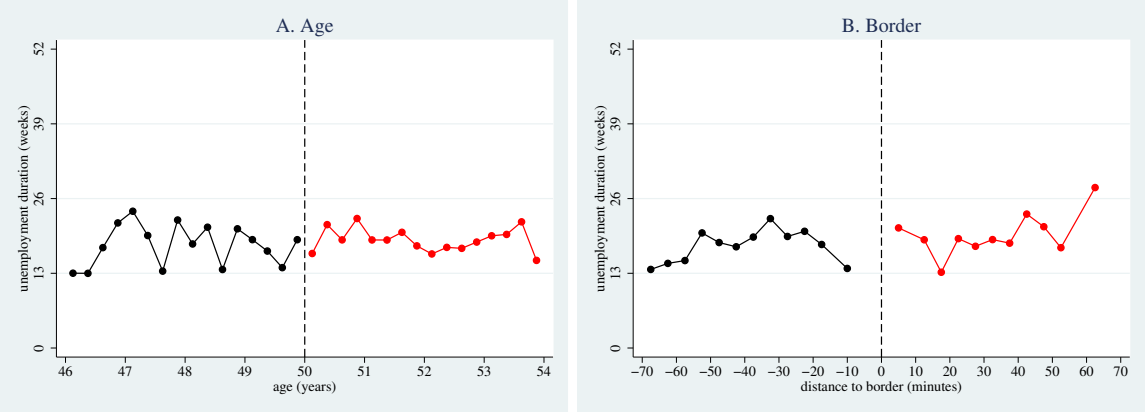


Notes: Sample restricted to inflow into unemployment the period 8/1989 until 7/1991 (during REBP). Sample is restricted to individuals aged 50 years or older.
Source: Own calculations, based on Austrian Social Security Database.

one approaches the border between treated and control regions from the control region side. Average unemployment duration oscillates around 26 weeks, i.e. almost twice the average for men (see Figure 3). However, as one crosses the border between treated communities and control communities, unemployment duration increases from 26 weeks to a level of 78 weeks, i.e. an increase by exactly one year. Thus, there appears to be a tremendous increase in average unemployment duration associated with REBP. Note that the effect of REBP at the border is much weaker than the effect of REBP at age 50 years.

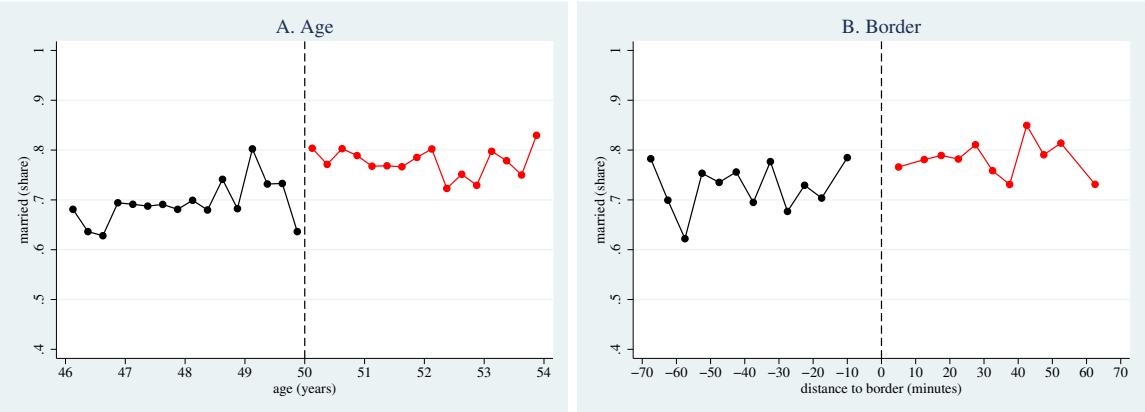
Figure 9 discusses the direct association of unemployment duration with age and distance to border respectively by using information on the situation before REBP. In line with the evidence for men, Figure 9A suggests that there is a positive correlation between unemployment duration and age, but there is no discontinuity at the age 50 years threshold. However, in contrast with our findings for men, there appears to be a discontinuity in unemployment duration at the border threshold (see Figure 9B). Job search lasts on average about 13 weeks in the control communities closest to the border, whereas unemployment duration is about 20 weeks just on the other side of the border. This suggests that the labor market for women is less well integrated on both sides of the border. Thus, it is important to develop a strategy that accounts for pre-existing differences in labor market success at the border.

Figure 9: The effects of age and distance to border before REBP: women



Notes: Sample restricted to inflow into unemployment the period 1/1986 until 12/1987 (before REBP). Sample for age identification is restricted to treated region. Sample for border identification is restricted to individuals aged 50 years or older.
Source: Own calculations, based on Austrian Social Security Database.

Figure 10: The composition of the unemployment inflow: women

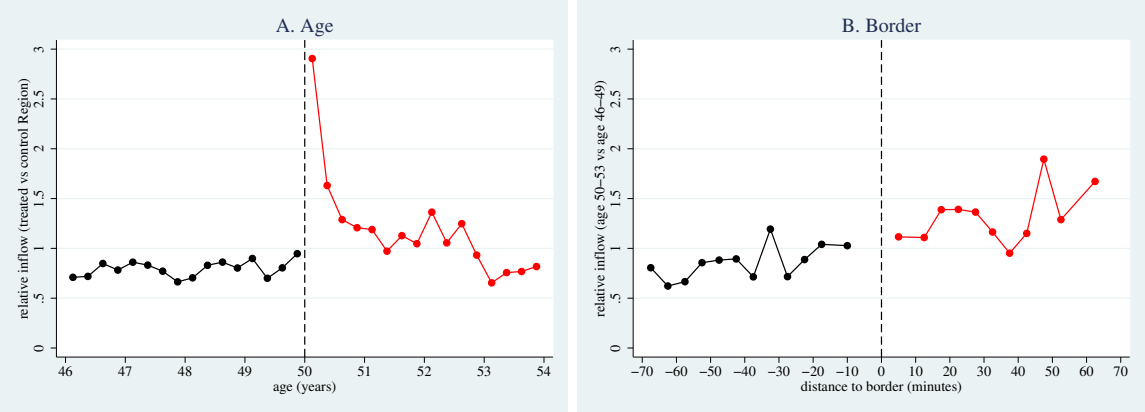


Notes: Sample restricted to inflow into unemployment the period 8/1989 until 7/1991 (during REBP). Sample for age identification is restricted to treated region. Sample for border identification is restricted to individuals aged 50 years or older.
Source: Own calculations, based on Austrian Social Security Database.

Figure 10 reports the possible effects of REBP on the composition of the unemployment inflow. Recall that whereas previous industry structure was balanced both with respect to age and region, there was a strong imbalance with respect to martial status between treated and control individuals. Investigating this imbalance in more detail, Figure 10A shows that there is a monotone positive increase in the share of married female job seekers. However, there are two interesting patterns at the age 50 years threshold. In the age bracket 49 years (quarters 1 through 4), there is a peculiar drop in the proportion of married job seekers entering unemployment. In contrast, in the age bracket 50 years (quarters 1 through 4) there appear to be positive deviations from a linear trend in the share married. Thus, these findings suggest that married women who just fail the age requirement somehow postpone entry into unemployment until they meet the age threshold.

In contrast, there appears to be no striking discontinuity with respect to marital status at the border between treated and control regions (Figure 10B). Slightly less than 70 % of all women who live in control regions at distance 60 to 70 minutes are married. The closer we get to the border between treated and control regions, the higher is the share of married job

Figure 11: Inflow effects due to REBP: women



Notes: Age: relative inflow is the ratio of the density of age in the treated region to the density of age in the control region. Border: relative inflow is the ratio of the density of distance to border in the age bracket 50-53 years to the corresponding density in the age bracket 46-49 years. Sample restricted to inflow into unemployment in the period 8/1989 until 7/1991 (during REBP).
Source: Own calculations, based on Austrian Social Security Database.

seekers. The share married is almost identical on both sides of the border (78 % in control regions, 76 % in treated regions). The share married does not vary in important ways with distance to border in treated regions.

This subsection closes with discussing the possible effects of REBP on the relative size of the inflow among women (Figure 11). There is a striking spike in the number of women entering unemployment exactly at age 50 years and 1 quarter in treated regions relative to control regions (Figure 11A). Whereas relative inflow is below around 1 in the age group 45-49 years, relative inflow peaks at almost 3 in the age cell 50 years and 1 quarter.[25] With increasing age, however, relative inflow drops strongly and reaches a level of about 1 in the age bracket 51 to 52 years. Relative inflow is below 1 in the age group 53 years.[26] It is tempting to explain this additional inflow with permanent separations between women and their employers leading to early retirement. There is, however, no information in the data that would help us investigate this hypothesis. The fact that the inflow size is affected strongly by REBP suggests that the age based identification strategy is likely to be affected by inflow effects.

Interestingly, in contrast to the age based identification strategy, the border based identification strategy appears to be much less strongly affected by inflow size effects (Figure 11B). Relative inflow increases monotonically and quite smoothly from control communities at distance 70 minutes from the border to treated communities at distance 20 minutes from the border from a likelihood ratio of about .6 to a likelihood ratio of 1. On the other side of the border, relative inflow is about 1.2 which is only slightly higher than relative inflow in con-

[25] Specifically, in control regions there 256 spells in the age bracket 50 years and 1 quarter. In treated regions, there are 596 (!) spells in the age bracket 50 years and 1 quarter. Relative inflow is .105=596/5659 (total age 46-49 inflow in treated regions) divided by .036=256/7063 (total age 46-49 inflow in control regions). There is no evidence that these spells are due to the closing of one large plant.

[26] This is due to the fact that the size of the inflow increases quite strongly at age 53 years in control regions, i.e. the age when women in control regions can also use the unemployment benefit system as a pathway to early retirement because potential benefit duration is one year.

trol communities providing information on the counterfactual unemployment duration without REBP. This suggests that the border based identification strategy is less affected by the effects of REBP on the size of the unemployment inflow.

5 Identification and Estimation

The focus of the evaluation is on the effect of extended benefits on unemployment duration. Let Y_1 denote unemployment duration with extended benefits, and Y_0 unemployment duration without extended benefits. Let $D = 1$ if the maximum duration of unemployment benefits for the job seeker equals 209 weeks, and $D = 0$ otherwise. Clearly, the data are only informative on unemployment duration with extended benefits, Y_1, among individuals with long potential benefit duration, i.e. with $D = 1$. Thus, the observed outcome is $Y = DY_1 + (1 - D)Y_0 = Y_0 + D(Y_1 - Y_0)$.

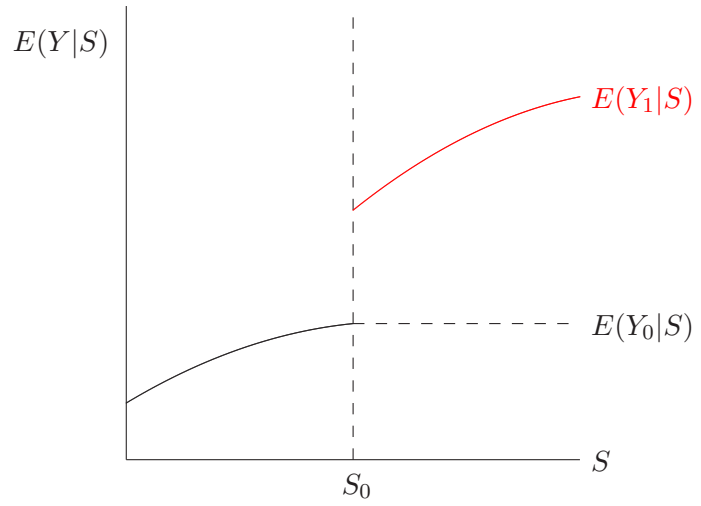
The primary object of this evaluation is to estimate the effect of extended benefits on unemployment duration, i.e. to estimate $Y_1 - Y_0$. The fundamental problem of causal inference is that the effect of treatment is never observed for an individual (Holland, 1986). If we understand the assignment process leading to job seekers receiving treatment, however, it is sometimes possible to identify the expected effect of treatment in certain sub-populations. The treatment assignment process in the REBP context is particularly appealing. The treatment D is a deterministic function of a continuous assignment variable S (age or distance to border). In particular, $D = I(S > S_0)$ with the indicator function $I(A) = 1$ if the condition A is true, and $I(A) = 0$ otherwise. Note that S_0 is the age 50 years threshold or the border threshold. Thus, assignment to treatment in our context takes place in a "sharp" regression discontinuity design (RDD).

The main idea in the regression discontinuity design approach to evaluation is to focus on contrasting the observed outcome Y just above and just below the assignment threshold

$$\begin{aligned} E(Y|S = S_0 + \epsilon) \quad &- \quad E(Y|S = S_0 - \epsilon) = \\ = E(Y_1 - Y_0|S = S_0 + \epsilon) \quad &+ \quad E(Y_0|S = S_0 + \epsilon) - E(Y_0|S = S_0 - \epsilon) \end{aligned} \tag{1}$$

where ϵ is a small number. The first term in equation (1) shows that contrasting the expected outcome just above and just below the threshold is informative on the expected effect of REBP on job seekers who just satisfy the eligibility requirement, i.e. $E(Y_1 - Y_0|S = S_0 + \epsilon)$. The second term in equation (1) refers to the difference between the counterfactual unemployment duration among eligible job seekers with short benefit duration and unemployment

Figure 12: Identification in the Regression Discontinuity Design



duration without treatment among ineligible individuals. This is a bias-term. Taking limits of equation (1) with respect to $\epsilon \downarrow 0$, this bias term disappears if unemployment duration without REBP is *continuous* at the assignment threshold (Hahn *et al.*, 2001). Thus, the fundamental identifying assumption of the regression discontinuity approach is that

$$lim_{\epsilon \downarrow 0}[E(Y_0|S = S_0 + \epsilon) - E(Y_0|S = S_0 - \epsilon)] = 0 \tag{2}$$

Figure 5 illustrates identification in the regression discontinuity design. The effect of REBP at the threshold S_0 can be identified by contrasting unemployment duration at the threshold with unemployment duration just below the threshold if there is no jump in $E(Y_0|S)$ at S_0.

Provided that the identifying assumption (2) is satisfied, the sharp RDD design allows identifying the average effect of treatment on the population of job seekers who just fulfill the eligibility criterion, i.e. with $S = S_0$. Information on this effect is crucial for policy makers thinking about changing the scope of the program. For instance, suppose that policy makers in Austria are interested in tightening the scope of the program by increasing the age eligibility threshold. The RDD strategy provides information on how this tightening of the size of the program affects the job seekers who loose eligibility. This is an important advantage of the RDD identification strategy compared to other identification strategies.

While the condition (2) can not be tested, I have provided three pieces of evidence that

allow discussing the validity of this identifying assumption. *First*, I have provided evidence on how expected unemployment duration varies with S in the time period before REBP was introduced (see Figures 4 and 9). This allows assessing whether the condition (2) is fulfilled without the program. However, introducing the program may invalidate evidence before the program was introduced. In particular, firms and workers may agree to postpone entry into unemployment until the eligibility criteria have been satisfied. I therefore provide, *second*, evidence that allows assessing whether important background characteristics such as marital status or previous employment in construction are balanced at the assignment threshold in Figures 5 and 10. *Third,* noting that $E(Y_0|S) = \int y_0 \frac{f(y_0,S)}{f(S)} dy_0$ suggests that continuity of the expected outcome without treatment – condition (2) – holds if the density of S, $f(S)$, is continuous at S_0. I therefore also provide evidence on the effects of REBP on the density of S in the inflow into unemployment in Figures 6 and 11. The idea is straightforward. Non-continuity of $f(S)$ at S_0 indicates that firms and workers react to REBP. This reduces the credibility of the regression discontinuity identification strategy because it sheds doubt on the fundamental but non-testable identifying assumption (2).

The focus of RDD estimation is on identifying average unemployment duration at the S_0 threshold. Let $lim_{\epsilon \downarrow 0} E(Y|S = S_0 - \epsilon) \equiv \mu_0$, thus μ_0 measures expected unemployment duration at the threshold for non-treated individuals. Let $lim_{\epsilon \downarrow 0} E(Y|S = S_0 + \epsilon) \equiv \mu_1$, thus μ_1 measures expected unemployment duration at the threshold estimated with data on treated individuals. The focus of the evaluation is on estimating $\mu_1 - \mu_0$. The following model provides estimates of μ_0 and $\mu_1 - \mu_0$ in a linear regression setting

$$Y_i = \alpha_0 + \alpha_1 D_i + \beta_0 (S_i - S_0) + \beta_1 D_i (S_i - S_0) + \epsilon_i \tag{3}$$

The parameter α_0 measures μ_0, i.e. expected unemployment duration at the threshold using information on non-treated individuals only. Moreover, the parameter α_1 measures the effect of REBP on unemployment duration at the assignment threshold S_0. The parameters β_0 and β_1 capture the direct effects of S on average unemployment duration. Note that the data S – age at entry into unemployment and distance to border between treated and control regions – is not measured on a continuous scale. This introduces a specification error into model (3). Random specification error introduces heteroscedasticity in the variance-covariance matrix of the error term and can be addressed by clustering on the cells of S that are observed in the data (Card and Lee, 2006).

The crucial issue in RDD estimation is the specification of the correlation between the outcome Y and the assignment variable S. This paper proposes two ways of assessing whether the two-sided linear model specification (3) is appropriate. The first sensitivity analysis augments

the regression with quadratic and cubic terms in $(S - S_0)$. This is a parametric method of assessing the sensitivity of our results. Second, I discuss sensitivity applying a local linear model to the data (Porter, 2003). Specifically, the local linear estimates are obtained by

$$argmin_{\alpha_0,\alpha_1,\beta_0,\beta_1} \sum_{i=1}^{N} [Y_i - \alpha_0 - \alpha_1 D_i - \beta_0(S_i - S_0) - \beta_1 D_i(S_i - S_0)]^2 K_h(S_i - S_0) \quad (4)$$

where $K_h(u) = 3/4(1 - (u/h)^2)I(|u| < h)$ is the Epanechnikov kernel, and h is the bandwidth. Note the basic model (3) is a special case of the model (4) obtained by setting the bandwidth to ∞, i.e. weighting all observations equally. In the empirical analysis, I set the bandwidth to 2 years at the age threshold and to 30 minutes at the border threshold. This ensures that about one half of all the observations from model (3) are used in model (4).

The empirical analysis also addresses two additional concerns. First, the assumption of continuity may not hold even before REBP was introduced. The sensitivity of the results based on model (3) can be assessed by using information before REBP was introduced. Specifically, the model

$$\begin{aligned} Y_i &= \alpha_0 T_i + \alpha_1 T_i D_i + \beta_0 T_i (S_i - S_0) + \beta_1 T_i D_i (S_i - S_0) + \\ &+ \gamma_0 + \gamma_1 D_i + \gamma_2 (S_i - S_0) + \gamma_3 D_i (S_i - S_0) + \epsilon_i \end{aligned} \quad (5)$$

is estimated where $T_i = 1$ if the unemployment spell starts in the "during REBP" period, and $T_i = 0$ otherwise. Again, the parameter α_1 provides the before-during-RDD (BD-RDD) estimate of the effect of REBP on unemployment duration. Second, the characteristics of individual job seekers may not be balanced at the threshold. The sensitivity analysis therefore adds all observed characteristics to the basic model (3).

6 Econometric Results

This section presents the econometric estimates of the effects of REBP on unemployment duration. Table 2 presents results for men, based on the age threshold in Panel A, and based on the border threshold in Panel B. The first Column reports estimates that contrast average unemployment duration on both sides of the age threshold. Results indicate that unemployment duration is 14.6 weeks longer among men in the age bracket 50-53 years compared to men aged 46-49 years. The second Column reports the results from the basic model (3). Results indicate that REBP prolongs unemployment duration by 14.8 weeks rather than 14.6 weeks.

Table 2: Men: The effect of extended benefit duration on unemployment duration

Column	(1)	(2)	(3)	(4)	(5)	(6)
			A. Age threshold			
Treatment effect	14.605	14.798	11.153	12.715	11.356	13.831
	(1.070)***	(1.928)***	(3.475)***	(2.577)***	(2.254)***	(1.851)***
Polynomial order	0	1	3	1	1	1
Bandwidth (years)	∞	∞	∞	2	∞	∞
BD-RDD	No	No	No	No	Yes	No
Control variables	No	No	No	No	No	Yes
Observations	9734	9734	9734	5382	19460	9734
R^2	0.02	0.02	0.02	0.01	0.01	0.06
			B. Border threshold			
Treatment effect	13.902	13.622	15.496	12.538	11.750	12.039
	(1.646)***	(2.988)***	(9.530)	(6.037)**	(3.096)***	(2.493)***
Polynomial order	0	1	3	1	1	1
Bandwidth (minutes)	∞	∞	∞	30	∞	∞
BD-RDD	No	No	No	No	Yes	No
Control variables	No	No	No	No	No	Yes
Observations	13296	13296	13296	5762	25341	13296
R^2	0.01	0.01	0.02	0.01	0.01	0.08

Notes: Robust standard errors in parentheses (clustered on age and distance to border). * significant at 10%, ** significant at 5%, *** significant at 1%. BD-RDD refers to model (5) that uses information on the period before REBP to control for pre-existing discontinuities at the age and border threshold.
Source: Own calculations, based on ASSD.

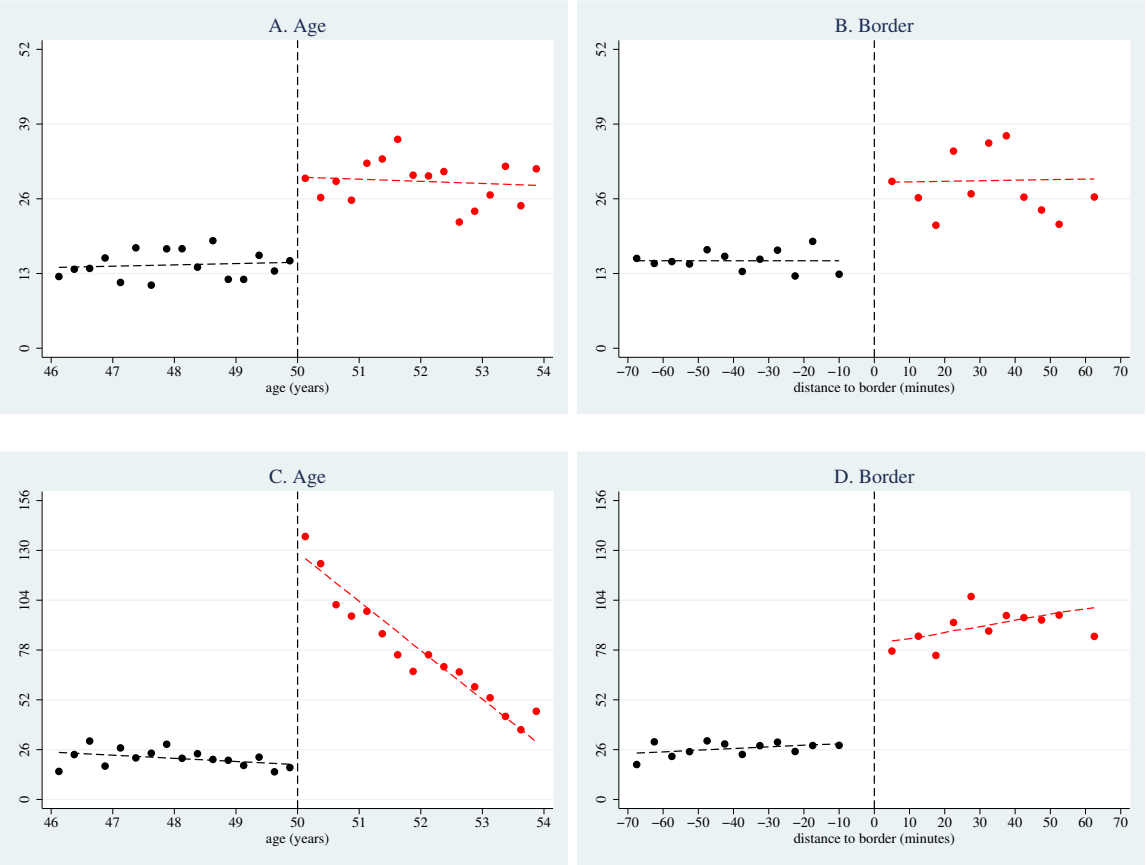
This suggests that unemployment duration is uncorrelated with age in the narrow age bracket 46 to 53 years.

Figure 13A reports the fit of the regression estimates of the basic model (3) to the data. There is a surprising agreement of this simple regression specification with the observed data. Average duration of unemployment in the last quarter of age 49 years and in the first quarter of age 50 years is identical to the prediction from the (3).

Because there is not necessarily a linear trend in the outcome, column 3 in Table 2 reports results based on a cubic specification (again on both sides of the threshold). Results indicate that the effect of REBP is weaker than in the basic model (11.2 weeks as opposed to 14.8 weeks). Column 4 in Table 2 reports results that use Epanechnikov kernel weights to give more weight to observations that are close to the age 50 threshold. The local linear estimate of the effect of REBP on unemployment duration is 12.7 weeks, again lower than the basic model estimate of 14.8 weeks.[27] Column 5 accounts for possible pre-existing differences in unemployment duration at the age 50 threshold by using information before REBP was introduced. Results suggest that REBP prolongs unemployment by about 11.3 weeks – a weaker effect than in

[27]Note that both estimators (in Column 3 and 4) that are more robust to mis-specification than the basic model (column 2) produce much less efficient estimates of the treatment effect. Whereas the basic model has a standard error of 1.9 weeks, the cubic model has a standard error of 3.5 weeks and the local linear model has a standard error of 2.6 weeks.

Figure 13: The Fit of the Basic Model (3) to the Raw Data



Notes: Figures report cell average unemployment duration (in weeks) and cell average predicted unemployment duration based on the basic model (3). Estimates of the basic model are reported in Column (2) of Table 2 and Table 3.

the basic model. Column 6 addresses the concern with respect to possible non-balance of observations in terms of observed characteristics by controlling for these characteristics. Results suggest that REBP prolongs unemployment duration by 13.8 weeks.

The second identification strategy compares men entering unemployment living on both sides of the border between treated and control regions (Table 2, Panel B). Contrasting treated and control regions produces a prima facie treatment effect of about 13.9 weeks of REBP on average unemployment duration (column 1). Adding a linear trend in distance to region – as in the basic model (3) – indicates that REBP leads to an increase in unemployment duration by 13.6 weeks rather than 13.9 weeks. Again, fitting the quite non-linear trend observed in the raw data with a linear trend captures the situation at the threshold quite well (figure 13B). Adding a quadratic and cubic term in distance to border leads to a stronger, albeit insignificant, estimate of the effect of REBP on unemployment duration (column 3). The local linear estimate of the corresponding effect is 12.6 weeks (column 4)– weaker than the basic model estimate of 13.6 weeks. Accounting for pre-existing differences in unemployment duration at the border suggests that REBP prolongs unemployment duration by 11.8 weeks (column 5), and accounting for differences in observed characteristics on both sides of the threshold suggests that REBP prolongs unemployment duration by about 12.0 weeks.

Comparing estimates at the age and border threshold the following findings emerge. First, a relatively simple estimation strategy that allows for a linear trend on both sides of the threshold appears to identify an estimate of the discontinuity that corresponds to that observed in the raw data (Figure 13). Second, this simple estimate of the treatment effect is quite robust with respect to analyses that relax the assumption of two-sided linearity, the continuity assumption, and the balance with respect to observed characteristics. All of the alternative estimates of the treatment effect include the original basic model estimate within their 95 % confidence intervals. Third, we find that the estimates at the age threshold are larger than the border estimates in 4 out the total of 6 estimates. This is, arguably, due to the fact that the border strategy measures the effect of extending potential benefit duration from 52 weeks to 209 weeks, whereas the age strategy identifies the effect of extending potential benefit duration from 39 weeks to 209 weeks (recall that workers aged 50 years or older are eligible for 52 weeks of UB, whereas workers aged 40-49 are eligible for 39 weeks of UB).

Turning to results for women (Table 3), I now discuss results based on the age strategy (panel A) and the border strategy (panel B). Note that the particular feature of the age identification strategy is that the unemployment inflow near the age 50 years threshold is strongly affected by REBP (figure 11). This means that it is unlikely that average unemployment duration of women who have not yet passed the age 50 threshold is informative on the counterfactual situation for the age 50 unemployment inflow. Moreover, it is likely that RDD estimate of the effect of REBP is upward biased. The basic idea is that using REBP as an early retirement scheme is particularly attractive for a firm that lays off a relatively unproductive job seeker. Offering such a worker an early retirement package that is acceptable is a way to preserve one's reputation as a long-term employer as well as shedding parts of the workforce that do not enhance a firm's profits. Using REBP to implement this early retirement package is particularly attractive because unemployment insurance helps in paying part of the value of the entire early retirement package. It is thus not possible to draw reliable inference on the effects of REBP at the age 50 threshold by implementing an exact RDD identification strategy. Suppose, however, that we are quite certain that unemployment duration with REBP is a linear function of age as figure 7 appears to suggest. One way of drawing inference on the effects of REBP on unemployment duration is to use this assumption to put weight on observations that are further away from the age 50 threshold thus disregarding the peculiar inflow at the age 50 threshold. This means that the estimation strategies in Columns 2, 5, and 6 are more credible than the strategies in Columns 3 and 4 because the latter strategies place particular weight on spells at or near the age 50 threshold.

Table 3 shows that contrasting women aged 50-53 years with women aged 46-49 years produces a prima facie effect of REBP on unemployment duration of 68.2 weeks (column 1). This

effect is, however, downward biased since unemployment duration decreases strongly with age among women aged 50 or older. Adding a two-sided linear trend produces an estimate of about 109.6 weeks in the basic model specification (column 2). The simple identification strategy is in line with the raw data below the threshold but it is a below average unemployment duration at age 50 and 1 quarters according to figure 13C that superimposes the regression fit on the raw data. A model that adds quadratic and cubic terms in age to the basic model (3) produces a much stronger effect of REBP of 125.7 weeks (column 3). The local linear estimate of the effect of REBP on unemployment duration is 121.8 weeks – almost in line with the cubic model estimate of 125.7 weeks but again larger than the basic model estimate. Arguably, the fact that the effects are estimated to be larger in strategies that place more weight on observations at the border reflects bias rather than improved estimation of the causal effect of REBP.[28] The remaining analyses therefore rely on the two-sided linear specification that uses all observations. The BD-RDD analysis produces an estimate of the effect of REBP on unemployment duration of 109.4 weeks which is exactly in line with the basic model estimate (column 5). Moreover, adding control variables to this specification tends to reduce the treatment effect by about 7 weeks, from 109.6 weeks to 102.6 weeks (column 6).

Turning to the results obtained when contrasting unemployment duration for women living on both sides of the border between treated and control regions (Table 3, Panel B), we find that unemployment lasts 62.6 weeks longer in treated regions compared to control regions (column 1). Adding a two sided linear trend reduces the estimated treatment effect to 50.6 weeks (column 2). Fitting a cubic polynomial on both sides of the border reduces the estimate of the treatment effect somewhat (estimate is 46.4 weeks) but doing so reduces the precision of the estimate considerably (standard error increases from 6.0 weeks to 15.8 weeks; Column 3). The local linear estimate of the effect of REBP on unemployment duration is 43.3 weeks (column 4), again slightly weaker than the basic model estimate of 50.6 weeks. Accounting for pre-existing differences in unemployment duration at the border between treated and control regions produces a slightly larger treatment effect of 54.0 weeks.[29] Adding control variables to the linear specification suggests that REBP tends to increase unemployment duration by about 44.9 weeks (column 6). Interestingly, we again find that the relatively simple specification with a two sided linear trend appears to capture the discontinuity in the raw data rather well and

[28] Indeed, an additional analysis that places zero weight on observations in the age bracket 48-51 years (not shown) but equal weight to observations aged 46-47 and 52-53 suggests that the REBP prolong unemployment duration by 85 weeks (significant at the 1 % level). This suggests that applying the basic model (3) to the age 50 threshold produces an upward biased estimate of the effect of REBP on unemployment duration among women.

[29] Note that in figure 9 there is a positive difference in unemployment duration between the treated and control communities at the border. Thus, one would expect the BD-RDD estimate in column 5 to be weaker than the levels estimate in Column 2. However, note that the BD-RDD estimate uses information from all communities to calculate the pre-existing differences. Applying the basic model to data before REBP suggests that the difference in unemployment duration before REBP was introduced is negative (-3.5 weeks; Table A6).

Table 3: Women: The effect of extended benefit duration and early retirement provisions on unemployment duration

Column	(1)	(2)	(3)	(4)	(5)	(6)
			A. Age threshold			
Treatment effect	68.158	109.645	125.716	121.830	109.338	102.584
	(6.317)***	(4.927)***	(4.873)***	(4.786)***	(5.292)***	(4.270)***
Polynomial order	0	1	3	1	1	1
Bandwidth (years)	∞	∞	∞	2	∞	∞
BD-RDD	No	No	No	No	Yes	No
Control variables	No	No	No	No	No	Yes
Observations	5659	5659	5659	3436	9911	5659
R^2	0.14	0.22	0.22	0.22	0.27	0.26
			B. Border threshold			
Treatment effect	62.554	50.580	46.356	43.324	54.046	44.856
	(2.973)***	(6.031)***	(15.793)***	(10.136)***	(5.929)***	(5.423)***
Polynomial order	0	1	3	1	1	1
Bandwidth (minutes)	∞	∞	∞	30	∞	∞
BD-RDD	No	No	No	No	Yes	No
Control variables	No	No	No	No	No	Yes
Observations	7091	7091	7091	3643	11497	7091
R^2	0.15	0.15	0.15	0.10	0.20	0.20

Notes: Robust standard errors in parentheses (clustered on age and distance to border). * significant at 10%, ** significant at 5%, *** significant at 1%. BD-RDD refers to model (5) that uses information on the period before REBP to control for pre-existing discontinuities at the age and border threshold.
Source: Own calculations, based on ASSD.

that this estimate appears to be relatively robust in the sense that the basic model estimate lies within the 95 % confidence intervals of the sensitivity analyses.

Table 4 presents a summary of our findings. The Table reports the estimated effects of REBP in the analysis that applies the basic model using control variables (column 6, Tables 2 and 3). Results for men indicate that extended benefit duration increases unemployment duration (panel A in Table 4). The identification strategy at the age threshold measures the effects of an increase from 39 weeks to 209 weeks – by 170 weeks. The duration of job search is prolonged by about 13.8 weeks by this treatment. The identification strategy that compares job seekers living on both sides of the border between treated and control regions identifies the effect of a treatment with slightly smaller dose, an increase by 3 years, from 52 weeks to 209 weeks. The estimated effect on unemployment is slightly smaller, 12.0 weeks rather than 13.8 weeks. Taking the ratio of effect and treatment dose, we find that each week of extended benefits produces about .08 additional weeks of unemployment duration or equivalently that it takes about 12.5 weeks of benefit duration to add one week of unemployment duration. Note that our results agree very much with the findings in Card and Levine (2000) and are somewhat larger than the result in Lalive and Zweimüller (2004b).[30]

[30]Note that the findings reported in this paper may differ from Lalive and Zweimüller (2004b) for at least

Table 4: Summary of Findings

	Age Threshold	Border Threshold
A. Men		
Change in Unemployment Duration (weeks)	13.831	12.039
	(1.851)***	(2.493)***
Change in Potential Benefit Duration (weeks)	170	157
UD change per PBD change	.081	.077
B. Women		
Effect on Unemployment Duration (weeks)	102.584	44.856
	(4.270)***	(5.423)***
Change in Potential Benefit Duration (weeks)	170	157
UD change per PBD change	.603	.286
Distance to early retirement (years)	4.00	2.46
UD change per distance to early retirement	.493	.351

Notes: Distance to early retirement is 54 years minus average age at threshold (50.0 years for Panel A; 51.5 years for Panel B).
Source: Change in unemployment duration based on Column (6) in Tables 2 and 3.

Comparing our findings for women and men, the following patterns emerge. First, we find that the effects of REBP for women are much larger than the effects of REBP for men (panel B in Table 4). The effect of REBP on unemployment duration at the age threshold is 102.6 weeks for women – more than 8 times the effect for men. The effect of REBP for women on living on the border between treated and control regions is 44.9 weeks – almost 4 times the effect for men. Second, the effect of REBP at the age 50 threshold is much larger than the effect at the border threshold. Arguably, this is due to REBP providing a pathway into early retirement. Women who just turn 50 years have to wait for 4 years whereas women who just turn 53 years only have to wait for 1 year until they reach age 54 – the age when special income support becomes available. Because the age strategy produces an average effect of REBP at 50 years – where the distance to early retirement is maximal – this strategy is bound to find a much stronger effect than the border strategy. The latter strategy produces an average effect of REBP at the border. Applying the Epanechnikov-kernel weights, we find that women entering unemployment in the treated communities at the border between treated and control regions are on average 51.5 years old. This means that the average distance to early retirement is much shorter in the border strategy. Standardizing the effects of REBP on unemployment duration by distance to age 54 years, we find that extending benefit duration into early retirement tends to increase the average unemployment spell by about one third

two reasons. First, Lalive and Zweimüller (2004b) apply a differences-in-differences identification strategy that measures the overall effect of treatment on the treated rather than the effect of treatment at the threshold. Second, simulations in Lalive and Zweimüller (2004b) apply to a reference individual rather than the average unemployment duration of eligible individuals.

to one half of a year per year remaining until early retirement. This suggests that Austrian unemployment insurance provided a quantitatively important pathway into early retirement.

7 Conclusions

Austria implemented in the late 1980s and early 1990s a unique program that provides 209 weeks of unemployment benefit duration but only to individuals aged 50 years or older who have been living in certain parts of Austria and satisfy a work requirement. Because the program was strictly targeted with respect to age and region, this paper proposes to evaluate the effects of this program using a regression discontinuity design. The basic idea is that job seekers who just fail the age or residence requirement may provide useful information on the counterfactual situation for eligible workers who just satisfy the requirement. Because women have access to early retirement at age 54 years but men have access to early retirement only at age 59 years, this program also offers a unique opportunity to learn about the interactions between the pension system and unemployment insurance.

Performing separate analyses for women and men, we find that providing 209 weeks of unemployment benefits instead of 39 weeks of benefits tends to increase unemployment duration by 13.8 weeks (0.081 weeks of unemployment per week of benefits) for men, and by 102.6 weeks (0.603 weeks per benefit week) for women at the age 50 years threshold. Second, the effect of REBP on job seekers who live close to the border between treated and control regions are weaker, 12.0 weeks for men (0.077 weeks per benefit week), and 44.9 weeks for women (0.286 weeks per benefit week). This finding is due to the fact that REBP is being used as a pathway to early retirement among women but not among men. Third, we find that a relatively simple two-sides linear specification of the dependence between the outcome variable and the assignment variable appears to capture the underlying discontinuity at the threshold.

References

Autor, D. and Duggan, M. (2006). The Pure Income Effect of Disability Cash Transfers: Evidence from the Veteran Administration's Disability Compensation Program. Working paper, MIT.

Berger, M., Galdo, J., and Smith, J. (2005). Estimating the Selection Bias of the Regression Discontinuity Design using a Tie-Break Experiment. Discussion paper, Syracuse University.

Besley, T. and Case, A. (2000). Unnatural Experiments? Estimating the Incidence of Endogenous Policies. *Economic Journal*, **110**(467), 672–694.

Card, D. E. and Lee, D. S. (2006). Regression Discontinuity Inference with Specification Error. *Journal of Econometrics*, page forthcoming.

Card, D. E. and Levine, P. B. (2000). Extended Benefits and the Duration of UI Spells: Evidence from the New Jersey Extended Benefit Program. *Journal of Public Economics*, **78**(1), 107–138.

Chetty, R. (2005). Why do Unemployment Benefits Raise Unemployment Durations? The Role of Borrowing Constraints and Income Effects. Working paper No. 11760, NBER.

Dahl, S.-A., Nielssen, O. A., and Vaage, K. (1999). Work or Retirement? Exit Routs for Norwegian Elderly. Discussion paper no. 32, IZA.

Hahn, J., Todd, P., and van der Klaauw, W. (2001). Identification and Estimation of Treatment Effects with a Regression-Discontinuity Design. *Econometrica*, **69**(1), 201–209.

Hairault, J.-O., Langot, F., and Sopraseuth, T. (2006). The Interaction betwen Retirement and Job Search: A Global Approach to Older Workers Employment. Discussion paper no. 1984, IZA.

Heyma, A. and Van Ours, J. C. (2006). How eligibility criteria and entitlement characteristics of unemployment benefits affect job finding rates of elerly workers. Working paper, Tilburg University.

Holland, P. W. (1986). Statistics and Causal Inference. *Journal of the American Statistical Association*, **81**(396), 945–960.

Holmes, T. J. (2005). The Location of Sales Offices and the Attraction of Cities. *Journal of Political Economy*, **113**(3), 551–581.

Hoxby, C. M. (2000). Does Competition among Public Schools Benefit Students and Taxpayers? *American Economic Review*, **90**(5), 1209–1238.

Hunt, J. (1995). The Effect of Unemployment Compensation on Unemployment Duration in Germany. *Journal of Labor Economics*, **13**(2), 88–120.

Katz, L. and Meyer, B. (1990). The Impact of the Potential Duration of Unemployment Benefits on the Duration of Unemployment. *Journal of Public Economics*, **41**(1), 45–72.

Lalive, R. and Zweimüller, J. (2004a). Benefit Entitlement and the Labor Market: Evidence from a Large-Scale Policy Change. In J. Agell, M. Keen, and A. Weichenrieder, editors, *Labor Market Institutions and Public Policy*, pages 63–100. Cambridge, Massachusetts: MIT Press.

Lalive, R. and Zweimüller, J. (2004b). Benefit Entitlement and Unemployment Duration: The Role of Policy Endogeneity. *Journal of Public Economics*, **88**(12), 2587–2616.

Lalive, R., van Ours, J. C., and Zweimüller, J. (2006). How Changes in Financial Incentives Affect the Duration of Unemployment. *Review of Economic Studies*, page forthcoming.

Lemieux, T. and Milligan, K. (2005). Incentive effects of social assitance: A regression discontinuity approach. Working paper, University of British Columbia.

Moffitt, R. A. (1985). Unemployment Insurance and the Distribution of Unemployment Spells. *Journal of Econometrics*, **28**(1), 85–101.

Moffitt, R. A. and Nicholson, W. (1982). The Effect of Unemployment Insurance on Unemployment: The Case of Federal Supplemental Benefits. *Review of Economics and Statistics*, **64**(1), 1–11.

Mortensen, D. (1977). Unemployment Insurance and Job Search Decisions. *Industrial and Labor Relations Review*, **30**(4), 505–517.

Nickell, S. and Layard, R. (1999). Labor Market Institutions and Economic Performance. In O. Ashenfelter and D. Card, editors, *Handbook of Labor Economics, Vol. 3*, pages 1801–1863. Amsterdam: North-Holland.

Porter, J. (2003). Estimation in the Regression Discontinuity Model. Working paper, Harvard University.

Riphahn, R. T. (1997). Disability retirement and unemployment – substitute pathways for labour force exit? An empirical test for the caes of Germany. *Applied Economics*, **29**(4), 551–561.

Van Ours, J. C. and Vodopivec, M. (2006). How Shortening the Potential Duration of Unemployment Benefits Entitlement Affects the Duration of Unemployment: Evidence from a Natural Experiment. *Journal of Labor Economics*, page forthcoming.

Winter-Ebmer, R. (1998). Potential Unemployment Benefit Duration and Spell Length: Lessons from a Quasi-Experiment in Austria. *Oxford Bulletin of Economics and Statistics*, **60**(1), 33–45.

A Appendix

Table A1: Descriptive statistics on all variables

Living in	TR	TR	CR
Age bracket	50-53	46-49	50-53
	A. Men		
Age	51.726	48.033	51.744
Distance to border (minutes)	28.178	27.167	-39.206
Married	.828	.785	.821
Single	.081	.097	.086
Education, secondary	.357	.417	.377
Education, tertiary	.018	.025	.022
Foreign	.101	.092	.081
Replacement rate	.413	.414	.414
ln Wage in previous job	6.503	6.484	6.493
Previous experience	.896	.887	.886
White collar	.087	.108	.087
Agriculture	.07	.054	.044
Utilities	.001	.001	.001
Food	.031	.034	.022
Textiles	.018	.017	.011
Wood	.04	.038	.037
Machines	.066	.055	.019
Other manufacturing	.1	.08	.069
Construction	.481	.492	.6
Tourism	.09	.103	.091
Transportation	.041	.057	.046
Other Services	.043	.05	.051
Number of spells	4759	4975	8537
	B. Women		
Age	51.505	48.103	51.891
Distance to border (minutes)	27.056	26.578	-37.083
Married	.78	.696	.721
Single	.074	.111	.101
Education, secondary	.206	.233	.193
Education, tertiary	.08	.087	.089
Foreign	.018	.019	.035
Replacement rate	.438	.441	.441
ln(wage in previous job)	6.174	6.1	6.13
Previous experience	.906	.876	.887
White collar	.336	.292	.297
Agriculture	.02	.026	.041
Utilities	.001	.000	.002
Food	.051	.047	.061
Textiles	.124	.108	.111
Wood	.025	.03	.027
Machines	.075	.084	.063
Other manufacturing	.119	.088	.104
Construction	.03	.027	.034
Tourism	.303	.344	.334
Transportation	.019	.027	.022
Other services	.178	.167	.177
Number of spells	3466	2193	3625

Notes: TR = treated region, CR = control region.

Table A2: Key to variables in Tables A3 through A6

Age 50	=1 if aged 50 or older
age50_dage_1	age50 * dage_1
age50_dage_2	age50 * dage_2
age50_dage_3	age50 * dage_3
tr	=1 if living in treated region
tr_db_1	tr*db_1
tr_db_2	tr*db_2
tr_db_3	tr*db_3
andfabr	Other manufacturing
bau	Construction
dage_1	(age-50)
dage_2	(age-50) squ.
dage_3	(age-50) cub.
db_1	distance to border
db_2	distance to border squ.
db_3	distance to border cub.
dienstl	Other services
during	= 1 if spell during REBP
during_age50	during*age50
during_age50_dage_1	during*age50*(age-50)
during_dage_1	during * dage:1
during_tr	during * tr
during_tr_db_1	during * tr *db_1
during_db_1	during * db_1
educ_hi	Education, tertiary
educ_med	Education, secondary
elmasch	Machines
foreign	Foreign
gasthand	Tourism
holzind	Wood
landw	Agriculture
lwage_ljob	ln(wage in previous job)
marr	married
nahrung	Food
previous_experience	Previous experience
single	Single
textil	Textiles
verkehr	Transportation
versorg	Utilities
white_collar	White collar

Table A3: Results for Table 2 Panel A

	(1)	(2)	(3)	(4)	(5)	(6)
age50	14.605	14.798	11.153	12.715	3.442	13.831
	(1.070)***	(1.928)***	(3.475)***	(2.577)***	(1.416)**	(1.851)***
dage_1		0.229	0.645	-0.085	0.299	0.514
		(0.432)	(4.878)	(1.694)	(0.290)	(0.435)
dage_2			0.910			
			(2.724)			
dage_3			0.223			
			(0.434)			
age50_dage_1		-0.603	10.683	3.315	-0.715	0.020
		(0.899)	(8.158)	(2.622)	(0.590)	(0.886)
age50_dage_2			-7.857			
			(5.065)			
age50_dage_3			0.885			
			(0.874)			
during_age50					11.356	
					(2.254)***	
during_age50_dage_1					0.112	
					(1.026)	
during_dage_1					-0.069	
					(0.541)	
during					-0.838	
					(1.428)	
marr						-3.791
						(1.963)*
single						2.567
						(2.944)
educ_med						2.037
						(1.239)
educ_hi						-10.493
						(5.303)*
foreign						-6.755
						(1.311)***
rr						-28.661
						(28.208)
lwage_ljob						1.150
						(2.314)
previous_experience						-13.235
						(8.955)
white_collar						28.738
						(3.794)***
landw						-17.628
						(6.473)***
versorg						9.702
						(18.019)
nahrung						9.895
						(8.412)
textil						2.302
						(8.026)
holzind						-11.518
						(6.664)*
elmasch						-7.709
						(7.758)
andfabr						-6.298
						(6.408)
bau						-15.842
						(6.519)**
gasthand						-2.310
						(7.131)
verkehr						-10.349
						(6.914)
dienstl						-1.781
						(7.206)
Constant	14.519	14.970	14.539	14.354	15.808	15.406
	(0.546)***	(1.038)***	(2.400)***	(1.739)***	(0.767)***	(1.017)***
Observations	9734	9734	9734	5382	19460	9734
R-squared	0.02	0.02	0.02	0.01	0.01	0.06

Notes: Robust standard errors in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1% Source: Own calculations based on ASSD.

Table A4: Results for Table 2 Panel B

	(1)	(2)	(3)	(4)	(5)	(6)
tr	13.902	13.622	15.496	12.538	1.872	12.039
	(1.646)***	(2.988)***	(9.530)	(6.037)**	(2.518)	(2.493)***
db_1		-0.000	-0.335	-0.077	0.079	-0.021
		(0.035)	(0.579)	(0.182)	(0.026)***	(0.030)
db_2			-0.009			
			(0.016)			
db_3			-0.000			
			(0.000)			
tr_db_1		0.010	0.128	0.165	-0.108	0.071
		(0.084)	(1.071)	(0.358)	(0.067)	(0.074)
tr_db_2			0.030			
			(0.034)			
tr_db_3			-0.000			
			(0.000)			
during_tr					11.750	
					(3.096)***	
during_tr_db_1					0.118	
					(0.094)	
during_db_1					-0.079	
					(0.036)**	
during					-2.212	
					(1.472)	
marr						-3.655
						(1.998)*
single						1.962
						(2.757)
educ_med						2.204
						(0.990)**
educ_hi						-3.937
						(5.479)
foreign						-7.609
						(1.181)***
rr						-74.375
						(34.118)**
lwage_ljob						-5.209
						(2.993)*
previous_experience						-17.213
						(7.251)**
white_collar						31.581
						(3.450)***
landw						-16.056
						(7.279)**
versorg						-4.084
						(15.580)
nahrung						12.403
						(8.702)
textil						3.765
						(8.905)
holzind						-10.390
						(7.422)
elmasch						3.328
						(8.388)
andfabr						-4.293
						(7.004)
bau						-15.767
						(7.087)**
gasthand						-1.693
						(7.121)
verkehr						-10.154
						(7.026)
dienstl						-3.197
						(7.931)
Constant	15.221	15.220	11.497	13.555	17.431	15.786
	(0.615)***	(1.614)***	(6.129)*	(3.742)***	(1.337)***	(1.233)***
Observations	13296	13296	13296	5762	25341	13296
R-squared	0.01	0.01	0.02	0.01	0.01	0.08

Notes: Robust standard errors in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1% Source: Own calculations based on ASSD.

Table A5: Results for Table 3 Panel A

	(1)	(2)	(3)	(4)	(5)	(6)
age50	68.158	109.645	125.716	121.830	0.307	102.584
	(6.317)***	(4.927)***	(4.873)***	(4.786)***	(2.378)	(4.270)***
dage_1		-1.640	-1.371	-3.940	0.322	-1.149
		(0.891)*	(6.158)	(2.073)*	(0.627)	(0.930)
dage_2			2.839			
			(3.665)			
dage_3			0.773			
			(0.608)			
age50_dage_1		-23.852	-66.663	-38.367	-0.323	-23.277
		(2.150)***	(12.460)***	(4.824)***	(1.032)	(1.872)***
age50_dage_2			19.617			
			(8.262)**			
age50_dage_3			-3.868			
			(1.495)**			
during_age50					109.338	
					(5.292)***	
during_age50_dage_1					-23.530	
					(2.361)***	
during_dage_1					-1.962	
					(0.951)**	
during					-0.648	
					(1.981)	
marr						4.759
						(2.975)
single						-1.017
						(4.970)
educ_med						1.332
						(2.986)
educ_hi						-0.921
						(4.265)
foreign						-29.643
						(6.228)***
rr						73.940
						(37.221)**
lwage_ljob						5.452
						(3.554)
previous_experience						74.722
						(18.071)***
white_collar						30.694
						(3.242)***
landw						-8.236
						(6.122)
versorg						42.561
						(63.028)
nahrung						-7.590
						(5.795)
textil						-6.115
						(5.020)
holzind						-9.761
						(6.919)
elmasch						10.174
						(4.877)**
andfabr						7.370
						(5.192)
bau						-3.786
						(6.592)
gasthand						-4.839
						(4.154)
verkehr						-7.798
						(7.451)
dienstl						-0.494
						(4.534)
Constant	21.233	18.122	16.010	15.535	18.770	24.686
	(1.018)***	(1.752)***	(2.997)***	(2.361)***	(1.411)***	(1.849)***
Observations	5659	5659	5659	3436	9911	5659
R-squared	0.14	0.22	0.22	0.22	0.27	0.26

Notes: Robust standard errors in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1% Source: Own calculations based on ASSD.

Table A6: Results for Table 3 Panel B

	(1)	(2)	(3)	(4)	(5)	(6)
tr	62.554	50.580	46.356	43.324	-3.465	44.856
	(2.973)***	(6.031)***	(15.793)***	(10.136)***	(2.288)	(5.423)***
db_1		0.085	-0.173	-0.086	0.040	0.093
		(0.064)	(0.901)	(0.279)	(0.033)	(0.060)
db_2			-0.002			
			(0.025)			
db_3			0.000			
			(0.000)			
tr_db_1		0.240	0.810	1.015	0.060	0.302
		(0.174)	(1.741)	(0.519)*	(0.067)	(0.158)*
tr_db_2			0.017			
			(0.057)			
tr_db_3			-0.000			
			(0.001)			
during_tr					54.046	
					(5.929)***	
during_tr_db_1					0.180	
					(0.176)	
during_db_1					0.046	
					(0.065)	
during					10.242	
					(2.717)***	
marr						4.551
						(2.828)
single						-0.781
						(3.967)
educ_med						4.846
						(2.390)**
educ_hi						4.756
						(3.923)
foreign						-17.992
						(4.368)***
rr						86.708
						(35.125)**
lwage_ljob						6.752
						(3.829)*
previous_experience						59.782
						(11.450)***
white_collar						27.634
						(2.762)***
landw						-11.062
						(9.302)
versorg						22.986
						(37.996)
nahrung						-10.394
						(9.678)
textil						-14.196
						(9.299)
holzind						-11.090
						(9.622)
elmasch						4.704
						(9.325)
andfabr						-0.295
						(10.976)
bau						-9.484
						(11.673)
gasthand						-12.393
						(8.933)
verkehr						-19.672
						(12.288)
dienstl						-7.346
						(9.148)
Constant	26.837	30.004	25.342	25.917	19.762	34.108
	(1.011)***	(2.634)***	(10.209)**	(6.251)***	(1.580)***	(2.377)***
Observations	7091	7091	7091	3643	11497	7091
R-squared	0.15	0.15	0.15	0.10	0.20	0.20

Notes: Robust standard errors in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1% Source: Own calculations based on ASSD.