# Unemployment Insurance, Disability Insurance and the Early-Retirement Decision

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**Abstract**

We explore how more generous unemployment insurance (UI) rules affect the early-retirement decision of older unemployed workers. In Austria, workers aged 55+ enjoy relaxed access to disability insurance (DI) and take-up of a disability pension essentially allows workers to withdraw permanently from the labor market. To identify the causal impact of more generous UI benefits on early retirement we exploit a policy change that increased the maximum duration of UI benefits from initially 30 weeks to 209 (!) weeks. Since the UI benefit extension was confined to a sub-set of Austrian regions, this policy change allows us to compare residents in eligible regions to residents in non-eligible regions. We find that workers in the age group 50-54 exploit the more generous unemployment benefits as a channel that allows them to retire early by taking advantage of longer UI benefits followed by relaxed access to DI benefits. We also find a very large increase in early retirement rates for individuals closer to the retirement age (age group 55-57). These individuals do not only strongly reduce their labor supply, they also substitute UI for DI in order to bridge the gap to eligibility for regular public pensions.

**Keywords:** Early retirement, policy reform, disability, unemployment

**JEL Classification Numbers:** J14, J26

# 1 Introduction

Understanding the decision that lets workers prematurely retire from work, is of crucial importance for economic policy. Increasing life expectancy and low fertility rates have been creating increasing pressure for reform to pay-as-you-go pension systems. Most importantly, most of these reforms aim at increasing the early retirement age. To be successful, these reforms also require a thorough understanding of the process that induces older workers to leave the labor market prematurely. There are mainly two reasons why the early retirement decision of older unemployed individuals face a different situation than other workers. First, once hit by unemployment, it is harder for older workers than for prime-age workers to find a new job. Second, older workers have potentially access to a multitude of welfare state programmes: in particular, they often get preferential treatment in unemployment insurance (UI) and disability insurance (DI) resulting on substantially lower transition rates from unemployment back to regular jobs. Understanding the incentive and liquidity effects of the entire set of welfare state programmes on the job search behavior is crucial for policy reform.

The aim of our study is to estimate the impact of generosity of the UI system on the incidence of early retirement and the particular pathways of early retirement. To identify such an effect we study the Regional Extended Benefits Programme (REBP) which allowed workers above age 50 to draw regular unemployment benefits for as long as four (!) years. Because this policy was restricted to certain regions of the country, our identification strategy involves difference-in-differences comparisons of individuals in eligible regions to individuals in non–eligible regions, before, during, and after the reform. We find that individuals with access to the REBP had a huge effect on the incidence of early retirement. We estimate that unemployment entrants aged 50 to 54 who ultimately ended up as early retirees was 7.1 percentage points higher among individuals eligible to the REBP. Among workers who became unemployed between ages 55 and 57 the incidence of early retirees even increased by 13.5 percentage points for REBP-eligible individuals.

Our analysis allow us to go one step further by looking at the alternative pathways to early retirement that was created through access to the REBP. We find that, among unemployment entrants aged 50 to 54, excess early retirement is almost entirely driven by individuals who used the REBP to bridge the gap until the age of relaxed access to DI benefits. Our estimated 7.1 percent points excess retirement were due 5.6 percentage points excess DI take-up and only 1.1 percent due to other sources (such as benefits for those in need "Notstandshilfe", sickness benefits, and inactivity). Our results are even more striking in the case of individuals aged 55 to 57. Individuals who entered unemployment in this age bracket, remained unemployed until age 60 when they could draw regular unemployment benefits. In fact, our estimated 13.5 percent of excess retirement in this age group, comprises of an increase in 17.8 percentage points of individuals who stay on UI benefits and a reduction of 4.5 percentage points in DI benefits. In other words, there is a large programme-substitution effect, that lets individuals use the long duration of UI benefits before applying to regular public pension rather than entering bridging the gap to regular pension by the lengthy process of applying for DI benefits.

The focus of our empirical analysis is of unemployed workers. Focusing on unemployed workers is particularly interesting because the typically labor market history of an early retiree starts with losing his or her job, becoming unemployment benefit recipient and, after a successless search for appropriate new job, applying for disability insurance benefits and withdrawing from work permanently. In our empirical analysis we also briefly consider transitions from employment to early retirement in the age groups 50-54 and 55-57, respectively. We find that, while transition from employment to disability are non-negligible, they are much less driven by incentives created by DI or UI regulations. This suggests that policies that directly affect transitions out of unemployment to disability are more likely to be driven by economic incentives. Hence policy reforms that target the unemployment-disability margin are more likely to affect the incidence of early retirement.

We think that Austria is a particularly interesting case for studying the early retirement decision. First, policy makers in Austria have used early retirement schemes disproportionately to mitigate labor market problems of older workers over the past decades. As a result, the effective retirement age of Austria has decreased to somewhat less than 59, well below the OECD average.[1] Second, while early retirement schemes created larger incentives for older workers to leave the work force than in many other countries, the Austrian early retirement system works qualitatively similar to most other countries. Hence understanding the Austrian situation is of more general interest.

Like in most other OECD countries, the Austrian early retirement system is a mix of preferential

[1]According to OECD (2006), in 2004 the average effective retirement age among males ranged from 58 years in Hungary to 74 years in Mexico. The effective retirement ages in US, UK, Switzerland, Germany and France the effective retirement ages were 63, 62, 66, 61, and 59.

treatment of older workers both in unemployment, disability insurance, as well as specific early retirement schemes. In this paper we focus on the effects for preferential treatment in access to unemployment and disability insurance to understand the labor supply decisions of older workers. In particular, it is important to understand how unemployment insurance rules and disability insurance rules allow older workers to withdraw from the labor market before the statutory minimum age and bridge until eligibility to regular old-age pensions by drawing income transfer from those welfare programmes. In Austria, workers aged 50+ are granted a maximum duration of unemployment benefits for 52 weeks (as opposed to 39 weeks for workers aged 40-49 and 30 weeks for workers below 40). Moreover, workers above age 55 had relaxed access to disability insurance during the period under study.[2] The minimum age when regular public pensions can be drawn is age 60 (age 55) for male (female) workers with a continuous work history and hence a continuous history of contributions to the old-age social security system.

Our paper is related to a small literature studying how the broader set of welfare state programmes impact on the labor supply decisions of older workers. This is different from the larger literature that studies the isolated effect of (or reforms to) a single programs on labor supply and/or early retirement. Papers that study the interaction/spillover effects of the unemployment insurance and disability insurance systems for the early retirement decision include Karlström et al. (2008), Kyyrä (2010), Bloemen et al. (2011), and Staubli (2010). Karlström et al. (2008) study how a DI reform in Sweden affected labor supply of older workers. It turns out that stricter DI rules increased take-up of unemployment and sickness benefits, but did not increase employment rates. Kyyrä (2010) provide more favorable evidence from Finland where a series of reforms that changed the age-thresholds for UI and partial retirement and tightened medical criteria for DI eligibility. As a result of these reforms, the effective retirement age increased by almost 4 months. Staubli (2010) studies the effect of a reform Austria that increased the age at which older individuals have relaxed access to DI from age 55 to age 57. The results of suggest a significant decline in disability enrollment and a somewhat weaker increase in employment. The Austrian DI reform also produced non-negligible spillover effects to UI and sickness insurance benefits. Our study differs from the above ones by its focus on the impact of an UI rather than DI reform; and by its focus on unem-

[2]Access to disability insurance became more restrictive in 1996, when the minimum age of relaxed access to disability insurance was increased from 55 to 57. For an analysis of this policy change see Staubli (2010).

ployed workers. A recent paper by Bloemen et al. (2011) is closest to our paper. They look at how a reform to UI in the Netherlands that increased search requirements for the older unemployed affected their transition rates to employment, early retirement and sickness/disability benefits. It turns out that stricter search requirements increased not only employment rates but also DI take up. In contrast to Bloemen et al. (2011) our papers focuses on the impact of changes to the maximum duration of UI benefits rather than on search requirements. Moreover, since the Austrian REBP treated the various labor market regions differentially, our empirical strategy is based not only on contrasts before and after the policy change but also on a cross-regional comparisons of eligible and non-eligible individuals.

A further related literature has studies the interaction between DI and UI programs. Autor and Duggan (2003, 2006) document the rise in disability payrolls in the U.S. that happened despite improving health conditions in the population. Autor and Duggan (2003) show that less strict screening, declining demand for less skilled workers, and an increase in the earnings replacement rate are the most plausible candidates to explain the rise in DI take up. Petrongolo (2009) studies the impact of the UK JSA reform of 1996 that imposed stricter job search requirements and additional administrative hurdles for UI benefit claimants. It turns out that the fall in UI benefit recipients was associated with higher take-up of DI benefits. Furthermore, rather than increasing the transition to regular jobs, the reform temporarily decreased the outflow to employment.[3]

The paper is organized as follows. In the next section we review the institutional background of Austria. In particular, we discuss the various pathways to early retirement that the Austrian welfare state offers to older workers and the rules associated with the regional extended benefit program. In section 3 we develop a theoretical framework for optimal early retirement and develop various testable hypothesis concerning the impact of an UI reform. In section 4 we describe our data and provide some preliminary descriptive evidence of the impact of the REBP. Section 5 lays out our identification strategy. In section 6 we discuss our main results. Section 7 summarizes our main results and draws some policy conclusions.

[3]Related to this paper is the work on UI benefits duration extensions of older workers by Kyyrä and Wilke (2007), Kyyrä and Ollikainen (2008), and Lalive (2008). Winter-Ebmer (2003), Lalive and Zweimüller (2004a, 2004b), and Lalive (2008) analyzed the labor market effects of the REBP change and discussed potential endogeneity issues. Chen and van der Klaauw (2008), Staubli (2010), de Jong et al. (2011) (DI screening and eligibility) and Gruber (2000) and Autor and Duggan (2003) (DI benefits) investigated labor supply effects of DI parameters. Finally, spillover effect in other social programs were analyzed by Garrett and Glied (2000), Schmidt and Sevak (2004), Bound et al. (2004), and Duggan et al. (2007).

# 2 Institutional Background

## 2.1 Pathways to Retirement

Austria's public pension system provides the most important income source for retired individuals. The pension system, that expenditures in 2005 were equal to 13% of national income, is very generous (OECD (2009b)) compared to OECD countries that spent on average 7% of GDP on public pensions. The resulting labor supply effects for older workers are substantial: In 2007, Austria's mal employment rate of 55 and older was around 39 percent. This implies, compared to the OECD country average of 54% (OECD (2009a)), a substantial labor market withdrawal. This is even more puzzling given the fact that the employment rate among prime aged (age group between 25 to 54) was 3% above the OECD level of 88%. This Chapter outlines the institutional settings of the old-age pensions and disability insurance as important pathways to retirement. Moreover, we show how the unemployment insurance provides a way to withdraw from labor market before claiming public pension benefits.

**Old-age pension.** Austria's pension system covers all active labor market participants. Statutory pension benefits can be claimed at the age of 65 (60) for men (women). Workers are eligible to old-age pensions with either 15 contribution years (periods of employment, including sick leave, and maternity leave) or at least 15 insurance years (sum of contribution years and qualifying years that are periods of unemployment, military service, or secondary education) within the last 30 years. Experienced workers are allowed to retire early via old age pension at the age of 60 (men) or 55 (women), respectively. This option is provided to individuals with either i) at least 15 insurance years within the last 30 years or ii) 15 contribution years and 30 insurance years in total.

The amount of pension benefits, irrespective of the retirement age, are mainly determined by two components: First, the average wage of the 15 highest labor income years constitutes the so-called assessment basis. Second, the number of accumulated insurance years determines to what extend the assessment basis is converted into an old-age pension. Postponing the retirement age by one year, or having an additional insurance year, increases the replacement rate by roughly 2 percent. A typical male worker with complete curriculum, that corresponds to a statutory retirement with 45 insurance years, is eligible to a gross replacement rate of 80 percent. This is very generous given the average replacement rate of 59% in OECD countries (OECD (2009b)). Individuals that receive old-age pension benefits are subject to income tax and health insurance contributions.

**Unemployment insurance.** The unemployment insurance provides an important pathway to withdraw from labor market because almost 40% of new enrolled unemployed transition directly to the disability or old-age pension. Unemployment benefits replace around 55 % of the last wage and are neither taxed nor means-tested. Workers above the age of 50 that have at least (less than) 9 contribution years within the last 15 years can claim unemployment benefits up to 52 (30) weeks.[4] After the exhaustion of unemployment benefits, the unemployed can apply for “transfer payments for those in need” (“Notstandshilfe”). Those transfers are means-tested and can be at maximum 97% of the unemployment benefits.[5]

The access to early retirement at 60 (55, females) via old age pension is considerably eased for the long term unemployed. Individuals are required to have been unemployed for at least 12 month within the last 15 months. No further restrictions are imposed on the work history such as insurance or contribution years. The old-age pension benefits are calculated in the same way as early retirement due to long insurance duration.

The use of the special income support program (“Sonderunterstützung”) provides a very attractive way to withdraw from labor market one year before early retirement age. The SIS lasts one year and provides benefits that are 25% higher than unemployment benefits. Eligibility is based on having at least 15 contribution years out of the last 25 years. Most important, the receipt of SIS is treated as an unemployment spell, therefore, by combining the SIS program and early retirement, many older male (female) unemployed are able to withdraw form labor market at the age of 59 (54).

**Disability insurance.** The importance of Austria’s disability insurance is mainly due to its financial generosity and relaxed eligibility criteria for workers close to retirement. Disability benefits are determined in the same way as old age pension benefits. Hence, the average gross

[4]Before August 1989, the potential unemployment duration was 30 for all individuals above 50. See Lalive et al. (2006) for a detailed description of the policy change and how it affected younger workers.

[5]The unemployment assistance benefits correspond on average to 78% of the unemployment benefits Winter-Ebmer (2003).

replacement rate is around around 70 percent of the last wage that is very high by intergenerational standards. The second feature of the DI is the considerable relaxation of the eligibility criteria at the age threshold of 55. In general, disability benefits are awarded to individuals with an impairment that reduces the ability to work by more than 50% relative to a comparable healthy person if i) it does not entail a loss of social status and ii) there exist at least 100 jobs in the field (vacant and occupied) in Austria (Wörister (1999)). Above the age of 55, criterion ii) is relaxed to a broader interpretation of a similar occupation. We refer to the less restricted access at the age of 55 as the "relaxed disability".

## 2.2 The Regional Extended Benefit Program

The Regional Extended Benefit Program (REBP) is rooted in the strong protectionism of Austria's heavy industry. After World War II, the nationalization of Austria's iron, steel, and oil industries, and related heavy industries was supposed to preclude the Soviets from appropriating private firms. After the mid-1970, the state-run company Österreichische Industrie AG, in charge of administrating the nationalized firms, faced shrinking markets due to the international oil and steel crisis, low productivity, and out-dated smokestack industries. The resulting financial losses were covered by governmental subsidies - manly to protect jobs in these industries. In 1986, a speculation scandal in the steel industry triggered the abolishment of the protectionism, introduced privatization, and the implementation of a though restructuring plan. This process caused mass layoffs and downsizing of production plants, especially in the steel sector.

The REBP, enacted in June 1988, aimed to protect older workers against bad labor market conditions in the steel industry. The Austrian government reduced this exposure extending the potential unemployment duration from 52 weeks to 209 weeks for workers older than 50. The REBP was implemented until December 1991 in 28 regions. However, at the end of 1991, the Austrian parliament decided to prolong the program until August 1993 for a sub-group of six regions (extended duration). Figure 1 plots the REBP regions with normal and extended duration.

*Figure 1*

The program eligibility based on the following criteria: i) age 50 or older, ii) continuous work history, iii) location of residence in one of the 28 selected labor market districts since at least 6 months prior to the claim, and iv) start of new unemployment spell after June 1988 or spell in progress in June 1988.

This policy change provides a a quasi-experimental design by comparing REBP regions (treatment) with non-REBP regions (control). Hence, we can investigate how extended unemployment benefits affect retirement behavior. Figure 2 visualizes how the REBP financially eased the access to disability insurance and early retirement for male unemployed.

*Figure 2*

Figure 2 clearly shows that eligible individuals can withdraw from labor market at 51 with a non interrupted use of unemployment benefits up to the age of 55, when the disability benefits eligibility is relaxed. After 55, the use of the REBP, in combination with special income support, allowed individuals to withdraw from labor market without having a financial gap.

## 3 Theoretical Framework

Most developed countries provide a rich set of pathways to withdraw from labor market. Especially older workers, that are close to effective retirement age, are eligible to social insurance benefits from many sources such as unemployment, disability, or old-age pensions. Hence, a comprehensive analysis of retirement behavior requires a sound understanding and modeling of competing pathways. Moreover, heterogeneity among individuals is essential in understanding the use of competing pathways. We combine two sources of heterogeneity that are established in the retirement literature: First, given the individual wants retire, financial incentives[6] have a major impact on the choice of the specific retirement program. Second, individuals's health status[7] determines if individuals go back to work or not. Of course, health status and financial incentives interact in a sense that high retirement benefits can incentivize even individuals with low disutility of work to retire.

[6]See for example Gustman and Steinmeier (1986), Stock and Wise (1990), and Gruber and Wise (1999,2004) on how financial incentives affect retirement behavior.

[7]See for example Diamond and Sheshinski (1995), Autor and Duggan (2003), and Bound et al. (2010).

Austria provides a rich laboratory to investigate the interaction of different retirement programs. We suit the theoretical model to two features of Austria's institutional setting: First, the design of the social security leads to a high dispersion of unemployment and disability benefits for similar individuals. This is mainly due to different rules of calculating the benefits level. Unemployment insurance benefits are mainly a function of the last wage and, therefore, the replacement rate of 55% is similar across individuals. Whereas the disability benefits are determined by the average wage of the 15 years with the highest labor income. The following Table reports the strong heterogeneity of disability replacement rate within wage quartiles.

*Table 2*

Therefore, we account for the strong heterogeneity in disability benefits and assume, to reduce model complexity, a constant UI replacement rate.

Second, the design of the social insurance provides a justification to model the age groups 50-54 and 55-59 separately: Individuals between the age of 50 and 54 can use the REBP to bridge up to 55 and use the relaxed disability to retire. Older unemployed, that are individuals between the age of 55 and 59, can withdraw from labor market by choosing among two non-work related pathways: Either they can apply for disability, that is generously awarded above 55, or remain unemployed until 60 and claim early retirement benefits.

**Age group 50 to 54.** Unemployed at the age of 50 have two options to transition to other states. The first option is given by the strategy to stay unemployed until the age 55 and retire via disability. Using standard assumptions[8] the lifetime utility is given by two components.

First, up to 54, the individual derives utility from consuming unemployment benefits. The unemployed gets $b^u$ until the exhaustion of the regular unemployment benefits $T$. Afterwards, we assume that the individual is eligible for unemployment assistance benefits $a$. Hence, the normalized income over the entire unemployment period is given by $b = Tb^u + (1-T)a$.

Second, after 55, the individual's income is given by the disability pension $d$. Formally, this

[8]This implies i) additive separable utility over time, ii) exponential discounting, iii) infinite lifetime, and iv) concave twice differentiable utility over consumption.

corresponds to the lifetime utility

$$\tilde{V}^U = u(b) + \beta \frac{u(d)}{1-\beta} \tag{1}$$

given a discount rate $\beta$ and flow utility $u(\cdot)$. This set-up imposes a borrowing constraint against future income and no initial assets. Moreover, in line with evidence form the data, we assume that DI benefits are equal or higher than UI benefits, or $b \leq d$.

Working is an other way to leave the unemployment state. We assume that unemployed individuals can go back to work with no monetary or utility costs and get a job for certain. In line with Diamond and Sheshinski (1995) we impose an additive separable disutility $\theta$ of work. Given a consumption stream $\tilde{c}$, the lifetime utility equals to

$$\tilde{V}^W = \frac{u(\tilde{c})}{1-\beta} - \theta. \tag{2}$$

This strategy involves working until the age of 60, or two periods in the model, earn wages $w$, and retire early. Note that the old-age pension benefits are similar to the disability benefits but augmented by the factor $\alpha > 1$.[9] Hence, the lifetime budget constraint is given by

$$\sum_{t=0}^{\infty} \frac{\tilde{c}}{R^t} = w + \frac{w}{R} + \sum_{t=2}^{\infty} \frac{\alpha d}{R^t} \tag{3}$$

with $R$ denoting the gross interest rate. We further assume that $\beta R = 1$.

Optimal decision making of individuals is characterized by an indifference curve. Given a level of disability benefits $d$, the function $\tilde{\theta}^W(d)$ denotes the health level required to make an individual indifferent between work and retire early via unemployment benefits.

**Proposition 1** $\tilde{\theta}^W(d)$ *is single valued and strictly positive for all* $d \in (b, w)$. *Moreover, if* $\alpha R^{-1} \leq 1$ *then* $\frac{\partial \tilde{\theta}^W}{\partial d} < 0$.

The property $\frac{\partial \tilde{\theta}^W}{\partial d} < 0$ reinforces the intuition that individuals retire if financial benefits are high and/or health conditions are bad. The left graph in Figure 3 illustrates the indifference curve in the $(d, \theta)$-space. The assumption $\alpha R^{-1} \leq 1$ is a sufficient, but not necessary, condition that

[9] The multiplier $\alpha$ represents the intertemporal link between disability benefits (age 55) and old-age pension benefits (age 60).

makes sure that the indifference curve is bent downwards.[10] Hence, more generous retirement benefits lead to a higher rate of labor force exit.

**Age group 55 to 59.** Individuals becoming unemployed after 55 face three different pathways to retirement. First, due to the relaxed disability threshold at 55, they can directly retire via disability insurance. This option yields a constant flow of $d$ income with lifetime utility $V^D = \frac{u(d)}{1-\beta}$. Second, individuals can withdraw from labor market by using unemployment benefits

$$b = Tb^u + (1-T)a$$

and retire at the age of 60. Note that early retirement benefits are a fixed proportion $\alpha > 1$ of the disability benefits $d$. The lifetime utility of this option is given by

$$V^U \quad = \quad u(b) + \beta \frac{u(\alpha d)}{1-\beta}.$$

Finally, individuals can go back to work and retire, similar to the second option, at the age of 60. The value of this pathway is given by the utility of the consumption stream reduced by the disutility of work $\theta$, or $V^W = \frac{u(c)}{1-\beta} - \theta$. The consumption level is determined by the intertemporal budget constraint

$$\sum_{t=0}^{\infty} \frac{c}{R^t} = w + \sum_{t=1}^{\infty} \frac{\alpha d}{R^t}.$$

In contrast to the age group 50-54, individual's optimal decision is characterized by three areas that define three optimal pathways in the $(\theta, d)$ space.

**Proposition 2** *The indifference curve $\theta^W(d)$ is single valued and strictly positive for all $d \in (b, w)$. Moreover, if $\alpha R^{-1} \leq 1$ then $\frac{\partial \theta^W}{\partial d} < 0$ almost everywhere. Given the individual retires, only financial incentives matter for deciding to withdraw via unemployment or disability insurance.*

This setting extends the baseline model of age groups 50-54 by an additional choice: To get the

[10] To see why a violation of this condition changes the results, think about the following case: Keep $R$ and $\theta$ fixed. One can always find an $\alpha > 0$ that incentivizes people to go back to work because the opportunity costs of early retirement raises with $\alpha$. In practice, this condition is satisfied because Austrian's pension system is not "fair" with respect to postponing the retirement by one year (see Hofer and Koman (2006)).

disability benefits without "delay". The following picture represents how individuals decide on the optimal pathway given their location in the $(\theta, d)$ space.

Figure 3

The interpretation of the different areas is straight forward. Individuals that are in bad health conditions and eligible for high disability benefits chose the disability pathway. If the disability benefits are relatively low compared to unemployment benefits then it is optimal to stay unemployed and retire early. Finally, individuals with good health status and low disability pension benefits go back to work.

**Extending the potential benefit duration.** The regional extended benefits program (REBP) increased the potential benefit duration dramatically. Given the simple model previously outlined, we are able to analyze work incentives for both age groups. Formally, the REBP policy change corresponds to an increase in the UI duration parameter $T$. The predicted effects are summarized by the following Hypothesis.

**Hypothesis 1 (REBP)** *Age group 50-54: Decrease in labor supply due to higher transitions to disability insurance. Age group 55-59: Increased use of old-age pensions caused by i) less transition back to work and ii) less use of disability pensions (program substitution effect).*

Figure 4 visualizes the predicted effect of the change in UI benefits duration on the relevant thresholds.

Figure 4

The interpretation of the effects is straight forward. In the age group 50 to 54 (Figure 4 LHS) the threshold moves down since staying unemployed is more attractive. In the age group 55 to 59 (Figure 4 RHS), more individuals choose the unemployment-retirement pathway due to two effects: First, individuals have less incentives to go back to work. This is represented by the fact that the unemployment-retirement threshold moves down. Second, even for those individuals that are do not work, the unemployment pathway is relatively more attractive. Therefore, the disability-unemployment threshold moves to the right. Note that the disability-employment threshold is not affected since individuals claiming disability do not make use of unemployment benefits.

**Increasing initial wealth.** Do wealthier individual, keeping everything else fixed, retire earlier? We analyze the effects of a small increase in wealth $dA$ given that individuals start from $A = 0$. The predicted wealth effect is stated by the following Hypothesis.

**Hypothesis 2 (Wealth)** *An increase in wealth increases the use of early retirement in both age groups.*

The intuition is linked to the functional specification of the disutility of work: Individuals that work have always higher consumption than non-workers - otherwise they would have a strong incentive to retire. Hence, the marginal value of an additional unit of wealth is higher for non-workers because of the strict concavity of the utility function. This argumentation holds true for both age groups. Interaction effects between the pathways are difficult to predict.

# 4 Data and Descriptive Evidence

## 4.1 Data

To examine the impact of extended unemployment benefits on transitions out of unemployment, we combine register data from two different sources. The Austrian Social Security Database (ASSD) provides very detailed longitudinal information dating back to 1972 on the labor market history and earnings for the universe of private sector workers in Austria (see Zweimüller et al. (2009)). The second source is the Austrian unemployment register, which contains information on socio-economic characteristics including the place of residence.

Our main sample consists of all male workers aged 50-59 at the beginning of their unemployment spell who enter unemployment from a job in the non-steel sector in the time period 1/1986 until 12/1987 and in the time period 6/1988 until 12/1995. These spells are followed up until end of 2006. We focus on men because women are already eligible for pension benefits at age 55 (as opposed to age 60 for men). Thus, women do not face a choice between different transition paths to retirement. We exclude unemployment spells starting between 1/1988 and 5/1988 because ongoing spells were also eligible for the REBP. Excluding these spells guarantees that the before-period is not affected by the REBP. We also exclude unemployed men with less than 15 employment years in the past 25 years. Only job seekers who satisfy this criteria are eligible for the REBP. The final sample comprises 161,211 unemployment spells.

Table 3 presents summary statistics on job seekers entering unemployment before (1/1986–12/1987), during (6/1988–7/1993), and after the REBP (7/1993–12/1995) by region of residence. The sample generally looks quite similar in observable characteristics between the treated and control regions. A comparison of the exit destinations before, during, and after the REBP provides first evidence on the impact of the policy change. Specifically, in the treated regions relative to the control regions, the reemployment probability declines dramatically during the REBP. The decline is accompanied by a substantial increase in transitions from unemployment to disability and retirement.

*Table 3*

To explore the impact of additional wealth on the exit destination out of unemployment, we exploit variation across job losers in the receipt of lump-sum severance payments. Individuals who are laid off after 3 years of service qualify for a lump sum severance payment equal to two months of their last salary. This amount increases to 3 months for workers with 5 years of service, 4 months after 10 years, and 12 months after 25 years. Employees who quit or are fired for cause are not eligible for severance pay. We focus on observations around the discontinuity of 3 years by only including unemployed men with 1 to 5 years of service at their previous firm because over 80% of job losers in our sample have less than 5 years of service. Table 4 presents summary statistics for the severance pay sample by region of residence before and during the REBP. The sample generally looks quite similar in observable characteristics between the treated and control regions.

*Table 4*

### 4.2 Descriptive Evidence

To assess the impact of the change in unemployment benefit duration graphically, Figure 5 plots the fraction of transitions from unemployment into employment, disability, and retirement over age by region of residence before and during the REBP. As shown in the top left subfigure, after the implementation of the program the fraction of transitions to employment in the treated regions declines after age 50. This decline was compensated by an increase in transitions from unemployment to disability (top middle subfigure) as well as an increase in transitions from unemployment to retirement (top right subfigure). In the control regions, trends in unemployment exits are quite comparable before and during the REBP.

*Figure 5*

## 5 Identification Strategy

The impact of the REBP on transitions out of unemployment can be estimated by using a difference-in-difference (DD) approach. The first difference is over time, since the program was in effect only from June 1988 to July 1993. The second difference is across geographic areas; only older job seekers living in one of the 28 selected regions were eligible for the benefit extension. A third difference would be age because only job seekers age 50 or older were eligible for the REBP. However, as shown in Figure 5, the majority of unemployed workers below age 50 return to employment. A comparison between job seekers below and above age 50 will therefore not be very informative to identify the effect of extended benefits on transitions from unemployment into disability or retirement.

The difference-in-difference comparison is implemented by estimation regressions of the following type:

$$y_{it} = \alpha + \beta TR_{it} + \gamma D_t + \delta A_t + \pi(D_t \times TR_{it}) + \tau(A_t \times TR_{it}) + \lambda_t + X_{it}'\theta + \varepsilon_{it} \tag{4}$$

where $i$ denotes individual, $t$ is the start date of the unemployment spell, and $y_{it}$ is the outcome variable of interest. The Variable $TR$ is a dummy variable that indicates whether or not an individual lives in a treated region to control for region-specific trends; $D$ is an indicator taking the value 1 if the unemployment spell started after the REBP was in effect (June 1988); $A$ is an indicator taking the value 1 if the unemployment spell started after the REBP was abolished (January 1992 in TR1s and August 1993 in TR2s); $\lambda_t$ is a vector of year fixed effects to control for changes in macroeconomic conditions; and $X_{it}$ is a vector of background characteristics to control for observable differences that might confound the analysis (age fixed effects, marital status, blue-collar status, education, work experience, years of service, sick leave history, last wage, previous industry, and quarter of inflow parameters).

The coefficients of interest are $\pi$ and $\tau$ which measure the effect of the REBP on older job seekers in the treated regions relative to the control regions in the years when the program was in effect relative to before its implementation ($\pi$) and in the years after which the program was abolished relative to during the program ($\tau$). Clearly, ff the introduction and abolishment of the REBP have symmetric effects on the outcome variable of interest we have $\pi = -\tau$.

Equation (4) is estimated separately for the age groups 50-54 and 55-57 because we expect the impact of the REBP on transitions out of unemployment to be very different for both groups. Job seekers aged 50-54 may use the REBP to bridge the gap until age 55 at which conditions for disability classification are relaxed. Job seekers aged 55-57, on the other hand, can directly apply for DI benefits under the relaxed eligibility criteria, but may use the REBP instead to bridge the gap until the early retirement age.

To explore the impact of the policy reform for each age separately, we generalize this identification strategy to an interaction term analysis:

$$\begin{aligned} y_{it} &= \alpha + \sum_{j=50}^{59} \beta_j (d_{ijt} \times TR_{it}) + \sum_{j=50}^{59} \gamma_j (d_{ijt} \times D_t) + \sum_{j=50}^{59} \delta_j (d_{ijt} \times A_t) \\ &\quad + \sum_{j=50}^{59} \pi_j (d_{ijt} \times D_t \times TR_{it}) + \sum_{j=50}^{59} \tau_j (d_{ijt} \times A_t \times TR_{it}) + \lambda_t + X'_{it}\theta + \varepsilon_{it} \end{aligned} \tag{5}$$

where $d_{ijt}$ is a dummy that indicates whether individual $i$ is age $j$ at the start date $t$ of the unemployment spell. Each coefficient $\pi_j$ and $\tau_j$ capture all variation in the outcome variable specific to individuals of age $j$ in the treated region (relative to the control regions) when the program was in effect ($\pi_j$) and after the program was abolished ($\tau_j$), using variation in the duration of unemployment benefits over time.

The central identifying assumption is that there are no omitted time-varying and region-specific effects correlated with the program. Lalive and Zweimüller (2004b) detect no substantial differences in unemployment outcomes across treated and control regions prior to the inception of the REBP. However, they show that the entitled regions were characterized by a strong concentration of employment in the steel sector, which casts doubts on the assumption that the REBP is an exogenous policy. Therefore, we focus on job seekers not previously employed in the steel sector. This strategy will still yield biased results if the restructuring of the steel sector spills over to other industries. Lalive and Zweimüller (2004b) find that spillover effects from the steel industry to other industries are small. As shown in Figure 6, the REBP led to a substantial increase in unemployment inflow. A final concern is that this additional inflow is selective due to additional layoffs by firms or more voluntary quits by workers. However, as shown in Table 3, characteristics of job seekers in treated and control region are quite similar in the years the REBP was in effect. To test the implications from our theoretical model, we estimate the effects of the REBP for different subsamples of individuals.

We examine the impact of the severance pay on transitions out of unemployment by running the following equation:

$$\begin{aligned} y_{it} &= \alpha + \beta TR_{it} + \gamma SP_i + \delta D_t + \mu A_t + \pi_0(D_t \times TR_{it}) + \pi_1(D_t \times TR_{it} \times SP_i) \\ &+ \tau_0(A_t \times TR_{it}) + \tau_1(A_t \times TR_{it} \times SP_i) + \lambda_t + X'_{it}\theta + \varepsilon_{it} \end{aligned} \tag{6}$$

where $SP_i$ is a dummy for severance pay. The coefficient $\gamma$ identifies the impact of a severance payment on the transition probability from unemployment into the state of interest (employment, disability, or retirement); $\pi_0$ ($\tau_0$) measures the effect of the inception (abolishment) of REBP for job seekers who are not eligible for severance pay; and $\pi_1$ ($\tau_1$) measures the effect of the inception (abolishment) of REBP for job seekers who received a severance pay relative to those not eligible for severance pay.

# 6 Results

## 6.1 Basic Results

The first set of results is summarized in Table 5, which shows the OLS estimates of equation 4. The dependent variable is an indicator, which is equal to 1 if an individual exits unemployment through the state in question and 0 otherwise. The first row shows that the probability of reentering employment decreases by 7.1 percentage points among the 50-54 year old treated unemployed in the years the REBP is in effect. This decline is almost entirely compensated by an increase in transitions to disability of 5.6 percentage points, while transitions to retirement remain unchanged. The third row shows that the effects are reversed after the program was abolished although the estimates are somewhat larger in size.

Among the treated individuals aged 55-57, the introduction of the REBP led to a decline in transitions from unemployment to employment of 13.5 percentage points, which is twice as large as for the 50-54 year olds. Consistent with the predictions from the theoretical model, there is also clear evidence for a program substitution effect. In the years the program is in effect older job seekers are significantly less likely to enter the DI program and more likely to use the REBP as a bridge to retirement. As a consequence of the decline in exits to employment and disability, there is a substantial increase in transitions from unemployment to retirement of 17.8 percentage points. Similar to the younger job seekers, there is a clear reversal in the effects on unemployment exits for the 55-57 year olds after the program was abolished.

*Table 5*

To further explore the impact of the introduction and abolishment of the REBP, Figure 7 plots the estimated coefficients of the interaction terms from equation (5) for each age $l$ separately. Each dot on the solid lines is an indicator for living in a treated region and being a given age during the REBP (red line) and after the REBP (black line). A 95-percent confidence interval is shown by dotted lines.

As shown in the first panel, coefficients for reentering employment are significantly negative up to age 57 during the REBP is in effect. Consistent with the institutional rules, there is no employment effect for 58 and 59 year old job seekers because they do not need the REBP to bridge the gap until the early retirement age of 60. The second panel shows that in the treated regions unemployed men below age 55 are more likely to enter the DI program at the end of their unemployment spell, but there is no change in the transition pattern to retirement (third panel). For unemployed workers above age 55, coefficients for entering disability are negative, providing evidence for the program substitution effect. With the introduction of the REBP, the exit channel into the old-age pension scheme has become financially more attractive relative to disability. Consistent with this view, there is a large increase in transitions to retirement for unemployed men above age 55 during the

REBP is in effect. Finally, the black line highlights that after the abolishment of the REBP the effects on transitions out of unemployment are reversed for all ages.

Figure 7

### 6.2 Subsample Analysis

Our theoretical model predicts that the dynamics of transitions out of unemployment depend on health and the benefit generosity of exit channels. To shed light on the importance of these factors, we examine the effects of the REBP for different subsamples of individuals. To explore the role of benefit generosity we group individuals into quartiles based on their potential (net) DI replacement rate. The potential net DI replacement rate determines the generosity of the disability channel relative to the retirement channel because unemployment benefits replace a constant fraction of the last net wage. Then equation (4) is estimated separately for the bottom and top quartile of the DI replacement rate distribution (Table 6).

The second column of Table 6 indicates that younger and older job seekers at the top of the DI replacement rate distribution are more than twice as likely to enter DI relative to unemployed in the bottom quartile. Similarly, the forth column shows that the program substitution effect is driven by job seekers at the bottom quartile. Among older unemployed in the top quartile transitions from unemployment to disability are unchanged because for those individuals disability is likely to be financially more attractive compared to retirement even after the REBP is in effect. Thus, as predicted by our theoretical model, benefit generosity is an important determinant for the exit channel from unemployment.

*Table 6*

To explore the role of health, Table 7 presents OLS estimates of equation (4) for healthy and unhealthy job seekers. An individual is defined as healthy if he or she has not spent any time in sick leave prior to start date of the unemployment spell. An individual is defined as unhealthy if the time spent on sick leave prior to the unemployment spell is greater than the median time for individuals with positive sick leave days. As shown in the first and fourth columns, transitions from unemployment to employment decrease (increase) more during (after) the REBP for the unhealthy relative to the healthy. Thus, health appears to be an important determinant for return-to-work behavior as predicted by the theoretical model.

The remaining columns indicate that health plays also an important role for the choice between disability and retirement exit. In the age group 50-54 unhealthy unemployed are more likely to enter the DI during the REBP and less likely to do so after the REBP is abolished. In the years the REBP is in effect, healthy unemployed aged 55-57 are less likely to enter disability after the unemployment spell and more likely to enter retirement. This pattern is reversed after the abolishment of the REBP. For unhealthy unemployed, on the other hand, there is no evidence for such a program substitution effect. This finding suggest that there are costs associated with an application for DI benefits and these costs are likely to be higher for healthy individuals.

*Table 7*

## 6.3 Wealth Effect

We begin by providing graphical evidence on the effect of additional wealth on transitions out of unemployment into different states. Figure 8 shows the reemployment probability in the treated and control regions for those who received severance pay and those who did not during the REBP was in effect. The Figure shows a substantial reduction in transitions from unemployment to employment in the treated regions at age 50, particularly among severance pay recipients. Similarly, in the treated regions severance pay recipients above age 50 have a significantly lower reemployment probability during the REBP is in effect. Also in the control regions severance pay recipients have a substantial lower. The pattern in reemployment probabilities is similar in the control regions, except for the large drop at age 50.

*Figure 8*

Table 8 presents OLS estimates of equation 6.

## 6.4 Policy Implications

The aim of this section is to calculate the net budgetary impact of the REBP. Because of the differential effect of the reform for 50-54 year olds and 55-57 year olds, these two groups are considered separately. Table 9 presents OLS estimates of equation (**??**) where the dependent variable is days spent in employment, disability and unemployment up to age 60. Since the majority of men has withdrawn permanently from the labor market at age 60, we believe that the REBP has no impact on labor supply beyond that age. Based on these estimation results it is possible to estimate the net budgetary effects of the REBP program, as shown in Table 10.

*Table 9*

*Table 10*

### 6.5 Welfare Analysis: REBP

This Section investigates welfare effects of the potential benefits duration based on the REBP program for the age group 55 to 59. We proceed in two steps: First, we show how this policy change affects government's net expenditures. Second, we derive a sufficient statistic to evaluate the optimality of the UI duration for the elderly in Austria. Back-of-the-envelope calculations indicate that the REBP was too generous.

**Budget effects.** Let $Z$ be space of all potential health-disability benefits combinations, or $Z = [0, \infty) \times [b, w]$. The distribution function $F$ over $Z$ represents the density of individuals over $(\theta, d)$. Finally, we partition $Z$ into three sub groups: The unemployed denoted by $Z^U$, employed $Z^U$, and disabled $Z^D$. The measure of each region is represented by $p^U$, $p^U$, and $p^D$.

We introduce payroll taxes $\tau$ on income. Net present expenditures are given by

$$N = \int_{Z^W} \left( \sum_{t=1}^{\infty} \frac{\alpha d}{R^t} - \tau w \right) dF(z) + \int_{Z^U} \left( b + \sum_{t=1}^{\infty} \frac{\alpha d}{R^t} \right) dF(z) + \int_{Z^D} \sum_{t=0}^{\infty} \frac{d}{R^t} dF(z)$$

The effect of extending the potential benefits duration on net expenditures

$$\frac{dN}{dT} = p^U(b^u - a) + \frac{dp^D}{dT} \left( \frac{R-\alpha}{R-1} d^{U,D} - b \right) - \frac{dp^W}{dT} (b + \tau w) \quad (7)$$

Equation (7) can be subdivided into three parts

1. Mechanical effect: $p^U(b-a)$. Additional costs of increasing $T$ if individuals would not change behavior.

2. Behavioral effect I: $-\frac{dp^W}{dD}(b+\tau w)$. Employment effect: Each individual that changes from work to unemployment gets $b$ and does not pay taxes ($\tau w$) anymore.

3. Behavioral effect II: $\frac{dp^D}{dT}\left(\frac{R-\alpha}{R-1}d^{U,D}-b\right)$. Program substitution effect.

**Optimization by the social planner.** Suppose the government maximizes an utilitarian welfare function and government can only alter the unemployment benefits duration $T$.

$$W=\int_{Z^W}V^W(z)dF(z)+\int_{Z^U}V^U(z)dF(z)+\int_{Z^D}V^D(z)dF(z)$$

such that $N\leq\bar{R}$ the budget constraint is satisfied. $\bar{R}$ denotes additional resources that are available, i.e. accrued contributions during the life cycle.

Define the "elasticities"

$$\varepsilon_{p^D,T}=-\frac{dp^D}{dT}T \text{ and } \varepsilon_{p^W,T}=-\frac{dp^W}{dT}T$$

Assuming interior solution we can approximate the local optimality condition by

**Proposition 3** *The optimal unemployment benefits duration can be approximated by*

$$\bar{\gamma}_R\frac{\Delta\bar{c}}{\bar{c}_W}\approx\frac{\varepsilon_{p^D,T}}{\sigma}\left(1-\frac{R-\alpha}{R-1}\frac{d^{U,D}}{b}\right)+\frac{\varepsilon_{p^W,T}}{\sigma}\left(1+\frac{\tau w}{b}\right)\tag{8}$$

*given the average relative risk aversion $\bar{\gamma}_R$, the consumption difference $\frac{\Delta\bar{c}}{\bar{c}_W}$ between workers and long-term unemployed, and the weighing factor $\sigma=\frac{p^U T(b^u-a)}{b}$.*

Equation (8) balances costs and benefits from the REBP extension.

**Welfare calibration.** Long-term income of the unemployed before intervention is given by one year unemployment insurance, or 1/5 (normalized) times the replacement rate of around $b^u=40\%w$ (median income before taxes, see Lalive (2008), and unemployment assistance $a=70\%b^u$ during the remaining years. Overall we get

$$b=\frac{1}{5}\times 0.4w+\frac{4}{5}\times 0.7\times 0.4w=0.30w$$

| **Parameter** | **Value** |
|---|---|
| ATE on pathway choices | $\varepsilon_{p^D,T} = 0.05 \times \frac{1}{3} = 0.017$ <br> $\varepsilon_{p^W,T} = 0.13 \times \frac{1}{3} = 0.043$ |
| Weighting factor | $\sigma = \frac{0.15 \times 0.2 \times (0.40w - 0.7 \times 0.40w)}{0.30w} = 0.012$ |
| Ratio: DI and UI replacement rates | $\frac{d^{U,D}}{b} = \frac{0.55w}{0.3w} = 1.83$ (?) |
| Ratio: Tax rate and UI replacement rate | $\frac{\tau w}{b} = \frac{0.1w}{0.30w} = 0.34$ (?) |
| Annual accrual rate early retirement | $\alpha_a \approx 1.02$ Hofer and Koman (2006) |
| Annual interest rate | $R_a = 1.035$ |

We implement the right-hand side by

$$\frac{0.017}{0.012}\left(1 - \frac{1.035^5 - 1.02^5}{1.035^5 - 1}1.83\right) + \frac{0.043}{0.012}(1 + 0.34) = 0.28 + 4.8$$

Conclusions (given parameter choice above)

- Employment effect >> program substitution effect.
- Assume that consumption drop is around $\frac{\Delta c}{c} = 0.7$ (Interpretation: long-term unemployed have 70% less consumption than "similar" workers before retirement $\frac{\Delta c}{c} = \frac{1-0.3}{1}$). Then a risk aversion of $\gamma > 7$ is required to justify an extension of the unemployment benefits duration (beyond one year). Hence, extending the unemployment duration, such as the REBP, is welfare decreasing. (Moreover, these results show that we should actually reduce unemployment benefits duration for the elderly ... ???? )

**Very important remarks:**

- No duration considered! Might have important effects ...
- Calibration should be done more carefully (this represents only a first pass ...) Especially, the results on cost-side are very high.

## 7 Conclusion

In this paper, we study the labor supply effect of UI and DI insurance programs for the incidence of early retirement in Austria. We think that Austria is a particularly interesting case for studying the early retirement decision. Over the past decades, Austrian policy makers have used early retirement schemes disproportionately to mitigate labor market problems of older workers. As a result, the incidence of early retirement is much higher in Austria compared to other OECD countries. However, while early retirement schemes created larger incentives for older workers to leave the work force than in many other countries, the Austrian early retirement system works qualitatively similar to most other countries. Hence understanding the Austrian situation is of more general interest.

We focus on the impact of one particular policy parameter that is of crucial importance for transitions from UI to early retirement: the maximum duration of UI benefits. This parameter is of particular interest, because long unemployment benefits in connection with disability transfers are a very (perhaps the most) important pathway to early retirement in many countries. To identify the impact of the maximum duration of UI benefits for the early retirement decision, we exploit the introduction of the Regional Extended Benefits Program (REBP). This policy allowed workers above age 50 to draw regular UI benefits for as long as 4 (!) years (up from originally 0.6 years). Because this policy was restricted to certain regions of the country, our identification strategy involves difference-in-differences comparisons of individuals in eligible regions to individuals in non–eligible regions, before, during, and after the reform.

We find that the REBP was essentially an early retirement programme. The percentage early retirees among unemployment entrants aged 50 to 54 was 7.1 percentage points higher among individuals eligible to the REBP. The percentage early retirees among unemployment entrants between ages 55 and 57 even increased by 13.5 percentage points for REBP-eligible individuals. Among unemployment entrants aged 50 to 54 the REBP helped to bridge the gap until the age of relaxed access to DI benefits. Among unemployment entrants aged 55 to 57 the REBP was used to bridget the gap until the age of public pensions. There is a large program-substitution effect, that lets individuals use the long duration of UI benefits instead of bridging the gap to regular pension by the lengthy process of applying for DI benefits.

From a policy perspective, our study suggests that policy reforms aiming at increasing the effective retirement age should take particular care to carefully consider the entire set of welfare programs that impact on the early retirement decision. A policy mix that allow for simultaneous and coordinated reforms in UI and DI systems to tackle the unemployment disability margin, together with complementary measures that induce firms to hire older workers and that make older individuals better employable, are the most promising route for policy reforms.

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### Proposition 1

**Proof.** Note that consumption smoothing is optimal because we assume $\beta R = 1$. Rewrite the intertemporal budget constraint to get $\tilde{c} = \frac{1}{R^2}\left[(R^2-1)w + \alpha d\right]$. Set $\tilde{V}^W = \tilde{V}^U$ to get the indifference curve $\tilde{\theta}^W = u(\tilde{c}) - u(b) + \frac{\beta}{1-\beta}[u(\tilde{c}) - u(d)]$. Hence, $\tilde{\theta}^W$ is single valued. Moreover, the $\tilde{\theta}^W$ is positive if we assume that $w > d > b$. Differentiation of $\tilde{\theta}^W$ with respect to $d$ yields $\frac{\partial \tilde{\theta}^W}{\partial d} = \frac{1}{1-\beta}\left\{u'(\tilde{c})\frac{\alpha}{R^2} - \beta u'(d)\right\} = \frac{\beta}{1-\beta}\left\{u'(\tilde{c})\frac{\alpha}{R} - u'(d)\right\}$ using $\beta R = 1$ in the second equality. Finally, because $u'[\tilde{c}(d))] < u'(d)$ for all $d \in (w, b)$ we conclude that $\alpha R^{-1} \leq 1$ is sufficient, but not necessary, to get $\frac{\partial \tilde{\theta}^W}{\partial d} < 0$. ■

### Proposition 2

**Proof.** Note that consumption smoothing is optimal because we assume $\beta R = 1$. Rewrite the intertemporal budget constraint as $c = \frac{1}{R}\left[(R-1)w + \alpha d\right]$. The work indifference curve $\theta^W(d)$ is given by the health level that satisfies $V^W = \min\left(V^D, V^U\right)$ for a given $d$. To simplify the exposition, we check the properties for each threshold separately: i) The work versus disability threshold $\theta^{W,D}$, that is the $\theta$ that solves $V^W = V^D$. That is simply given by $\theta^{W,D} = \frac{1}{1-\beta}\left[u(c) - u(d)\right]$. Since we have $c > d$ we conclude that $\theta^{W,D}$ is positive and single valued. Moreover, $\frac{\partial \theta^{W,D}}{\partial d} = \frac{1}{1-\beta}\left[u'(c)\frac{\alpha}{R} - u'(d)\right]$ is negative if $\alpha R^{-1} \leq 1$. A similar procedure can be applied to the work versus unemployment threshold: $\theta^{W,U}$ represents the health level that solves $V^W = V^U$. The differentiation of $\theta^{W,U}$ yields $\frac{\partial \theta^{W,U}}{\partial d} = \frac{\alpha\beta}{1-\beta}\left[u'(c) - u'(\alpha d)\right]$ using the assumption $\beta R = 1$. $\frac{\partial \theta^{W,U}}{\partial d} < 0$ regardless of $\alpha$ since both pathways make use of old-age pension. Since properties are satisfied for both thresholds separately it has to be true for the min operator as well, except differentiation at the intersection (does not exist).

Finally, given the individual withdraws from labor market ($\theta \geq \theta^W(d)$), the decision to retire via disability or unemployment-old age does not depend on $\theta$. Set $V^U = V^D$ to get a vertical line $d^{D,U}$ that separates the disability and unemployment retirement pathway. ■

### Hypothesis 1

**Proof.** Age group 50-54: Differentiation of $\tilde{\theta}^W$ with respect to $T$ yields $\frac{\partial \tilde{\theta}^W}{\partial T} = -(b^u - a) \cdot u'(b) < 0$. Age group 55-59: i) An increase of $T$ decreases $\theta^{W,U}$ for any $d$. The differentiation of $\theta^{W,U}$ with respect to $T$ yields $\frac{\partial \theta^{W,U}}{\partial T} = -(b^u - a) \cdot u'(b) < 0$. ii) This implies that $d^{D,U}$ moves to the right. We can check that by $\frac{\partial d^{D,U}}{\partial D} = -\frac{(b-a)\cdot u'(b)}{\frac{1}{1-\beta}\left[\frac{\alpha}{R}u'(\alpha d) - u'(d)\right]}$ (using $R\beta = 1$) which is negative if $\alpha R^{-1} \leq 1$. ■

### Hypothesis 2

**Proof.** Assume that $A$ is very small such that individuals that retire early cannot smooth consumption. Age group 50-54: The work-unemployment threshold with assets $\tilde{\theta}^W_A$ is defined by

$$\tilde{\theta}^W_A = \frac{1}{1-\beta} \cdot u\left[\frac{(R^2-1)w + \alpha d}{R^2} + \frac{R-1}{R}A\right] - u(b+A) - \frac{\beta}{1-\beta}u(d)$$

Differentiation at $A = 0$ yields $\frac{\partial \tilde{\theta}^W_A}{\partial A} = \frac{1}{1-\beta}\frac{R-1}{R}u'(\tilde{c}) - u'(b) < 0$ if $\beta R = 1$. Age group 55-59: Similar to Proposition 2 we show the properties for $\theta^{W,D}_A$ and $\theta^{W,U}_A$ separately. $\theta^{W,D}_A$ is defined by

$$\theta^{W,D}_A = \frac{1}{1-\beta}\left[u\left(\frac{(R-1)(w+A) + \alpha d}{R}\right) - u\left(d + \frac{1-R}{R}A\right)\right]$$

Differentiation at $A = 0$ yields $\frac{\partial \theta^{W,D}_A}{\partial A} = \frac{1}{1-\beta}\frac{R-1}{R}[u'(c) - u'(d)] < 0$ if $\beta R = 1$. $\theta^{W,U}_A$ is defined by

$$\theta^{W,U}_A = \frac{1}{1-\beta}u\left(\frac{(R-1)(w+A) + \alpha d}{R}\right) - u(b+A) - \beta\frac{u(\alpha d)}{1-\beta}$$

Differentiation at $A = 0$ yields $\frac{\partial \theta^{W,U}_A}{\partial A} = \frac{1}{1-\beta}\frac{R-1}{R}u'(c) - u'(b) < 0$ if $\beta R = 1$. ■

### Equation (7)

**Proof. First step** (Definitions): Note that we have the density $f(\theta, d) > 0$ over the domain $[0, \infty) \times [b, w]$. The following functions are of particular help

$$f^w(d) = \int_0^{\theta^W(d)} f(\theta, d)d\theta \text{ and } f^n(d) = \int_{\theta^W(d)}^{\infty} f(\theta, d)d\theta.$$

where $\theta^W(d)$ represents the work-no-work threshold. Interpretation $fw(d)$: Conditional measure of individuals with DI benefits $d$ that works. The fraction of people in the different insurances are given by $p^W = \int_b^w f^w dd$, $p^U = \int_b^{d^{U,D}} f^w dd$ and $p^D = 1 - p^W - p^U$.

**Second step** (Budget): The net budget constraint equals

$$N=\int_b^w f^w(d)\left(\sum_{t=1}^{\infty}\frac{\alpha d}{R^t}-\tau w\right)dd+\int_b^{d^{U,D}} f^n(d)\left(b+\sum_{t=1}^{\infty}\frac{\alpha d}{R^t}\right)dd+\int_{d^{U,D}}^{w} f^n(d)\sum_{t=0}^{\infty}\frac{d}{R^t}dd$$

Use the definition of $p^W$ and $p^U$ and the relationship $\sum_{t=1}^{\infty}\frac{1}{R^t}=\frac{1}{R-1}$ to rearrange Equation () such that

$$N=\int_b^w f_d^w\frac{\alpha d}{R-1}dd+\int_b^{d^{U,D}} f_d^n\frac{\alpha d}{R-1}dd+\int_{d^{U,D}}^{w} f_d^n\frac{Rd}{R-1}dd-p^W\tau w+p^U b$$

or

$$N=\int_b^w\int_0^{\infty} f(\theta,d)\frac{\alpha d}{R-1}d\theta dd+\int_{d^{U,D}}^{w} f_d^n d\frac{R-\alpha}{R-1}dd-p^W\tau w+p^U b.$$

**Third step** (Marginal change of benefits duration $dT>0$): Not that the first term in Equation (9) drops out. The second term $N_1=\int_{d^{U,D}}^{w} f_d^n d\frac{R-\alpha}{R-1}dd$ yields (apply Leibniz rule)

$$\frac{dN_1}{dT}=\int_{d^{U,D}}^{w}\frac{df_d^n}{dT}\frac{d(R-\alpha)}{R-1}dd-\frac{dd^{U,D}}{dT}f^n_{d^{U,D}}\frac{d^{U,D}(R-\alpha)}{R-1}=-\frac{dp^D}{dT}\frac{R-\alpha}{R-1}d^{U,D}$$

using the fact that $\frac{df_d^n}{dT}=0$ and $\frac{dp^D}{dT}=\frac{dd^{U,D}}{dT}f^n_{d^u}$. Next, combine $\frac{dN_1}{dT}$ with the derivatives of the third and forth term in Equation(9) to get the overall effect

$$\begin{aligned}\frac{dN}{dT} &= -\frac{dp^D}{dT}\frac{R-\alpha}{R-1}d^{U,D}-\frac{dp^W}{dT}\tau w+\frac{dp^U}{dT}b+p^U\frac{db}{dT}\\ &= \frac{dp^D}{dT}\left(\frac{R-\alpha}{R-1}d^{U,D}-b\right)-\frac{dp^W}{dT}(b+\tau w)+p^U(b-a)\end{aligned}$$

the last step follows from $\frac{dp^W}{dT}+\frac{dp^U}{dT}+\frac{dp^D}{dT}=0$ and $\frac{db}{dT}=b^u-a$. ■

## Proposition 4

**Proof. First step** (Balanced Budget): To meet budget neutrality we impose

$$\frac{d\tau}{dT}p^W w=\frac{dN}{dT}$$

Additional tax revenues have to cover additional net expenditures. Dividing by $p^U(b^u - a)$ we get

$$-\frac{d\tau}{dT}\frac{p^W w}{p^U(b^u - a)} = 1 + \frac{1}{p^U(b^u - a)}\frac{dp^D}{dT}\left(\frac{R-\alpha}{R-1}d^{U,D} - b\right) - \frac{1}{p^U(b^u - a)}\frac{dp^W}{dT}(b + \tau w)$$

Define the "elasticities"

$$\varepsilon_{p^D,T} = -\frac{dp^D}{dT}T \text{ and } -\varepsilon_{p^W,T} = \frac{dp^W}{dT}T$$

to simplify

$$-\frac{d\tau}{dT}\frac{p^W w}{p^U(b^u - a)} = 1 + \frac{\varepsilon_{p^D,T}}{p^U T(b^u - a)}\left(\frac{R-\alpha}{R-1}d^{U,D} - b\right) + \frac{\varepsilon_{p^W,T}}{p^U T(b^u - a)}(b + \tau w).$$

Use definition $\sigma^{-1} = \frac{1}{p^U}\frac{b}{T(b^u - a)}$ to further simplify

$$-\frac{d\tau}{dT}\frac{p^W w}{p^U(b^u - a)} = 1 - \frac{\varepsilon_{p^D,T}}{\sigma}\left(1 - \frac{R-\alpha}{R-1}\frac{d^{U,D}}{b}\right) - \frac{\varepsilon_{p^W,T}}{\sigma}\left(1 + \frac{\tau w}{b}\right).$$

**Second step** (Marginal utility gains) The first order change of welfare by extending $T$ marginally is given by

$$\frac{dW}{dT} = \int_{Z^U}\left\{(b^u - a)u'(b)\right\}dF(z) + \int_{Z^W}\left\{\frac{R-1}{R}\frac{d\tau}{dT}\frac{u'(c)}{1-\beta}\right\}dF(z)$$

Remark: We do not have to take into account individuals that move from one pathway to another. This holds true because individuals that move are located at the margin and are indifferent between pathway choices (hence, no welfare gains from moving). See for example Saez (2002) for a more general argumentation (sort of Leibniz integration over two dimension).

Using the assumption $\beta R = 1$ and the notation

$$\bar{u}'^U = \frac{\int_{Z^U} u'(b)dF(z)}{p^U} \quad \text{and} \quad \bar{u}'^W = \frac{\int_{Z^W} u'(c)dF(z)}{p^W}$$

we get

$$\frac{dW}{dT} = (b^u - a)p^U \bar{u}'^U - w\frac{d\tau}{dT}p^W \bar{u}'^W$$

Finally set $\frac{dW}{dT} = 0$ and rearrange the formula above

$$\frac{\bar{u}'^U}{\bar{u}'^W} = \frac{w}{b^u - a}\frac{p^W}{p^U}\frac{d\tau}{dT}$$

Finally, combining the results from step one and step two yields

$$\frac{\bar{u}'^U - \bar{u}'^W}{\bar{u}'^W} = -\frac{\varepsilon_{p^D,T}}{\sigma}\left(1 - \frac{R-\alpha}{R-1}\frac{d^{U,D}}{b}\right) + \frac{\varepsilon_{p^W,T}}{\sigma}\left(1 + \frac{\tau w}{b}\right)$$

**Third step (Approximation of marginal utility gain):** The left hand side can be approximated using a similar procedure to Chetty (2006). We proceed in two steps: First, we show that the marginal utility is approximated by the marginal utility at the average consumption. Define $\bar{c}_w = \int_{Z_W} c\, dR(z)$. We approximate the average utility term by

$$\begin{aligned}
\bar{u}'^W &= \left(p^W\right)^{-1}\int_{Z^W} u'(c)dF(z) \\
&= \left(p^W\right)^{-1}\int_{Z^W}\left[u'\left(\bar{c}_w\right) + u''\left(\bar{c}_w\right)\left(\bar{c}_w - c\right) + hot.\right]dF(z) \\
&= \left(p^W\right)^{-1}\left\{\int_{Z^W} u'\left(\bar{c}_w\right)dF(z) + \int_{Z^W}\left[hot.\right]dF(z)\right\} \\
&\approx \left(p^W\right)^{-1}\left\{u'\left(\bar{c}_w\right)\int_{Z^W} dF(z)\right\} \\
&= u'\left(\bar{c}_w\right)
\end{aligned}$$

Second step: Approximization of $\frac{u'(b)-u'(\bar{c}_w)}{u'(\bar{c}_w)}$. Taylor approximation yields

$$\frac{u'(b) - u'\left(\bar{c}_w\right)}{u'\left(\bar{c}_w\right)} \approx \frac{u''\left(\bar{c}_w\right)\left(\bar{c}_w - b\right)}{u'\left(\bar{c}_w\right)} = \gamma\frac{\Delta\bar{c}}{\bar{c}}$$

with $\Delta\bar{c} = \bar{c} - b$ and $\gamma$ denoting the relative risk aversion. ■

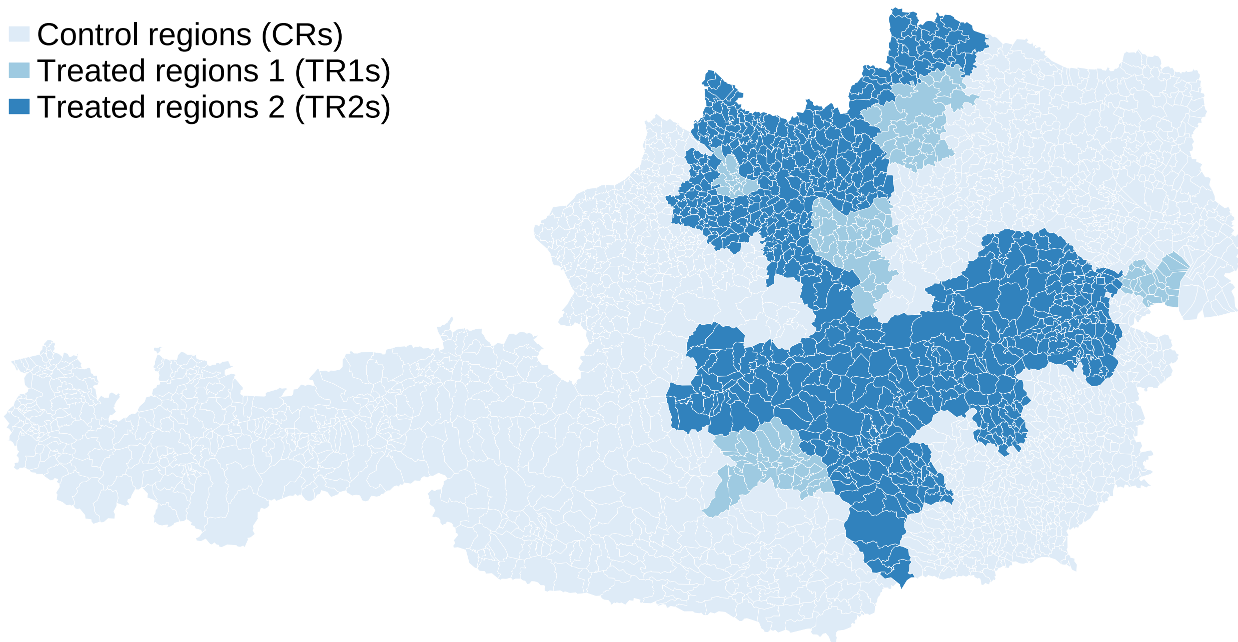


Figure 1: The Regional Extended Benefits Program (REBP)

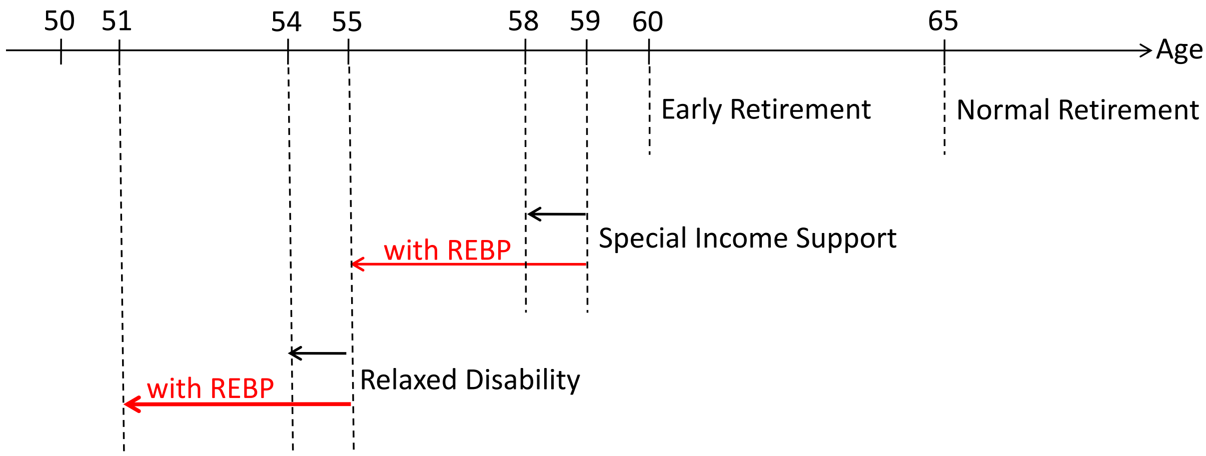


Figure 2: Pathways to retirement with/without REBP-eligibility

Table 1:

Insert Table here

Table 2: DI replacement rates by quartile of last wage

| | Mean | S.D. | Min | Max |
|---|---|---|---|---|
| Age 50-54 | | | | |
| Q1 | 77.1 | 32.1 | 15.6 | 404.6 |
| Q2 | 68.5 | 16.5 | 19.1 | 281.6 |
| Q3 | 68.6 | 13.5 | 19.7 | 219.8 |
| Q4 | 68.7 | 11.7 | 21.1 | 334.0 |
| | | | | |
| Age 55-59 | | | | |
| Q1 | 73.9 | 28.4 | 17.9 | 362.2 |
| Q2 | 70.0 | 15.7 | 21.0 | 166.8 |
| Q3 | 70.9 | 13.3 | 16.9 | 216.2 |
| Q4 | 72.3 | 11.1 | 18.2 | 200.6 |

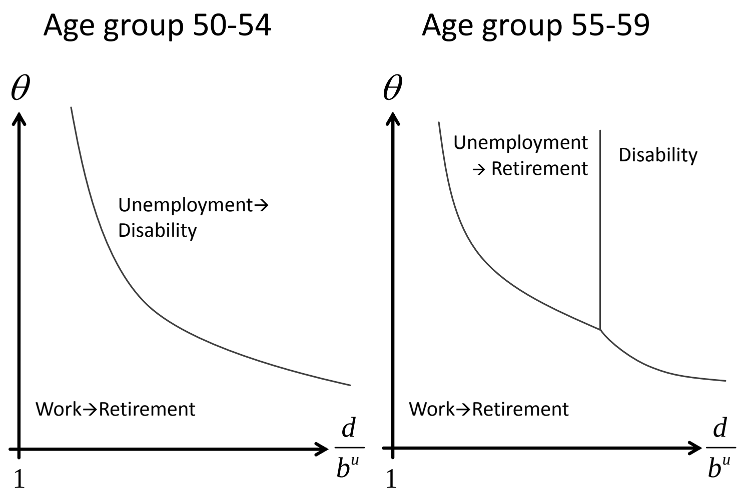


Figure 3: LHS: Age group 50-54, RHS: Age group 55-59

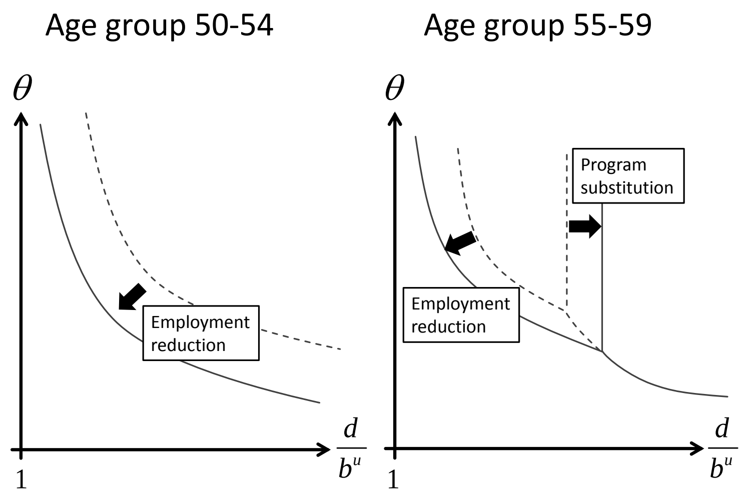


Figure 4: Effect of REBP change on optimal retirement/work decision.

Table 3: Treatment and control group characteristics

| | Before REBP | | During REBP | | After REBP | |
|---|---|---|---|---|---|---|
| | CRs | TRs | CRs | TRs | CRs | TRs |
| *Exit destinations (%)* | | | | | | |
| Employment | 82.4 | 81.7 | 77.3 | 58.8 | 71.6 | 71.9 |
| Disability | 9.2 | 9.6 | 11.4 | 21.9 | 15.3 | 17.8 |
| Retirement | 7.9 | 8.1 | 10.5 | 17.7 | 11.6 | 8.9 |
| Censored | 0.6 | 0.6 | 0.8 | 1.5 | 1.5 | 1.4 |
| *Duration variables (days)* | | | | | | |
| Unemployment duration | 168 | 174 | 201 | 530 | 334 | 339 |
| Duration until employment | 115 | 112 | 114 | 139 | 146 | 148 |
| Duration until disability | 498 | 525 | 611 | 1,347 | 1,186 | 1,225 |
| Duration until retirement | 714 | 576 | 709 | 1,038 | 985 | 978 |
| *Background characteristics* | | | | | | |
| Age at UI entry | 54.2 | 54.1 | 54.1 | 53.8 | 54.0 | 53.9 |
| Sick days | 82 | 75 | 90 | 76 | 85 | 83 |
| Married | 0.818 | 0.839 | 0.798 | 0.828 | 0.797 | 0.808 |
| Education | | | | | | |
| Low | 0.648 | 0.674 | 0.616 | 0.575 | 0.534 | 0.551 |
| Medium | 0.318 | 0.308 | 0.338 | 0.378 | 0.392 | 0.392 |
| High | 0.034 | 0.018 | 0.045 | 0.047 | 0.074 | 0.057 |
| Daily Wage | 57.6 | 56.5 | 61.0 | 65.8 | 68.0 | 67.3 |
| Blue collar | 0.891 | 0.919 | 0.870 | 0.843 | 0.795 | 0.834 |
| Experience (years) | 11.3 | 11.5 | 10.9 | 11.4 | 11.0 | 11.0 |
| Tenure (years) | 2.3 | 2.6 | 2.4 | 3.7 | 3.0 | 2.9 |
| Number of observations | 24,130 | 6,756 | 42,548 | 19,328 | 58,348 | 10,101 |

Table 4: Severance pay sample

| | Before REBP | | | | During REBP | | | |
|---|---|---|---|---|---|---|---|---|
| | No Severance | | With Severance | | No Severance | | With Severance | |
| | CRs | TRs | CRs | TRs | CRs | TRs | CRs | TRs |
| *Exit destinations (%)* | | | | | | | | |
| Employment | 78.4 | 81.1 | 68.3 | 65.4 | 72.4 | 52.1 | 60.0 | 31.5 |
| Disability | 11.9 | 12.6 | 15.4 | 11.8 | 15.3 | 31.0 | 19.5 | 46.6 |
| Retirement | 8.8 | 5.8 | 15.6 | 22.4 | 11.2 | 15.5 | 18.8 | 19.6 |
| *Duration variables (days)* | | | | | | | | |
| Unemployment duration | 210 | 211 | 260 | 217 | 300 | 710 | 403 | 952 |
| Duration until employment | 130 | 117 | 150 | 127 | 142 | 155 | 186 | 178 |
| Duration until disability | 596 | 656 | 550 | 429 | 876 | 1,464 | 920 | 1,533 |
| Duration until retirement | 843 | 1,096 | 760 | 637 | 973 | 1,310 | 873 | 1,200 |
| *Background characteristics* | | | | | | | | |
| Age at UI entry | 54.0 | 53.7 | 54.3 | 54.5 | 53.9 | 53.5 | 54.1 | 53.8 |
| Sick days | 54.0 | 53.7 | 54.3 | 54.5 | 53.9 | 53.5 | 54.1 | 53.8 |
| Married | 0.811 | 0.862 | 0.834 | 0.831 | 0.807 | 0.829 | 0.815 | 0.845 |
| Education | | | | | | | | |
| Low | 0.597 | 0.624 | 0.515 | 0.637 | 0.534 | 0.502 | 0.506 | 0.464 |
| Medium | 0.345 | 0.339 | 0.397 | 0.316 | 0.391 | 0.421 | 0.396 | 0.462 |
| High | 0.058 | 0.037 | 0.088 | 0.046 | 0.076 | 0.077 | 0.098 | 0.074 |
| Daily Wage | 59.3 | 56.0 | 59.1 | 58.5 | 64.1 | 68.2 | 66.7 | 73.7 |
| Blue collar | 0.836 | 0.896 | 0.770 | 0.823 | 0.801 | 0.800 | 0.740 | 0.737 |
| Experience (years) | 11.8 | 11.9 | 12.2 | 12.5 | 11.4 | 11.9 | 11.9 | 12.3 |
| Number of observations | 2,447 | 651 | 751 | 237 | 8,023 | 2,727 | 2,840 | 1,249 |

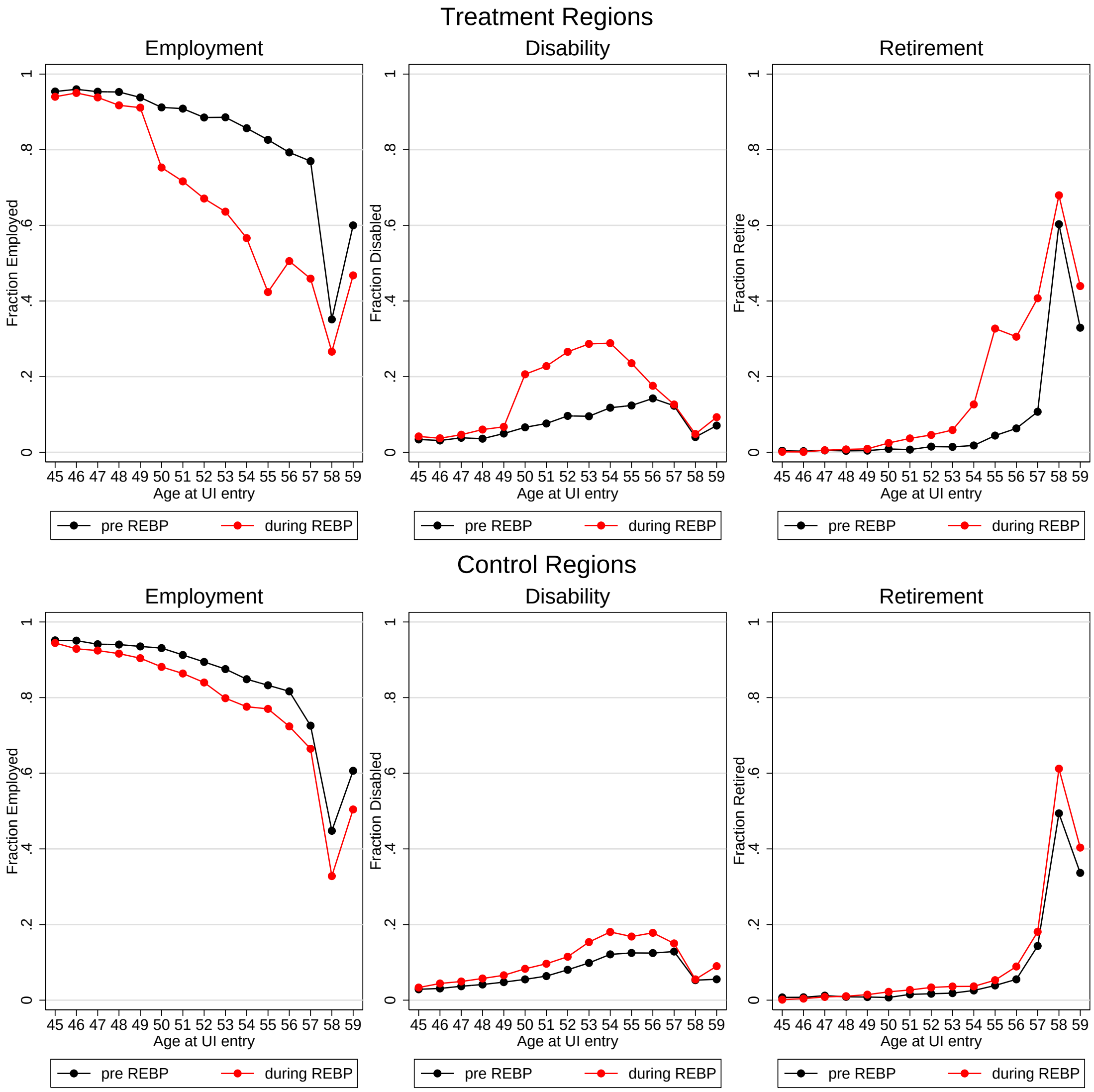


Figure 5: Impact of the REBP, men

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

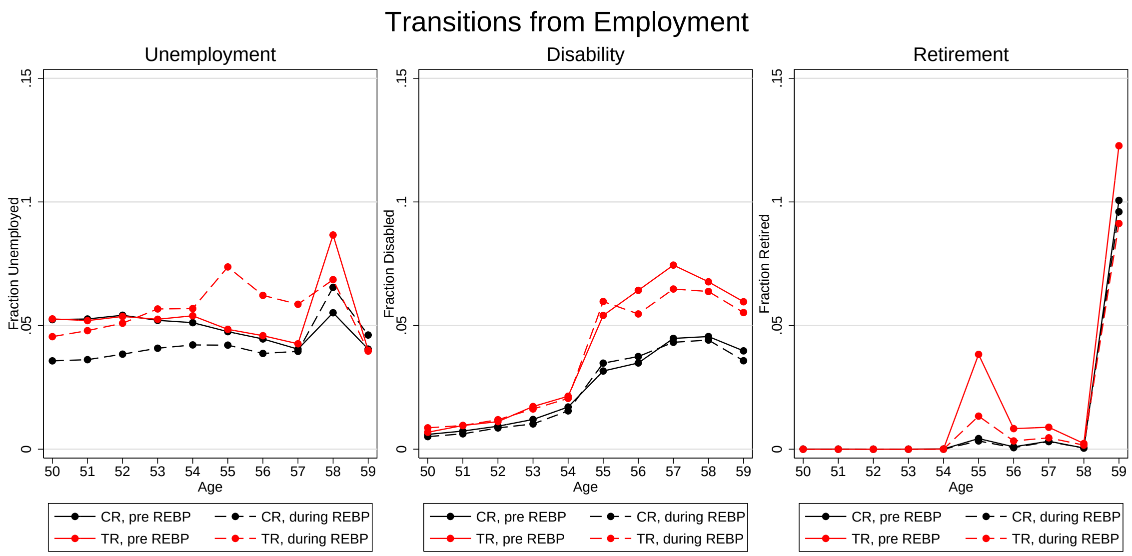


Figure 6: Impact of REBP on transitions from employment, men

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

Table 5: Baseline results

| | Age 50-54 | | | Age 55-57 | | |
|---|---|---|---|---|---|---|
| | Employment | Disability | Retirement | Employment | Disability | Retirement |
| REBP introduced | -0.071*** | 0.056*** | 0.011 | -0.135*** | -0.045** | 0.178*** |
| ($D \times TR$) | (0.015) | (0.013) | (0.008) | (0.023) | (0.019) | (0.032) |
| REBP abolished | 0.105*** | -0.070*** | -0.023*** | 0.130*** | 0.053*** | -0.184*** |
| ($A \times TR$) | (0.017) | (0.014) | (0.006) | (0.018) | (0.014) | (0.020) |
| Treated regions | -0.084*** | 0.075*** | 0.002 | -0.091*** | 0.191*** | -0.109*** |
| ($TR$) | (0.020) | (0.026) | (0.017) | (0.027) | (0.027) | (0.031) |
| During | 0.018 | -0.017 | -0.007 | -0.014 | -0.079*** | 0.095*** |
| ($D$) | (0.017) | (0.021) | (0.015) | (0.020) | (0.021) | (0.025) |
| After | -0.012 | 0.012 | -0.002 | -0.011 | 0.006 | 0.005 |
| ($A$) | (0.008) | (0.007) | (0.004) | (0.014) | (0.012) | (0.013) |
| No. of Obs. | 103,360 | 103,360 | 103,360 | 40,557 | 40,557 | 40,557 |
| $R^2$ | 0.230 | 0.170 | 0.072 | 0.357 | 0.097 | 0.302 |

Notes: The Table reports coefficients from a linear probability model. Standard errors adjusted for clustering within labor market regions. Controls: marital status, education, last annual wage, unemployment, blue collar status, employment history, tenure in last job, previous industry, and quarter of inflow. Significance levels: *** = 1%, ** = 5%, * = 10%.

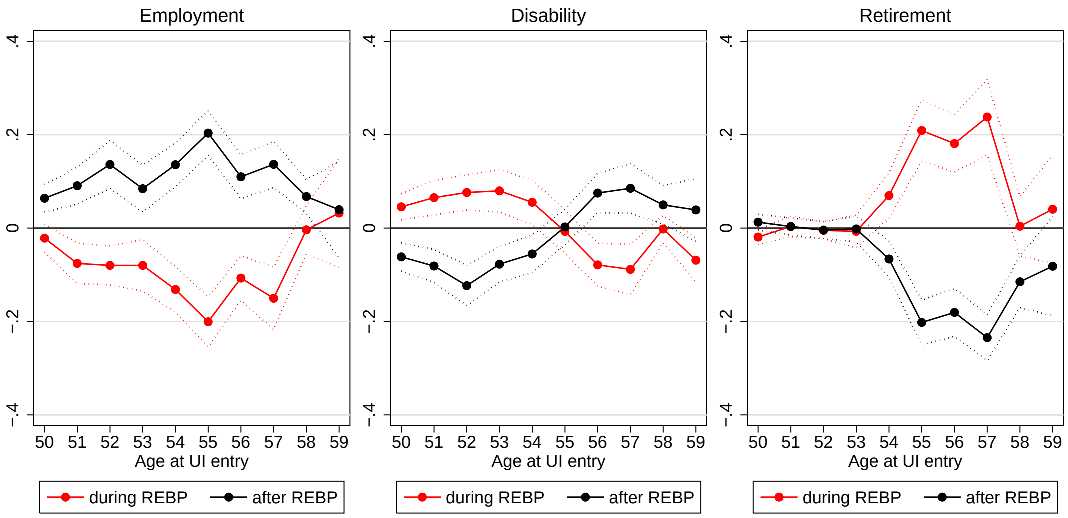


Figure 7: Impact of the REBP by age

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

Table 6: Effects by DI replacement rate

| | Age 50-54 | | | Age 55-57 | | |
|---|---|---|---|---|---|---|
| | Employment | Disability | Retirement | Employment | Disability | Retirement |
| Below 25$^{\text{th}}$ percentile | | | | | | |
| REBP introduced | -0.056*** | 0.033** | 0.016 | -0.121*** | -0.095*** | 0.202*** |
| $(D \times TR)$ | (0.020) | (0.016) | (0.012) | (0.043) | (0.025) | (0.040) |
| REBP abolished | 0.118*** | -0.074*** | -0.029*** | 0.118*** | 0.060*** | -0.185*** |
| $(A \times TR)$ | (0.016) | (0.015) | (0.009) | (0.025) | (0.022) | (0.022) |
| No. of Obs. | 53,439 | 53,439 | 53,439 | 20,280 | 20,280 | 20,280 |
| $R^2$ | 0.225 | 0.155 | 0.071 | 0.335 | 0.091 | 0.299 |
| Above 75$^{\text{th}}$ percentile | | | | | | |
| REBP introduced | -0.076*** | 0.073*** | 0.007 | -0.140*** | -0.005 | 0.158*** |
| $(D \times TR)$ | (0.022) | (0.021) | (0.008) | (0.031) | (0.037) | (0.038) |
| REBP abolished | 0.112*** | -0.072*** | -0.032*** | 0.147*** | 0.010 | -0.155*** |
| $(A \times TR)$ | (0.025) | (0.024) | (0.008) | (0.027) | (0.034) | (0.033) |
| No. of Obs. | 49,921 | 49,921 | 49,921 | 20,277 | 20,277 | 20,277 |
| $R^2$ | 0.244 | 0.193 | 0.076 | 0.381 | 0.109 | 0.307 |

Notes: The Table reports coefficients from a linear probability model. Standard errors adjusted for clustering within labor market regions. Controls: marital status, education, last annual wage, unemployment, blue collar status, employment history, tenure in last job, previous industry, and quarter of inflow. Significance levels: *** = 1%, ** = 5%, * = 10%.

Table 7: Effects by health

| | Age 50-54 | | | Age 55-57 | | |
|---|---|---|---|---|---|---|
| | Employment | Disability | Retirement | Employment | Disability | Retirement |
| Healthy | | | | | | |
| REBP introduced | -0.066*** | 0.051*** | 0.009 | -0.140*** | -0.053** | 0.191*** |
| $(D \times TR)$ | (0.015) | (0.013) | (0.008) | (0.023) | (0.019) | (0.032) |
| REBP abolished | 0.106*** | -0.074*** | -0.020** | 0.128*** | 0.056*** | -0.184*** |
| $(A \times TR)$ | (0.018) | (0.013) | (0.008) | (0.016) | (0.015) | (0.021) |
| No. of Obs. | 60,296 | 60,296 | 60,296 | 25,275 | 25,275 | 25,275 |
| $R^2$ | 0.232 | 0.153 | 0.087 | 0.424 | 0.091 | 0.339 |
| Unhealthy | | | | | | |
| REBP introduced | -0.106*** | 0.079*** | 0.026** | -0.161*** | 0.016 | 0.152*** |
| $(D \times TR)$ | (0.029) | (0.025) | (0.013) | (0.048) | (0.041) | (0.040) |
| REBP abolished | 0.123*** | -0.083*** | -0.033*** | 0.143*** | 0.011 | -0.156*** |
| $(A \times TR)$ | (0.023) | (0.024) | (0.009) | (0.033) | (0.034) | (0.032) |
| No. of Obs. | 21,609 | 21,609 | 21,609 | 7,679 | 7,679 | 7,679 |
| $R^2$ | 0.252 | 0.207 | 0.034 | 0.262 | 0.110 | 0.201 |

Notes: The Table reports coefficients from a linear probability model. Standard errors adjusted for clustering within labor market regions. Controls: marital status, education, last annual wage, unemployment, blue collar status, employment history, tenure in last job, previous industry, and quarter of inflow. Significance levels: *** = 1%, ** = 5%, * = 10%.

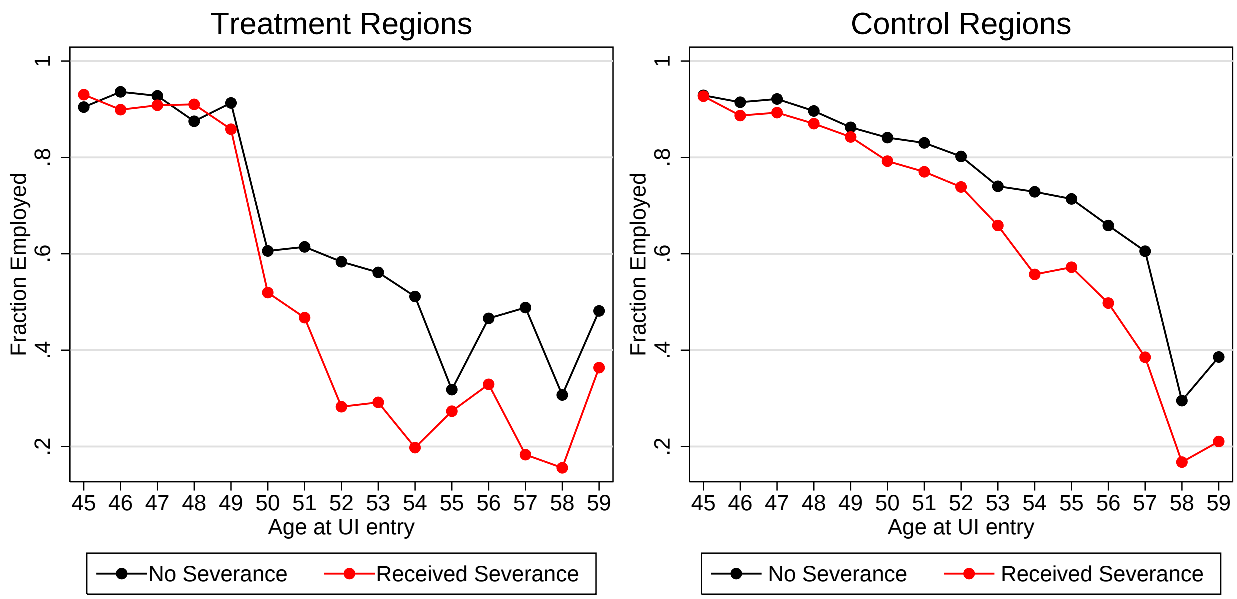


Figure 8: Impact of the REBP on return to employment, men

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

Table 8: Severance payment (SP)

| | Age 50-54 | | | Age 55-57 | | |
|---|---|---|---|---|---|---|
| | Employment | Disability | Retirement | Employment | Disability | Retirement |
| REBP introduced | -0.174*** | 0.153*** | 0.011 | -0.185*** | 0.030 | 0.164*** |
| ($D \times TR$) | (0.030) | (0.028) | (0.014) | (0.040) | (0.031) | (0.039) |
| REBP introduced with SP | -0.117*** | 0.104*** | 0.007 | 0.027 | 0.013 | -0.043 |
| ($D \times TR \times SP$) | (0.026) | (0.027) | (0.012) | (0.035) | (0.047) | (0.053) |
| REBP abolished | 0.161*** | -0.133*** | -0.015* | 0.185*** | -0.014 | -0.173*** |
| ($A \times TR$) | (0.032) | (0.030) | (0.009) | (0.038) | (0.032) | (0.036) |
| REBP abolished with SP | 0.100*** | -0.065* | -0.015 | 0.006 | 0.073 | -0.102** |
| ($A \times TR \times SP$) | (0.036) | (0.034) | (0.013) | (0.056) | (0.073) | (0.049) |
| Received severance pay | -0.068*** | 0.050*** | 0.010 | -0.111*** | 0.049* | 0.059*** |
| ($SP$) | (0.012) | (0.013) | (0.008) | (0.028) | (0.026) | (0.017) |
| | | | | | | |
| No. of Obs. | 18,638 | 18,638 | 18,638 | 6,716 | 6,716 | 6,716 |
| $R^2$ | 0.232 | 0.188 | 0.058 | 0.287 | 0.107 | 0.215 |

Notes: The Table reports coefficients from a linear probability model. Standard errors adjusted for clustering within labor market regions. Controls: marital status, education, last annual wage, unemployment, blue collar status, past sick days, employment history, tenure in last job, previous industry, and quarter of inflow. Significance levels: *** = 1%, ** = 5%, * = 10%.

Table 9: Effect on weeks spent in different states until age 60

| | Age 50-54 | | | Age 55-57 | | |
|---|---|---|---|---|---|---|
| | Employment | Disability | Unemployment | Employment | Disability | Unemployment |
| During*Treat | -16.6*** | -5.3 | 28.5*** | -12.9*** | -16.9*** | 30.1*** |
| | (4.7) | (4.2) | (6.1) | (3.1) | (3.7) | (4.6) |
| After*Treat | 39.6*** | 15.4*** | -48.7*** | 19.0*** | 10.8*** | -32.5*** |
| | (4.1) | (3.6) | (4.6) | (2.8) | (3.3) | (5.5) |
| No. of Obs. | 103,360 | 103,360 | 103,360 | 40,557 | 40,557 | 40,557 |
| $R^2$ | 0.207 | 0.044 | 0.193 | 0.249 | 0.094 | 0.270 |

Notes: The Table reports coefficients from a OLS regression. Standard errors adjusted for clustering within labor market regions. Controls: marital status, education, last annual wage, unemployment, blue collar status, employment history, tenure in last job, previous industry, and quarter of inflow. Significance levels: *** = 1%, ** = 5%, * = 10%.

Table 10: Cost-benefit analysis

| | UI expenses (A) | DI expenses (B) | Tax revenues (C) | Government expenses (A+B-C) |
|---|---|---|---|---|
| Age 50-54 | | | | |
| No. of individuals | 12,699 | 12,699 | 12,699 | |
| Weekly avg. transfer (2008 euros) | 195 | 257 | 175 | |
| $\Delta$ duration (weeks) | 28.5 | -5.3 | -16.6 | |
| $\Delta$total (million euros) | 70.6 | -17.3 | -36.9 | 90.2 |
| | | | | |
| Age 55-57 | | | | |
| No. of individuals | 5,058 | 5,058 | 5,058 | |
| Weekly avg. transfer (2002 euros) | 203 | 268 | 193 | |
| $\Delta$ duration (weeks) | 30.1 | -16.9 | -12.9 | |
| $\Delta$total (million euros) | 30.9 | -22.9 | -12.6 | 20.6 |
| | | | | 110.8 |

Notes: