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Causal effect of income on health: Investigating two closely related policy reforms in Austria

by

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Causal effect of income on health: Investigating two closely related policy reforms in Austria*

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Abstract

I investigate the effect of income on mortality of the pensioners, comparing three subsequent policy periods in Austria. The pensioners who retired in the second period received 25% lower pension than those in the first period. This reduction in income was removed in the third policy period. These two reforms allow a causal identification of the effect of income on health. I estimate that lower pension did not change the mortality rate. The results are confirmed using both experiments and different methods of estimation. Furthermore, with regard to the expenditure on health services, I get that only prescribed drug consumption increased, with the remaining analyzed factors being unaffected.

Keywords: Income, Mortality, Health, Expenditure
JEL classification: I12, J14, H55

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1 Introduction

Health and income are positively correlated (see, e.g., Bloom and Canning, 2000; Rogot et al., 1992). Income might affect health and health might influence income in many different ways. Wealthier individuals can afford more and better health care, are able to spend more money on health prevention, can also afford to pay more on living in better and healthier environments, and may be more sensitive to unhealthy working conditions. "The differential use of health knowledge and technology" (Cutler et al., 2006, p. 115) may also explain important parts of the relation between social status (including income) and health. There are also paths through which income may have a negative effect on health. Usually, the effect of earning more comes with increased working hours, increased accidental risks, and/or increased stress at work. This influence of income on health can be described using a health production framework (Grossman, 1972).

On the other hand, health may influence labor supply, effort, and thus, income. Smith (1998, 1999) and Wu (2003) analyze the causal effect of health on income using unanticipated health shocks.

Scholars prefer randomized experiments to analyze the causal effect of income on health. However, in most cases, the experiments are economically and/or ethically not feasible[1]. In the cases where the effect of income on health is of primary interest, it may seem paradoxical to pay the participants of a study to accept less income, and it may seem offensive to take away money from randomly drawn citizens. We rely on the exploitation of natural experiments based on the evaluation of the policies affecting income to analyze the causal effect of income on health.

[1] Thomas et al. (2006) is one of the recent exceptions.

The empirical literature shows a positive but not always significant causal effect of income on health. Benzeval et al. (2000), Case (2001), and Frijters et al. (2005) find a small causal effect of income on self-reported health. Cawley et al. (2010) analyze the effect of reduced social security payments on the retirees' weight and BMI in the US and do not find any evidence for the causal effects of income on the weight or BMI of elderly Americans. Adams et al. (2003) analyze the causal effect of income for elderly persons in the US. They do not find any "associations of health conditions and changes in total wealth" (p. 51) for persons aged 70 and above. Lindahl (2005) does not find any significant effect of lottery prizes on mortality in Sweden.

In their meta study, Cutler et al. (2006) conclude with regard to the determinants of mortality within countries that it "seems clear that much of the link between income and health is a result of the latter causing the former, rather than the reverse." (p. 115) This suggests that all those findings of quantitatively small and mostly insignificant effects are in line with their interpretation.

Switching to Austria, in May 2000, the European Court of Justice ruled that one type of early retirement violated the European law. This decision surprised the government and the public and the subsequent abolition of this retirement in June 2000 can be seen as a natural experiment. Before the abolition, retirees received *up to 25 % more gross pension* than thereafter. Four months after the regime change, the replacement rate was raised to its previous high level again. Using the data from Austrian social security records, I exploit these two changes to study the causal effect of income on health for elderly persons.

To measure health, I use the mortality rates over a period of seven years, which is the ultimate indicator of bad health for these elderly persons. Second, for a small proportion of the individuals, the data from the public health insurance is available. Therefore, I can use the health expenditure on drugs or medical aid, visits to general or special practitioners, and hospital visits.

The Austrian social security records contain detailed information not only on the employment histories but also on the health histories of all Austrian private sector employees. I compare the cohorts aged 57 to 59 in the period January to September 2000 for the first regime change and cohorts aged 57 to 60 in the period June to December 2000 for the second regime change. All cohorts compared are exposed to the same health "risks" (epidemics, etc.) all the time.

The seven year mortality values for these persons are not statistically different. I see that only the expenditure on drugs increases significantly, but all other expenses and measures (visits to a doctor or a hospital, expenditure on medical aids, etc.) are unaffected.

2 Institutional Background

2.1 Austrian Pension System

Between the 1970s and the 1990s, Austria had a generous pension system that contained various provisions for early retirement (see Hofer and Koman, 2006). In 2000, Austria spent 14.3 % of its GDP on pension expenditure (Eurostat Statistics Database, Economic Policy Committee, 2010). Although the regular retirement age is similar to that in other European countries (65 for men and 60 for women), the actual retirement age of men decreased steadily from nearly 62 in the 1970s to about 58 in 1995. Since then, it has increased slightly to 58.5 in 2000 and has stayed around 59 since 2005 (Hauptverband der österr. Sozialversicherungsträger, 2010). The large share of pension expenditure in the GDP and the low retirement age is accompanied by one of the lowest participation rates of elderly men and women amongst the OECD countries (Organisation for Economic Co-operation and Development, 2006).

Up to the year 2000, several early retirement schemes enabled men aged 60 and women aged 55 to retire early, e.g., for those who have been insured for long or are unemployed. Early retirement due to reduced working capacity was possible for men aged 57 and above. For males, the only other alternative to retire at the age of 59 or earlier was the invalidity pension (IP). For both alternatives, a doctor has to check whether or not the applicant had reduced working capacity.[2]

The calculation of pension benefits is based on the number of years insured (the contribution years) as a basis for the replacement rate. The pension amount is calculated on the basis of the average monthly earnings in the best 15 years of contribution with an average net replacement ratio of 75% (Organisation for Economic Co-operation and Development, 2005).[3]

2.2 Invalidity Pension versus Early Retirement due to Reduced Working Capacity

In 1993, the Austrian government introduced multiple new provisions for early retirement. One of these was the "Early Retirement due to Reduced Working Capacity" (ERRWC). This provision was introduced for older workers with reduced working capacity as another form of retirement (along with the invalidity pension). The main difference between the two schemes is a higher replacement

[2]I concentrate on men because the reforms were not effective for women.

[3]A detailed description of the calculation of pension benefits in the Austrian pension system can be found in Manoli et al. (2009).

rate for the workers retiring under the ERRWC *(details later)*. The introduction was announced months before, and hence, individuals could have adapted easily by postponing their retirement decision. Thus, the introduction of the ERRWC does not qualify for a natural experiment.

In May 2000, the European Court of Justice ruled that the ERRWC violated European Law, because the difference in the retirement age for men and women discriminated against men. The decision blindsided the government and the public in Austria. The ERRWC was abolished immediately. Before the abolition, retirees received a higher pension. After the abolition employees with reduced working capacity could only apply for the IP. Using this natural experiment, I can study the effect of income on health.

Under all regimes and for both types, the ERRWC and the IP, an individual, who wanted to retire, had to be declared as being disabled using the same medical checkup at the Austrian pension insurance agency. The same physicians evaluated these pension applicants in the same rooms, using exactly the same procedures and medical tests. The applicants were randomly assigned to the physicians.[4] While both types focused on reduced working capacity, the ERRWC additionally required a larger job history for eligibility (working six years in the last 15 years). For the empirical comparisons between ERRWC and IP below, I only consider the individuals fulfilling this criterion of eligibility.

The exact differences in the replacement rates (i.e., in the resulting pension benefits) of the two regimes can be seen in Figure 1a. The graph shows the exact replacement rate for a male employee aged 57 to 59 with a varying number of contribution years on the x-axis. If this employee contributed for up to 36 years to the public pension insurance, he would have received the same pension benefits

[4]This has also been confirmed by the Austrian public pension insurance agency.

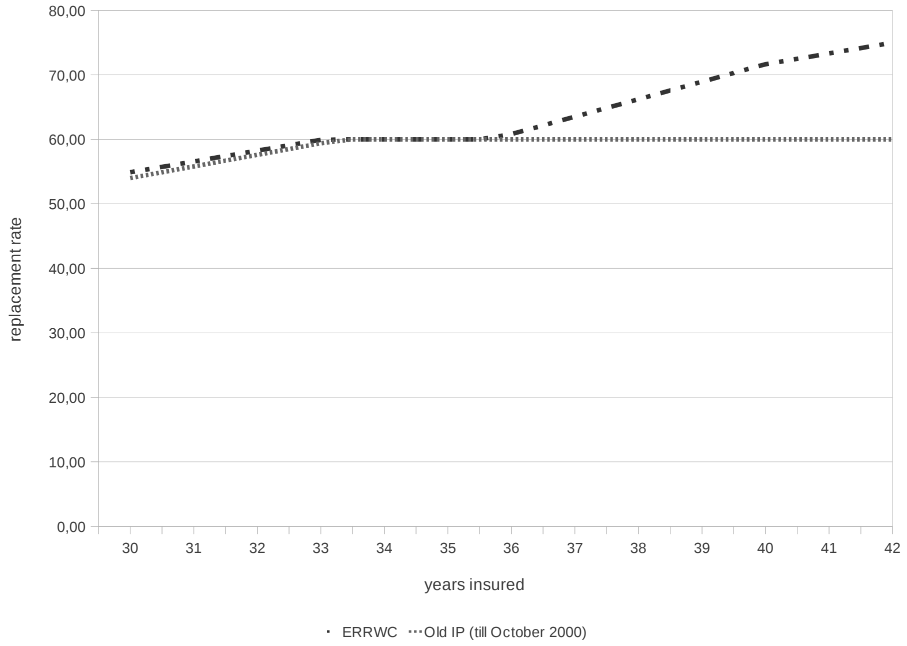
in both regimes. Any further increase in the number of contribution years widens the gap in the replacement rate.

Immediately after the abolition of the ERRWC, the government discussed the situation of pension applicants with reduced working capacity and consequently, removed the replacement rate cap of 60% on the IP and slightly revised the calculation of the replacement rate. The resulting replacement rate differences between the two IP regimes can be found in Figure 1b. As compared to the previous case, both regimes are identical except for the replacement rate; there is no need to control for the number of years insured in the last 15 years.

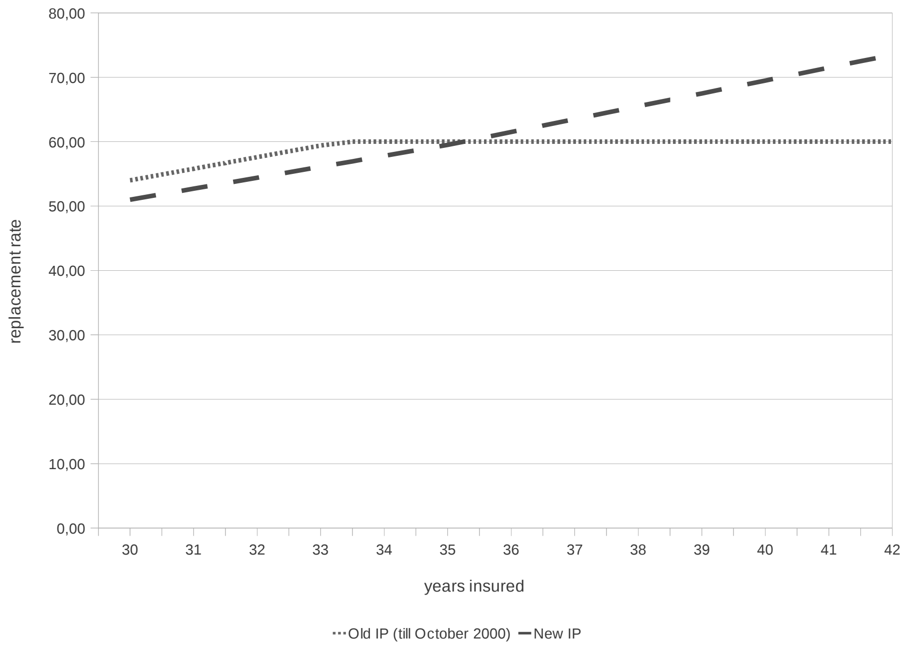
Due to the presence of a different pension regime before 2000, I only consider the employees who retired in 2000. Until June 2000, the ERRWC regime with a high replacement rate was in place (regime 1). The applicants to the ERRWC in May (at the time of its abolition) started receiving pension benefits in June. Following this, only the IP regime with the replacement rate cap remained until the end of September 2000 (regime 2). These retirees received reduced pension benefits for at least seven years. From October 2000 onwards, the IP was changed with respect to its replacement rate cap (regime 3).

Figure 1: *Replacement rate of an employee aged 57 to 59 depending on the number of contribution years and pension type*

(a) *Before and after June 2000 (regimes 1 and 2)*



(b) *Before and after October 2000 (regimes 2 and 3)*



3 Data

I use the administrative employment records from the Austrian social security system covering the years 1972 to 2009 in detail (Zweimüller et al., 2009). The records include very detailed data on employers, employees, and employment spells for all private sector employees. Some information on the type of employment was recorded retrospectively even up to 1955 and before. This data set also includes the exact date of death that forms the base for my first objective health measure: mortality.

In addition, I use the public health insurance records of Upper Austria (a state in Austria, with about one tenth of the country's population). Again, only the private sector employees are included. The public health insurance office collects all information about the patient-specific health expenditure, most of which is stored on a quarterly basis. Some of the expenses can be associated with special drugs or diagnoses.

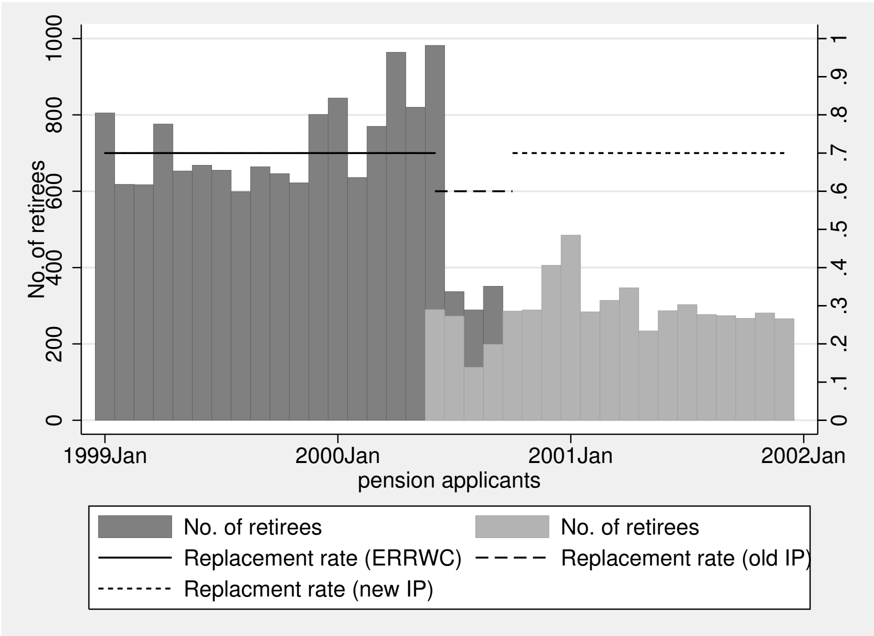
Figure 2a shows the inflow of IP and ERRWC retirees in the years 1999 to 2001. The IP retirees were only taken into account if they fulfilled the stronger requirement of the ERRWC[5], and as such, not all invalidity retirees are included. In June 2000, there was a significant reduction in the inflow of retirees with reduced working capacity because of the abolition of the ERRWC.[6]

[5] An ERRWC retiree should have worked six years in the last 15 years.

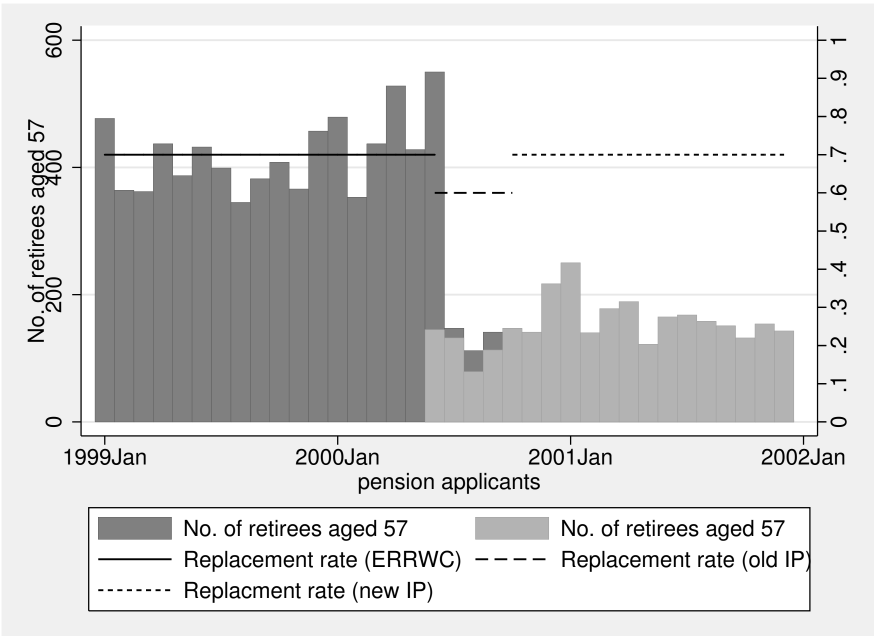
[6] Figures 2a and 2b show the presence of ERRWC retirees even after June 2000. Some retirees had to postpone their retirement due to additional payments at the end of their (long) employment. A minority had sued the pension agency on being eligible to that pension and were, therefore, recorded later on.

Figure 2: *Inflow of (IP and ERRWC) retirees over time and the replacement rate regime*

(a) *All retirees aged 57 to 59 (regimes 1, 2, and 3)*



(b) *Retirees aged 57 (regimes 1, 2, and 3)*



Due to the changes in the general inflow of retirees, one could presume that the older retirees could have been different. As such, I restrict the sample to those individuals who were exactly 57 years old in all regimes (Figure 2b). There is no significant change either because the regime with lower retirement income lasted only for four months or because the inflow of retirees did not differ between younger and older retirees.

Table 1 shows all male retirees by month of entry and pension type. I study the effect of the abolition of the ERRWC in the end of May 2000 by constructing a first sample. This sample contains the ERRWC retirees from January to June 2000 (regime 1) and the IP retirees from June to September 2000 (regime 2). These correspond to the rows labeled "ERRWC" and "IP" in Table 1, respectively.

The removal of the replacement rate cap four months later will be analyzed using *all* IP retirees (i.e., with no restriction on the contribution years) from July to December 2000 (regimes 2 and 3); this corresponds to the row "IP ALL" in Table 1. Here, the retirees from October onwards (regime 3) receive a higher replacement rate for the same number of contribution years.

Health can be measured in various ways. Many authors use self-reported health indicators (Contoyannis et al., 2004; Frijters et al., 2005), while others measure health on the basis of objective variables such as BMI, weight (Cawley et al., 2010) – and mortality (see especially Cutler et al., 2006). In this paper, I use the 7-year mortality risk as the main health outcome. In 2000, the 7-year mortality risk was 8.3% for 57 years old men and 9.9% for 59 years old men (see Statistik Austria (2011), mortality table 2000). In the samples, the mean mortality was 7.5% for the ERRWC retirees and 8% for the IP retirees, which is slightly lower than the mortality risk for the whole male population aged 57 to 59.

Table 1: *Inflow of retirees aged 57 to 59 by pension type and month of entry*

Year	Type	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1999	ERRWC	1,079	767	769	968	789	838	812	744	816	815	743	984	10,124
	IP	23	10	20	18	16	18	18	16	22	18	25	18	222
2000	ERRWC	**1,137**	**805**	**923**	**1,181**	**992**	**1,297**	344	297	362	257	131	94	7,820
	IP	31	17	21	33	29	339	377	223	334	412	367	491	2,674
	IP ALL						1,552	1,197	907	1,057	1,113	1,096	1,294	8,213
2001	ERRWC	159	35	37	41	22	21	23	12	15	12	13	6	396
	IP	592	355	404	436	328	384	389	354	348	335	343	319	4,587

Measuring health by mortality is a rather conservative approach because mortality will react only if health is strongly affected by the treatment. Therefore, I construct a second set of health measures through which the treatment may affect health. Using the data of the public health insurance records of Upper Austria, I calculate variables such as the number of visits to a general practitioner or specialist, health expenditure on prescribed medical drugs or medical aids, and the number of days in a hospital. These variables may be more sensitive to the treatments but may also bear more variation due to other factors that might be correlated with the treatment.

4 Empirical Strategy

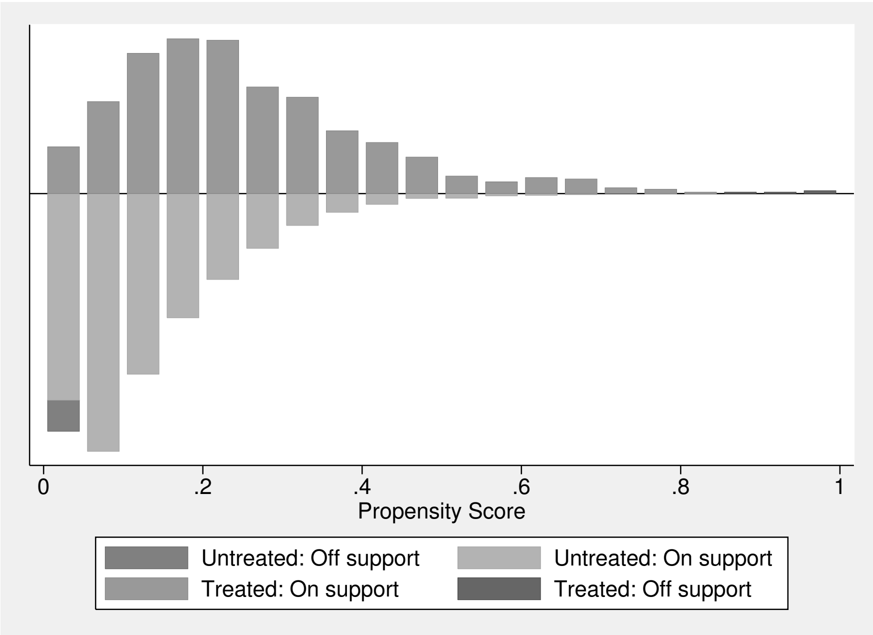
4.1 Abolition of the ERRWC

The pension regulations themselves match only the people with the minimum level of reduced working capacity in all three regimes. Nevertheless, this procedure establishes only some degree of randomization. After May 2000, the first reform, the individuals are still able to self-select into treatment by choosing not to retire at all.

Table 8 in the Appendix shows the descriptive statistics of the two groups before and after the first reform (column "First Sample"). The differences in the recent and 15-year employment history are not significant but seem to be relevant. The IP pensioners are slightly less healthy, more often unemployed, and therefore, less often at work. Looking at the individual characteristics, education is different for the two groups, and so is citizenship to a small extent.

Due to the differences in the replacement schemes on the one hand and the differences before and after the first reform (see also Figure 2a) on the other hand, I need to use matching strategies to overcome the possible selection effects. Other methods like regression discontinuity and difference-in-difference (DiD) are not applicable for this first reform because there also exist differences in several variables other than the treatment at the threshold, and because of the sample selection itself.

Figure 3: *Distribution of propensity score among treated and untreated*



The propensity score matching (PSM) model considers detailed individual employment and employment history characteristics as well as some measures of health and wealth.[7] All these variables are predetermined at the time of retire-

[7] I match on the income before retirement, sum of contribution base over the whole employment history, employment status right before retirement (unemployed, sick leave, or working), type of last employment before retirement (blue collar or white collar), classification of the economic activity of the last employer, location of the last workplace inside Austria, education (three categories), last income from employment, total net income (not top-coded) for the last five years (i.e., a measure for possible wealth accumulated), age at time of retirement (three age categories), and citizenship (Austrian, unknown, or foreign). For the last year before retirement

ment. Using a logit estimation for the propensity score, the balancing property is fulfilled, with the region of common support being in the interval $[0.007, 0.968]$ and substantially large (see also Figure 3). Only 0.6 percent of the treated and about 3 percent of the controls are off support. Finally, I use various matching methods (nearest neighbor, local linear regression matching, stratification matching, kernel matching, and a control function approach) to evaluate the causal effect of the reform on the 7-year mortality rate of the sampled retirees.

4.2 Removal of the Replacement Rate Cap

On October 1, 2000, the second reform, the removal of the replacement rate cap of 60% for IP, was initiated. This did not change the number of applicants by as much as the abolition of the ERRWC did. The details can be seen above in Figure 2a and Table 1. The regimes 2 and 3 do not differ in any aspect other than the replacement rate cap. This allows the application of a simple DiD approach to analyze the effect of an increase in income on health.

Figure 1b shows that the individuals with contribution years between 33.5 and 37.5 had a similar replacement rate. In contrast, the change in income is *at least* 15.8% for the individuals with more than 40 contribution years. Table 2 shows the resulting sample and group sizes.

Table 2: *Final size of the groups in the DiD design (first control group)*

	Control (33.5 to 37.5 years)	Treatment (more than 40 years)	Total
June to September 2000 (regime 2)	123	1,316	1,439
October to December 2000 (regime 3)	90	1,103	1,193
Total	213	2,419	2,632

and the preceding 14 years, I match on days worked (also nonlinear, with dummies for years), days unemployed, and days of sick leave. The procedure also includes several interactions of these variables.

Using this control group leads to a very small number of observations (123 pre-treatment and 90 with treatment) for the control group, because only men aged 57 and above are considered, and most of them had already contributed at least 40 years. Therefore, a second DiD is made using a different control group consisting of the normal early retirees aged 60. These individuals are also very similar to the treatment group aged 57 to 59 but go for the normal early retirement scheme, which is not affected by these reforms. Table 3 shows the resulting sample and group sizes.

Table 3: *Final size of the groups in the DiD design (second control group)*

	Control normal early retirees aged 60	Treatment IP retirees with more than 40 contribution years	Total
June - September 2000 (regime 2)	4,815	1,316	6,131
October - December 2000 (regime 3)	1,406	1,103	2,509
Total	6,221	2,419	8,640

Various exogenous factors are included in the DiD models; such variables are predetermined at the time of retirement. I include dummies for 12 different classes of economic activity of the main employer before retirement as these should cover some differences in the risk for work accidents, at least to some extent, typical occupational diseases. Furthermore, I control for the wages and the number of contribution months, i.e., the number of months insured in a public pension insurance. This also controls for some preference to go for retirement due to long employment life and/or possibly high replacement rate. To control for the differences in health before retirement, I use the number of sick days in the last year before retirement and in the preceding 14 years. The days working and days unemployed, each measured in the last year before retirement and in the preceding 14 years, control for the different risks of unemployment, and therefore, a possibly higher chance of early retirement. Finally, the employment status right before retirement segregated into the categories unemployed, sick, blue collar, and white collar should also account for the different health risks.

Figures 4 and 5 show the share of survivors after 7 years in retirement for the treatment and the control group before and after treatment. Considering the second control group before and during the treatment, both shares mostly follow a parallel path. Looking at the first control group, I get that the common trend seems to be violated after the treatment, but this is mostly due to the small number of observations in the control group, which increases the standard error. In a standard two-period DiD, the key assumption demands common trends of the control and the treatment groups before and after the treatment. Figure 5 suggests that this key assumption is fulfilled for the second control group, and if we sum up the figures for November and December, also for the first control group in Figure 4.

Figure 4: *Common trend validation for the 7-year survival rate in the first DiD model (with the control group being the IP retirees with no difference in the replacement rate)*

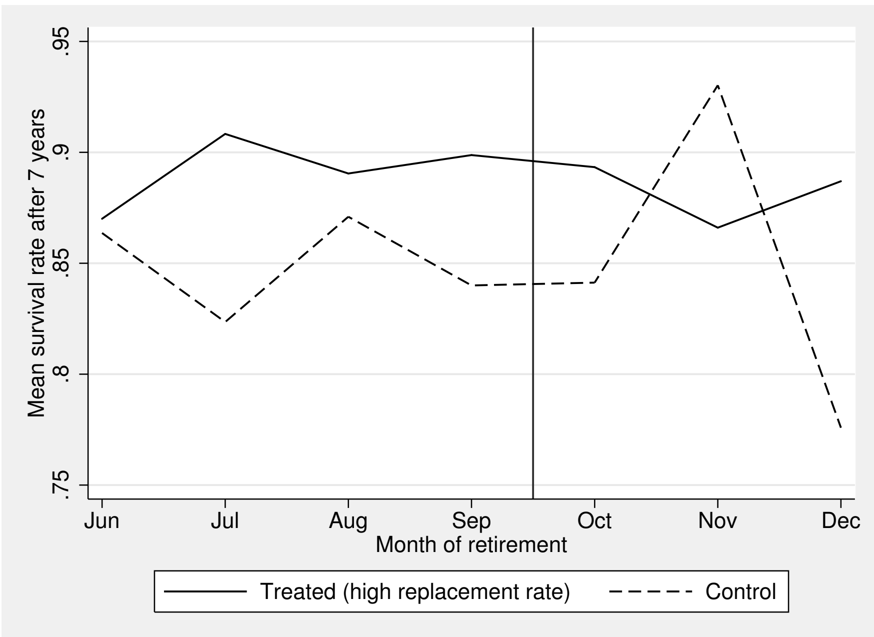
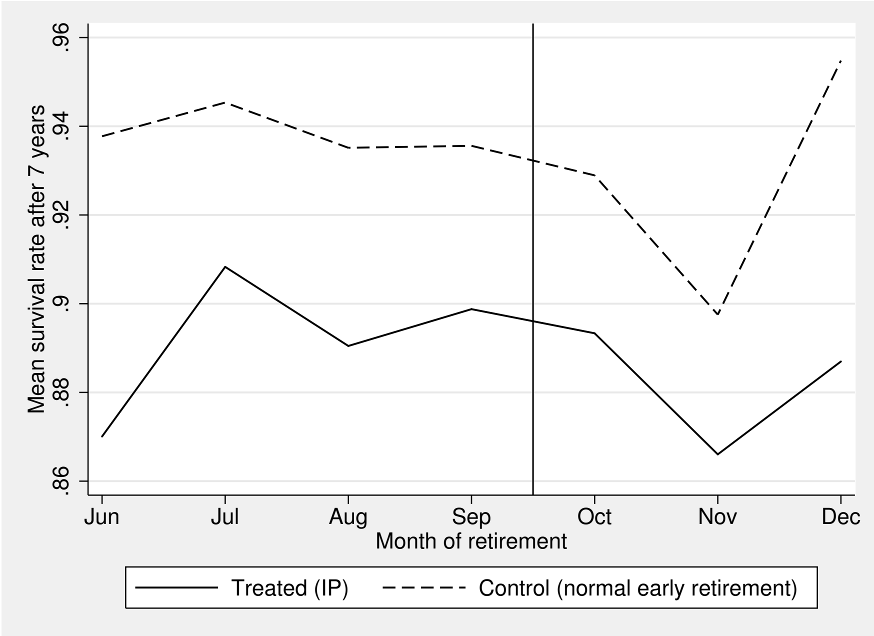


Figure 5: *Common trend validation for the 7-year survival rate in the second DiD (with the control group being normal early retirees aged 60)*



4.3 Health Expenditure

In addition to mortality, I analyze the health expenditure. Due to smaller sample sizes, I use this data primarily to verify my PSM design for the first sample and the DiD design for the second sample. As for the DiD approach, I can only use the second control group, i.e., the normal early retirees aged 60, because in the first control group, only about 20 observations would have been left. Table 4 contains the exact group sizes for this DiD approach.

Table 4: *Final size of the groups in the DiD design using public health data*

	Control normal early retirees aged 60	Treatment IP retirees with more than 40 contribution years	Total
June to September 2000	532	189	721
October to December 2000	163	172	335
Total	695	361	1056

The data allows me to compare eight quarters before retirement and 24 quarters thereafter. The health expenditure preceding retirement should not differ between the treatment and the control groups in order to test the validity of the chosen models with respect to selection in health. The differences after retirement can show the differences in health not measured by mortality risk.

5 Results

5.1 Mortality and Survival Rates

Tables 5 and 6 show the results of the PSM and the DiD procedures. Using several methods and variations, I do obtain results, but these are numerically small (as compared to the mean survival rate). Moreover none of the results is statistically significant.

These small and insignificant results of even such a huge decrease in income are in line with the literature on the effects of income on the health of elderly persons in the US (see Adams et al. (2003), Cawley et al. (2010), and Cutler et al. (2006)).

The average treatment effects on the treated (ATT) of the first sample do not vary much when using different matching methods (see Table 5). The results are not sensitive to a restriction of the sample to the observations on the common support. Moreover, the effects do not change much when using different bandwidths and calipers for the neighborhood or kernel matching.

Table 5: *Results of the effect of (an increase in) income on survival using PSM*

Survival probability (7 years)	PSM NN	LL	ST	Kernel	Radius	OLS control function approach			
ERRWC retirees (ATT)	-0.14	0.27	0.1	0.06	0.00				
	(1.79)	(1.16)	(1.0)	(1.20)	(1.20)				
ERRWC retirees (ATE)	0.47	1.36				0.59	0.57	1.67	1.62
	(1.82)	(1.63)				(1.24)	(1.24)	(1.46)	(1.43)
propensity score						incl.	incl.	incl.	incl.
propensity score^2							incl.	incl.	incl.
propensity score interacted with treatment								incl.	incl.
other covariates									incl.
constant						incl.	incl.	incl.	incl.
observations	4,654	4,654	4,654	4,654	4,526	4,525	4,529	4,529	4,529
R-squared						0.0001	0.001	0.002	0.058

NN:Nearest Neighbor, LL:Local Linear, ST:Stratification
The effects and standard errors are reported in percentage points. The standard errors are in parentheses.
The bootstrapped standard errors are used for local linear and stratification matching and robust standard errors are used for OLS.
*** p<0.01, ** p<0.05, * p<0.1

Table 6: *Results of the effect of (an increase in) income on survival using DiD*

	Control Group: IP Retirees with 33.5 to 37.5 contribution years		normal early retirees aged 60	
Survival probability	OLS	probit^a	OLS	probit^a
DiD (new IP)	0.41	0.08	0.61	1.00
	(6.41)	(3.20)	(1.13)	(0.95)
observations	2,632	2,632	8,640	8,640
(pseudo) R^2	0.057	0.070	0.030	0.043

The DiD and standard errors are reported in percentage points. The DiD values are calculated with the treatment group being the IP retirees with more than 40 contribution years in the public pension system.

a) The DiD values for the probit models are the marginal effects for the interactions in nonlinear models.

Additional control variables: monthly dummies, NACE codes (12), sum of assessment bases, contribution months, sick days (1 year), sick days (15 years), days working (1 year), days working (15 years), days unemployed (1 year), days unemployed (15 years), and employment status right before retirement (unemployed, sick, or blue collar).

The average treatment effects (ATE), though, are somewhat sensitive to the different methods used. They are not significant and generally show effects around 0.5 to 1.7 percentage points.

The results using the DiD method, though again insignificant, are only slightly higher than the ATT estimates of the PSM method. This result suggests that the real treatment effect is rather low and may even be not different from zero. The

DiD estimates are not sensitive to the inclusion of interactions and quadratics in sickness information nor to the inclusion of monthly dummies (i.e., a nonlinear time trend). Neither the point estimate nor the standard errors are affected.

5.2 Health Expenditure

With regard to the health expenditure, my samples cover quite few individuals. First, I use the data on the health expenditure eight months preceding retirement to verify the model with respect to the selection into treatment. Second, the effect of the increase in income on those outcomes is analyzed. I use the expenditure on drugs, expenditure on and number of medical aids, number of visits to a general practitioner (GP), number of visits to a specialist, and the number of days spent in a hospital.

The patients have to pay deductibles on drugs, medical aids, and days spent in a hospital, while for the rest, all expenses are covered by the insurance. The deductibles on drugs are rather low as compared to those on medical aids and days spent in a hospital (per day fee). As for the days spent in a hospital, a patient can leave a hospital earlier if he or she wants to, and some of the patients may have done this to save money, which might lead to a negative effect on this outcome due to the reduction in income.

Figures 6 and 7 show the effects of the decrease in income on the health expenditure outcomes. The graphs show the difference in the health expenditure outcomes (using the PSM or the DiD model) on the y-axis and the quarter before and after retirement on the x-axis. Using the quarterly results, I get that there are no significant differences before treatment, suggesting that the selection into treatment by health status can be ruled out using this data.

The graphs suggest some positive (but insignificant) increase in the drugs prescribed and in the number of visits to a specialist on the one hand, and a very slight decrease (again insignificant) in the number of days spent in a hospital after retirement.

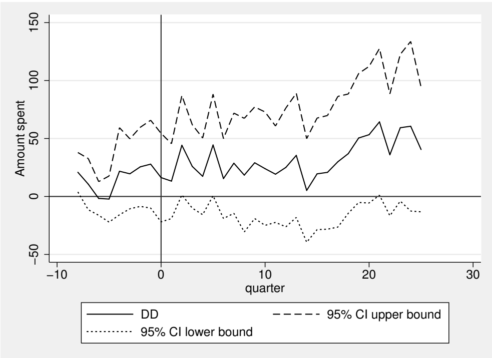
Finally, Table 7 shows the results of the PSM (using local linear regression matching) and DiD models for the aggregated pre and post retirement outcomes. All the pre-retirement outcomes are not significant, which again suggests that the selection into treatment by health status can be ruled out.

In the DiD model, I find a significant increase in the expenditure on medicines/drugs for the retirees under a lower replacement rate. This may be due to the relatively lower health due to the lower income. The medication may prevent the ultimate health outcome, mortality, from having an effect on the treatment.

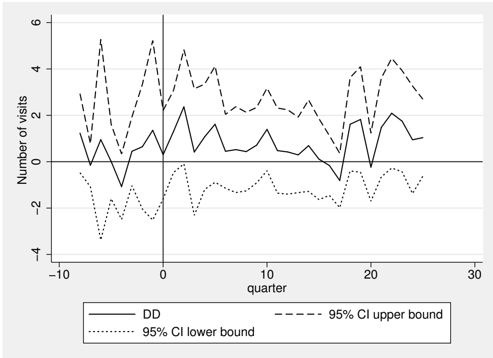
Moreover, the following effects are worth mentioning: the number of medical aids and the number of hospital days decreased after retiring under a lower replacement rate. Though, these effects are not significant, they can be considered reasonable as the patient would have to cover the relatively higher deductibles for such services. Since the retirees already have to bear their lower pension, they will try to avoid additional expenses such as deductibles.

Figure 6: *PSM (local linear regression) differences in the effect of decrease in income on the health expenditure after the first regime change (regimes 1 and 2)*

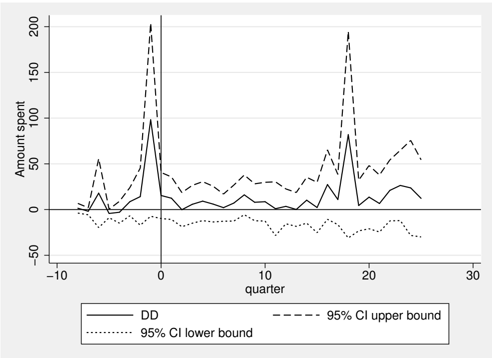
(a) *Amount spent on medicines prescribed*



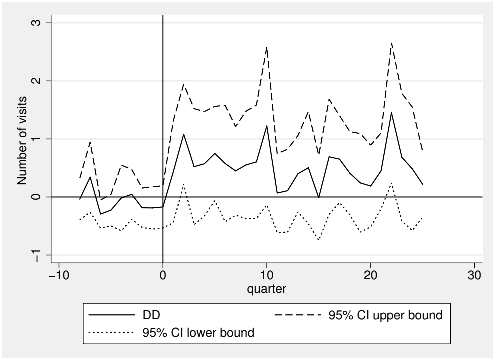
(b) *Number of visits to a GP*



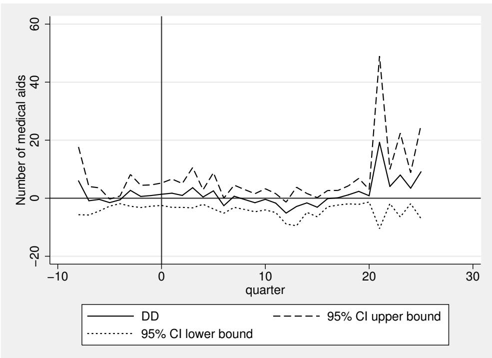
(c) *Amount spent on medical aids*



(d) *Number of visits to a specialist*



(e) *Number of medical aids*



(f) *Number of days spent in a hospital*

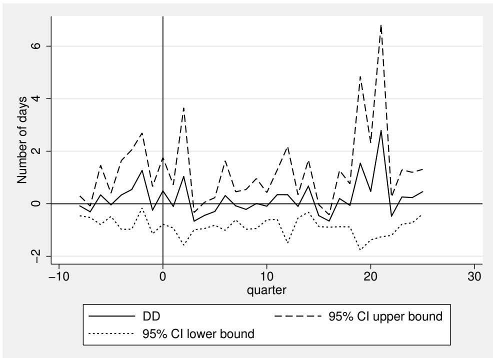
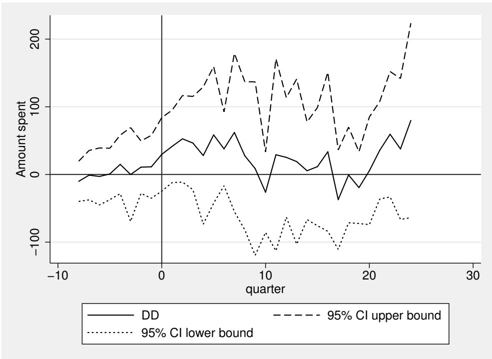
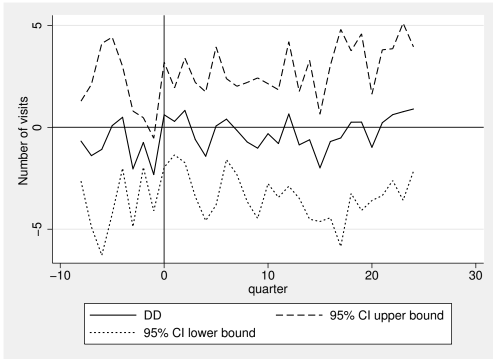


Figure 7: *DiD plots of the effect of decrease in income on the health expenditure after the second regime change (regimes 2 and 3)*

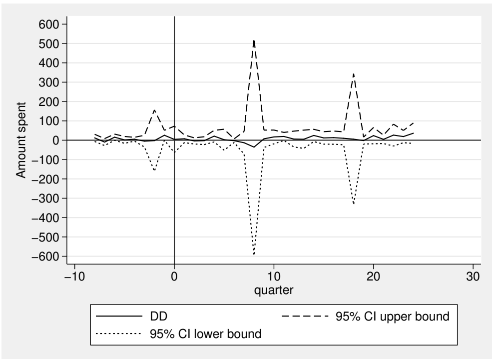
(a) *Amount spent on medicines prescribed*



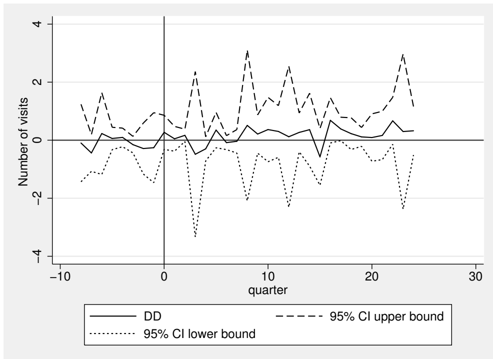
(b) *Number of visits to a GP*



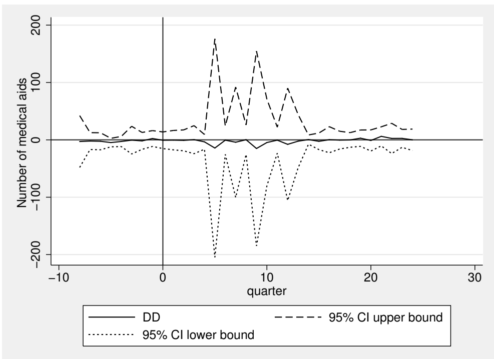
(c) *Amount spent on medical aids*



(d) *Number of visits to a specialist*



(e) *Number of medical aids*



(f) *Number of days spent in a hospital*

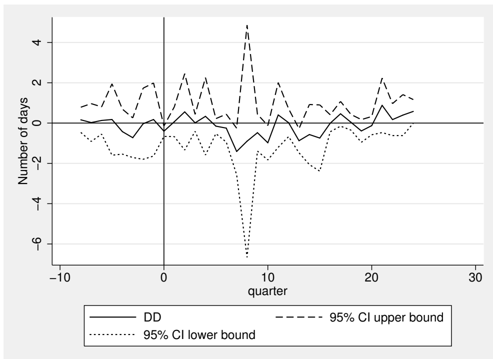


Table 7: *Results of the effect of (increase in) income on the health expenditure using the PSM and DiD methods*

	Sample/Method			
	First regime change PSM results		Second regime change - DiD results (with the normal early retirees as the control group)	
Variable	Mean	Effect	Mean	Effect
Before retirement				
amount spent on				
medicines prescribed	367.25	145.85	345.18	-1.64
	(618.81)	(101.12)	(629.85)	(55.40)
medical aids	79.93	73.34	89.48	37.12
	(288.17)	(62.64)	(324.50)	(33.37)
visits to a				
GP	35.99	0.577	30.54	-0.413
	(39.77)	(4.313)	(39.80)	(1.060)
specialist	5.19	0.164	5.88	-0.847
	(9.75)	(1.051)	(12.87)	(1.022)
number of				
medical aids	19.80	19.39	16.81	-14.96
	(194.34)	(26.31)	(162.25)	(64.99)
days spent in a hospital	4.97	1.178	3.64	-0.51
	(9.99)	(1.190)	(9.24)	(2.77)
After retirement				
amount spent on				
medicines prescribed	1,853.69	677.08	1,731.93	685.22*
	(3,149.04)	(516.05)	(3,800.29)	(371.90)
medical aids	324.75	245.16	328.77	198.90
	(1,194.79)	(213.99)	(1,311.36)	(168.05)
visits to a				
GP	110.97	-0.127	92.27	0.180
	(119.27)	(14.142)	(110.53)	(3.588)
specialist	14.98	8.50	15.52	4.369
	(37.96)	(8.52)	(40.80)	(4.219)
number of				
medical aids	60.40	31.45	69.47	-38.20
	(324.96)	(37.05)	(400.12)	(381.62)
days spent in a hospital	16.86	-1.18	14.34	-2.77
	(30.81)	(2.82)	(28.37)	(5.47)
observations	1,024		1,056	

The effects and standard errors for monetary factors are given in Euros. The standard errors for the effects on the number of visits are calculated using bootstrapping. The treatment group is the IP retirees with more than 40 contribution years in the public pension system.

Before retirement includes eight quarters before retirement and After retirement includes 24 quarters thereafter.
Additional control variables in the DiD method: monthly dummies, NACE codes (12), total sum of wages, contribution months, sick days (1 year), sick days (15 years), days working (1 year), days working (15 years), days unemployed (1 year), days unemployed (15 years), and employment status right before retirement (unemployed, sick, or blue collar).

6 Conclusion

The analysis shows that income has no causal effect on the mortality rates of old aged persons in Austria. Two different natural experiments of closely related policy reforms are analyzed using a PSM with various matching methods and a DiD model. The distance between the two cohorts being compared by the chosen methods is at most eight months. This implies that two close (if not the "same") cohorts are compared during the same period of time. These cohorts are exposed to the same risks such as epidemics or pandemics. My results are in line with the results of the literature on the effects of income on health for old aged individuals in the US (Adams et al., 2003; Cawley et al., 2010; Cutler et al., 2006).

Usually, the effect of earning more is no free lunch: it comes along with increased stress and/or increased working hours. This effect is ruled out by focusing only on pensioners. Using the detailed data from the Austrian social security records, both evaluations result in a low and insignificant effect on mortality compared to the large reduction in income. One reason for this result may be the very generous Austrian public health insurance system.

Focusing on other health-related outcomes, I can only access the data of one state, which covers fewer individuals. First, I use the data to verify the model with respect to the selection effects for the different types of pensions. The results for public health expenses and the number of visits to a doctor or a hospital *before* the retirement suggest that the identification strategy works and that the selection effects can be ruled out.

Second, the effect of decrease in income on other health-related outcomes after retirement is analyzed. Only the expenses on prescribed drugs increased significantly at a 10 percent level due to the loss in income. For the other health-related outcomes, such as the number of visits to a general practitioner, a specialist, and a hospital, and the expenditure on medical aids, no significant effects were found.

Table 8: *Descriptives of the ERRWC and IP retirees in the first and second samples*

	First Sample regimes 1 and 2		Second experiment/sample regimes 2 and 3		
Varialbes	**ERRWC**	**IP_1**	**IP_2**	**IP_3**	**ER_{60}**
Observations	3,957	697	2,419	213	6221
Employment history					
days worked (last year)	230.1	172.9	158.4	130.6	215.9
	(170.3)	(170.5)	(166.7)	(151.0)	(171.0)
days unemployed (last year)	93.9	135.8	84.5	106.8	81.4
	(135.4)	(144.1)	(131.9)	(140.9)	(140.8)
sick days (last year)	41.2	47.0	43.0	49.6	9.5
	(87.8)	(102.6)	(102.8)	(102.8)	(44.0)
days worked (last 15 years)	4,625.6	4,577.2	3,539.7	3,290.4	4,079.9
	(765.9)	(836.2)	(2,052.7)	(1,958.4)	(1,756.0)
days unemployed (last 15 years)	297.6	305.4	290.2	608.0	248.0
	(507.2)	(481.0)	(656.6)	(1,052,6)	(659.8)
sick days (last 15 years)	68.9	59.2	76.9	129.7	58.9
	(150.9)	(136.5)	(335.7)	(451.8)	(402.8)
years insured (last 15 years)	13.1	13.0	13.2	11.3	13.5
	(1.9)	(1.8)	(2.4)	(4.1)	(2.5)
Income history					
contribution years	42.6	42.7	42.6	35.6*	44.5
	(1.31)	(1.39)	(1.21)	(1.21)	(1.47)
sum of contribution bases	429,909	454,636	363,801	362,972	444,461
	(108,725)	(114,529)	(178,027)	(160,601)	(155,251)
assessment base	2,059.4	2,174.9	1,857.2	1,793.4	2,172.2
	(494.5)	(520.3)	(695.9)	(704.7)	(672.2)
Education					
more than compulsory	34.2 %	47.9 %*	34.35 %	33.33 %	24.3 %*
secondary education	2.1 %	5.2 %*	1.98 %	8.45 %*	5.98 %*
higher education	0.1 %	0.9 %*	0.54 %	5.63 %*	3.12 %*
Citizenship					
unknown	7.0 %	6.3 %	2.8 %	5.7 %	5.6 %
other	16.3 %	16.8%	23.0 %	27.4 %	25.4 %
Treatment					
before October 2000	—	—	54.4 %	57.7 %	77.4 %

IP_1: IP retirees before October 2000 who would have been eligible for ERRWC; IP_2: All IP retirees between June to December 2000 with at least 40 contribution years (treatments 1 and 2); IP_3: All IP retirees between June to December 2000 with 33.5 to 37.5 contribution years (control 1); ER_{60}: All early retirees aged 60 between June and December 2000 with at least 40 contribution years (control 2)

* Significant differences between ERRWC and IP_1, IP_2 and IP_3, or IP_2 and ER_{60}

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