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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 in the early 2000s. 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 income 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 find that only prescribed drug consumption increased, with the remaining analyzed factors being unaffected.

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. Individuals who earn more can afford more and better health care. They are able to spend more money on health prevention, can afford to live 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 pathways through which income may have a negative effect on health. Usually, the effect of higher earnings is associated with increased working hours, accidental risks or increased stress at work. This influence of income on health can be described using a health production framework (Grossman, 1972).

In contrast, 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.

Snyder and Evans (2006) use the Social Security notch to find evidence for an effect of income on mortality among the elderly in the US. This research design answers the very narrow question, whether income in the form of social transfers effects mortality in the elderly population. One additional main finding is that other sources of income turned out to be more healthy for this population.

Further empirical literature shows a positive but not always significant causal effect of income on health. Benzeval et al. (2000), Case (2004) 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 a causal effect of income on the weight or BMI of elderly Americans. Adams et al. (2003) also analyze the causal effect of income on health 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. In Austria, Ahammer et al. (2015) investigate the effect of income on mortality in a different setting and establish a robust zero effect for prime aged workers. Lindahl (2005) does not find any significant effect of lottery prizes on mortality in Sweden. In

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	Regime 1	Regime 2	Regime 3
Time	- June 2000	June 2000 - September 2000	October 2000 -
Replacement rate	high	low	high
First Sample	Early Retirement (ERRWC)	Invalidity Pension (long employment history)	
Second Sample		Invalidity Pension (all)	Invalidity Pension (all)

Fig. 1. The regimes and types of retirement.

line with this study, Kim and Ruhm (2012) do not find any substantial effect of bequests on health in the US. They use HRS data to analyze the influence of inheritances on health, out-of-pocket health expenditures and many other factors. Corresponding to the absent effect on health they find only minor effects on out-of-pocket health expenditures and medical services, and "no convincing evidence" for changes in lifestyles to offset a possible positive effect.

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, the European Court of Justice ruled in May 2000, that one type of early retirement violated the European law. This decision surprised the government and the public. The subsequent abolition of this retirement in June 2000 can be seen as a natural experiment. Before the abolition, in "regime 1" retirees received *up to 25% more gross pension* than thereafter in "regime 2". Four months after the change, in "regime 3" the replacement rate was raised to its previous level again (see Fig. 1). Using data from Austrian social security records, I exploit these two notches to study the causal effect of income on health for elderly persons.

As a measure of health, I use the mortality rates over a period of seven years, which is a determinant of bad health for these elderly persons. In Addition, for a small proportion of the individuals, the data from the public health insurance is available. For this part of the sample, I can use the health expenditures on drugs or medical aids, visits to general or special practitioners, and hospital visits.

The Austrian social security records contain detailed information on employment histories and some information on health histories of all Austrian private sector employees. Using individuals aged 57–59 years, I compare retirees from the period January to June 2000 (regime 1) to retirees from the period June to September 2000 (regime 2) for the first regime change. Using cohorts aged 57–60, I contrast retirees from the period June to September 2000 with retirees from the period October to December 2000 for the second regime change. See Fig. 1 for a time line for those comparisons and samples. All cohorts compared are exposed to the same health "risks" (epidemics, etc.) all the time.

The seven year mortality rates for these persons are not statistically different between the regimes. Only expenditures on drugs increases significantly, but all other expenses and measures like visits to a doctor or a hospital, expenditures on medical aids, etc. are unaffected.

While the question of the effect of income on health is not novel, this paper contributes to the broad literature providing evidence from a different country and a different dataset. Moreover, it provides deeper insights in the effect of income on health expenditures. Some authors presume that the effect of income on health is absent, because medication is covered by public health insurance which can be considered a substitute for any out-of-pocket payments supporting a healthy lifestyle (see Adams et al., 2003). Except for prescribed drugs at the 10 percent level, I cannot find that income is substituted with public health expenditures in Austria.

Institutional background

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 pensions (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 stagnated 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 labor force participation rates of elderly men and women amongst the OECD countries (Organisation for Economic Co-operation and Development, 2006).

In Austria, the number of years insured (the contribution years) frame the basis for the replacement rate of pension benefits. In the relevant period, pension payments were 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).[1]

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 rate for the workers retiring under the ERRWC *(details later)*. The introduction was announced several months before, and hence, individuals could have adapted easily by postponing their

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

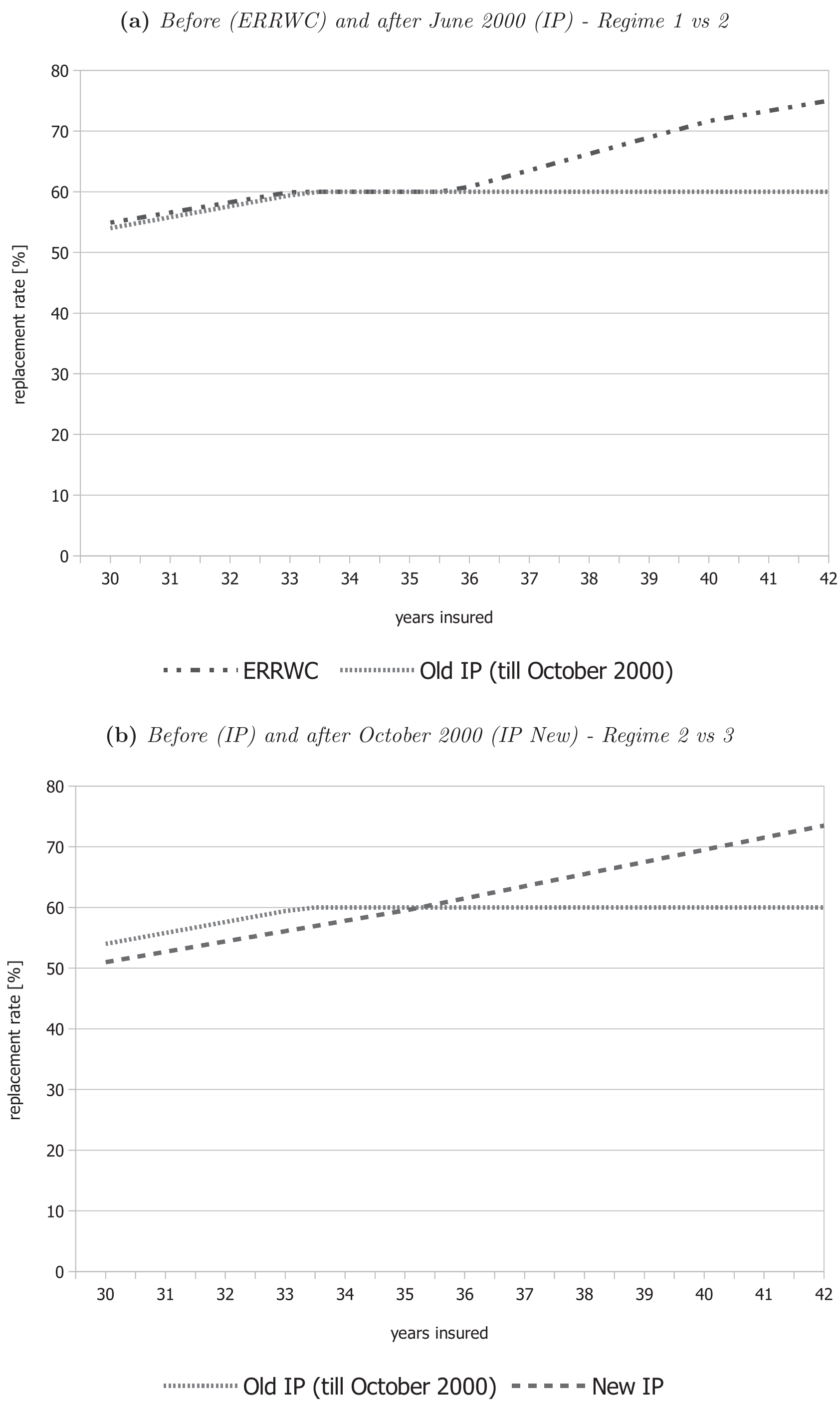

Fig. 2. Replacement rate of an employee aged 57–59 depending on the number of contribution years and pension type.

retirement decision. Thus, the introduction of the ERRWC does not qualify for a natural experiment.

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 had been contributing for a long time or were unemployed as elderly. 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 the applicant's working capacity.[2] The two differences between the two pension types were therefore the difference in the replacement rate as shown in Fig. 2a and the additional requirements concerning the number of months insured for the ERRWC.

In May 2000, the European Court of Justice ruled that the ERRWC (regime 1, see Fig. 1) 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, and new pension applicants could not take advantage of the higher pension income anymore. Hence employees with reduced working capacity could only apply for the IP (regime 2). Using this natural experiment, I 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

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

disabled by 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.[3] 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). Therefore, I only consider individuals fulfilling this criterion of eligibility in my analysis for the first change.

The exact differences in the replacement rates (i.e., in the resulting pension benefits) of the two regimes are illustrated in Fig. 2a. The graph shows the exact replacement rate for a male employee aged 57–59 with a varying number of contribution years on the x-axis. If this employee contributed for up to 36 years to the public pension system, he would have received the same pension benefits 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 (regime 3). The resulting replacement rate differences between the two IP regimes can be found in Fig. 2b. Here, 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 slightly 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 modified with respect to its replacement rate cap (regime 3).

During this period of time the standard early retirement scheme for 60+ did not change at all. These retirees can be considered a comparable group of applicants to the pension system.

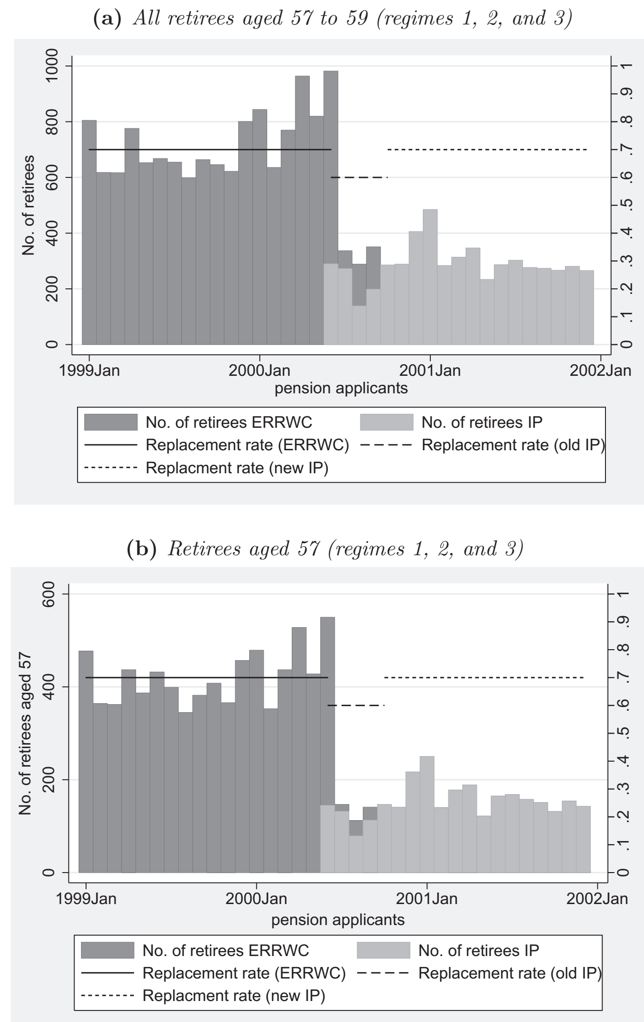

Fig. 3. Monthly inflow (number) of retirees and their according replacement rate.

Data

I use the administrative employment records from the Austrian social security system covering the years 1972–2009 (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 back to 1955 and earlier. This data set also includes the exact date of death which provides the basis 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 individual health expenditure, most of which is stored on a quarterly basis. Some of the expenses can be associated with special drugs or diagnoses.

Fig. 3a shows the monthly inflow of retirees by type of retirement between 1999 and 2001. The IP retirees (light gray) were only taken into account if they fulfilled the stronger requirement of the ERRWC[4], and as such, not all invalidity retirees are included (thy correspond to the line "IP" in Table 1).

In June 2000, there was a significant reduction in the inflow of retirees with reduced working capacity (ERRWC, dark gray) because of the abolition of the ERRWC.[5]

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 (Fig. 3b). There is no significant change, either because the regime with reduced 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. To study the abolition of ERRWC and removal of IP replacement cap separately, I have to construct two separate samples. First, I analyze the effect of the abolition of the ERRWC in June 2000 by constructing a sample containing 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.

Second, the removal of the replacement rate cap four months later will be analyzed using *all* IP retirees, with no restriction on

[3] The whole procedure has also been confirmed by the Austrian public pension insurance agency.

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

[5] Figs. 3a and 3b 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.

Table 1
Inflow of retirees aged 57–59 by pension type and month of entry.

Year	Type	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1999	ERRWC	1079	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	**1137**	**805**	**923**	**1181**	**992**	**1297**	344	297	362	257	131	94	7820
	IP	31	17	21	33	29	339	377	223	334	412	367	491	2674
	IP ALL						1552	1197	907	1057	1113	1096	1294	8213
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	4587

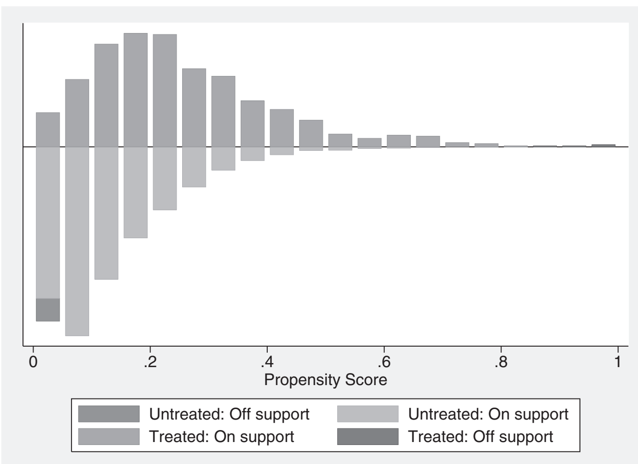

Fig. 4. Distribution of propensity score among treated and untreated.

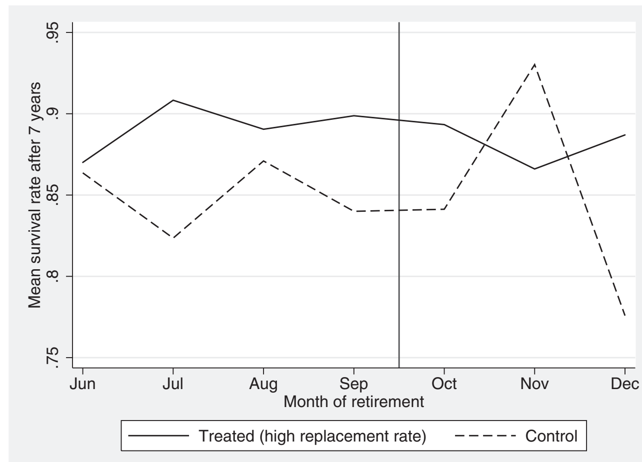

Fig. 5. Common trend validation for the 7-year survival rate in the first control group DiD model.

Table 2
Final group sizes in the DiD design.

	Control	Treatment	
First control group (IP with less than 37.5 contribution years)			
	Aged 33.5 to 37.5 years	More than 40 years	Total
June to September 2000 (regime 2)	123	1316	1439
October to December 2000 (regime 3)	90	1103	1193
Total	213	2419	2632
Second control group (normal early retirees)			
	Normal early retirees aged 60	IP retirees with more than 40 contribution years	Total
June – September 2000 (regime 2)	4815	1316	6131
October – December 2000 (regime 3)	1406	1103	2509
Total	6221	2419	8640

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 2000 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 more 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 variable. 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 57–59. 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 expenditures 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 unobserved factors.

Empirical strategy

In all following regressions I use an equivalent to the following basic linear probability model for the 7-year mortality of elderly workers to estimate the effect of the reduction in income:

$$mortality = \beta\mathbf{X} + \alpha_1 I(regime) + \alpha_2 I(treatment) + \alpha_3 I(regime) * I(treatment).$$

where X stand for control variables.[6] In the models for the first regime change, I do not have a control group, so there is no inclusion

[6] Control variables are – depending on the model – 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).

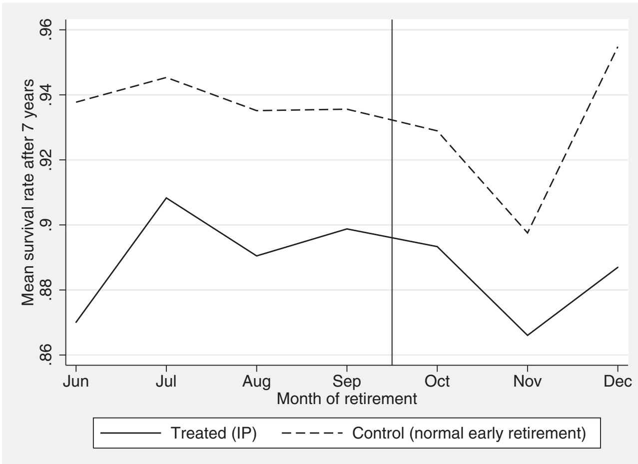

Fig. 6. Common trend validation for the 7-year survival rate in the second control group DiD model.

Table 5
Results of the effect of (an increase in) income on survival using DiD.

Survival probability	Control Group			
	IP Retirees with 33.5–37.5 contribution years		Normal early retirees aged 60	
	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	2632	2632	8640	8640
(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.
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).
[a] The DiD values for the probit models are the marginal effects for the interactions in nonlinear models.

Table 3
Final group sizes 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

of a bare *regime* and *treatment* effect. As for the second regime change, I can use a control group and the bare effects for *regime* and *treatment* are identified. At last, α_3 is the effect of income on health in these models.

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 the first reform in June 2000, the individuals are still able to self-select into treatment by choosing not to retire at all.

Table 7 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 ("sick days (last year)"), more often unemployed, and therefore, less often at work. Looking at the individual characteristics, education is different for both 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 Fig. 3a) 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 factors other than the treatment at the threshold, and for the reason of sample selection itself. The administrative records do not include pension income for the majority of affected retirees, which is why I can not use IV strategies to analyze the effect of interest.

Table 4
Results of the effect of (an increase in) income on survival using PSM.

Survival probability (7 years)	PSM					OLS			
	NN	LL	ST	Kernel	Radius	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	4654	4654	4654	4654	4526	4525	4529	4529	4529
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.
$^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$.

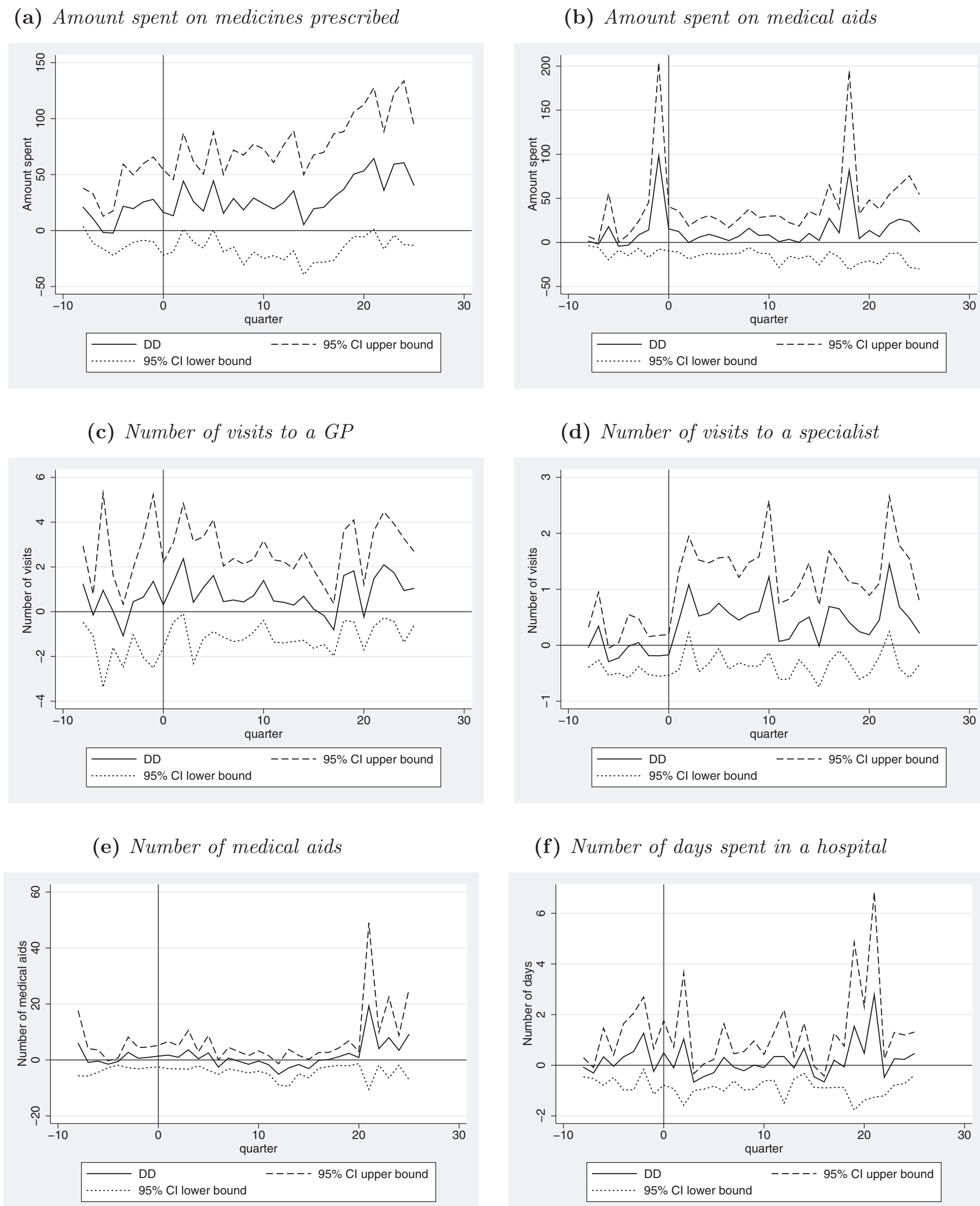

Fig. 7. PSM (local linear regression) differences in the effect of decrease in income on the health expenditure after the first regime change (regimes 1 and 2).

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 retirement. 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 Fig. 4). Only 0.6 percent of the treated and about 3 percent of the (pretreatment) 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.

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. Though it does not reinstall exactly the same replacement rate levels as in regime 1, this modification is equivalent to an increase of up to 23 percent in income. This reform did not change the number of applicants by as much as the abolition of the ERRWC did. The details are reported above in Fig. 3 and Table 1. The regimes 2 and 3 do not differ in any aspect other than the replacement rate calculation for IP. This allows the application of a simple DiD approach to analyze the effect (α_3) of an increase in income on health using the following model

[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 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.

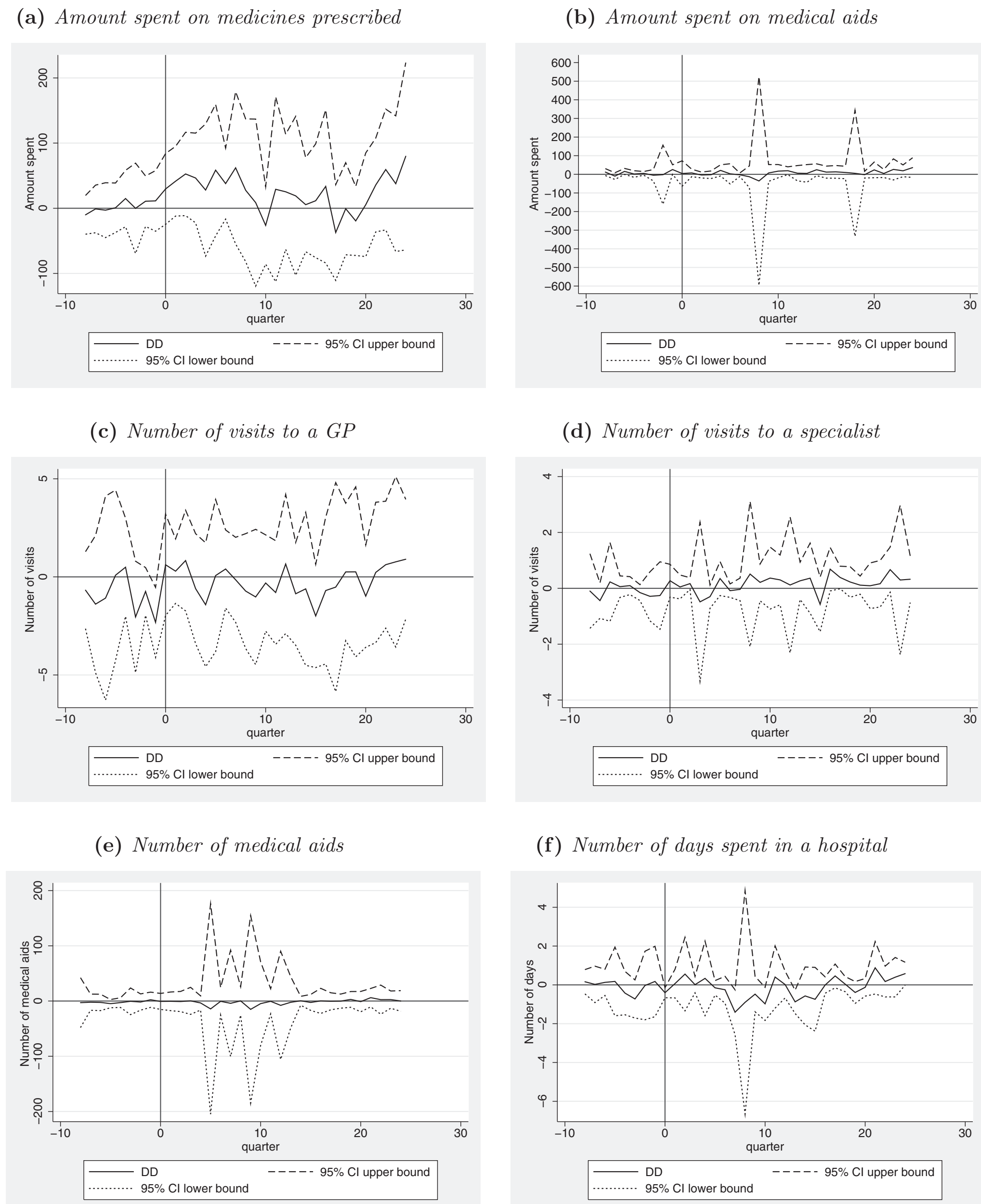

Fig. 8. DiD plots of the effect of decrease in income on the health expenditure after the second regime change (regimes 2 and 3).

$$mortality = \beta\mathbf{X} + \alpha_1 I(regime) + \alpha_2 I(treatment) + \alpha_3 I(regime) * I(treatment).$$

Fig. 2b 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 for this first control group design.

In the first control group the number of observations is very small (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 57–59 but go for the normal early retirement scheme, which is not affected by these reforms. Table 2 shows the resulting sample sizes in section "Second control group".

Various exogenous factors are included in the DiD models (see Table 7 for more details). All those 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 at least some differences in the risk for work accidents and typical occupational or industry related diseases.

Furthermore, I control for the pre-retirement wages and the number of months the individual contributed to the public pension insurance. This is also a way to control for retirement preference 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 the preceding 14 years. The days working and days unemployed, each measured in the last year before retirement and the preceding 14 years too, control for the different risks of unemployment, and therefore, a possibly higher chance of early retirement. Finally,

Table 6
Results of the effect of (increase in) income on the health expenditure using the PSM and DiD methods.

Variable	Sample/Method			
	First regime change PSM results		Second regime change – DiD results (with the normal early retirees as the control group)	
	Mean	Effect	Mean	Effect
Before retirement				
Amount spent on				
(a) Medicines prescribed	367.25	145.85	345.18	−1.64
	(618.81)	(101.12)	(629.85)	(55.40)
(b) Medical aids	79.93	73.34	89.48	37.12
	(288.17)	(62.64)	(324.50)	(33.37)
Visits to a				
(c) GP	35.99	0.577	30.54	−0.413
	(39.77)	(4.313)	(39.80)	(1.060)
(d) Specialist	5.19	0.164	5.88	−0.847
	(9.75)	(1.051)	(12.87)	(1.022)
Number of				
(e) Medical aids	19.80	9.39	16.81	−14.96
	(194.34)	(26.31)	(162.25)	(64.99)
(f) 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				
(a) Medicines prescribed	1,853.69	677.08	1,731.93	685.22*
	(3,149.04)	(516.05)	(3,800.29)	(371.90)
(b) Medical aids	324.75	245.16	328.77	198.90
	(1,194.79)	(213.99)	(1,311.36)	(168.05)
Visits to a				
(c) GP	110.97	−0.127	92.27	0.180
	(119.27)	(14.142)	(110.53)	(3.588)
(d) Specialist	14.98	8.50	15.52	4.369
	(37.96)	(8.52)	(40.80)	(4.219)
Number of				
(e) Medical aids	60.40	31.45	69.47	−38.20
	(324.96)	(37.05)	(400.12)	(381.62)
(f) Days spent in a hospital	16.86	−1.18	14.34	−2.77
	(30.81)	(2.82)	(28.37)	(5.47)
Observations	1024		1056	

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).

the employment status right before retirement segregated into the categories unemployed, sick, blue collar, and white collar also accounts for different health risks.

Fig. 5 (first control group) and 6 (second control group) show the share of survivors after 7 years in retirement for the treatment and the control groups 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 find that the common trend seems to be disturbed after the treatment, but this is mostly due to the small number of observations in this 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. Fig. 6 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 Fig. 5.

Health expenditure

In addition to mortality, I analyze 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 be left. Table 3 contains the exact group sizes for this DiD approach.

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

Results

Mortality and survival rates

Tables 4 and 5 show the results of the PSM and the DiD procedures. Using several methods and variations, I do obtain results, that are numerically small (as compared to the mean survival rate). Moreover none of the results is statistically significant.

These results 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; Cutler et al., 2006) and Austria (Ahammer et al., 2015).

Table 7
Descriptives of the ERRWC and IP retirees in the first and second samples.

Varialbes	First sample regimes 1 and 2		Second experiment/sample regimes 2 and 3		
	ERRWC	IP_1	IP_2	IP_3	ER_{60}
Observations	3957	697	2419	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)	4625.6	4577.2	3539.7	3290.4	4079.9
	(765.9)	(836.2)	(2052.7)	(1958.4)	(1756.0)
Days unemployed (last 15 years)	297.6	305.4	290.2	608.0	248.0
	(507.2)	(481.0)	(656.6)	(1052.6)	(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	2059.4	2174.9	1857.2	1793.4	2172.2
	(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}.

The average treatment effects on the treated (ATT) of the first sample do not vary much when using different matching methods (see Table 4). 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.

The average treatment effects (ATE) of the PSM, though, are somewhat sensitive to the different methods used. Outcomes are not significant and generally show effects ranging from 0.5 to 1.7 percentage points.

The results generated by the DiD approach are insignificant as well and only slightly higher than the ATT estimates of the PSM approach. This finding suggests that the real treatment effect is rather low and may even be not different from zero. The DiD estimates are neither sensitive to the inclusion of interactions and quadratics in sickness information nor to the inclusion of monthly dummies (i.e., a nonlinear time trend or time dependent selection). Neither the point estimate nor the standard errors are affected.

Health expenditure

With regard to the health expenditure, my samples cover only 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 *de*crease in income on those outcomes is analyzed. I use the expenditures on drugs, expenditures 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 hospital.

In Austria, patients have to pay deductibles on drugs, medical aids, and days spent in a hospital, while all other 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). Concerning the days spent in hospital, a patient has the option to leave the hospital earlier. Some of the patients may have done this in order to save money, which might lead to a negative effect on this outcome due to the reduction in income.

Fig. 7 represents results for the first regime change and Fig. 8 for the second. The figures are normalized such that both show the *effects of the decrease in income on the health expenditure outcomes* (the effects of the second reform are inverted). The graphs show the difference in health expenditure outcomes on the *y*-axis and the quarters before and after retirement on the x-axis. Using this quarterly results, I find 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 for the first regime change and no effects for the second regime change at all.

Finally, Table 6 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 expenditures 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.

Conclusion

This 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 health 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). Ahammer et al. (2015) use a large sample of (healthier) prime aged workers in Austria and find a robust zero effect. In contrast to them, I am using elderly disabled workers to study the effect. The average seven year mortality in my sample is 10 percent and higher – more than tripled – with no change in results.

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.

Focusing on other health-related outcomes, I can only access the data of *one* Austrian 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 expenditures on medical aids, no significant effects were found.

One reason may be the very generous Austrian public health insurance system. But I can at least rule out some of the compensating effects there. The individuals did not increase utilization (doctoral or hospital visits) or expenditures in the system. Income health gradients could stem from differential access to health care, but the effects don't show an increase in utilization.

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