The Effect of Involuntary Retirement on Healthcare Use*

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Abstract

We analyse the causal effect of involuntary retirement on detailed indicators of healthcare use and mortality. We leverage a pension reform in Hungary which forced public sector workers above the statutory retirement age to full time retirement. Using rich administrative data, we find that on the three-year horizon, involuntary retirement decreases the number of primary care doctor visits, the use of systemic antiinfectives and respiratory drugs, and the non-zero spending on antiinfectives, the drugs of the alimentary tract and metabolism and of the cardiovascular system. The impact on the latter two drug categories is driven by the drop in income due to involuntary retirement. We conclude that there is little evidence for health deteriorating effects of involuntary retirement and discuss the possible mechanisms behind our results.

JEL codes: I10, J26

Keywords: healthcare use, involuntary retirement

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1 Introduction

In most high-income industrialized countries, increasing the labour force participation rate of older workers is expected to remain high on the policy agenda to respond to the challenges of ageing societies. Despite the widespread aim to prolong working lives, a surprisingly high share of seniors retire involuntarily. The majority of new retirees in the US reported to have been forced to retire, and this share has been steadily increasing since 1998 from 33% to 55% in 2014 (Johnson and Gosselin, 2018). Another study of mismatch between preferred and actual ages of retirement in Europe estimates that at least 30% of retirees have quit the labour force involuntarily, often due to job loss (Steiber and Kohli, 2017). In 2019, among people aged 55-64, around a quarter left their last job because they had been dismissed or a job of limited duration had ended (Eurostat, 2020).

The consequences of involuntary retirement are relatively unknown. There is a large literature on the health effect of retirement, nevertheless, the health and healthcare use implications of retirement may depend on whether the retirement process is voluntary or involuntary. How does involuntary retirement affect healthcare use and health status? To answer this question, we investigate the impact of a forced exit on healthcare use, drug consumption and mortality based on a pension reform in Hungary, which provides us a unique exogenous shock to establish causal effects of involuntary retirement.

Studies about the health implications of voluntary retirement show mixed results. A common challenge of studying the health effects of retirement is endogeneity, as poor health may trigger exit from the labour market in a reverse causal relationship. As a response, recent studies apply research designs that identify causality, and mostly find that retirement is rather beneficial for the health of the retirees. Apart from differences in identification strategies, the variance in health-related outcome variables may also explain some of the contradicting results. A recent review of the literature argues that once we look at similar outcomes, the results of the vast majority of causal studies are consensual and imply that retirement leads to an increase in self-reported health, cognitive decline, and a decrease in healthcare consumption (Garrouste and Perdrix, 2021). When it comes to health status, some find that retiring is health preserving or has no effect (Neuman, 2008; Coe and Zamarro, 2011), others report that retirement is detrimental to health (Rohwedder and Willis, 2010; Celidoni et al., 2017; Heller-Sahlgren, 2017). Looking at various health measures, Rose (2020) shows that retirement substantially improves well-being and reported health but does not affect cognitive ability or mortality in the short run, based on several matched records from England. Grøtting and Lillebø (2020) also report that based on the Norwegian registers, retirement has a positive effect on physical health, especially for individuals with low socioeconomic status and no impact on mortality. Focusing on healthcare use, voluntary retirement reduces doctor visits and hospitalization for both genders, based on Austrian administrative data (Frimmel and Pruckner, 2020). Similarly, in Hungary, retirement lessens the use of outpatient specialist care and general practitioner care both for women and men, identified from two pension policies, an incease of early retirement age for women (Bíró and Elek, 2018) and the abolishment of the 60-year early retirement for men (Bíró and Elek, 2021). Eibich (2015) also finds that in Germany the probability to be hospitalized and the number of doctor visits, especially the latter, decrease after retirement. Nielsen (2019), based on the Danish full population data, arrives at a decrease in GP visits in case of early retirement, though there is no effect on health or healthcare utilization in case of statutory retirement. Grøtting and Lillebø (2020) and Rose (2020) also report no effect on healthcare utilization despite evidence of improved health. As a rare result, Zhang et al. (2018) find that in contrast to developed countries, retirement increases healthcare utilization in China, possibly due to the lower opportunity cost of time after retirement.

Another potential reason behind conflicting findings – besides research design and different health-related outcomes – is effect heterogeneity, as pointed out by Behncke (2012) and Eibich (2015). Effect heterogeneity across gender and education levels received some attention (Hessel, 2016; Grøtting and Lillebø, 2020), but we know little about the role of heterogeneity in the retirement process, in particular the role of control over the retirement decision. In a systematic review of longitudinal studies about the health implications of retirement, van der Heide et al. (2013) highlights the lack of studies that examine the differences between voluntary and involuntary retirement. There are some notable exceptions that analyse the impact of the mode of retirement on subjective health indicators. Dingemans and Henkens (2014) and Hershey and Henkens (2014) both use longitudinal data from the Netherlands, and find that compared with voluntary retirement, involuntary retirement is detrimental to life satisfaction. Dingemans and Henkens (2014) state that the impact of retirement on life satisfaction depends on how close the actual retirement path is to the preferred one, thus a bridge job can mitigate the negative shock. Bender (2012) (using data from the US) and Bonsang and Klein (2012) (using data from Germany) arrive at similar conclusions. Apart from abrupt and forced retirement, job loss at older ages also tends to have negative health effects (Gallo et al., 2000, 2006), especially among workers with limited wealth.

There are some examples of forced retirement in sectors where mandatory retirement at a certain age caps the duration of a career, for example in professional sport or academia. Ashenfelter and Card (2002); Clark and Ghent (2008); Warman and Worswick (2010) analyse the impact of the elimination of (or lack of) mandatory retirement on retirement decisions in the academic sector and all of them find that many choose to continue working once retirement is not forced, which indicates that mandatory retirement laws often impose involuntary retirement on employees, underlining the importance of studying its consequences.

A recent pension reform from Hungary provides us with a quasi-experiment, so we can identify the health-related consequences of involuntary retirement. Since 2013, public sector workers (except for healthcare workers) cannot earn wages and receive pension benefits at the same time. As a consequence, the vast majority of public sector workers who received pension benefits before July 2013 were unexpectedly "forced" to retire. Using a rich administrative data set from Hungary, we can evaluate the consequences of involuntary retirement on healthcare use.

We add to the recent studies that identify causal effects of retirement on health and healthcare use by establishing the causal effects of involuntary retirement above the statutory retirement age on objective indicators of healthcare. We have administrative measures on the use of outpatient and inpatient care and spending of prescription drug categories that are free from biases stemming from self-reporting, and which can also be considered as proxies for health status. We show that involuntary retirement tends to reduce primary care use and the demand for prescription drugs. These effects can be attributed to changes in incentives to invest in health, the negative income impacts of retirement and possibly direct health consequences. We do not find evidence that involuntary retirement would increase the risk of mortality.

2 Policy background

Hungary has a mandatory, pay-as-you go pension system, where pension benefits are based on earnings before retirement, with a minimum pension and a retirement age set by the government. We focus on a policy reform that abolished the joint possibility of receiving pension benefits and doing paid work in the public sector from 2013, leading to involuntary retirement among the majority of those who earned wages and received pension benefits at the same time. This legislation was announced in June 2012. If someone was working in the public sector on 1 January 2013 then the restriction applied only from 1 July 2013. If someone entered the public sector on or after 1 January 2013 then the restriction applied immediately. Generally, public sector workers to whom the restriction applied could choose between continued employment or old-age retirement (but not both). People working at a central budgetary institution were no longer allowed to work after reaching old-age retirement age, however, exceptions could be requested. In the following, we call the forced exit from the labour market "involuntary retirement", keeping in mind that the affected individuals received pension benefits even before the exit from the labour market.

Due to the shortage of workforce in the healthcare sector, the government offered that employers of healthcare workers above the old-age retirement age can request the sum of pension benefit as earnings supplement from the government. Because of this allowance, we exclude healthcare workers from the rest of the analysis.

3 Theoretical background

Various channels have been discussed in the literature that can potentially explain the impact of retirement on health status and healthcare use. Some of these mechanisms depend on whether the retirement is voluntary or involuntary.

Following Behncke (2012), we divide the mechanisms into two categories: the changing incentives to invest in health and the direct health effects of retirement.

Incentives to invest in health change with retirement because there are no incentives any more to raise productivity and hence to achieve higher earnings. At the same time, health preferences might also change with retirement, although the direction of the change is ambiguous. Galama et al. (2013) and Kuhn et al. (2015) provide formal models of the relations between health and retirement when both are endogenous. In the model of Galama et al. (2013), people invest in health when their health falls below a health threshold (become "unhealthy"). In their framework, the health threshold drops at the age of retirement as a result of increased leisure time (leisure is either a substitute or a complement of health) and because health has no effect on income after retirement. In the model of Kuhn et al. (2015), before retirement, the incentives to invest in health are affected by the value of health-related increases in earnings and/or reductions in the disutility of labour and also by the disutility of providing labour. These effects are no longer present after retirement.

In principle, the changes in incentives to invest in health after retirement are not affected by the transition mode to retirement (voluntary or involuntary).

The second major channel through which retirement affects health directly and healthcare use indirectly is stress. Retirement might be a relief from stressful work, for example the health benefits of retirement are partly explained by substituting work time with sleep and leisure, i.e., more physical activities (Eibich, 2015; Rose, 2020). At the same time, retirement as a life event can also be stressful (Behncke, 2012). Stress, in turn, is related to health behaviours (Cooper et al., 1992; Torres and Nowson, 2007), physical health (Kivimäki and Steptoe, 2018) and mental health (Virtanen et al., 2007). Retirement is more likely to be a stressful event if it was involuntary, possibly leading to negative health consequences. Related to the stress-channel, retirement might also impact health due to the loss of social network and the loss of so-called latent functions, such as opportunities for social contact with other people or contributing to status and personal identity for the individual (for further details on these theories, see Janlert and Hammarström, 2009). Again, if retirement is involuntary, the loss of social support provided by fellow workers and of further benefits (latent functions) of working life are likely to be more significant, implying stronger negative health impacts of retirement. Such negative health impacts could be gradually mitigated by adjustment to retirement (Wang et al., 2011). A forced and abrupt exit from the labour market may also hinder financial planning, which may lead to a negative income effect, again potentially contributing to ill health via increased stress and lower spending on health.

The stress induced by retirement and its potential impact on mental health call for an assessment of gender differences in coping with forced exit from the labour market. It is a common observation that women are more prone to internalizing disorders such as mood or anxiety disorders throughout the life-course (Seedat et al., 2009; Boyd et al., 2015). The underlying reasons are unclear (Riecher-Rössler, 2017), women may be more willing to report distress, though some studies suggest that the different societal roles explain much of the gender difference (Gove, 1984; Emslie et al., 2002), thus the stress of voluntary or forced retirement may also vary among men and women. There is some evidence that retirement in general is associated with increases in psychological anxiety for both genders (Richardson and Kilty, 1995). Isaksson and Johansson (2000) compared the impact of forced and voluntary early retirement following a downsizing of an insurance company in Sweden and found that both women and men report better psychological well-being in case of having a choice, however women reported lower values of work centrality and were more satisfied with retirement in general. An earlier study found that internally motivated retirement is especially influential on mental health among men (Quick and Moen, 1998). One of our contribution to the literature on gender differences in mental consequences of involuntary retirement is that we use an administrative data set, so we can rule out differential reporting of distress based on sex.

Overall, the theoretical background suggests that involuntary retirement reduces the demand for healthcare services as a result of reduced incentives to invest in health, and it is likely to have detrimental health effects due to higher levels of stress, possibly reflected in the consumption of prescription drugs. Also, we may see gender differences in mentally coping with forced retirement.

4 Data

4.1 Data source and variables

We use administrative data from Hungary, covering years 2003–2017 on a random 50% sample of the 2003 population.[1] The monthly labour force status, earnings and pension benefit indicators originate from the Central Administration of National Pension Insurance. Since pension status is imperfectly observed in year 2017, we exclude that year from the analysis. The demographic and health-related indicators originate from the National Health Insurance Fund Administration. The health-related indicators are available only since 2009, thus we restrict the main analysis to years 2009-2016. We have information on the monthly

[1]The data is a property of National Health Insurance Fund Administration, Central Administration of National Pension Insurance, National Tax and Customs Administration, National Employment Service and Educational Authority. The data was processed by the Databank of the Centre for Economic and Regional Studies.

number of general practitioner visits, days spent in a hospital and on the monthly public plus private (out-of-pocket) expenditure on prescribed pharmaceuticals. We categorise drug spending by Anatomical Therapeutic Chemical (ATC) groups and focus on the six ATC groups with the highest consumption among working pensioners in the second quarter of 2013. We collapse the data to half yearly level.

4.2 Descriptive statistics

In the second quarter (Q2) of 2013, among public sector working pensioners (excluding the healthcare sector) for whom the industry classification is not missing (68% of the cases), 62% worked in the industry of "Public Administration and Defence; Compulsory Social Security" and 31% in the industry of "Education". Looking at occupations, 29% were teaching professionals and 20% had elementary occupations. On average, labour earnings of the public sector working pensioners accounted for 63% of their total income (earnings plus pension benefits) – this source of income is lost after involuntary retirement.

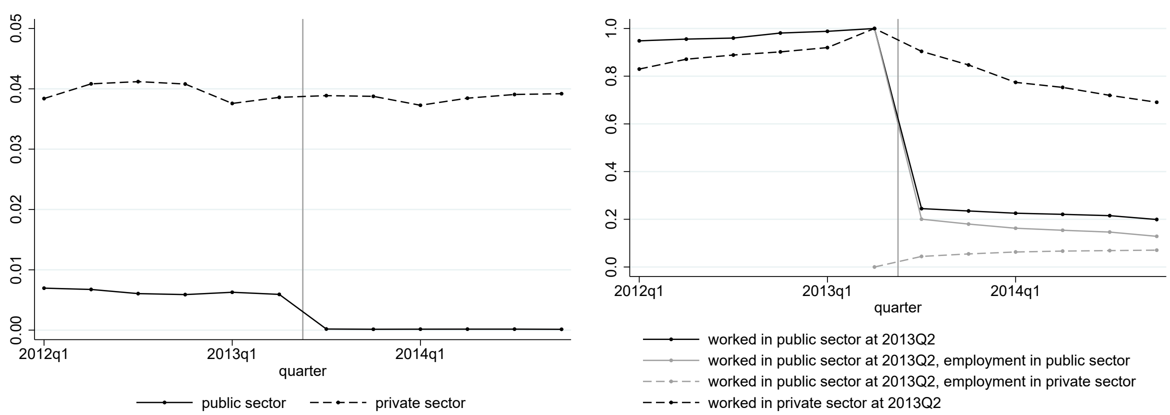
Figure 1 panel (a) shows that from 2013Q2 to 2013Q3, the public sector employment rate of old-age pensioners decreased to close to zero. Specifically, in 2013Q2, we observe 6,160 individuals in our data who received pension benefits and earnings from the public sector at the same time (0.6% of pensioners), which drops to 193 (0.02% of pensioners) in 2013Q3. We do not see such a drop in the private sector, where around 4% of pensioners worked. Panel (b) of Figure 1 shows that 24% of the people who were working in the public sector and received old-age pensions at the same time in 2013Q2 continued to work (82% of them stayed in the public sector). Continued employment was more likely among males, higher earners and professionals. On the other hand, among those who worked in the private sector and received old-age pensions, the employment rate remained 90% in the quarter after the policy came into effect.

Further descriptive statistics by the sector of work and retirement are provided in Appendix Table A1. The table indicates that apart from their higher age, individuals who work in the public sector and receive old-age pensions at the same time are quite similar to the not retired public sector workers aged 55 or above. There is a higher fraction of males among retired public sector workers (36% versus 30%) and they work on average fewer hours per week (33.8 hours versus 39.5 hours). If we compare individuals working in the public sector versus the private sector while receiving old-age pensions (first and third columns of Table A1), we observe that there is a lower fraction of males in the public sector, their monthly earnings, pension benefits and working hours are on average higher, are more likely to work as professionals and are less likely to work in skilled blue-collar jobs.

Figure 1: Employment rates

(a) Employment rate among pensioners

(b) Employment rate of people working and receiving old-age pensions at 2013Q2



Note: The sample of panel (a) consists of individuals receiving old-age pension benefits. The sample of panel (b) consists of individuals who worked and received old-age pensions just before the introduction of the reform (2013Q2). The current sector of employment for those who worked in the public sector at 2013Q2 is displayed from 2013Q2 (solid and dashed gray lines). The vertical line indicates the date since the simultaneous receipt of pension benefits and earnings is not possible in the public sector.

5 Methods and results

5.1 Baseline analysis

When analysing the effects of involuntary retirement, we restrict the sample to those individuals who were employed in the public or private sector and also received pension benefits in 2013Q2, aged 62-70 at that time point. In our setting, the public sector working pensioners are the treated, the private sector working pensioners are the control individuals. Using two types of fixed-effects models, we estimate the average effect of involuntary retirement over 2013HY2 - 2016HY2 with equation (1) and half-year (HY) specific effects with equation (2). Since a small fraction of public sector working pensioners opted for continued work instead of full retirement, our approach is an intention-to-treat analysis.

$$y_{it} = public_{i,2013Q2} \times after_t \times \alpha + \beta age_{it}^2 + \delta_t + \eta_i + \epsilon_{it}, \tag{1}$$

$$y_{it} = public_{i,2013Q2} \times \sum_{j=2009HY1}^{2016HY2} \tilde{\alpha}_j + \tilde{\beta} age_{it}^2 + \tilde{\delta}_t + \tilde{\eta}_i + \tilde{\epsilon}_{it}, \tag{2}$$

where i is the index of the individual and t denotes time (half-year), y_{it} is a health-related indicator of individual i at time t, δ_t and $\tilde{\delta}_t$ capture time fixed effects and η_i and $\tilde{\eta}_i$ capture individual fixed effects.[2] The binary indicator of $public_{i,2013Q2}$ equals one for an individual who worked (and received pensions) in the public sector in 2013Q2, the indicator of $after_t$ equals one from 2013Q3 onward, and $\tilde{\alpha}_j$ ($j = 2009HY1, \ldots, 2016HY2$) denote half-year (HY) specific time effects. The parameters of interest are α for the average effect and the $\tilde{\alpha}_j$-s for the half-year specific effects. (Note that one parameter, here $\tilde{\alpha}_{2012HY1}$, should be set to zero.)

Equation (1) is a difference-in-differences specification. In this setting, the identification assumption is that in the absence of the analysed policy, the health-related outcomes would have evolved similarly among working pensioners in the public sector and the private sector.

The FE results of equation (2) (Appendix Figure A1) show that some of the estimated pre-treatment effects are statistically significant. This can be the consequence of the selectivity of the treatment group, as discussed in section 4.2. Due to this problem, we estimate propensity-score weighted fixed-effects models (following Stuart et al., 2014; Austin and Stuart, 2015). Specifically, we estimate gender specific logit models of working in the public

[2] Age is measured half-yearly. We do not include linear age in the model due to its perfect collinearity with the individual and time fixed effects.

sector and also receiving pensions in 2013Q2, using the following regressors: age dummies, one-digit occupation code dummies and health measures (primary care and inpatient care use, amount of drug spending and binary drug spending indicators) between 2009HY2 - 2012HY1, i.e., in the three years before the announcement of the policy. We follow Austin and Stuart (2015) in the selection of regressors in the logit model, who state that it is more important to balance covariates that influence the outcome than covariates that influence the treatment rather than the outcome. The estimation results of the logit models are reported in Appendix Table A3. In the FE regression we weight the control individuals with the predicted probability and the treatment individuals with one, so as to estimate the average treatment effect on the treated (ATT). Appendix Table A4 shows that after weighting, the treatment and control samples are more balanced in terms of gender and occupation. The balance also improves for most of the healthcare use indicators in 2013Q2, however, the differences were minor across the groups even without weighting. A limitation of the weighting approach is that it cannot account for potential unobserved differences that would lead to different trends. Also, the weighting procedure tends to increase the standard errors (Stuart et al., 2014).

When looking at the demand for prescription drugs, we use the binary indicator of positive spending (extensive margin) and the logarithm of the amount of positive spending (intensive margin) as dependent variables, hence we estimate two-part (hurdle) models. For general practitioner (GP) visits we use linear models (no need to distinguish the two margins as the ratio of zero GP visits is very small) and for hospital stays we only use the binary indicator as outcome variable.

Table 1 shows that involuntary retirement has a statistically significant negative effect on primary care use. The half-yearly number of primary care visits decreases by 0.17, which is about 4.5% of the average number of half-yearly visits. Involuntary retirement also has significant negative effects (in the range of 3.1-5.1%) on the logarithmic spending on alimentary tract and metabolism drugs, cardiovascular drugs and antiinfectives for systemic

Table 1: Effect of involuntary retirement on half-year indicators of healthcare use and drug spending

Number of GP visits and logarithm of (positive) drug spending	GP visits	Alimentary tract & metabolism	Cardio-vascular	Anti-infectives	Musculo-skeletal	Nervous system	Respiratory system
Treatment effect	-0.171***	-0.051**	-0.043***	-0.031**	0.034	-0.019	-0.026
	[0.036]	[0.025]	[0.014]	[0.015]	[0.022]	[0.039]	[0.041]
Mean outcome (no logs, drug spending in HUF)	3.816	16,735	19,890	3,591	6,048	11,293	16,107

Binary indicators of use	Hospital stay	Alimentary tract & metabolism	Cardio-vascular	Anti-infectives	Musculo-skeletal	Nervous system	Respiratory system
Treatment effect	0.004	0.005	-0.008*	-0.024***	-0.008	-0.001	-0.016***
	[0.003]	[0.005]	[0.005]	[0.004]	[0.005]	[0.004]	[0.003]
Mean outcome	0.091	0.368	0.680	0.252	0.261	0.130	0.139

Note: Weighted fixed effects results of equation (1), average effect over 2013HY2-2016HY2. The table shows the estimated coefficient of the interaction between working in the public sector in 2013Q2 and the observation being after 2013Q3. We control for time and individual fixed effects and quadratic age. Robust standard errors in brackets, *** p<0.01, ** p<0.05, * p<0.1. Total sample size: 411,425 observations of 25,895 individuals. Drug categories: alimentary tract and metabolism – ATC A; cardiovascular system – ATC C; antiinfectives for systemic use – ATC J; musculo-skeletal system – ATC M; nervous system – ATC N; respiratory system – ATC R. 1 EUR ≈ 300 HUF in the analysed period.

use, and it reduces the probability of the consumption of antiinfectives for systemic use (by 2.4 percentage points) and of respiratory drugs (by 1.6 percentage points).

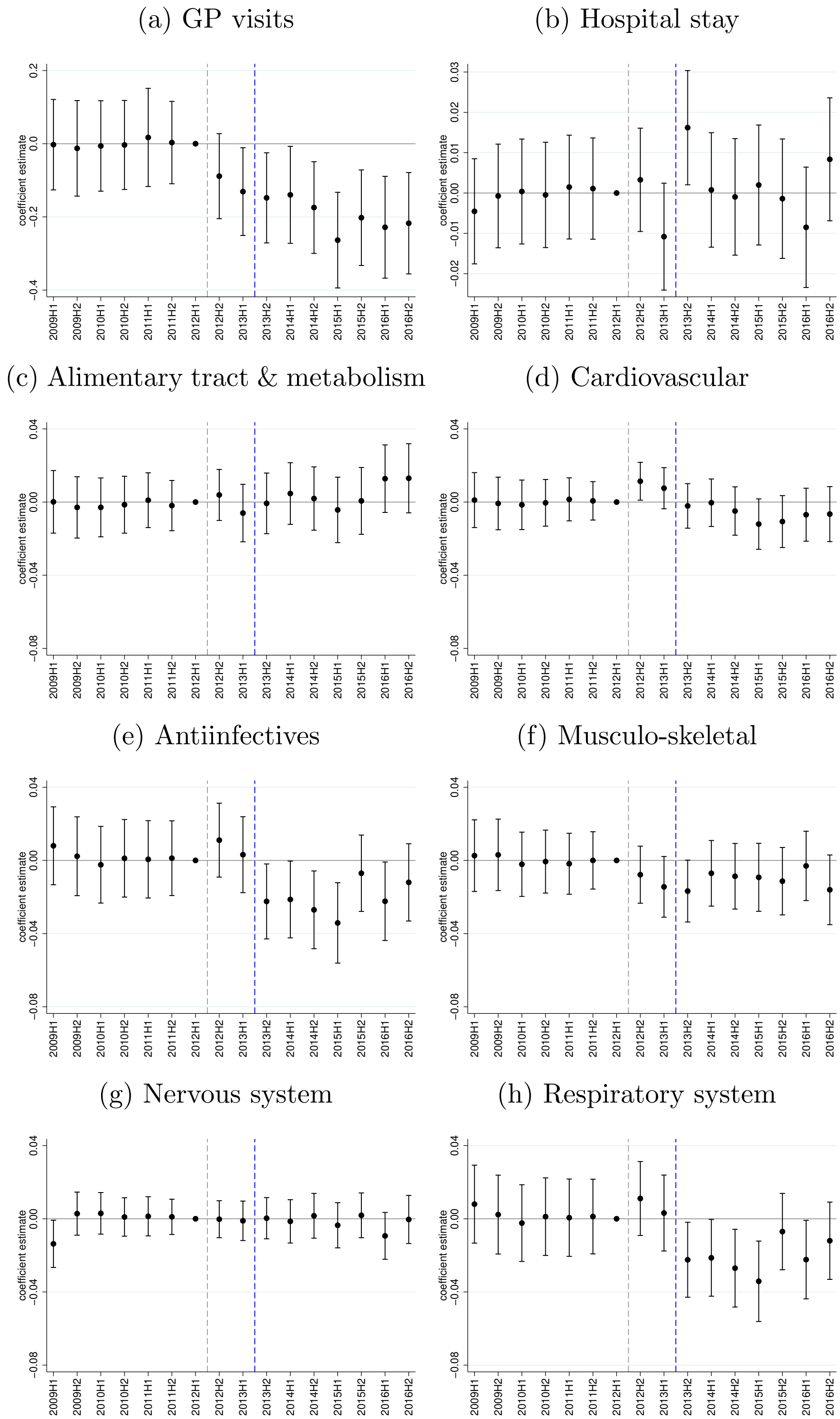
Hence, based on our findings, the demand for drugs that are typically used to treat infections (antiinfectives for systemic use and drugs of the respiratory system) decreases. We also see that after involuntary retirement, individuals opt for cheaper cardiovascular drugs, most likely due to income effects, which we will test in section 5.3.

We perform some robustness checks. First, Appendix Table A7 shows that the impacts on antihypertensive drugs (part of cardiovascular drugs), on antibacterials (part of antiinfectives for systemic use) and on drugs for obstructive airway diseases (part of respiratory drugs) are similar to the total impacts on the respective larger categories. Second, without the weighting of the control group, the estimated negative effects of involuntary retirement on healthcare use and drug spending are larger in absolute value and statistically stronger (Table A2). Third, the estimated negative effects tend to be larger in magnitude and statistically stronger if we estimate the impact of the policy only on the treated group by controlling for a quadratic time trend, in addition to quadratic age and individual fixed effects in the models of healthcare use (Table A5).

The half-year specific results of Figure 2 suggest that involuntary retirement decreases the demand for health-preserving care already around the time of the announcement of the reform, as indicated by the estimated half-year specific effect on primary care use. Meanwhile, the demand for prescription drugs starts to decrease after the implementation of the policy (i.e., from 2013HY2). There is weaker evidence for involuntary retirement affecting the magnitude of non-zero spending on drugs (Figure 3).

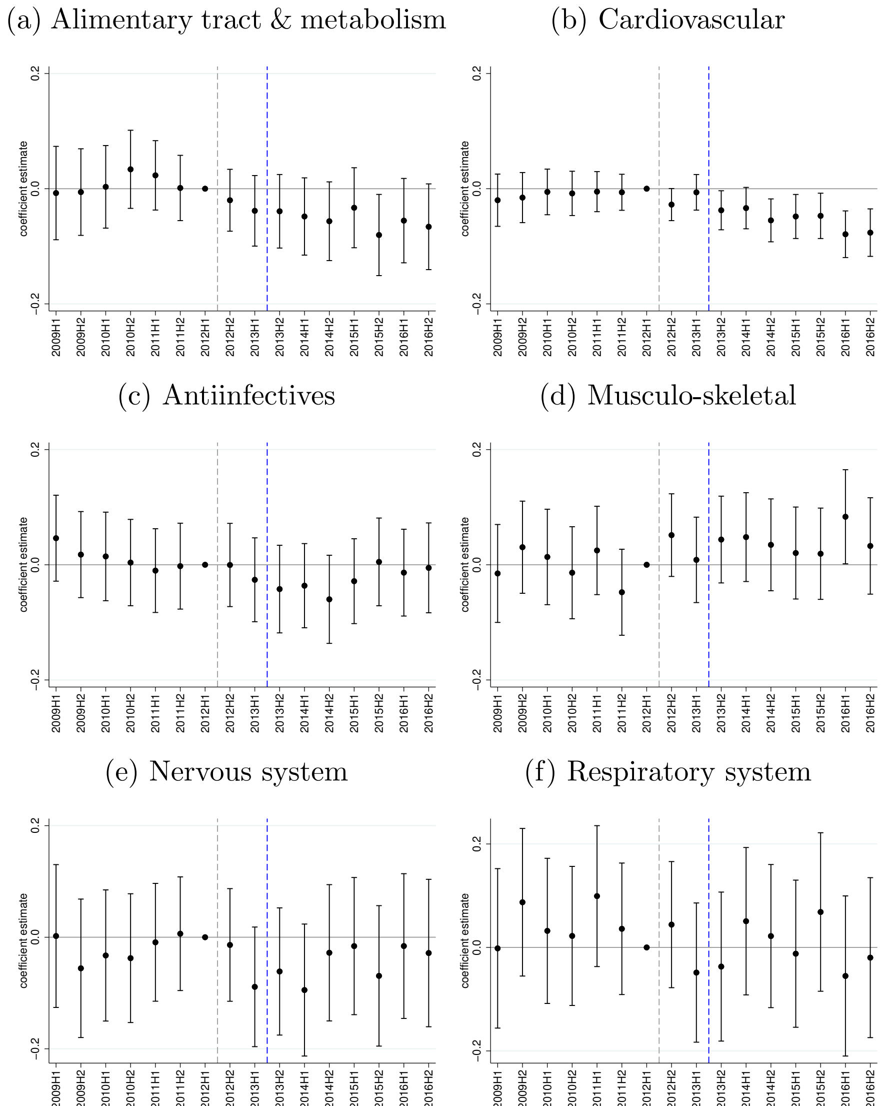
We also estimate the impact of involuntary retirement on three-year mortality between 2013HY2 and 2016HY1 with a linear probability model. We include the following regressors: gender, age dummies, one-digit occupation code dummies and health measures (primary care and inpatient care use, amount of drug spending and binary drug spending indicators) between 2011HY2 – 2012HY1, i.e., in the year before the announcement of the policy. This regression indicates that involuntary retirement decreases the three-year mortality by a statistically insignificant -0.26 percentage point (p-value: 0.371).

Figure 2: Half-year specific effect of involuntary retirement on healthcare use and binary indicators of drug spending



Note: Weighted fixed effects results of equation (2). Point estimates with 95% CI. The figure shows the estimated coefficients of the interaction between working in the public sector in 2013Q2 and time indicators. We control for time and individual fixed effects and quadratic age. Total sample size: 411,425 observations of 25,895 individuals. The grey vertical line indicates the announcement of the policy, the blue vertical line indicates the date since the simultaneous receipt of pension benefits and earnings is not possible in the public sector. Drug categories: alimentary tract and metabolism – ATC A; cardiovascular system – ATC C; antiinfectives for systemic use – ATC J; musculo-skeletal system – ATC M; nervous system – ATC N; respiratory system – ATC R.

Figure 3: Half-year specific effect of involuntary retirement on logarithmic drug spending



(a) Alimentary tract & metabolism (b) Cardiovascular (c) Antiinfectives (d) Musculo-skeletal (e) Nervous system (f) Respiratory system

Note: Weighted fixed effects results of equation (2). Point estimates with 95% CI. The figure shows the estimated coefficients of the interaction between working in the public sector in 2013Q2 and time indicators. We control for time and individual fixed effects and quadratic age. The grey vertical line indicates the announcement of the policy, the blue vertical line indicates the date since the simultaneous receipt of pension benefits and earnings is not possible in the public sector. Drug categories: alimentary tract and metabolism – ATC A; cardiovascular system – ATC C; antiinfectives for systemic use – ATC J; musculo-skeletal system – ATC M; nervous system – ATC N; respiratory system – ATC R.

5.2 Mental health

The theoretical considerations of section 3 suggest that involuntary retirement might have a negative – and possibly gender specific – impact on mental health. We capture mental health with the consumption of psychoanaleptics (ATC N06), which primarily include antidepressants.

We estimate the gender specific effect of involuntary retirement with modified versions of equation (1), where we allow the parameters – most importantly, the treatment effect α – to depend on gender via interaction terms. Also, in an alternative specification, we choose 2009H1-2012H1 as the reference period instead of 2009H1-2013H1. The rationale for the modified specification is that the announcement of the policy in June 2012 could already have mental health implications. The results are reported in Table 2.[3] These do not indicate an overall increase in the consumption of psychoanaleptics. The probability of the usage of psychoanaleptics increases by $0.5-0.7$ percentage point more among males than among females, and although statistically insignificant, the magnitude of this difference is substantial, compared to the average rate of psychoanaleptic consumption of 6.0%. Involuntary retirement also increases – albeit statistically not significantly – the spending on psychoanaleptics among males.

Table 2: Gender specific effect of involuntary retirement on the use of psychoanaleptics

	Reference period: 2009H1-2013H1		Reference period: 2009H1-2012H1	
	Probability of any spending	Logarithm of (pos.) spending	Probability of any spending	Logarithm of (pos.) spending
Treatment effect	-0.003	0.020	-0.003	-0.005
	[0.004]	[0.049]	[0.004]	[0.048]
Treatment effect × male	0.005	0.034	0.007	0.076
	[0.005]	[0.085]	[0.005]	[0.087]
Mean outcome (no logs, drug spending in HUF)	0.060	8,511	0.060	8,511

Note: Weighted fixed effects results of equation (1), average effect over 2013HY2-2016HY2 in the left panel of the table, over 2012HY2-2016HY2 in the right panel of the table. The table shows the estimated coefficient of the interaction between working in the public sector in 2013Q2 and the observation being after 2013Q3 (left part) or after 2012Q3 (right part), and the coefficient of further interaction with gender. We control for time and individual fixed effects and quadratic age. Robust standard errors in brackets, *** p<0.01, ** p<0.05, * p<0.1. Total sample size: 411,425 observations of 25,895 individuals. The outcome variables refer to ATC group N06. 1 EUR ≈ 300 HUF in the analysed period.

[3] Appendix Table A6 shows that there is no evidence for a gender specific effect of involuntary retirement on other indicators of healthcare use. In Appendix Figure A2 we present the half-year specific effects on psychoanaleptics separately for females and males.

5.3 Heterogeneity by occupation and the impact of income

We investigate whether the impact of involuntary retirement on healthcare use varies with the amount of lost income and with the type of the last occupation. A major drop in income might reduce the demand for costlier prescription drugs (which require higher out-of-pocket payments). To test this hypothesis, we interact the treatment indicator with a binary indicator of "large income drop". To generate this indicator, we first calculate the ratio of the mean earnings plus pension income after and before 2013Q2 for each individual in the treatment group. We then calculate its first quartile (which is 0.49). If the ratio in the treatment group is below the first quartile then the binary indicator of income drop is set to one, and zero otherwise.

We also investigate whether the impact of involuntary retirement differs by the type of occupation in 2013Q2. ISCO codes 1-4 are classified as white-collar occupations, ISCO codes 5-9 as blue-collar occupations. As we do not observe education level, the occupation categories serve as proxies for education as individuals working in white-collar jobs are, on average, better educated.

We perform the two heterogeneity analyses separately. The results reported in Table 3 provide some evidence for heterogeneities by occupation and by the drop in income. The negative effects of involuntary retirement on non-zero spending on the drugs of alimentary tract and metabolism and of the cardiovascular system are mostly driven by individuals who suffer a major loss of income. Also, for them, involuntary retirement decreases the probability of buying any cardiovascular drug or antiinfectives for systemic use. Finally, the negative effect on the number of primary care visits is more pronounced for the blue-collar than for the white-collar workers.

As the treatment group over-represents higher educated, higher earner and female individuals, it is important to note that we do not see major heterogeneities by occupation skill level (Table 3) or by gender (Table A6), suggesting that the results can be qualitatively generalised to the older working population.[4] Our results indicate that the negative impact of involuntary retirement on healthcare use in a less educated population is likely stronger.[5]

Table 3: Heterogeneity by occupation and income change: effect of involuntary retirement on half-year indicators of healthcare use and drug spending

Number of GP visits and logarithm of (positive) drug spending	GP visits	Alimentary tract & metabolism	Cardio-vascular	Anti-infectives	Musculo-skeletal	Nervous system	Respiratory system
Treatment effect	-0.118***	-0.041	-0.037**	-0.043**	0.048*	-0.026	-0.015
	[0.043]	[0.030]	[0.017]	[0.018]	[0.028]	[0.051]	[0.048]
Treat eff × blue-collar job	-0.140*	-0.036	-0.007	0.056	-0.045	0.020	-0.008
	[0.083]	[0.053]	[0.029]	[0.034]	[0.047]	[0.079]	[0.094]
Treatment effect	-0.144***	-0.032	-0.031**	-0.020	0.017	0.002	-0.018
	[0.040]	[0.027]	[0.015]	[0.017]	[0.024]	[0.042]	[0.047]
Treat eff × large income drop	-0.103	-0.072*	-0.047*	-0.041	0.063	-0.084	-0.036
	[0.065]	[0.044]	[0.026]	[0.027]	[0.042]	[0.074]	[0.065]
Mean outcome (no logs, drug spending in HUF)	3.816	16,735	19,890	3,591	6,048	11,293	16,107

Binary indicators of use	Hospital stay	Alimentary tract & metabolism	Cardio-vascular	Anti-infectives	Musculo-skeletal	Nervous system	Respiratory system
Treatment effect	0.003	0.001	-0.004	-0.020***	-0.005	0.001	-0.013***
	[0.004]	[0.007]	[0.006]	[0.005]	[0.006]	[0.004]	[0.004]
Treat eff × blue-collar job	0.004	0.012	-0.012	-0.011	-0.008	-0.004	-0.008
	[0.007]	[0.012]	[0.010]	[0.009]	[0.011]	[0.008]	[0.008]
Treatment effect	0.004	0.007	-0.003	-0.019***	-0.009*	0.000	-0.016***
	[0.004]	[0.006]	[0.005]	[0.005]	[0.005]	[0.004]	[0.004]
Treat eff × large income drop	-0.003	-0.006	-0.022***	-0.019**	0.005	-0.004	-0.001
	[0.006]	[0.010]	[0.009]	[0.007]	[0.009]	[0.007]	[0.006]
Mean outcome	0.091	0.368	0.680	0.252	0.261	0.130	0.139

Note: Weighted fixed effects results, average effect over 2013HY2-2016HY2. Robust standard errors in brackets, *** p<0.01, ** p<0.05, * p<0.1. Total sample size: 411,425 observations of 25,895 individuals. Drug categories: alimentary tract and metabolism – ATC A; cardiovascular system – ATC C; antiinfectives for systemic use – ATC J; musculo-skeletal system – ATC M; nervous system – ATC N; respiratory system – ATC R. ISCO codes 5-9 are classified as blue-collar jobs. The binary indicator of "large income drop" is set to one if the ratio of the mean earnings plus pension income after and before 2013Q2 is below the first quartile of this ratio in the treatment group. 1 EUR ≈ 300 HUF in the analysed period. The table shows the estimated coefficient of the interaction between working in the public sector in 2013Q2 and the observation being after 2013Q3, and the coefficients of further interactions with having a blue collar job in 2013Q2 and large income drop. We control for time and individual fixed effects and quadratic age.

[4]Further heterogeneity analyses (not reported here) show that the impact of involuntary retirement does not vary with age, with the binary indicator of at least one day of sick leave in 2012HY1 or with baseline health, as captured by total drug spending before the announcement of the policy.

[5]Having worked in a blue-collar job and experiencing a large income drop are both estimated to increase the probability of three-year mortality (by 0.80 and 0.31 percentage points, respectively) but these increasing effects are statistically insignificant even at the 10% significance level. When estimating the impact on mortality, we follow the same approach as explained at the end of section 5.1.

6 Discussion and conclusions

Based on a pension reform in Hungary, we estimated the causal effect of involuntary retirement on primary care use, inpatient care use and spending on prescription drug categories. Our results show that involuntary retirement decreases primary care doctoral visits, the probability of taking antiinfectives for systemic use and drugs for the respiratory system. Also, involuntary retirement decreases the amount of non-zero spending on alimentary tract and metabolism drugs, antiinfectives and drugs of the cardiovascular system, mostly driven by those who suffer a major loss of income as a result of forced retirement.

To identify the consequences of involuntary retirement on healthcare use, we leveraged a quasi-experiment of forced exit from the labour market, affecting public sector workers. While public sector workers over-represent higher educated, higher earner and female individuals, we provided evidence with the help of heterogeneity analyses that our results are generally relevant to older working population. Note however, that our results were based on an intention-to-treat analysis as about a quarter of the affected individuals opted for continued employment (and suspension of retirement benefits) instead of full retirement. Since it is likely that those opted for continued employment for whom retirement would have been the most detrimental, the average estimated negative impacts of involuntary retirement on healthcare use could have been even stronger under full compliance.

To investigate the external validity of our results further, we compare our findings to the related literature. Our estimated impacts of involuntary retirement on healthcare use are in line with the findings of the literature on the effects of voluntary retirement (Eibich, 2015; Frimmel and Pruckner, 2020; Bíró and Elek, 2021), suggesting that control over the retirement decision does not make a huge difference in doctor visits and hospital stays. While the results are not readily comparable, it is suggestive to compare the impacts of Hungarian pension policies. We find that the average number of primary care visits decreases by about 4.5% after involuntary retirement, compared to the 17.5% reduction following voluntary retirement, as reported by Bíró and Elek (2021). Previous studies on involuntary retirement focused on the negative effect on life satisfaction (Dingemans and Henkens, 2014; Hershey and Henkens, 2014), thus we reduce the gap in the literature by establishing causal impacts on objective indicators of healthcare. Based on our results, potentially decreased life satisfaction due to involuntary retirement is not reflected in increased healthcare utilization or drug spending.

While we eliminate some of the bias inherent in self-reported measures, our inference of health status from physician visits and drug prescription has some limitations. Interpreting the various potential mechanisms behind our findings sheds light on the health impact. First, retirement reduced the demand for healthcare services already around the time when the reform was announced, in line with the theory of decreased incentives to maintain good health as a pensioner not depending on labour income. The number of primary care visits decreased especially among the blue-collar workers holding physically more demanding jobs compared to white-collar workers. Also, after retirement, the option of claiming sick leave benefits no longer works as an incentive for healthcare utilisation, albeit we do not find evidence that the impact of involuntary retirement on healthcare use would vary with the prevalence of earlier sick leave claims.

Second, the reduced demand for antibiotics or respiratory drugs possibly indicates improved health, as retirement might decrease the risk of infections due to the lower number of contacts with other people. Nevertheless, as involuntary retirement implies a decline in income, the demand for prescription drugs might also decrease because of the presence of cost sharing. We find that individuals with a large drop in income due to involuntary retirement are less likely to buy any cardiovascular drugs and in case they do, they tend to opt for cheaper ones, indicating budget constraints. We find similar evidence for reduced amounts of non-zero spending on drugs of the alimentary tract and metabolism. Less investment in health, including lower spending may have negative health impacts. The negative income effect of unexpected and forced retirement is a notable health risk compared to voluntary retirement. However, when looking at three-year mortality, we do not find evidence that involuntary retirement would increase the risk of mortality.

The consumption of psychoanaleptics, including antidepressants, did not change significantly after involuntary retirement. It increased among men, and although the estimated effect is statistically insignificant, its magnitude is substantial. Overall, we do not find clear evidence for (gender specific) mental health impacts, bearing in mind that mental well-being may be affected but not reflected in drug consumption in the short run.

Our results suggest that in the short run, based on hospitalizations and mortality, mental and physical health are rather unaffected. Based on reduced drug consumption, health may even improve after retirement, though the negative income effect of involuntary retirement seems to drive some of the decrease.

Analyzing healthcare utilization indicators allows us to directly observe the implications of retirement for the healthcare system. Our results point to a trade-off lying in inducing retirement, as the budgetary gains from decreased healthcare use are curtailed by the higher government spending on pensions. In other words, it seems that in the short run, involuntary retirement alleviates the burden on the healthcare system but it increases expenditure on pensions. Further studies are needed to assess the long-run impacts of involuntary retirement on healthcare use and health status.

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Appendix

A Descriptive statistics by employment status

Appendix Table A1: Descriptive statistics

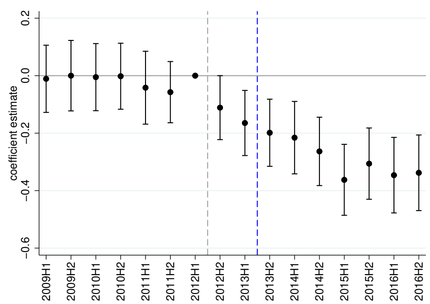
	public sector, working retired	public sector, not retired	private sector, working retired	private sector, not retired
age	63.659	57.125	63.357	57.195
male	0.362	0.301	0.460	0.590
monthly earnings (HUF)	275,142	267,168	124,403	205,202
working hours	33.827	39.451	26.946	37.212
monthly pensions (HUF)	163,894	3,197	126,169	8,331
armed forces	0.005	0.001	0.000	0.000
managers	0.086	0.118	0.102	0.096
professionals	0.408	0.398	0.092	0.069
associate professionals	0.152	0.200	0.149	0.122
clerical support workers	0.057	0.043	0.087	0.065
services and sales	0.046	0.055	0.162	0.104
skilled agricultural	0.003	0.002	0.010	0.013
craft and related trades	0.021	0.026	0.078	0.175
machine operators	0.016	0.019	0.081	0.165
elementary occupations	0.206	0.138	0.239	0.192

Note: The table shows average values at the second quarter of 2013, that is in the last quarter when the simultaneous receipt of pension benefits and earnings was possible in the public sector. The sample is restricted to working individuals aged 55 and above. The average of monthly pensions is not zero for the not retired because in some special cases, the not retired might also receive pensions, such as dependent pensions.

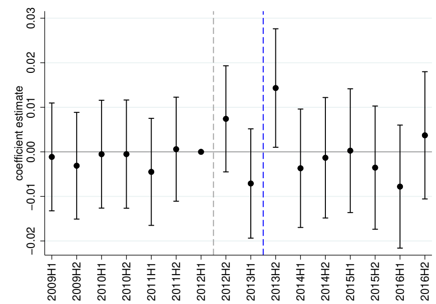
B Specification checks and details of the weighting procedure

Appendix Figure A1: Results without weighting: Effect of involuntary retirement on half-year indicators of healthcare use and drug spending

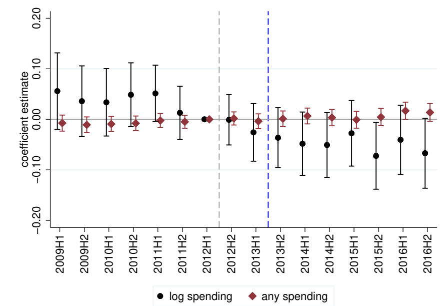
(a) GP visits



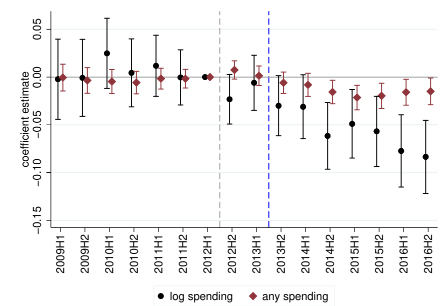
(b) Hospital stay



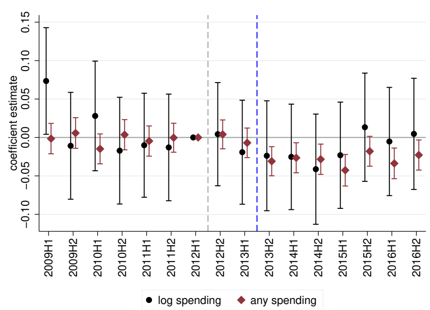
(c) Alimentary tract & metabolism



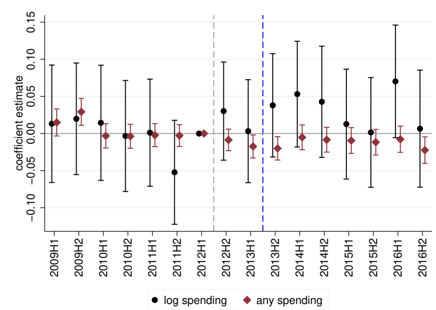
(d) Cardiovascular



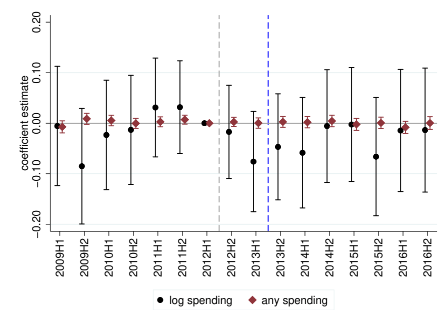
(e) Antiinfectives



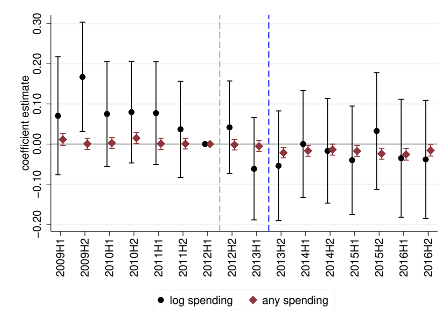
(f) Musculo-skeletal



(g) Nervous system



(h) Respiratory system



Note: Fixed effects estimation results of equation (2) without weighting. Point estimates with 95% CI. The figure shows the estimated coefficients of the interaction between working in the public sector in 2013Q2 and time indicators. We control for time and individual fixed effects and quadratic age. Sample size: 411,425 observations of 25,899 individuals. For drugs, both the effects on logarithmic positive spending and on the probability of any spending are shown. Drug categories: alimentary tract and metabolism – ATC A; cardiovascular system – ATC C; antiinfectives for systemic use – ATC J; musculo-skeletal system – ATC M; nervous system – ATC N; respiratory system – ATC R.

Appendix Table A2: Results without weighting: Effect of involuntary retirement on half-year indicators of healthcare use and drug spending

Number of GP visits and logarithm of (positive) drug spending	GP visits	Alimentary tract & metabolism	Cardio-vascular	Anti-infectives	Musculo-skeletal	Nervous system	Respiratory system
Treatment effect	-0.247***	-0.070***	-0.057***	-0.018	0.027	-0.011	-0.073*
	[0.035]	[0.023]	[0.013]	[0.014]	[0.021]	[0.037]	[0.039]
Mean outcome (no logs, drug spending in HUF)	4.074	16,830	19,751	3,526	5,646	10,280	18,300

Binary indicators of use	Hospital stay	Alimentary tract & metabolism	Cardio-vascular	Anti-infectives	Musculo-skeletal	Nervous system	Respiratory system
Treatment effect	0.002	0.011**	-0.014***	-0.027***	-0.012***	-0.002	-0.022***
	[0.003]	[0.005]	[0.004]	[0.004]	[0.005]	[0.003]	[0.003]
Mean outcome	0.089	0.365	0.674	0.230	0.261	0.132	0.130

Note: Fixed effects results of equation (1), average effect over 2013HY2-2016HY2. The table shows the estimated coefficient of the interaction between working in the public sector in 2013Q2 and the observation being after 2013Q3. We control for time and individual fixed effects and quadratic age. Robust standard errors in brackets, *** p<0.01, ** p<0.05, * p<0.1. Total sample size: 411,425 observations of 25,895 individuals. Drug categories: alimentary tract and metabolism – ATC A; cardiovascular system – ATC C; antiinfectives for systemic use – ATC J; musculo-skeletal system – ATC M; nervous system – ATC N; respiratory system – ATC R. 1 EUR ≈ 300 HUF in the analysed period.

Appendix Table A3: models of working pensioners working in the public sector

	females		males	
	coefficient	standard error	coefficient	standard error
age (reference: age 62)				
age 63	0.132	[0.0841]	0.0784	[0.109]
age 64	0.116	[0.0888]	0.105	[0.113]
age 65	0.0792	[0.0922]	0.479***	[0.109]
age 66	0.0343	[0.0981]	0.607***	[0.111]
age 67	-0.0393	[0.113]	0.528***	[0.125]
age 68	-0.18	[0.120]	0.479***	[0.127]
age 69	0.0739	[0.118]	0.473***	[0.131]
age 70	-0.458***	[0.160]	0.362**	[0.152]
occupation (reference: elementary occupations)				
managers	0.545***	[0.0987]	-0.0253	[0.108]
professionals	1.876***	[0.0707]	1.707***	[0.0880]
associate professionals	0.242***	[0.0759]	0.165	[0.114]
clerical support workers	-0.339***	[0.0992]	-0.305	[0.245]
services and sales	-1.168***	[0.123]	-1.164***	[0.155]
skilled agricultural	-2.200**	[1.010]	-0.305	[0.298]
craft and related trades	-1.439***	[0.364]	-0.653***	[0.135]
machine operators	-2.474***	[0.714]	-0.879***	[0.149]
drug spending (1,000 HUF), 2012HY1				
ATC A	-0.0038	[0.00416]	0.00276	[0.00399]
ATC C	-0.003	[0.00369]	0.00327	[0.00358]
ATC J	-0.0014	[0.0170]	0.00944	[0.0186]
ATC M	0.01	[0.00638]	0.00331	[0.0134]
ATC N	-0.00569	[0.00852]	0.00461	[0.0108]
ATC R	-0.00426	[0.00546]	-0.00629	[0.00622]
GP visits, 2012HY1	0.0168	[0.0102]	-0.0191	[0.0123]
inpatient stay, 2012HY1	-0.0341	[0.106]	0.073	[0.112]
binary indicators of drug spending, 2012HY1				
ATC A	0.0375	[0.0819]	-0.041	[0.103]
ATC C	0.121	[0.101]	-0.0313	[0.127]
ATC J	0.0242	[0.0838]	0.0796	[0.100]
ATC M	-0.0748	[0.0789]	-0.0211	[0.0978]
ATC N	-0.0761	[0.118]	-0.368**	[0.156]
ATC R	0.147*	[0.0891]	-0.0651	[0.113]

drug spending (1,000 HUF), 2011HY2				
ATC A	0.00382	[0.00463]	-0.00495	[0.00463]
ATC C	0.000269	[0.00389]	-0.00285	[0.00379]
ATC J	-0.00951	[0.0176]	-0.0320*	[0.0191]
ATC M	-0.0190**	[0.00749]	0.0283**	[0.0124]
ATC N	0.00589	[0.00953]	-0.00051	[0.0118]
ATC R	0.00621	[0.00548]	-0.00501	[0.00701]
GP visits, 2011HY2	-0.00713	[0.0106]	-0.0201	[0.0132]
inpatient stay, 2011HY2	0.153	[0.107]	-0.0888	[0.118]
binary indicators of drug spending, 2011HY2				
ATC A	-0.0727	[0.0869]	0.122	[0.112]
ATC C	-0.0712	[0.113]	0.206	[0.140]
ATC J	-0.00233	[0.0875]	0.221**	[0.102]
ATC M	0.0493	[0.0827]	-0.0835	[0.101]
ATC N	0.0227	[0.125]	0.201	[0.157]
ATC R	-0.0634	[0.0960]	-0.0486	[0.120]
drug spending (1,000 HUF), 2011HY1				
ATC A	0.00444	[0.00480]	0.000941	[0.00474]
ATC C	-0.00103	[0.00359]	0.000847	[0.00368]
ATC J	-0.00356	[0.0166]	-0.0418**	[0.0187]
ATC M	-0.00885	[0.00744]	-0.0109	[0.0159]
ATC N	0.0124	[0.0101]	-0.0019	[0.0133]
ATC R	-0.0164***	[0.00636]	-0.0009	[0.00651]
GP visits, 2011HY1	-0.00565	[0.00874]	0.00677	[0.0103]
inpatient stay, 2011HY1	-0.268**	[0.112]	0.148	[0.110]
binary indicators of drug spending, 2011HY1				
ATC A	0.027	[0.0867]	-0.0501	[0.113]
ATC C	0.0803	[0.113]	-0.142	[0.144]
ATC J	0.0461	[0.0835]	0.139	[0.1000]
ATC M	-0.00407	[0.0815]	0.0845	[0.100]
ATC N	-0.0678	[0.125]	0.0268	[0.162]
ATC R	0.111	[0.0916]	0.0831	[0.113]
drug spending (1,000 HUF), 2010HY2				
ATC A	-0.00716	[0.00481]	0.00181	[0.00498]
ATC C	0.00174	[0.00372]	-0.00449	[0.00370]
ATC J	-0.0395**	[0.0169]	0.00745	[0.0180]
ATC M	0.0119	[0.00740]	0.00477	[0.0160]
ATC N	-0.00287	[0.0104]	0.00448	[0.0132]
ATC R	0.00724	[0.00623]	0.00537	[0.00778]
GP visits, 2010HY2	-0.00427	[0.0129]	0.00621	[0.0152]
inpatient stay, 2010HY2	0.0681	[0.114]	0.0513	[0.119]
binary indicators of drug spending, 2010HY2				
ATC A	0.0493	[0.0892]	-0.19	[0.117]
ATC C	-0.0511	[0.113]	-0.0477	[0.141]
ATC J	0.171**	[0.0823]	-0.0599	[0.104]
ATC M	-0.166**	[0.0843]	0.0689	[0.102]
ATC N	-0.0931	[0.130]	-0.172	[0.158]
ATC R	0.0688	[0.0916]	0.273**	[0.115]

drug spending (1,000 HUF), 2010HY1				
ATC A	0.00493	[0.00491]	-0.00509	[0.00510]
ATC C	0.00747*	[0.00396]	0.0018	[0.00366]
ATC J	0.0139	[0.0171]	-0.00047	[0.0190]
ATC M	-0.006	[0.00682]	-0.0017	[0.0161]
ATC N	-0.00745	[0.0109]	0.00503	[0.0115]
ATC R	5.07E-05	[0.00663]	-0.0003	[0.00768]
GP visits, 2010HY1	0.00645	[0.0126]	-0.00206	[0.0151]
inpatient stay, 2010HY1	0.014	[0.111]	0.051	[0.119]
binary indicators of drug spending, 2010HY1				
ATC A	-0.0171	[0.0887]	0.0513	[0.113]
ATC C	-0.137	[0.108]	0.288**	[0.133]
ATC J	-0.158*	[0.0864]	-0.0405	[0.104]
ATC M	-0.0283	[0.0798]	-0.0783	[0.0988]
ATC N	0.0723	[0.125]	0.0329	[0.150]
ATC R	-0.0332	[0.0945]	0.0546	[0.119]
drug spending (1,000 HUF), 2009HY2				
ATC A	-0.00129	[0.00440]	0.0059	[0.00453]
ATC C	-0.00525	[0.00329]	0.00158	[0.00309]
ATC J	-0.0497***	[0.0187]	0.0057	[0.0178]
ATC M	0.0150**	[0.00639]	-0.0229	[0.0166]
ATC N	-0.00368	[0.00935]	-0.00362	[0.0107]
ATC R	0.00149	[0.00558]	0.00594	[0.00672]
GP visits, 2009HY2	-0.0125	[0.0110]	-0.00517	[0.0127]
inpatient stay, 2009HY2	0.00364	[0.115]	-0.00243	[0.120]
binary indicators of drug spending, 2009HY2				
ATC A	-0.123	[0.0856]	0.0298	[0.107]
ATC C	0.055	[0.0977]	-0.1	[0.122]
ATC J	0.151*	[0.0844]	0.0871	[0.0976]
ATC M	0.220***	[0.0693]	0.153*	[0.0902]
ATC N	-0.0485	[0.115]	0.252*	[0.142]
ATC R	0.173*	[0.0943]	-0.283**	[0.124]
constant	-1.928***	[0.0860]	-2.641***	[0.113]
Observations	12,573		13,308	

Note: Standard errors in brackets, *** p<0.01, ** p<0.05, * p<0.1. The sample is restricted to individuals who are employed and receive old-age pensions at the same time. The outcome is the binary indicator of working in the public sector.

Appendix Table A4: Descriptive statistics, with and without weighting

	(1) public sector, working retired	(2) private sector, non-weighted	(3) working retired weighted	(4) standardized difference of (1) and (3)
age	65.037	64.800	64.982	0.024
male	0.424	0.529	0.437	-0.025
occupation at 2013Q2				
armed forces	0.004	0.000	0.000	0.084
managers	0.098	0.112	0.114	-0.050
professionals	0.436	0.099	0.326	0.227
associate professionals	0.137	0.139	0.158	-0.059
clerical support workers	0.046	0.074	0.057	-0.049
services and sales	0.037	0.157	0.050	-0.061
skilled agricultural	0.004	0.011	0.005	-0.017
craft and related trades	0.024	0.082	0.032	-0.047
machine operators	0.017	0.077	0.023	-0.041
elementary occupations	0.197	0.250	0.236	-0.095
monthly GP visits	1.902	2.109	1.997	-0.047
hospital stay (binary)	0.057	0.053	0.056	0.007
binary indicators of drug use				
ATC A	0.310	0.312	0.309	0.001
ATC C	0.669	0.650	0.652	0.036
ATC J	0.124	0.120	0.131	-0.022
ATC M	0.177	0.188	0.185	-0.021
ATC N	0.100	0.103	0.099	0.004
ATC R	0.090	0.087	0.094	-0.014

Note: The table shows the mean of the listed variables at 2013Q2. Those variables are reported that are included in the logit models of working pensioners working in the public sector. The sample is restricted to individuals working and receiving old-age pensions at 2013Q2, aged 62-70 at that time point. The last column shows the standardized difference of columns (1) and (3), which is the difference of means divided by the square root of the average of the two individual variances. Difference below 0.10 is treated as an appropriate balance in propensity score studies (e.g. Austin, 2009).

Appendix Table A5: Estimation results without control group: Effect of involuntary retirement on half-year indicators of healthcare use and drug spending

Number of GP visits and logarithm of (positive) drug spending	GP visits	Alimentary tract & metabolism	Cardio-vascular	Anti-infectives	Musculo-skeletal	Nervous system	Respiratory system
After reform	-0.221***	-0.081***	-0.131***	-0.050**	0.076***	-0.043	0.012
	[0.044]	[0.022]	[0.012]	[0.022]	[0.027]	[0.040]	[0.045]
Mean outcome (no logs, drug spending in HUF)	3.760	16,666	19,812	3,592	6,251	11,726	15,815

Binary indicators of use	Hospital stay	Alimentary tract & metabolism	Cardio-vascular	Anti-infectives	Musculo-skeletal	Nervous system	Respiratory system
After reform	0.016***	-0.001	-0.017***	-0.023***	0.029***	0.007*	-0.023***
	[0.005]	[0.006]	[0.004]	[0.007]	[0.006]	[0.004]	[0.005]
Mean outcome	0.092	0.370	0.680	0.252	0.259	0.129	0.138

Note: Fixed effects results, average effect over 2013HY2-2016HY2. The table shows the estimated coefficient of the observation being after 2013Q3 in the sample of individuals who worked in the public sector at 2013Q2 and received old-age pensions at the same time. We control for linear and quadratic time trend and quadratic age. Robust standard errors in brackets, *** $p<0.01$, ** $p<0.05$, * $p<0.1$. Total sample size: 59,053 observations of 3,711 individuals. Drug categories: alimentary tract and metabolism – ATC A; cardiovascular system – ATC C; antiinfectives for systemic use – ATC J; musculo-skeletal system – ATC M; nervous system – ATC N; respiratory system – ATC R. 1 EUR ≈ 300 HUF in the analysed period.

C Gender specific impact of involuntary retirement

Appendix Table A6: Heterogeneity by gender: effect of involuntary retirement on half-year indicators of healthcare use and drug spending

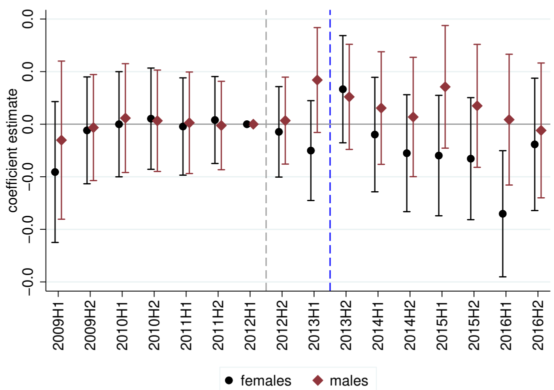
Number of GP visits and logarithm of (positive) drug spending	GP visits	Alimentary tract & metabolism	Cardio-vascular	Anti-infectives	Musculo-skeletal	Nervous system	Respiratory system
Treatment effect	-0.209***	-0.046	-0.052***	-0.021	0.045	-0.032	-0.050
	[0.049]	[0.031]	[0.019]	[0.019]	[0.033]	[0.049]	[0.050]
Treatment effect × male	0.093	-0.012	0.019	-0.025	-0.026	0.031	0.058
	[0.073]	[0.051]	[0.028]	[0.032]	[0.043]	[0.082]	[0.085]
Mean outcome (no logs, drug spending in HUF)	3.816	16,735	19,890	3,591	6,048	11,293	16,107

Binary indicators of use	Hospital stay	Alimentary tract & metabolism	Cardio-vascular	Anti-infectives	Musculo-skeletal	Nervous system	Respiratory system
Treatment effect	0.005	-0.003	-0.011*	-0.029***	-0.009	-0.004	-0.024***
	[0.004]	[0.007]	[0.007]	[0.006]	[0.007]	[0.005]	[0.005]
Treatment effect × male	-0.003	0.019*	0.007	0.014	0.003	0.008	0.018**
	[0.007]	[0.011]	[0.010]	[0.009]	[0.010]	[0.007]	[0.007]
Mean outcome	0.091	0.368	0.680	0.252	0.261	0.130	0.139

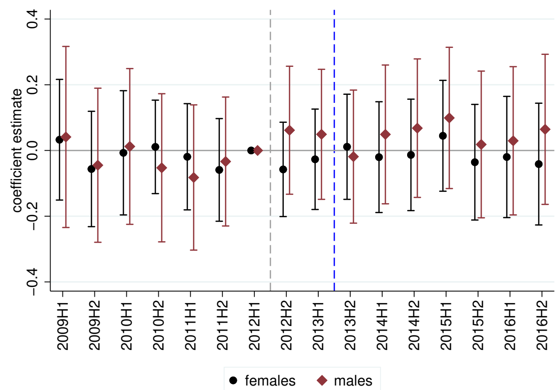
Note: Weighted fixed effects results (equation (1)), average effect over 2013HY2-2016HY2. The table shows the estimated coefficient of the interaction between working in the public sector in 2013Q2 and the observation being after 2013Q3, and the coefficient of further interaction with gender. We control for time and individual fixed effects and quadratic age. Robust standard errors in brackets, *** $p<0.01$, ** $p<0.05$, * $p<0.1$. Total sample size: 411,425 observations of 25,895 individuals. Drug categories: alimentary tract and metabolism – ATC A; cardiovascular system – ATC C; antiinfectives for systemic use – ATC J; musculo-skeletal system – ATC M; nervous system – ATC N; respiratory system – ATC R. 1 EUR ≈ 300 HUF in the analysed period.

Appendix Figure A2: Gender specific effect of involuntary retirement on the use of psychoanaleptics

(a) Probability of any spending



(b) Logarithm of (positive) spending



Note: Weighted fixed effects results of equation (2). Point estimates with 95% CI. The figure shows the estimated coefficients of the interaction between working in the public sector in 2013Q2 and time indicators. We control for time and individual fixed effects and quadratic age. Total sample size: 411,425 observations of 25,895 individuals. The grey vertical line indicates the announcement of the policy, the blue vertical line indicates the date since the simultaneous receipt of pension benefits and earnings is not possible in the public sector. The outcome variables refer to ATC group N06.

D Impact of involuntary retirement on detailed categories of pharmaceuticals

Appendix Table A7: Effect of involuntary retirement on half-year indicators of drug spending

Logarithm of (positive) drug spending	ATC A10	ATC C02-09	ATC J01	ATC N05	ATC N06	ATC R03
Treatment effect	-0.017	-0.026*	-0.034**	-0.023	0.024	-0.054
	[0.042]	[0.014]	[0.015]	[0.053]	[0.040]	[0.061]
Mean outcome (no logs, HUF)	33,386	13,763	3,039	3,874	8,533	32,430

Binary indicators of use	ATC A10	ATC C02-09	ATC J01	ATC N05	ATC N06	ATC R03
Treatment effect	-0.001	-0.011**	-0.022***	0.000	-0.001	-0.007***
	[0.002]	[0.005]	[0.004]	[0.002]	[0.003]	[0.002]
Mean outcome	0.109	0.631	0.235	0.022	0.060	0.058

Note: Weighted fixed effects results (equation (1)), average effect over 2013HY2-2016HY2. The table shows the estimated coefficient of the interaction between working in the public sector in 2013Q2 and the observation being after 2013Q3. We control for time and individual fixed effects and quadratic age. Robust standard errors, *** $p<0.01$, ** $p<0.05$, * $p<0.1$. Total sample size: 411,425 observations of 25,895 individuals. ATC group definitions: A10 – drugs used in diabetes; C02-09 – drugs mostly used in hypertension; J01 – antibacterials for systemic use; N05 - psycholeptics; N06 - psychoanaleptics; R03 – drugs for obstructive airway diseases. 1 EUR ≈ 300 HUF in the analysed period.