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The effect of negative income shocks on pensioners

*By Julian Vedeler Johnsen and Alexander Willén**

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Abstract

This paper provides novel evidence on the labor supply response to negative income shocks in retirement, exploiting an institutional feature that caused differential and unexpected income losses among otherwise identical individuals in a sharp regression discontinuity design. We conclude that retired pensioners do not return to work despite income losses of up to seven percent of their annual income. The paper further shows that the negative income shock had no impact on the health of pensioners. At the height of an ongoing global crisis in which public pension funds are rapidly losing value, these results may be particularly important.

JEL Codes: I38, J14, J26
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Content

1. Introduction

Population ageing threatens the financial stability of existing public pension schemes. In response, governments across the globe have pursued extensive retirement reforms.[1] Most of these reforms revolve around incentivizing workers to postpone retirement and encouraging pensioners to return to work (OECD 2015). While there is a rich literature examining the impact of financial incentives on workers' decision to *delay retirement* (e.g. Jensen and Richter 2004; Coile and Gruber 2007; Behaghel and Blau 2012; Laun 2017; Haller 2019; Malkova 2020), there is no evidence on the effect of financial incentives on pensioners' decision to *re-enter the labor force* after they have retired.

In light of increasing efforts to activate the older population, understanding how pensioners in retirement respond to financial incentives is important. Between 2016 and 2050, the percent of the world's population aged 65 and over is expected to increase from 9 percent to 17 percent (NIH 2016).[2] Without effective policies that extend the working lives of the population, and encourage retirees to reenter the workforce, the public finance effects will be substantial. Unfortunately, a lack of exogenous variation in pension income has made it difficult to examine the relationship between income and pensioners' decision to re-enter the workforce. In this paper, we exploit a unique feature of the Swedish pension system that caused differential and unexpected income losses among otherwise identical pensioners in a sharp regression discontinuity design. This allows us to provide the first causal estimates in the literature on the labor supply response to income shocks among full-time pensioners.

The feature of the Swedish pension system we exploit is known as the automatic balancing mechanism (ABM). The ABM is an automatic benefit-adjustment mechanism that ensures the solvency of the public pension system by tying pension payouts to the ratio of assets to liabilities in the system. When the ratio drops below one (due to a reduction in assets or an increase in liabilities), pension benefits are cut to eliminate the deficit. When the ratio recovers and exceeds one, a period of catch-up occurs with higher rates of indexation and accumulation. The catch-up period ends when the pension benefits are equal to what they would have been absent ABM activation. Thus, the income lost due to the ABM is never recovered. First introduced by Sweden in 2001, a number of countries across the globe have introduced elements of this mechanism into their pension systems.

The Swedish pension system fell out of balance for the first time in 2010. Consequently, the ABM was activated and cut pension benefits. The catch-up period ended in 2018, and

[1] Over the past 10 years, all OECD countries have reformed parts of their pension systems (OECD 2013).
[2] In the OECD, it is estimated to increase from 16 percent to 27 percent (OECD 2015).

between 2010 and 2018 almost $7.8 billion was lost in pension benefits. This represents an average individual loss among pensioners of approximately $5800 during these eight years; 4 months of public pension benefits for the average pensioner. The largest loss occurred in 2011, in which the average pensioner lost $1100, or three-fourths of a full month of benefits.

By lowering pension benefits, the ABM incentivizes pension-eligible workers to remain in the labor force, and retired pensioners to return to work. We use detailed administrative data to examine how this income shock affected the labor market behavior of individuals that had retired prior to the announcement of the ABM activation.[3] It is important to note that, in our setting, pensioners keep their existing pensions even if deciding to return to work. Data limitations prevent us from examining the impact of the shock on an individual's decision to delay retirement.[4] However, this question has been studied at length elsewhere (e.g. Jensen and Richter 2004; Coile and Gruber 2007; Behaghel and Blau 2012; Laun 2017; Haller 2019).[5]

We rely on a sharp regression discontinuity design, leveraging the fact that the magnitude of the income shock changes discontinuously at pre-specified thresholds in the public pension scheme. Specifically, individuals who received almost identical public pensions prior to ABM activation were exposed to substantially different shocks depending on which side of a specific benefit level threshold they were located, with losses ranging from 0 percent to 7 percent of their annual public pension benefits. We exploit these discontinuities to examine the impact of negative income shocks on the labor market outcomes of pensioners.

Given existing evidence on the relationship between income, work and health, the negative income shock may translate into changes in the health of pensioners, either due to their labor market response to the shock, or due to the reduction in disposable income. To fully understand the effect of negative income shocks on pensioners, we also evaluate how the ABM affected the health of pensioners. We exploit detailed medical registries containing information on all prescriptions and patient visits during our analysis period. Understanding not only

[3] This prevents endogenous selection into retirement based on ABM activation.

[4] The issue with looking at non-retired pensioners is that their pension income has not yet been fixed (it will be adjusted until they enter retirement). As we will explain in Section 3.2, we need exact pension income to assign each individual's position relative to the discontinuities in the system which we make use of in our identification strategy. While this is a limitation of our analysis, questions related to delaying retirement have been studied at length elsewhere (e.g. Jensen and Richter 2004; Coile and Gruber 2007; Behaghel and Blau 2012; Laun 2017; Haller 2019). Our relative contribution to the literature is to examine the labor supply response to income shocks among pensioners who have already exited the labor force, a question that has not been studied before.

[5] For example, Jensen and Richter (2004) use survey data to look at the household labor response in areas that experienced a pension freeze compared to areas that did not experience a pension freeze. This is an interesting finding, but distinct from ours, as it can be driven by both intensive as well as extensive responses, and by individual as well as household responses.

pensioners' labor market response to income shocks, but also how these shocks affect health, enables us to better understand the relationship between income and the welfare of pensioners.

This study contributes to a growing literature on the labor market behavior of pensioners by providing a more complete understanding of how pensioners and older workers respond to economic incentives. First, there is a rich literature examining the impact of financial incentives on workers' decision to delay retirement (e.g. Jensen and Richter 2004; Snyder and Evans 2006; Coile and Gruber 2007; Behaghel and Blau 2012; Chetty et al. 2012; Brown 2013; Johansson et al. 2016; Manoli and Weber 2016; Laun 2017; Malkova 2020). These papers exploit variation in tax rates and pension benefits induced by various exogenous events to study the interaction between the labor supply of older workers and their financial situation. A number of these studies have found significant labor market effects induced by incentives that are of a comparable magnitude to those studied in this paper. For example, Snyder and Evans (2006) exploits a notch that generated a 4 percent change in annual income – similar to the difference between any two of our groups – and find statistically significant and economically meaningful labor market effects.[6]

Second, another strand of literature closely linked to our work is that which examines the effects of the Earnings Test for Social Security (AET) in the US, which reduces the social security benefits of individuals if they earn above a certain amount and decide to retire prior to the normal retirement age. Prior studies on the AET have found moderate substitution elasticities on the intensive margin (e.g. Friedberg, 1998; Friedberg, 2000; Song and Manchester, 2007; Gelber et al., 2020a; Engelhardt and Kumar 2009; Engelhardt and Kumar 2014), and more recent work has begun identifying effects on the extensive margin as well (e.g. Gelber et al. 2020b). For example, Gelber et al. (2020b) find that the AET reduces the employment rate of Americans at the margin of retirement (aged 63-64) by 3.3 percentage points. While the marginal impact of the AET is larger than the marginal impact of the ABM, the total loss in annual income induced by the AET is comparable to that generated by the ABM for a large share of the older population.

[6] Snyder and Evans (2006) use household survey data (CPS) to compare the post-65 labor force participation of individuals born on either side of the social security notch generated by legislation in 1977. This legislation took place before individuals had entered retirement, and their results show that workers born after the cutoff (first quarter of 1917) has a higher labor force participation rate at old ages compared to workers born before the cutoff. This interesting finding is likely because these individuals decide to delay retirement and stay longer in the workforce. The distinct contribution of our paper is to examine how pensioners that have existed the labor force respond to negative income shocks, something that cannot be identified using the data in Snyder and Evans (2006).

Our contribution relative to both of these literatures is that we estimate the labor supply response to an income shock among pensioners who have already left the labor force, something that has not been studied before. This advances the existing knowledge on the labor market behavior of older workers and pensioners, and helps us develop a more comprehensive understanding of how various policies and shocks interact with pensioners' labor supply.[7]

This paper provides two sets of key results. First, we estimate very precise zero effects of the income shock on the labor market outcomes of retired pensioners, and conclude that pensioners in retirement do not return to work despite losing up to 7 percent of their annual income. Specifically, we estimate the elasticity to be -0.03.[8] This result is interesting not only in light of existing studies that identify meaningful income effects on the decision to postpone retirement (e.g. Chetty et al. 2012; Brown 2013; Johansson et al. 2016; Manoli and Weber 2016; Laun 2017; Heller 2019), but also in light of the growing evidence on both intensive and extensive margin effects of the Social Security Earnings Test in the US (e.g. Friedberg, 1998; Friedberg, 2000; Song and Manchester, 2007; Gelber et al., 2020a; Engelhardt and Kumar 2009; Engelhardt and Kumar 2014, Gelber et al. 2020b). While our results are not directly comparable as we are studying the supply response to an income shock while the majority of these studies are identifying net-of-tax participation elasticities, relating of our results to the findings in the existing literature helps us develop a more complete understanding of the labor market behavior of pensioners.

Second, we show that the income shock has no effect on the health of retirees. While this is consistent with papers documenting a lack of health effects associated with income changes among older individuals in western countries (e.g. Adams et al. 2003; Michaud and van Soest 2008; Lindahl 2005), we are the first to show that this also holds for retired pensioners.

The results from this analysis have important policy implications. Specifically, the almost perfectly inelastic labor supply response to income shocks demonstrates that policies that alter the income of pensioners in retirement will be ineffective in inducing them to return to work. In addition, the lack of health effects suggests that the externalities associated with the

[7] Another relevant strand of literature is that which studies the effect of unearned income shocks on labor supply, such as the effect of winning the lottery (Imbens, Rubin and Sacerdote 2001; Lindahl 2005; Cesarini et al. 2017). This literature tends to find modest reductions in labor supply as an implication of increased unearned income, with unearned income crowding out earned income. However, our analysis focuses on individuals who have already made the decision to exit the labor force and enter full-time retirement. As such, it is difficult to compare these papers with the current analysis.

[8] This applies to regions with very low unemployment rates as well, where it is reasonable to assume that the lack of a labor market response is not simply due to a lack of available jobs and demand-side obstacles for reentering the labor market.

ABM approach of insuring pension systems may be small. At the height of a global crisis where pension funds are rapidly losing value, these results may be particularly important.

2 Institutional Background

The Swedish pension scheme consists of a mandatory public pension, an occupational pension, and private savings. Historically, the majority of pension income has come from the public pension, but occupational pension represents an increasing share of pension income among high-wage workers. Abstracting away from private savings, the average replacement rate among individuals born in the 1930ies was approximately 80 percent of their wage, and around 75 percent of that came from the public pension (Sørensen et al. 2016).[9]

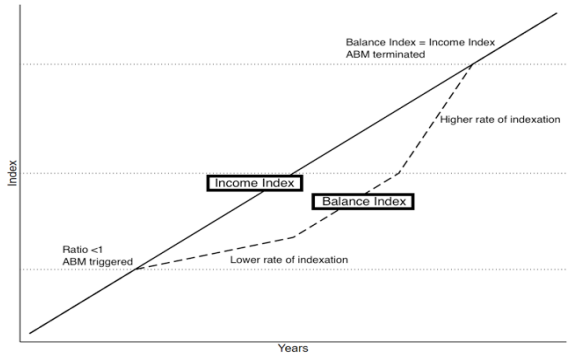
The public pension consists of a means-tested guarantee pension, a modest defined contribution tier (2.5% of payroll) and a pay-as-you-go (PAYG) scheme with a fixed contribution rate (16% of payroll).[10] The guarantee pension is gradually phased-out as the PAYG benefits increase. The guarantee pension is adjusted based on an *inflation index* each year, while the PAYG pension is adjusted based on an *income index* that reflects the annual change in average income.

The public pension scheme contains an automatic benefit-adjustment mechanism (ABM) that ensures the solvency of the PAYG system. The ABM is activated when the balance ratio of pension assets (contributions plus buffer funds) to pension liabilities (future pension payouts) drops below one (calculated annually). It operates by reducing the accrual rate of workers' accumulations and the indexation of pensions in payments. It does so by multiplying the *income index* by the balance ratio of assets to liabilities, generating a new annual adjustment index called the *balance index*. Since the *balance index* is lower than the *income index*, the value of the total pension rights is adjusted at a lower rate and may even decrease. When the balance ratio recovers and exceeds one, a period of catch-up occurs with higher rates of indexation. The catch-up period ends when the *balance index* exceeds the *income index*. The income lost due to the ABM is never recovered. Panel A of Figure 1 illustrates how the balancing mechanism works. Note that the ABM activation can lead to a loss in real pension income, not only to a reduction in the growth rate of pension income.

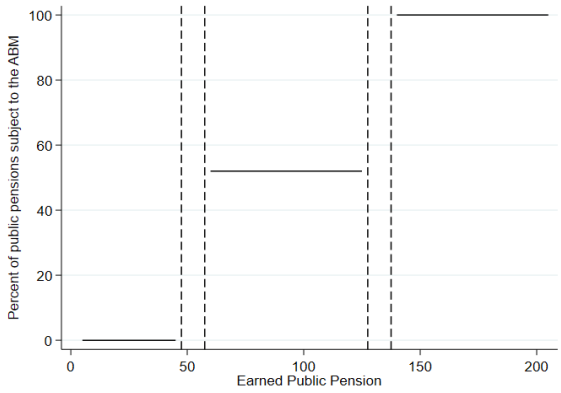
[9] Occupational pension represents a larger share of the final pension amount among high income retirees. However, these individuals are not part of our analysis (see Section 3).

[10] The PAYG benefits (income-based pension) are based on notionally defined contribution accounts: workers pay into the system and build balances during their working years, and these balances are used to calculate their annuities when they retire. The modest defined contribution tier is similar to the 401(k) plans in the US.

Figure 1. Background and Institutional details



A) The Automatic Balancing Mechanism



B) The discontinuous income losses

C) Average income loss due to the ABM

Notes: Panel A) illustrates how the Automatic Balancing Mechanism is implemented when the pension scheme falls out of balance. Panel B) provides a visual illustration of the discontinuities in the percent of public pensions subject to the potential losses imposed by the activation of the ABM around the two thresholds in the PAYG pension system, illustrating the partial and full phase out of the guarantee pension. The horizontal lines indicate regions in which individuals are pushed back beyond the discontinuity due to the pension loss, and therefore becomes more insured against the loss by receiving an increasing share of guarantee pension. Panel C) plots monthly public pension (in 000s SEK) for the average pensioner over the period 2009 to 2018. 1000 SEK is equivalent to $103. The black line represents pension benefits after the activation of the ABM, while the grey line represents pension benefits had the ABM not been activated.

Crucial to our analysis is the fact that the ABM only applies to the PAYG scheme, and not to the guarantee pension. This design feature generates two discontinuities in the magnitude of the income loss experienced by individuals in the event of ABM activation. Specifically, individuals who only receive the guarantee pension will not experience a cut in benefits (100 percent insured), individuals who receive part of their pension in the form of guarantee pension will experience a partial reduction (48 percent insured), and individuals who receive no guarantee pension will experience a full reduction (0 percent insured).[11] The discontinuities are illustrated in Panel B of Figure 1.[12] In other words, the ABM affects pensioners differently

[11] Appendix Figure A1 provides a detailed illustration of the phase-out of the guarantee pension which is driving the discontinuities shown in panel B of Figure 1.

[12] Note that a negative shock to the pension income of individuals just above the thresholds will push them below the thresholds, such that their guarantee pension increases. Thus, an individual one dollar above the lower threshold will only experience a one dollar drop in income due to the ABM, as the guarantee pension will prevent further

based on certain thresholds, which in turn depend on their labor histories that cannot be manipulated following retirement. This provides us with an ideal setting for examining the labor market effect of a negative income shock in retirement. We leverage the variation in income loss induced by the ABM in a regression discontinuity design to examine the impact of negative income shocks on the labor market and health outcomes of pensioners.

Although 33 percent of pensioners in Sweden receive some amount of guarantee pension (Pension Authority 2020), it is worth noting that our population of study falls in the left tail of the pension income distribution. The relatively low pension accumulation among those in our analysis sample suggests that these individuals may have less prior labor market attachment relative to the average pensioner. In Section 5, we explore this by conditioning our analysis on work history. Note that the number of observations around the partial phase out is smaller than the number of observations around the full phase out. This means that our ability to detect effects will be greater around the second discontinuity.

The ABM activated for the first time in 2010, lowering pension benefits in 2010, 2011 and 2014. The catch-up period ended in 2018, and between 2010 and 2018 almost $7.8 billion was lost in pension benefits. This represents an average individual loss of approximately 4 months of public pension benefits during these eight years. Panel C of Figure 1 demonstrates how much the average pensioner lost due to the ABM over the period 2010-2018. The grey line represents the public pension that would have been received in the absence of ABM activation and the black line represents the actual public pension that was received. The largest loss occurred in 2011, in which the average pensioner lost approximately $1100 in annual income (in absolute value relative to the pre-ABM year). It should be noted that during our analysis period, the ABM was based on the balance ratio of the previous three years. Thus, ABM activation in a given year is not reflective of poor economic conditions in that year, but rather reflective of events that happened between one and three years ago. For example, when the break hit in 2010, it was not due to poor economic performance in 2010 (GDP growth of 6 percent), but rather an implication of the financial crisis and the negative growth in 2009 (GDP growth of - 5.2 percent).

reductions. Similar argument applies to the higher threshold. We eliminate these individuals from the estimation through the use of a donut-hole RD design, with the excluded areas being illustrated by the horizontal lines in panel B of Figure 2. The donut-hole we use removes individuals who are just above the thresholds such that the negative income shock pushes them down into a lower pension income group. We discuss this in more detail in Section 3.

Once the ABM got activated in 2010, pensioners quickly realized that the reduction in pension payouts would be of a more persistent nature.[13] For example, the largest pension union in the country began pushing for a reform of the ABM already in 2011, anticipating that the reduced payouts would persist for several years. The union also established a website on which seniors could calculate their expected loss for a number of years into the future based on relatively modest assumptions.[14] In addition, several media outlets started to report, as early as 2010, that the ABM would hit pensioners a number of times in the foreseeable future, providing further indication that this would not be a short-term transitory income shock (e.g. GP 2010; Avanza 2011; GP 2011; SR 2011; SvD 2013). Finally, each year, the government sends out a report to every individual in Sweden with information about their accumulated pension income, whether the ABM had been active that year, and how much this reduced their pension income by (see Appendix Figure A2 for a visual illustration). This report also includes a discussion of the expected development of the pension fund in the future, and following the activation of the break in 2010, these discussions made clear that a more prolonged benefit cut period was to be expected. The fact that the unexpected pension cut was expected to last for multiple years makes a labor supply response from the affected pensioners more likely. The reason is that when the income loss is expected to last over multiple years, getting a job may appear more desirable.

3 Data and Method

3.1 Data

We rely on population-wide administrative data drawn from several registries of the IFAU database, originally collected by Statistics Sweden. The first registry is *LOUISE*, which provides annual socioeconomic, demographic, and labor market information on all individuals between the ages of 16 and 74. Using unique individual identifiers that allow us to follow

[13] At the same time, there is little evidence to suggest that the activation of the ABM was anticipation in the years prior to 2010. For example, in the budget projection by the Swedish National Financial Management Authority in 2006, it was anticipated that the ABM would remain in balance throughout the first decade of the 21st century (ESV 2005). The unexpected surplus in 2007 contributed to a further strengthening of the balancing numbers in the system. Towards the middle of 2009, a year after the individuals in our sample had entered full-time retirement, speculations arose among the political leadership that the break may possibly be activated in 2010. However, through media outlets, the political leadership of Sweden (such as the Social Insurance Minister Christina Pehrsson) clearly explained that it was impossible to know whether the break would be activated in 2010 or not (PA 2009). This was partly due to the uncertain economic times, but also due to the government awaiting a report on the ABM from the Swedish Social Insurance Agency. The pension group, consisting of representatives from the five leading political parties in Sweden, were to evaluate this report and decide whether changes to the ABM system should be made. Not until this work had been completed, towards the end of 2009, would it become clear how the ABM would affect pensions in 2010. If there had been perfect foresight and perfect information, then the ABM shock would be incorporated into the optimization problem of retirees when they decided to retire in 2008. However, based on the above discussion we find it highly unlikely that there was perfect information and foresight.

[14] The website is still active, and can be accessed via http://www.pensionsbromskalkylatorn.se/

individuals across the registries, we merge this data with detailed information from the Pension Authority. This provides us with complete information on pensionable income, pension payouts and retirement status, for each individual between 2003 and 2014.

The focus of this analysis is on individuals who have entered retirement prior to the activation of the ABM. We therefore restrict the sample to individuals between the ages of 65 and 74 who had no positive labor market earnings and were registered as full-time pensioners with the pension authority in the two years prior to ABM activation (2008 and 2009).[15] To better isolate the individual response to the shock, we further restrict the sample to one-person households. This eliminates the issue of spousal responses from the analysis.[16] In addition, we exclude individuals who have private pension insurance. We impose this restriction to ensure comparability across the different groups shown in Panel B of Figure 1, and to hone in on individuals that are most affected by the public pension income shock. Finally, we eliminate retirees in the right-tail of the pension income distribution and restrict the analysis to individuals that fall within the pension range shown in Panel B of Figure 1.[17] We do this to ensure a balanced set of individuals across the three groups.[18]

In the first step of our analysis, we use individual-level pension data to verify that the activation of the ABM led to discontinuous losses in pension income among individuals depending on how much of the individuals' pension that came from the PAYG scheme. In the second step of the analysis, we examine if this negative income shock induced individuals to return to work, and if so, how much of their lost pension income they recovered through supplemental work. Acknowledging that the income loss may be more salient to individuals with low wealth (they cannot compensate the income loss through increased use of savings),

[15] We restrict the sample to those aged 65+ as this is the age at which individuals can withdraw the guarantee pension. We condition on retirement in 2008 because we need to know the individuals' complete annual pensions in the year prior to ABM activation (2009) to identify which group they belong to (Panel B of Figure 1). If we only condition on retirement in 2009, the reported pensions of every individual, except those who retired on January 1, will not represent their full annual pension. Table A1 provides descriptive statistics of the main outcomes for each group in 2005, a few years before they entered retirement.

[16] Spousal responses to pension policies have been well documented in the literature (e.g. Johnsen, Vaage and Willén 2020).

[17] The restrictions we impose eliminates a significant share of retirees from our analysis. Specifically, there were approximately 657 700 individuals between the ages of 65 and 74 in Sweden in 2009. 252 100 of these individuals were single households. Of these, approximately 117 900 were fully retired in 2008 and 2009 with no labor earnings. 70 400 of these had pensions that fell around the discontinuities that we examine in this paper. Finally, 48 200 of these had no private pensions.

[18] We eliminate retirees in the right-tail of the pension income distribution such that the range of incomes covered by the third group is identical to the range of incomes that is covered by the second group. This means that we eliminate individuals with pension incomes greater than 4.88 basic amounts (208,864 SEK). It should be noted that the decision to eliminate retirees in the right-tail of the pension income distribution has no impact on our results, which is expected given the nature of our regression discontinuity design. However, it does enable us to zoom in on the discontinuities in the figures.

we exploit information from the Swedish wealth registry and performed stratified analyses based on wealth accumulation.

After having examined the labor market response to the ABM shock, we examine the health effects of this income shock. To do so, we link our data to the Swedish prescription and outpatient- and inpatient care registries. We focus on the number of GP and hospital visits, and the number of unique prescriptions drugs used by the individual. To parsimoniously summarize the health effects, we also combine these three variables into a health index. We do so by first rescaling them to range from zero to one, and then combining them into an index normalized to a have mean zero and a standard deviation of one.

As shown in Panel C of Figure 1, the ABM lowered pension benefits in 2010, 2011 and 2014. In our analysis, we focus on labor market outcomes in 2011. This represents the year in which the largest income decline took place, and the year in which we are most likely to identify labor market responses (recall that our sample is restricted to individuals who were full-time retirees in 2008). In Section 4.4, we supplement these results with estimated cumulative effects for the entire period for which we have data (2010-2014).

3.2 Method

We rely on a regression discontinuity design, leveraging the fact that the size of the income shock changes discontinuously at pre-specified thresholds in the public pension benefit scheme. Specifically, individuals who only receive the guarantee pension (non-treated) did not experience any change in pension benefits, individuals who receive part of their pension in the form of guarantee pension (partly treated) experienced a partial reduction, and individuals who receive no guarantee pension (fully treated) experienced a full reduction. This provides us with two thresholds, and we implement the RD design by restricting the sample to either the non-treated and partly treated groups, or the partly and fully treated groups, and estimating the following linear model by OLS:

$$PL_{it} = \alpha + \beta_1 Above_i + \beta_2 \text{PAYG}_i + \beta_3 (Above_i * \text{PAYG}_i) + \tau X_i + \varepsilon_{it}, \quad (1)$$

where PL_{it} represents the pension loss experienced by individual *i* in year *t* as a percent of the individual's pre-ABM pension. *Above* indicates whether (1) or not (0) individual *i* is above the threshold. PAYG is the PAYG pension income and represents our running variable. We choose bandwidths using the mean-squared error procedure recommended by Calonico et al. (2014).

The coefficient β_1 is our coefficient of interest, and measures the pension loss experienced by pensioners just above one of the thresholds shown in Panel B of Figure 1. Since

the pension loss as a percentage of the pre-ABM pension is fixed between each thresholds, we do not anticipate any slope effects as measured by coefficients β_2 and β_3. Equation (1) also controls for gender and birth year fixed effects, both included in the vector X.[19]

As discussed in Section 2, a negative shock to the pension income of individuals just above the thresholds will push them below the thresholds, such that their guarantee pension increases. Thus, an individual with a pension income one dollar above the lower threshold will only experience a one dollar drop in pension income due to the ABM, as the guarantee pension will prevent the pension from dropping further. Similarly, a negative shock to the pension income of individuals just above the higher threshold will push them below the second discontinuity shown in Panel B of Figure 1, such that they now receive some guarantee pension, muting the impact of the ABM. To facilitate our analysis, we eliminate these individuals from the estimation through the use of a donut-hole RD design. The donut-hole we use removes individuals who are just above the thresholds such that the negative income shock pushes them down into a lower pension income group.

In addition to the RD design described above, we also provide results using an alternative identification approach in which we instrument pension loss with indicators for being partly and fully exposed to the ABM. We estimate the following IV model by 2SLS:

$$PL_{it} = \alpha_1 + \alpha_2 Partly\_treat_i + \alpha_3 Fully\_treat_i + \alpha_4 PAYG_i + \alpha_5 PAYG_i^2 + \tau X_i + \varepsilon_i \quad (2)$$

$$Y_i = \gamma_1 + \gamma_2 \widehat{PL}_{it} + \gamma_3 PAYG_i + \gamma_4 PAYG_i^2 + \tau X_i + e_i, \quad (3)$$

where PL_{it}, $PAYG_i$, and X_i are specified as in Equation (1). $PAYG_i^2$ is squared pre-ABM pension earnings, which we include to more flexibly control for the running variable. Our coefficient of interest is γ_2, which measures the effect of a 1 percent reduction in non-earned income on the specified outcome. When the outcome is labor earnings, this coefficient provides the response elasticity to a negative income shock. Although the IV approach is less intuitively appealing than the RD design, it has the benefits of directly providing our response elasticity of interest and of allowing us to estimate the effect for our full analysis sample, including the observations in the donut holes.

[19] A person in retirement has a set budget, and a reduction in income will affect the person's ability to balance that budget. This effect will not depend on the absolute level of the income shock, but rather on how large this shock is relative to the budget the individual started with. This is the motivation for focusing on percentage loss rather than absolute loss.

Having demonstrated that the magnitude of the income loss varies discontinuously by the share of an individual's public pension that comes from the guarantee pension (not subject to the ABM) and the share of the individual's public pension that comes from the PAYG pension (subject to the ABM), we use these thresholds to examine pensioners' labor market responses to, and health effects of, negative income shocks. We rely on the same regression discontinuity design as above, estimating versions of equation (1) using earnings and health outcomes as dependent variables. We inflation-adjust all values using 2009 as the base year.

Individuals above the age of 65 who have left the labor force may face demand-side barriers (e.g. age discrimination) to reenter the workforce. To explore this, we perform a heterogeneity analysis based on variation in the unemployment rate across local labor markets. The idea is that local labor markets with low unemployment rates likely experience labor shortages, and employers in these regions would be more willing to hire pensioners than employers in local labor markets with high unemployment rates. Finally, we acknowledge that individuals with low labor force attachments may find it more difficult to secure a job due to lack of experience and networks. To this end, we also estimate our model restricting the sample to pensioners who were employed at the age of 60.

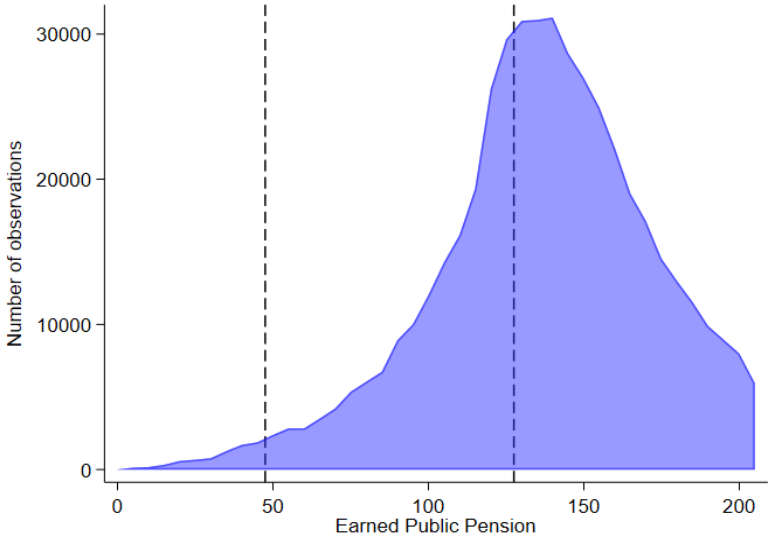
3.3 Balance and Identifying Assumption

Our identifying assumption is that treatment assignment is as good as random around the thresholds, such that those who are just to the right of the thresholds are comparable to those who are just to the left of the thresholds. As an individual's public pension is determined by an individual's entire work history, and as our running variable is based on pension income among pensioners prior to the announcement of ABM activation, perfect treatment manipulation is unlikely. Though it is impossible to test the validity of this assumption - that pensioners are unable to perfectly determine their treatment status – there are a number of exercises that can be performed to obtain suggestive evidence in favor of the required assumption.

First, we can examine the density of observations across the thresholds, ensuring that individuals are not manipulating treatment status by bunching on either side of each threshold. To this end, Figure 2 shows the density of individuals across the thresholds. The figure provides no evidence in favor of discontinuities in the density of observations around the threshold, which is expected given that an individual's location relative to the threshold is determined by the person's lifetime income history. Using the formal density tests developed by McCrary (2016) and Cattaneo et al. (2020) we fail to reject the null hypothesis of no manipulation around

each of the two thresholds (p-values of 0.292 and 0.379, respectively). This suggests that pensioners are not able to perfectly manipulate their treatment status.

Figure 2. Density of observations around the thresholds



Notes: The figure shows the number of observations by PAYG pension ("Earned Public Pension") for our main sample of single-person households aged 65 to 74 who were full-time retirees in 2009 (prior to the ABM-activation in 2010). Data come from population-wide administrative registers collected by Statistics Sweden and the Swedish Pension Authority.

Second, we can examine the continuity of our outcomes through both thresholds prior to the activation of the ABM. If individuals just above the thresholds are systematically different from individuals just below the thresholds, that would indicate that there is sorting of individuals across the thresholds, and invalidate our empirical approach. In Table 1, we show that individuals just above the thresholds are not systematically different from those just below the thresholds, supporting a causal interpretation of our results (excluding individuals who fall inside the donut hole). Graphical evidence corresponding to the results in this table are provided in Appendix Figures A3 (employment, earnings, and wealth) and A4 (health outcomes). Taken together, the available evidence supports the assumption required for causal inference: those who were just above the thresholds are not systematically different from those who were just below the thresholds.

Table 1. Balance Test

	Partly vs non-treated		Fully vs partly treated	
	(1)	(2)	(3)	(4)
Employed	0.008	0.019	0.024	0.036*
	(0.047)	(0.051)	(0.022)	(0.021)
Earnings (in 000s SEK)	0.026	2.347	2.863	4.990
	(4.636)	(4.493)	(3.723)	(3.558)
Wealth (in 000s SEK)	-24.62	-19.04	42.82	39.56
	(63.95)	(64.06)	(27.63)	(27.53)
GP visits (#)	1.023	1.002	0.050	0.077
	(0.656)	(0.650)	(0.138)	(0.141)
Hospital visits (#)	0.090	0.106	-0.010	-0.018
	(0.173)	(0.176)	(0.047)	(0.047)
Prescriptions (#)	0.573	0.860	-0.422*	-0.324
	(0.906)	(0.898)	(0.216)	(0.216)
Health index	0.185	0.216	-0.077	-0.060
	(0.206)	(0.206)	(0.049)	(0.049)
Gender FE		✓		✓
Cohort FE		✓		✓
Quadratic control function	✓	✓	✓	✓
N	17 435		38 882	

Notes: The table reports the β_1 coefficients obtained from estimation of equation (1) on outcomes measured in 2005 (recall that our sample is restricted to individuals who were full-time retirees already in 2008, such that we must perform this balancing exercise in a pre-2008 year). Employment is defined as one if the individual has positive labor earnings, and zero otherwise. The health index is a composite measure of prescriptions and GP and hospital visits, normalized to mean 0 and standard deviation of 1. A higher score on the health index indicates worse health (more health visits or prescriptions). Our main sample consists of single men and women aged 65 to 74 who were full-time retired prior to the ABM-activation in 2010. Data come from population-wide administrative registers collected by Statistics Sweden and the Swedish Pension Authority.

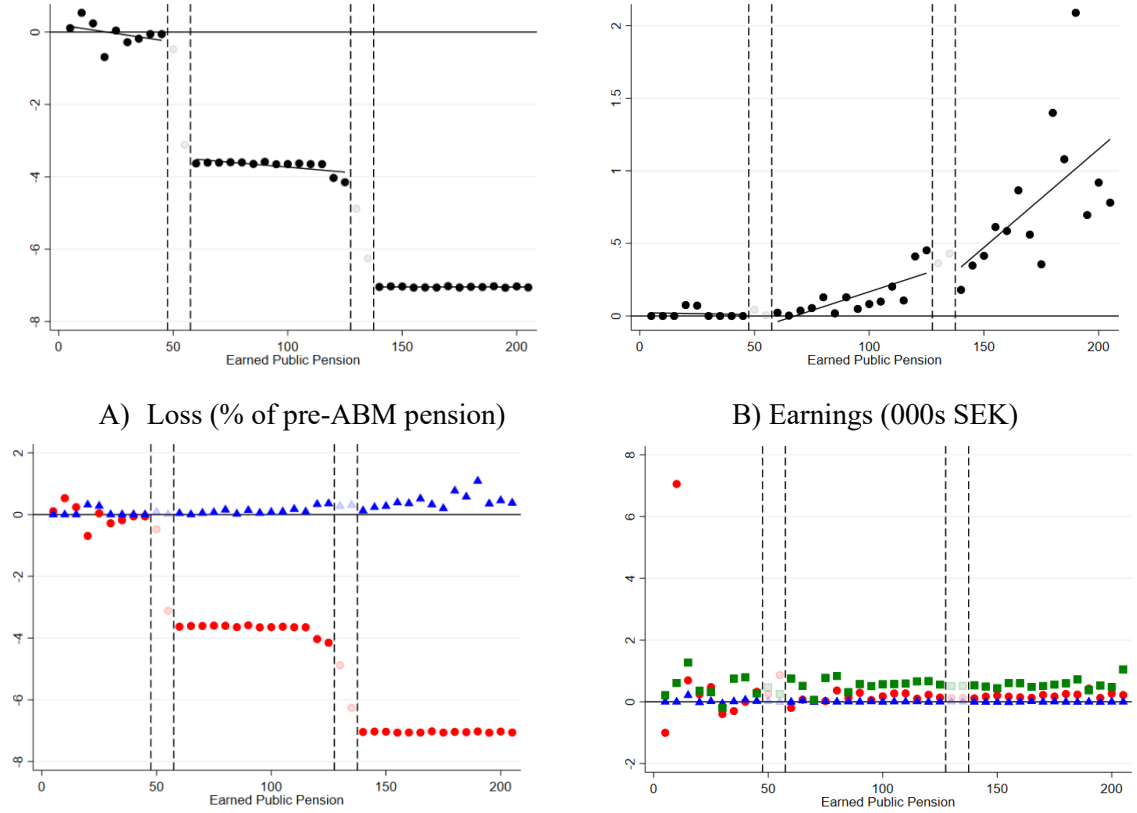
4 Results

4.1 Pension Income

Panel A of Figure 3 provides preliminary evidence on the pension loss experienced by individuals as a share of their pre-ABM PAYG pension.[20] The dots show mean loss of pension income in 2011 as a percent of the total pre-ABM pension income, grouping individuals into 5000 SEK bins by their pre-ABM PAYG pension. The dashed vertical lines represent the thresholds in the PAYG system and the corresponding donut-holes. Individuals inside these intervals are excluded from our estimation. The solid lines are local linear regressions fit separately on each side of each threshold weighted by the size of each bin, using a rectangular kernel and a bandwidth of 500 SEK.

[20] Panels A and B in Figure A5 provides additional graphical evidence of the discontinuity in the loss for each of the two thresholds, using optimal bandwidths based on the mean-squared error procedure.

Figure 3. Descriptive Evidence



A) Loss (% of pre-ABM pension) B) Earnings (000s SEK)

C) Loss and earnings (% of pre-ABM pension) D) GP visits, hospital visits, and prescriptions

Notes: The x-axes in all panels measure income-based public pension (PAYG) in 2009, grouping individuals into 5000 SEK ($516) bins. With respect to the y-axes, Panel A) plots public pension income loss in 2011 as a percent of total public pension received in 2009; Panel B) plots earnings (000s SEK) in 2011; Panel C) plots public pension loss (red dots) and earnings (blue squares) in 2011 as a percent of total public pension received in 2009; and Panel D) plots GP visits (red dots), hospital visits (blue triangles), and prescriptions (green squares). The health outcomes in Panel D) are defined as the difference in the outcome between 2011 and 2009. The dashed vertical lines in all panels represent the donut holes: individuals inside these intervals are excluded from our main estimation. Our main sample consists of single men and women aged 65 to 74 who were full-time retired prior to the ABM-activation in 2010. Data come from population-wide administrative registers collected by Statistics Sweden and the Swedish Pension Authority.

Panel A of Figure 3 provides strong evidence of a discontinuity in gross pension loss at the two thresholds. Specifically, the figure shows that individuals in the non-treated group are unaffected by the ABM, while individuals in the partly and fully treated groups suffer losses equivalent to about 3.5 and 7 percent. It is important to note that this represents an average drop in annual pension income, not a marginal drop.[21] The magnitude of this drop is therefore quite substantial. For example, based on a calculation performed by the Swedish National Pension Authority, a 7 percent drop in total pension benefits amounts to two-thirds of total annual food spending by the average pensioner (MinPension 2020). Thus, unless pensioners in these groups are spending significantly below their means, they need to acquire additional income, consume potential savings, or reduce consumption, in response to the shocks.

[21] Drawing parallels with the ETI literature, a 3.5% drop in marginal tax rate is small, but a 3.5% drop in average tax rate is nontrivial (e.g. Saez et al. 2012).

In addition, it is worth noting that a number of prior studies on financial work incentives among older workers close to the normal retirement age have found significant labor market effects induced by similarly-sized incentives. For example, Snyder and Evans (2006) exploits a notch that generated a 4 percent change in annual income – similar to the difference between any two of our groups – and find statistically significant and economically meaningful labor market effects. Further, Gelber et al. (2020b) examines the impact of the Earnings Test for Social Security and find that the AET reduces the employment rate of Americans at the margin of retirement (aged 63-64) by 3.3 percentage points. While the marginal impact of the AET is larger than the marginal impact of the ABM, the total loss in annual income induced by the AET is comparable to that generated by the ABM for a large share of the older population.

Figure 3 does not allow for formal hypothesis testing. To this end, Panel A of Table 2 shows coefficient estimates of the income loss obtained through estimation of equation (1), comparing non-treated with partially treated individuals (columns 1-2) and partially treated with fully treated individuals (columns 3-4). The estimates closely mirror the visual evidence in Panel A of Figure 3, showing that individuals just above the first threshold experienced a 3.5 percent reduction in pension income, and that individuals just above the second threshold experienced an additional 3.1 percent reduction in pension income (total loss of 6.6 percent).

It is worth noting that we examine the impact on gross pension income, and that the impact on net pension income is smaller since it is a non-linear transformation of gross pension income. We are unable to provide an analysis on net pension income due to imperfect data on all aspects of the tax and transfer system. However, it is important to emphasize that the other main welfare programs to individuals in retirement in Sweden (e.g. housing allowance for the elderly) do not coincide with the phase-in thresholds of the PAYG scheme we exploit in our analysis. Thus, there are no discontinuities in these programs that could have counteracted the effects of the ABM.

Table 2. Main results

	Partly vs non-treated		Fully vs partly treated	
	(1)	(2)	(3)	(4)
Panel A. Loss (RD)				
Pensions loss (in % of baseline pensions)	-3.476***	-3.408***	-3.103***	-3.142***
	(0.305)	(0.336)	(0.042)	(0.057)
Panel B. Earnings response (RD)				
Earnings (in % of baseline pensions)	-0.044	-0.005	-0.008	0.006
	(0.087)	(0.031)	(0.127)	(0.142)
Panel C. Health outcomes (RD-DiD)				
GP visits (difference from baseline)	-0.073	0.122	-0.110	-0.130
	(0.864)	(1.000)	(0.151)	(0.177)
Hospital visits (difference from baseline)	0.031	0.012	-0.004	-0.002
	(0.037)	(0.039)	(0.011)	(0.011)
Prescriptions (difference from baseline)	0.068	-1.053	0.127	0.181
	(0.0451)	(0.724)	(0.131)	(0.160)
Gender FE	✓	✓	✓	✓
Cohort FE	✓	✓	✓	✓
Linear control function	✓		✓	
Quadratic control function		✓		✓
N	17 435		38 882	

Notes: The table reports the β_1 coefficients from equation (1), examining the effect of being partly and fully exposed to the ABM on pension loss (Panel A), earnings (Panel B), and health outcomes (Panel C) in 2011. Pension loss is defined as total public pension loss in 2011 as a percent of total public pension in 2009. Earnings is measured as labor earnings in 2011 as a percent of total public pensions in 2009. The health outcomes are first-differenced, measured as the difference in outcomes in 2011 relative to baseline outcomes in 2009. Our main sample consists of single men and women aged 65 to 74 who were full-time retired prior to the ABM-activation in 2010. Data come from population-wide administrative registers collected by Statistics Sweden and the Swedish Pension Authority.

4.2 Labor Market Response

Panel B of Figure 3 suggests that the negative income shock caused by the ABM had little impact on the labor market behavior of pensioners, showing no visible discontinuities in labor earnings at the thresholds.[22] The dots show mean labor earnings (in 000s SEK) in 2011, grouping individuals into 5000 SEK bins by their pre-ABM PAYG pension. As mentioned in Section 2, our sample consists of individuals who were full-time retirees prior to the activation of the ABM, such that any effects on labor earnings must be driven by the extensive margin.[23]

In panel C of Figure 3, we plot both the pension loss and the earnings response as a percent of baseline pension income.[24] The figure makes clear that there is no labor market response to the pension loss, implying that the negative income shocks, ranging from 3.5 to 6.6 percent of pre-ABM income, did not induce retired pensioners to reenter the workforce. The

[22] However, the figure does show that a number of individuals return to work following retirement. This is important for interpreting our results, showing that the null response to the income loss is not simply due to a lack of available jobs.

[23] Examining employment through equation (1) directly yields point estimates (standard errors) of 0.001 (0.003) and 0.001 (0.007) at the two kinks.

[24] Panels C and D in Appendix Figure A5 provides graphical evidence of the continuity in earnings as a percent of baseline pension income for each of the two thresholds separately.

point estimates in Panel B of Table 2, obtained through estimation of equation (1) with earnings in percent of baseline pension income as the dependent variable, provide results consistent with this figure. The standard errors we obtain are small, and we can reject earnings responses larger than 0.3 percent of baseline pension income. In Section 5, we study if these results apply to all retirees in our sample, or if there is heterogeneity in the labor response across certain subgroups.

In Table 3, we report estimates from the IV approach, in which we estimate the potential earnings gain as a function of the estimated pension loss. Column (2) provides the first estimate in the literature on the response elasticity to a negative income shock in retirement. We estimate this elasticity to be 0.05, with a 95 percent confidence interval ranging from -0.02 to 0.11. Our novel finding of a zero elasticity on the decision of full-time retirees to *reenter employment* complements and contrasts previous findings of meaningful elasticities on the decision of elderly workers to *postpone retirement* (e.g. Chetty et al. 2013; Manoli and Weber 2016; Laun 2017).

Table 3. The effect of income loss using an instrumental variables approach.

	First-stage	Second-stage			
			Health outcomes		
	Loss	Earnings	GP visits	Hospital visits	Prescriptions
	(1)	(2)	(3)	(4)	(5)
Partly treated	-2.57***				
	(0.081)				
Fully treated	-4.82***				
	(0.087)				
Loss		0.05	0.03	0.00	0.06**
		(0.03)	(0.03)	(0.00)	(0.03)
Observations			45 462		

Notes: The first-stage examines the effect of being partly and fully exposed to the ABM on pension income loss (column 1). The F-statistic from the first-stage is 6563. The second-stage examines the effect of income loss on earnings (column 2) and health outcomes (columns 3 to 5). Pension loss is defined as total public pension loss in 2011 as a percent of total public pension in 2009. Earnings is measured as labor earnings in 2011 as a percent of total public pensions in 2009. The health outcomes are first-differenced, measured as the difference in outcomes in 2011 relative to baseline outcomes in 2009. Our sample consists of single men and women aged 65 to 74 who were full-time retired prior to the ABM-activation in 2010. Data come from population

Given the discontinuous losses in pension income, and the lack of significant labor market responses, the ABM may have compressed the income distribution of pensioners and resulted in reduced income inequality. In Appendix Figure A6, we plot the 2011 income distribution (sum of pension, employment, and capital income) of all individuals who were full-time pensioners in 2009 and compare it to the counterfactual distribution absent the ABM. The

figure shows an equality-improving shift in the income distribution following the ABM, with a shorter right-hand tail and an increased mass at the center of the distribution. While there is no change in the 90/10 ratio, there is a reduction in the 50/10 ratio. Specifically, following the activation of the ABM, pensioners at the 10th percentile earn 62 percent of the median pension income. This is 3 percent more than if the ABM would not have been activated. However, while this is an interesting finding, it is worth emphasizing that the debate on equality is generally not driven by concerns about the 50/10 ratio.[25]

One potential concern with examining the labor market response in 2011 is related to the *"förhöjt grundavdrag,"* a tax policy which increased the take-home pay of retirees. However, the 2010 tax cut was modest in size, providing the average retiree in our sample with an additional $150 in annual income. Bearing in mind that the ABM activation in 2011 led the average pensioner in our sample to lose $1100, this only has a modest impact on the magnitude of the effect, as is unlikely to explain the lack of a labor market response.

4.3 Health Effects

Given the existing evidence on the relationship between income and health, the negative income shocks that we study may translate into changes in the health of retirees. Understanding not only pensioners' labor market response to income shocks, but also how the combined effect of these shocks and labor market responses influences health, enables us to better understand the implication of financial work incentives on the welfare of pensioners.

We estimate equation (1) using a range of health-based outcomes as dependent variables. The outcomes we focus on are the number of GP and hospital visits and the number of unique prescription drugs used by the individual. Given the existing evidence on the relationship between income and health, and the fact that pension income is a function of lifetime income, we expect that those with higher pension income generally are of better health. However, unless the ABM-induced income shocks have an impact on health, there is no reason to expect that health would drop discontinuously around the thresholds. To facilitate interpretation of our results and better isolate the effect of the income shock on health, we investigate first-differenced health outcomes from the pre-ABM activation year (2009) to 2011. This allows us to net out any pre-existing differences in health among the people in our analysis.[26]

[25] Note that this figure looks at the 2011 income distribution of all individuals who were full-time pensioners in 2009, and not only on our analysis sample which is restricted to single-household individuals, as this provides a better measure of the overall implications of the ABM on income inequality.
[26] This is equivalent to a RD-DiD approach. All our results are robust to using the RD approach.

Panel D of Figure 3 shows the difference in prescriptions and GP and hospital visits from 2009 to 2011, grouping individuals into 5000 SEK bins by their pre-ABM PAYG pension.[27] The figure shows that the negative income shock had little impact on the health outcomes of pensioners: there are no visible discontinuities in health at the thresholds.

The results from estimating equation (1) with the above health outcomes as dependent variables are shown in Panel C of Table 2. Looking across the columns, there are no economically meaningful or statistically significant health effects associated with the ABM-induced income shocks. While this is consistent with existing literature documenting a lack of health effects associated with income changes among older individuals in western countries (e.g. Adams et al. 2003; Michaud and van Soest 2008; Lindahl 2005), we are the first to show that this also holds for retired pensioners.

4.4 Cumulative Effects

One potential reason for the lack of any economically meaningful and statistically significant labor and health effects in 2011 could be that it takes time for these effects to emerge. Specifically, returning to work might be a too costly response to a short-term income shock, but if the income loss lasts over multiple years, getting a job may appear more desirable. Similarly, health accumulates over time, and while we do not observe any health effects in 2011, it is possible that such effects arise over time as the income shock prolongs. To this end, we supplement our main results with estimated cumulative effects for the entire period for which we have data (2010-2014). To summarize the health effects in a single table, we combine all health outcomes into a health index as described in Section 3. An increase in the health index represents a decline in health (an increase in GP or hospital visits or unique prescriptions).

The results from this exercise are shown in Table 4. These results do not differ from the main estimates displayed in Table 2, and suggest that the lack of effects in our baseline analysis is not simply due to a delayed response.

[27] Panels A through F in Appendix Figure A7 provides graphical evidence of the continuity in GP visits, hospital visits, and prescriptions for each of the two thresholds.

Table 4. Main results for each year 2010 to 2014

	Partly vs non-treated			Fully vs partly treated		
	Loss (%)	Earnings (%)	Health index	Loss	Earnings	Health index
2010	-0.77*** (0.23)	0.15 (0.14)	-0.05 (0.10)	-0.75*** (0.05)	-0.03 (0.10)	0.05* (0.03)
N		17 433			39 072	
2011	-3.40*** (0.31)	-0.02 (0.04)	-0.15 (0.16)	-3.15*** (0.05)	0.01 (0.14)	0.04 (0.04)
N		17 435			39 074	
2012	-2.94*** (0.33)	0.02 (0.06)	-0.17 (0.18)	-2.85*** (0.05)	0.01 (0.20)	0.01 (0.04)
N		16 867			37 865	
2013	-1.64*** (0.44)	-0.44 (0.47)	-0.38** (0.18)	-1.51*** (0.04)	0.00 (0.17)	0.08 (0.05)
N		13 722			30 117	
2014	-3.34*** (0.49)	-0.11 (0.08)	-0.21 (0.23)	-2.48*** (0.07)	0.16 (0.37)	0.12* (0.06)
N		10 690			23 088	
Gender FE	✓	✓	✓	✓	✓	✓
Quadratic control function	✓	✓	✓	✓	✓	✓

Notes: The table reports the β_1 coefficients obtained from estimation of equation (1) separately for years 2010 (the year the ABM was activated) to 2014 (the year our data ends). The sample consists of single men and women aged 65 to 74 who were full-time retired prior to the ABM-activation in 2010. Data come from population-wide administrative registers collected by Statistics Sweden and the Swedish Pension Authority.

5 Heterogeneity Analysis

The above results show that the ABM-induced income shock had no impact on the labor market and health outcomes of retired pensioners. However, the effects identified in Section 4 may miss important effect heterogeneity across certain socioeconomic dimensions. First, the income shock may have a larger impact on individuals with low wealth as they are unable to compensate for the loss through increased use of savings. Second, pensioners with little prior labor force attachment may find it more difficult to reenter the labor market. Finally, retirees may face certain demand-side obstacles, such as age discrimination, to reenter the labor market.

In Table 5, we show results from a number of stratified regressions with the goal of exploring each of these possible channels: Panel A shows results for the overall sample (for comparison); Panel B shows results stratified by pre-ABM activation wealth; Panel C shows results based on the unemployment rate in the retiree's local labor market; Panel D displays results by prior labor market attachment.[28] Looking across the panels in Table 5, we see that there are no systematic effects of the ABM shock on earnings or health outcomes for the different subgroups. This suggests that the results obtained in Table 2 apply more broadly to the individuals in our sample, and that the lack of a labor market response is likely not due to weak labor force attachment, demand-side obstacles, or wealth accumulation.[29]

[28]Panels G and H in Appendix Figure A7 provides graphical evidence of the continuity in the health index outcome for each of the two thresholds.

[29] To further examine the existence of demand-side obstacles, we have also exploited a labor scarcity index established by the national unemployment office of Sweden, in which a representative set of occupation in the country is ranked according to the mismatch between the number of applicants and the number of vacant positions. The index ranges from 1 (a considerable abundance of applicants) to 5 (a considerable scarcity of applicants), and we use this index to perform an additional stratification analysis. The idea is that retirees whose work experience is in occupations that has a considerable abundance of applicants will experience significant demand-side obstacles to returning to the labor force, something that may attenuate our results. We therefore reestimate our main equation limiting the sample to those with work experience in occupations that do not face considerable competition for jobs. Unfortunately, we only have sufficient variation to perform this analysis around the second threshold, with results greatly mirroring those in Table 2, with a point estimate of 0.17 and a standard error of 0.25.

Table 5. Heterogeneity Analysis

	Partly vs non-treated		Fully vs partly treated	
	Earnings	Health index	Earnings	Health index
	(1)	(2)	(3)	(4)
Panel A. All	-0.005	-0.142	0.006	0.038
(N = 17 435 / 38 882)	(0.031)	(0.159)	(0.142)	(0.035)
Panel B. By wealth				
Low wealth (< median)	0.054	-0.198	-0.055	-0.028
(N = 7 562 / 17 258)	(0.074)	(0.260)	(0.158)	(0.046)
High wealth (> median)	-0.039	-0.156	0.035	0.037
(N = 9 873 / 21 624)	(0.040)	(0.202)	(0.057)	(0.043)
Panel C. By local unemployment rate				
Low local unemp. rate (< median)	-0.011	-0.044	-0.158	0.064
(N = 8 714 / 19 879)	(0.010)	(0.264)	(0.201)	(0.051)
High local unemp. rate (> median)	0.002	-0.121	0.161	0.013
(N = 8 721 / 19 003)	(0.047)	(0.177)	(0.190)	(0.046)
Panel D. By labor market attachment				
Employed at age 60	-0.515	-0.552	0.059	0.062
(N = 4 100 / 11 689)	(0.626)	(0.539)	(0.206)	(0.057)
Not employed at age 60	-0.046	-0.113	0.042	0.027
(N = 13 335 / 27 193)	(0.033)	(0.167)	(0.181)	(0.044)
Gender FE	✓	✓	✓	✓
Cohort FE	✓	✓	✓	✓
Quadratic control function	✓	✓	✓	✓

Notes: The table reports the β_1 coefficients obtained from estimation of equation (1) separately for subsamples of retirees with different socioeconomic characteristics. Wealth and local unemployment rates are measured in 2009 (pre-ABM-activation), while labor market attachment is proxied by employment status at age 60 (as none of these individuals were employed in 2009). Earnings is measured as labor earnings in 2011 as a percent of total public pensions in 2009, and the health index is a composite measure of prescriptions and GP and hospital visits, normalized to a mean of 0 and a standard deviation of 1. A higher score on the health index indicates worsening health from 2009 to 2011 (more health visits or prescriptions). Our main sample consists of single men and women aged 65 to 74 who were full-time retired prior to the ABM-activation in 2010. Data come from population-wide administrative registers collected by Statistics Sweden and the Swedish Pension Authority.

6 Discussion and Conclusion

Between 2016 and 2050, the percent of the world's population aged 65 and over is expected to double, substantially reducing the effective size of the labor force and putting considerable pressure on public finances. In light of this population ageing, there has been increasing efforts across the globe to decrease the number of years individuals spend in retirement.

We have exploited an unusual feature of the Swedish public pension system using detailed population-wide registry data. This has allowed us to overcome the challenges faced by previous research on the topic, and enabled us to provide the first analysis in the literature on the effect of financial incentives on pensioners' decision to re-enter the labor force after they have retired.

We present two sets of results. First, we provide the first labor supply response estimates of full-time retirees in the literature, demonstrating that individuals who have made the decision to retire are unresponsive to income shocks. Specifically, we estimate the response elasticity of an income shock in retirement to be -0.03. Second, we demonstrate that the income shock has no impact on the health of pensioners. While this is consistent with existing literature documenting a lack of health effects associated with income changes among older individuals in western countries, we are the first to show that this also holds for pensioners.

The results from this analysis have important policy implications. First, the almost perfectly inelastic labor response of pensioners demonstrates that policies that alter the income of pensioners in retirement will be ineffective in inducing them to return to work. Second, the lack of health effects suggests that the negative externalities associated with the ABM approach of insuring public pension systems may be small. At the height of a global crisis where markets are crumbling and pension funds rapidly are losing value, these results may be particularly important.

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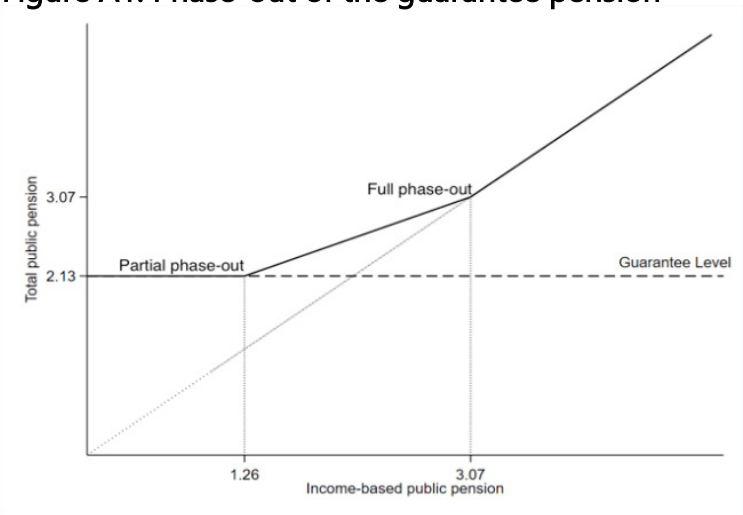
Appendix

Table A1. Descriptive statistics

	Non-treated	Partly treated	Fully treated
2005			
Employed	0.096	0.202	0.298
	(0.294)	(0.401)	(0.457)
Earnings (1 000 SEK)	5.377	21.308	50.079
	(24.287)	(56.928)	(104.947)
GP visits	1.268	1.408	1.323
	(2.672)	(3.246)	(3.708)
Hospital visits	0.259	0.243	0.209
	(0.932)	(0.891)	(0.746)
Prescriptions	4.468	4.693	3.773
	(4.969)	(4.804)	(4.095)
2011			
Loss	-0.14 %	-3.82 %	-7.04 %
Employed	0.003	0.014	0.030
	(0.058)	(0.119)	(0.171)
Earnings (1 000 SEK)	0.021	0.211	0.655
	(0.380)	(4.634)	(0.908)
GP visits	2.057	2.062	2.032
	(6.171)	(5.187)	(5.533)
Hospital visits	0.072	0.039	0.030
	(0476)	(0.295)	(0.256)
Prescriptions	7.794	7.822	6.784
	(6.943)	(6.551)	(5.883)
N	879	16 556	22 326

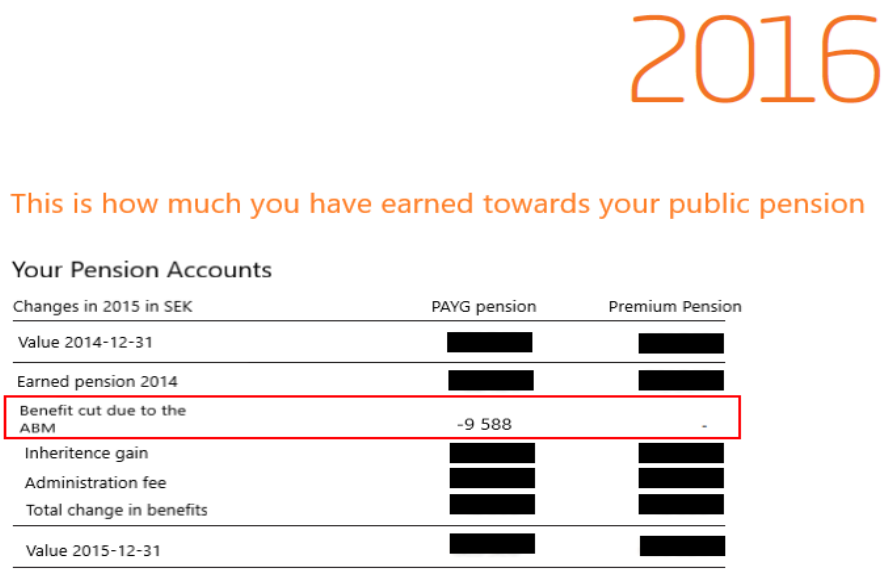
Notes: The table presents summary statistics for our main sample of pensioners by treatment status. The sample consists of single men and women aged 65 to 74 who were full-time retired prior to the ABM-activation in 2010. Data come from population-wide administrative registers collected by Statistics Sweden and the Swedish Pension Authority.

Figure A1. Phase-out of the guarantee pension



Notes: The figure plots total public pension by PAYG public pension ("income-based public pension"), illustrating the partial and full phase out of the guarantee pension. The axes measure pension benefits in basic amounts in the Swedish pension scheme. In 2009, one basic amount was equivalent to SEK 42,800 ($4430).

Figure A2. Salience of the ABM


2016

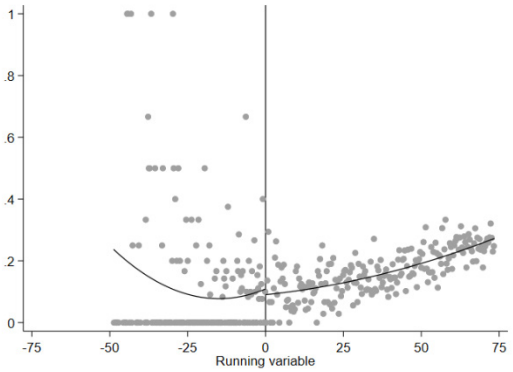
This is how much you have earned towards your public pension

Your Pension Accounts

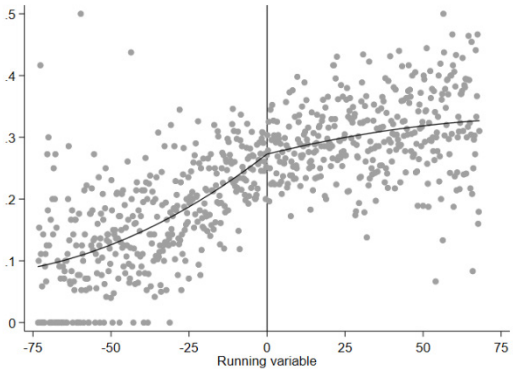
Changes in 2015 in SEK	PAYG pension	Premium Pension
Value 2014-12-31	[redacted]	[redacted]
Earned pension 2014	[redacted]	[redacted]
Benefit cut due to the ABM	-9 588	-
Inheritence gain	[redacted]	[redacted]
Administration fee	[redacted]	[redacted]
Total change in benefits	[redacted]	[redacted]
Value 2015-12-31	[redacted]	[redacted]

Notes: The figure provides a visual illustration of the pension summary in the orange envelope sent to each individual in Sweden with pension holdings. The depiction is taken from the 2016 report, but similar summaries where provided in the other years.

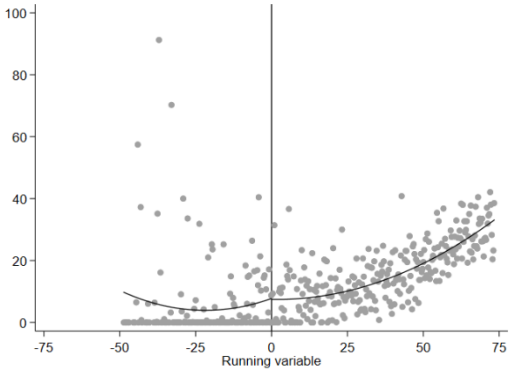
Figure A3. Balance check, employment and earnings in 2005.



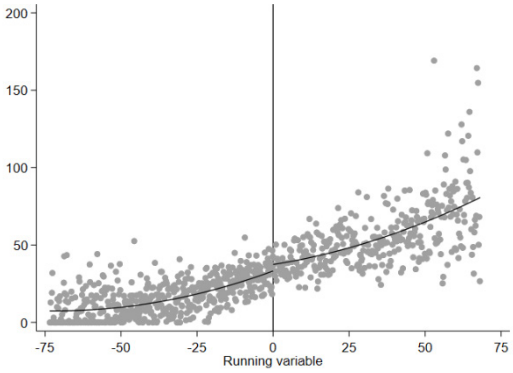
a) Employment, partly vs non-treated



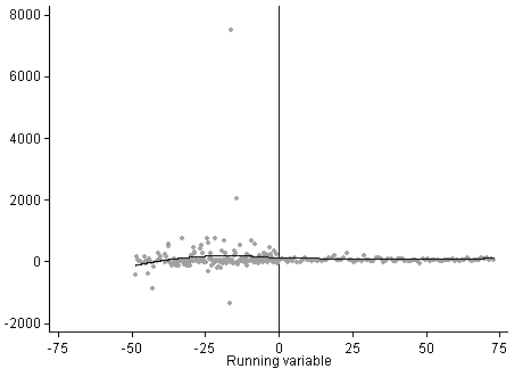
b) Employment, fully vs partly treated



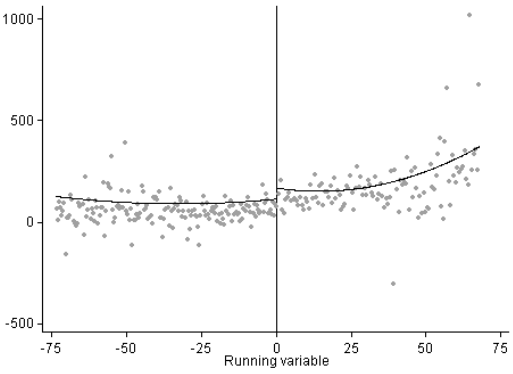
c) Earnings, partly vs non-treated



d) Earnings, fully vs partly treated



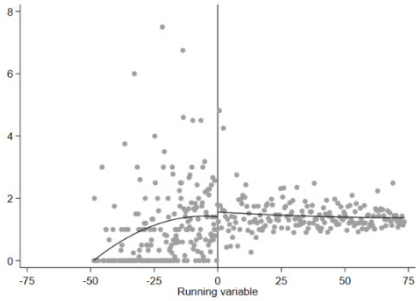
e) Wealth, partly vs non-treated



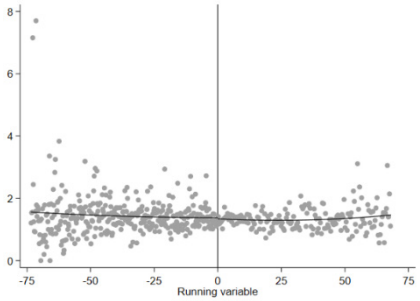
f) Wealth, fully vs partly treated

Notes: The x-axes in all panels measure the distance (in 1 0000 SEK) from the relevant phase-out threshold of the guarantee pension. Panel a) plots employment (labor earnings > 0) in 2005 for partly versus non-treated pensioners; Panel b) plots employment (labor earnings > 0) in 2005 for fully versus partly treated pensioners; Panel c) plots earnings (in 1 000 SEK) in 2005 for partly versus non-treated pensioners; Panel d) plots earnings (in 1 000 SEK) in 2005 for partly versus non-treated pensioner. Panel e) plots net wealth (in 1 000 SEK, minus real estate) in 2005 for partly versus non-treated pensioners; Panel f) plots net wealth for fully versus partly treated pensioners The sample consists of single men and women aged 65 to 74 who were full-time retired prior to the ABM-activation in 2010. We drop pensioners in the donut holes discussed in Section 3, who are mechanically moved from one group to another in response to ABM activation. Data come from population-wide administrative registers collected by Statistics Sweden and the Swedish Pension Authority.

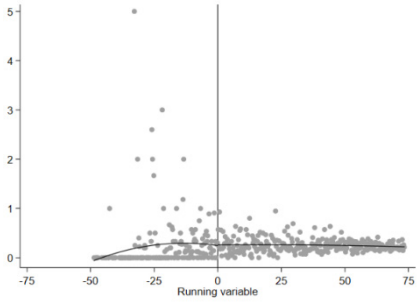
Figure A4. Balance check, health outcomes in 2005.



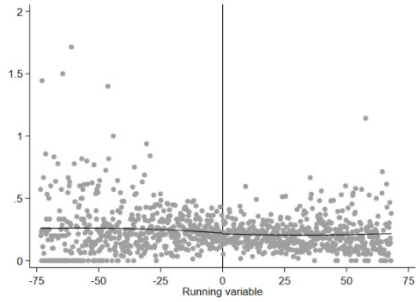
A) GP visits, partly vs non-treated



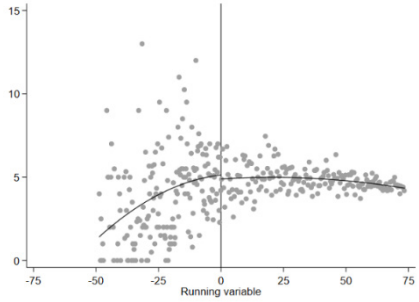
B) GP visits, fully vs partly treated



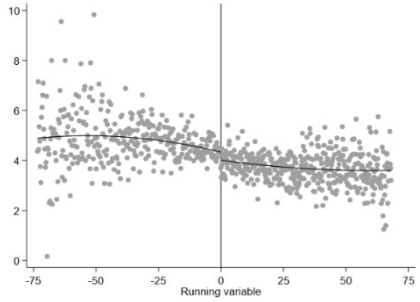
C) Hospital visits, partly vs non-treated



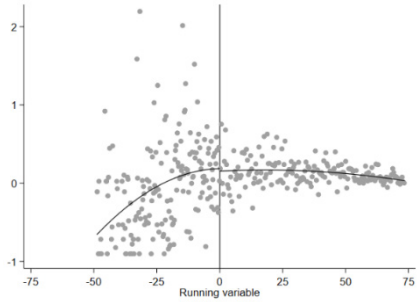
D) Hospital visits, fully vs partly treated



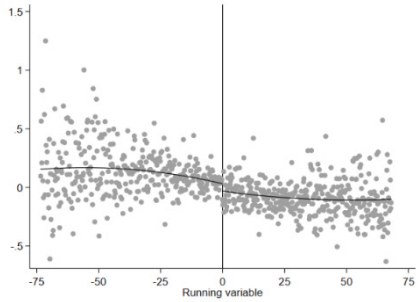
E) Prescriptions, partly vs non-treated



F) Prescriptions, fully vs partly treated



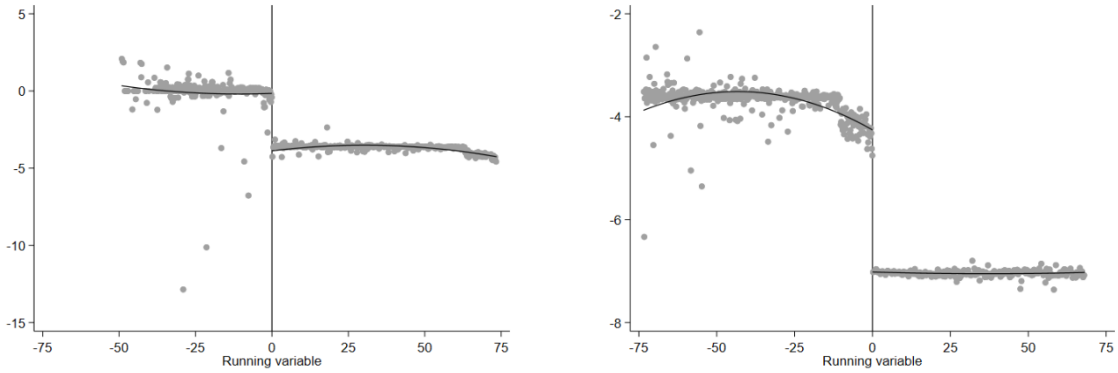
G) Health index, partly vs non-treated



H) Health index, fully vs partly treated

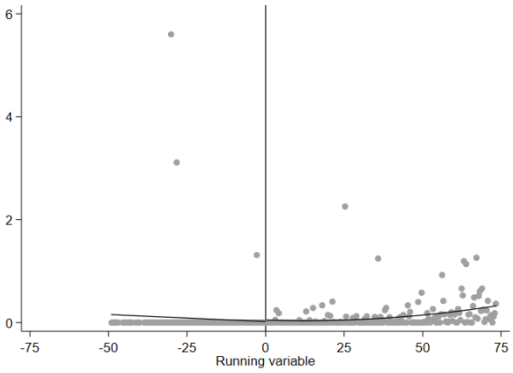
Notes: The x-axes in all panels measure the distance (in 1 0000 SEK) from the relevant phase-out threshold of the guarantee pension. Panel A) plots GP visits in 2005 for partly versus non-treated pensioners; Panel B) plots GP visits in 2005 for fully versus partly treated pensioners; Panel C) plots hospital visits in 2005 for partly versus non-treated pensioners; Panel D) plots hospital visits in 2005 for fully versus partly treated pensioners; Panel E) plots prescriptions in 2005 for partly versus non-treated pensioners; Panel F) plots prescriptions in 2005 for fully versus partly treated pensioners; Panel G) plots a composite health index (consisting of prescriptions and hospital and GP visits) in 2005 for partly versus non-treated pensioners; Panel H) plots a composite health index (consisting of prescriptions and hospital and GP visits) in 2005 for fully versus partly treated pensioners. The sample consists of single men and women aged 65 to 74 who were full-time retired prior to the ABM-activation in 2010. We drop pensioners in the donut holes discussed in Section 3, who are mechanically moved from one group to another in response to ABM activation. Data come from population-wide administrative registers collected by Statistics Sweden and the Swedish Pension Authority.

Figure A5. RD plots for Loss and Earnings in 2011

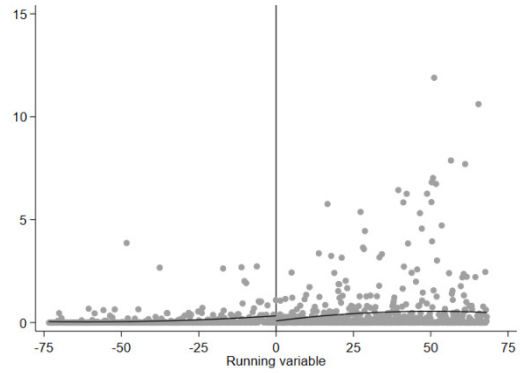


A) Loss (%), partly vs non-treated

B) Loss (%), fully vs partly treated



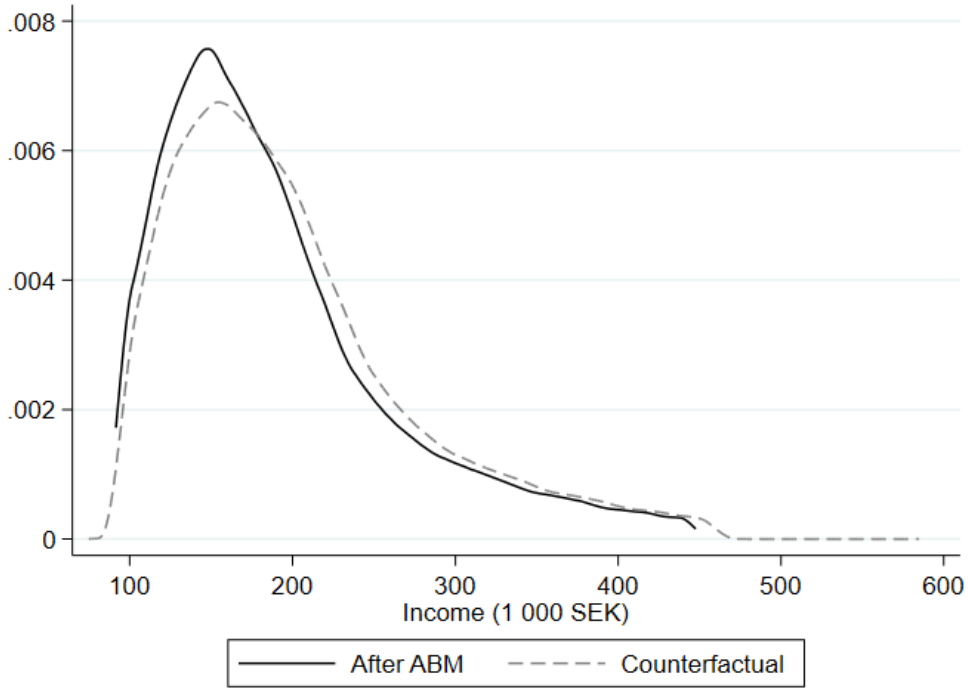
C) Earnings (%), partly vs non-treated



D) Earnings (%), fully vs partly treated

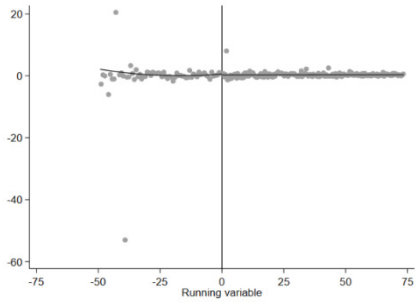
Notes: The x-axes in all panels represent the distance (in 1 0000 SEK) from the relevant phase-out threshold of the guarantee pension. Panel A) plots public pension income loss in 2011 as a percent of total public pension received in 2009 for partly versus non-treated pensioners; Panel B) plots public pension income loss in 2011 as a percent of total public pension received in 2009 for fully versus partly treated pensioners; Panel C) plots earnings in 2011 in percent of total public pension received in 2009 for partly versus non-treated pensioners; Panel D) plots earnings in 2011 in percent of total public pension received in 2009 for partly versus non-treated pensioners. The sample consists of single men and women aged 65 to 74 who were full-time retired prior to the ABM-activation in 2010. We drop pensioners in the donut holes discussed in Section 3, who are mechanically moved from one group to another in response to ABM activation. Data come from population-wide administrative registers collected by Statistics Sweden and the Swedish Pension Authority.

Figure A6. Income Distribution and Inequality

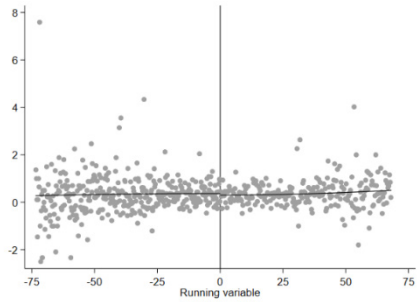


Notes: The solid line shows the 2011 income (the sum of pension, employment and capital income) distribution among all individuals in Sweden who were full-time pensioners in 2009, the year prior to the activation of the ABM. The dashed line shows the counterfactual 2011 income distribution that would have existed had the ABM not been activated. Data come from population-wide administrative registers collected by Statistics Sweden and the Swedish Pension Authority.

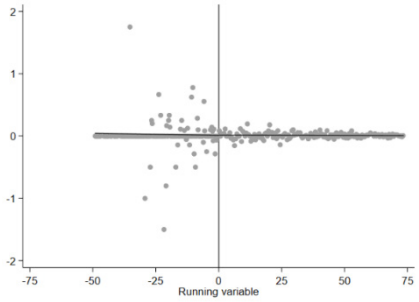
Figure A7. RD-DiD plots for GP visits, hospital visits, Prescriptions, and health index in 2011 relative to 2009.



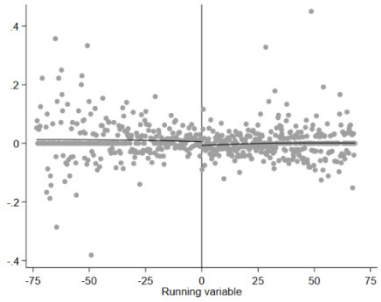
A) GP visits, partly vs non-treated



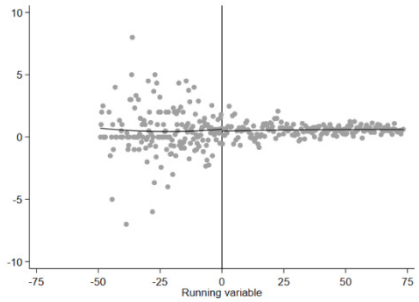
B) GP visits, fully vs partly treated



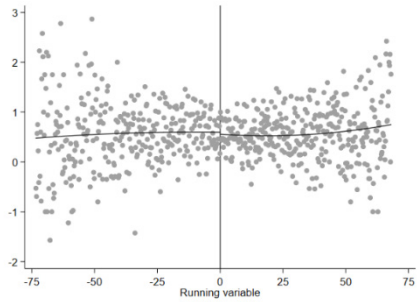
C) Hospital visits, partly vs non-treated



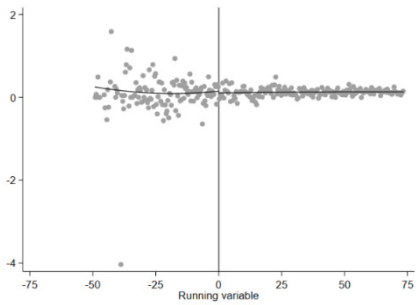
D) Hospital visits, fully vs partly treated



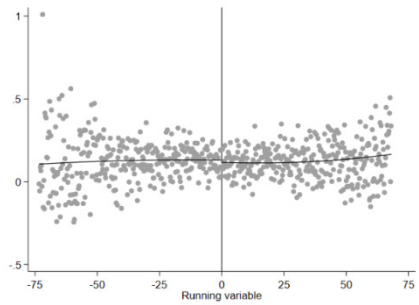
E) Prescriptions, partly vs non-treated



F) Prescriptions, fully vs partly treated



G) Health index, partly vs non-treated



H) Health index, fully vs partly treated

Notes: The x-axes in all panels measure the distance (in 1 0000 SEK) from the relevant phase-out threshold of the guarantee pension. Panel A) plots the change in GP visits from 2009 to 2011 for partly versus non-treated pensioners; Panel B) plots the change in GP visits from 2009 to 2011 for fully versus partly treated pensioners; Panel C) plots the change in hospital visits from 2009 to 2011 for partly versus non-treated pensioners; Panel D) plots the change in hospital visits from 2009 to 2011 for fully versus partly treated pensioners; Panel E) plots the change in prescriptions from 2009 to 2011 for partly versus non-treated pensioners; Panel F) plots the change in prescriptions from 2009 to 2011 for fully versus partly treated pensioners; Panel G) plots the change in a composite health index (consisting of prescriptions and hospital and GP visits) from 2009 to 2011 for partly versus non-treated pensioners; Panel H) plots the change in a composite health index (consisting of prescriptions and hospital and GP visits) from 2009 to 2011 for fully versus partly treated pensioners. The sample consists of single men and women aged 65 to 74 who were full-time retired prior to the ABM-activation in 2010. We drop pensioners in the donut holes discussed in Section 3, who are mechanically moved from one group to another in response to ABM activation. Data come from population-wide administrative registers collected by Statistics Sweden and the Swedish Pension Authority.