The Effect of Negative Income Shocks on Pensioners

*By Julian V. Johnsen and Alexander Willén**

April 2022

Abstract

This paper provides the first evidence on the labor supply response to negative income shocks among full-time retirees, exploiting an institutional feature that caused differential and unexpected income losses among otherwise identical individuals in a sharp regression discontinuity design. We conclude that full-time retirees do not return to work despite losing a meaningful share of their annual income. Specifically, we can rule out response elasticities larger than 0.051. This precisely estimated null effect also extends to retirees who have limited savings, who face little demand-side obstacles to reentering the labor force, and to younger individuals who just recently entered retirement. The paper further shows that the negative income shock had no impact on the health of pensioners as measured by their utilization of the health care system. The lack of an employment and health care utilization response suggests that a reduction in benefit levels may have little impact on individuals in our context. At the height of an ongoing global crisis in which public pension funds are rapidly losing value, these results are particularly important.

JEL Codes: I38, J14, J26

Keywords: Labor Supply, Health, Pension Policy, Retirement

* Johnsen: SNF - Center for Applied Research at NHH (e-mail: julian.johnsen@snf.no). Willén: Department of Economics, Norwegian School of Economics (e-mail: alexander.willen@nhh.no). This work was partially supported by the Research Council of Norway through its Centers of Excellence Scheme (Project no. 262675) and by the Institute for Evaluation of Labor Market and Education Policy (Project no. 170/2018). Sepanta Sharafuddin provided excellent research assistance. Address both authors: Department of Economics, Norwegian School of Economics, Helleveien 30, 5045 Bergen, Norway.

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). However, while there is a rich literature examining the impact of financial incentives on workers' decision to *delay retirement* (e.g., Laun 2017; Malkova 2020; Haller 2021), there is no evidence on the effect of financial incentives on pensioners' decision to unretire and *re-enter the labor force.*

In light of increasing efforts to activate the older population, understanding how full-time retirees 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). Thus, 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. However, a lack of exogenous variation in pension income among full-time retirees has prevented previous literature from examining the relationship between income and pensioners' decision to unretire.

In this paper, we overcome this obstacle by exploiting a feature of the Swedish pension system that caused differential and unexpected benefit cuts among otherwise identical pensioners in a regression discontinuity design. This allows us to provide the first estimates in the literature on the labor supply response to income shocks among full-time retirees. Understanding the labor supply behavior of fully-retired individuals is of independent interest and provides important insights on labor supply decisions across the lifecycle. In addition, it provides vital guidance to policymakers tasked with adapting current pension systems in face of ongoing demographic changes.

The feature of the pension system that we exploit is known as the automatic balancing mechanism (ABM). The ABM automatically ensures the solvency of the public pension system by tying pension payouts to the ratio of assets to liabilities in the system. When this ratio drops below one, 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 – including Canada, Germany, and

[1] Since the early 2000s, all OECD countries have reformed parts of their pension systems at least once (OECD 2013).

Japan– have introduced elements of this mechanism into their pension systems. As this feature is becoming increasingly integrated into pension systems around the world, understanding its effect on pensioners is crucial.

The Swedish pension system fell out of balance for the first time in 2010. Consequently, the ABM activated and cut pension benefits. The ABM remained in effect until 2018, and between 2010 and 2018 almost $7.8 billion was lost in pension benefits.[2] This is equivalent to total public expenditure on health care and social welfare by the national government in any given year (2018/19:SoU1). The largest loss occurred in 2011, in which already retired individuals lost between 0 and 7 percent of their total annual pension benefits. This loss is equivalent to more than 9 months of the average pensioner's total food consumption in that year (MinPension 2020). Importantly, this is a sizable benefit change compared to other international pension benefit reforms,[3] and therefore represents an ideal setting for studying the labor supply response of retirees to income shocks.[4]

By lowering pension benefits, the ABM unintentionally incentivizes pension-eligible workers to remain in the labor force, and retired pensioners to return to work. We use rich population-wide administrative data to examine how this shock affected the labor market behavior of individuals who had left the labor force and entered full-time retirement prior to the activation of the ABM. While institutional restrictions prevent us from studying the impact of the shock on older workers' decision to delay retirement, 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).[5] The causal effect of adverse income shocks on individuals' decision to unretire, however, has to the best of our knowledge never been examined before. Importantly, retirement is not an absorbing state— between 6 and 14 percent of retirees reverse their retirement decision after having exited the labor force in Sweden

[2] 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.

[3] As an example, the large Austrian's pension reform in 1988 reduced average benefits with 5 percent, and none of the OECD pension reforms over the last decade have reduced benefits with more than 7 percent on average.

[4] We believe that this represents an ideal setting for studying the labor supply response of retirees to income shocks for two reasons. First, compared to other international pension reforms, this is a large pension benefit cut, and if we do not find any labor response to this shock we would not plausibly expect it in other settings. Second, if we do not find any labor response among retirees from this income shock, it means that pension benefits need to be cut much more to induce a meaningful amount of full-time retirees to re-enter the labor market. This means that it may not be a politically feasible policy lever in many contexts. Thus, the current setting allows for an examination of the labor supply response of retirees to income shocks at a margin that is relevant for current policy debates.

[5] 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.

(Pettersson 2014), and more than 26 percent of retirees do the same in the US (Maestas 2010). Pettersson (2014) also shows that higher pension benefits are negatively correlated with unretirement. This implies a potentially important role for financial incentives in altering the unretirement behavior of individuals, and understanding the causal link between unretirement and financial incentives is therefore of great independent value.

We use a regression discontinuity design, leveraging the fact that the magnitude of the shock changes discontinuously at pre-specified thresholds in the pension scheme. Specifically, pensioners 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 income losses ranging from 0 percent to 7 percent of their annual pension benefits. We exploit these discontinuities (each corresponding to a loss of approximately 3.5 percent of their annual pension benefits) to examine the impact of negative income shocks on the labor market outcomes of pensioners who had left the labor force and entered full-time retirement prior to the ABM. We also conduct a detailed analysis on the effect of the income shock on the health of the affected individuals, proxied by their utilization of the health care system. This is motivated in part by existing evidence on a positive relationship between income and health, and in part by the idea that any potential unretirement behavior among retirees may translate into worsened health. To correctly identify the value of the running variable required for our RD design, the baseline analysis is restricted to single households with no private pension insurance. In Section 6, we show that including individuals with private pension insurance, or restricting the sample to married individuals, has no impact on the results.

The main contribution of our paper is to provide novel evidence on the labor supply of already retired individuals. This is a difficult question to address empirically, because the political cost of cutting benefits for already retired individuals is extremely high. There is therefore very little plausibly exogenous variation in benefit cuts among the retired population. To the best of our knowledge, this is the first paper in the literature to examine the labor supply of already retired individuals, and the first paper to provide an estimate of the income elasticity of the retired population. However, there are several relevant strands of literature that have explored the impact of financial and other retirement incentives among older (non-retired) workers.

First, there is a rich and growing literature examining 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 identified effects on the extensive margin as well (e.g. Gelber et al. 2020b). However, the AET provides a marginal incentive (a change in the net-of-tax rate, i.e. the marginal gain from additional earnings), and has no income effect for full-time retired individuals. This policy can therefore not be used to examine the labor supply of already retired individuals. In contrast, the Swedish ABM creates a pure income effect for full-time retired individuals, providing us with an ideal setting for exploring the relationship between income and unretirement.

More broadly, the paper contributes to the literature on financial incentives and retirement behavior (e.g., Jensen and Richter 2004; Snyder and Evans 2006; Coile and Gruber 2007; Behaghel and Blau 2012; Chetty et al. 2013; Brown 2013; Johansson et al. 2016; Manoli and Weber 2016; Laun 2017; Malkova 2020; Seibold 2021; Haller 2021). These papers exploit exogenous variation in tax rates and pension benefits 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 very similar magnitude to those studied in this paper. For example, Snyder and Evans (2006) exploits a social security notch that generated a four 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] However, recent papers in this literature also suggest that responses to purely financial incentives may have more modest effects, especially compared to the influence of reference ages (Behaghel-Blau 2012; Manoli-Weber 2016, 2018; Seibold 2021). Responses may therefore be smaller, or even zero, for already-retired individuals. The distinct contribution of our paper is to examine how pensioners that have exited the labor force respond to negative income shocks, something that cannot be identified in these papers.

Finally, the paper contributes to the literature on unearned income effects in labor supply more generally, where evidence is limited and based on specific contexts, such as winning a lottery (e.g., Imbens et al. 2001; Lindahl 2005; Cesarini et al. 2017). This literature finds modest reductions in labor supply as a result of increased unearned income. However,

[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).

none of these have been able to isolate the effects of income shocks on existing retirees. Studying full-time retirees is of great independent interest, not only because their behavior likely differs from working individuals for many reasons, but also because it represents a particularly vulnerable group that cannot adjust their labor market behavior on the intensive margin.

We provide two sets of key results. First, we estimate precise null effects of the income shock on the labor market outcomes of full-time retirees, and conclude that pensioners in retirement do not return to work despite losing a meaningful share of their annual income. Specifically, we can rule out response elasticities larger than 0.051 at the 95 percent confidence level. Importantly, this precisely estimated null effect extends to retirees who have limited savings (proxied by wealth and lack of private pension savings), who face little demand-side obstacles to reentering the labor force (proxied by the local unemployment rate), who recently entered full-time retirement, and to the youngest age cohorts in our sample. The lack of an employment response is an interesting result given existing studies which have used considerably smaller-sized income shocks to identify meaningful labor supply responses among workers. For example, Haller (2021) studies pension reforms in Austria that generated a 1.25 percent reduction in future benefits, and finds that this 1.25 percent change in benefits leads to an increase in employment at age 60 of around 10 percent. Mullen and Staubli (2016) examines a series of disability insurance reforms in Austria, some of which led to no more than a 1 percent change in disability insurance benefits, and finds significant increases in disability insurance claiming. Snyder and Evans (2006) find that a four percent change in annual income caused individuals to delay retirement.[7] These papers illustrate that financial incentives of smaller or similar magnitudes to those examined in the current paper have been shown to alter the labor market behavior of individuals in meaningful ways. While we acknowledge that the above studies have focused on individuals of working age rather than on retirees, we believe that it is of great independent value to understand whether individuals who have left the labor force and entered retirement are equally responsive to such shocks. Specifically, it helps us better understand the relationship between financial incentives and unretirement, and how large financial shocks may have to be in order to induce extensive margin response among retirees.

[7] A final example is Gelber et al. (2020b), who 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 that of the ABM, the total loss in annual income induced by the AET is comparable to that generated by the ABM.

Our second key result is that the negative income shock has no effect on the health of retirees, as measured by health care utilization. While this is consistent with papers documenting a lack of health effects associated with income changes among older individuals (e.g. Adams et al. 2003; Lindahl 2005; Michaud and van Soest 2008), we are the first to show that this also holds for retired pensioners – a group of individuals who cannot respond to income shocks along the intensive margin of labor supply.

In terms of contextualizing our findings, Sweden is located in the middle of the OECD ranking in terms of public pension generosity, slightly above the US and Canada but far below countries such as Austria and Portugal (OECD 2017). Thus, while one may expect any potential effects to be larger in settings where the baseline pension is lower, and smaller in settings where the baseline pension is higher, the Swedish setting is likely informative of similar-sized cuts in a large number of OECD countries.

The results from our 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 likely not induce them to return to work; at least not at the margin relevant to policymakers and social planners. Specifically, provided that the income shock is large enough, it will eventually force individuals to unretire. However, in terms of international comparisons, a 3.5 percent drop in pension benefits is relatively substantial. For example, Norway raised the minimum pension with $400 a year in 2020, Sweden raised public pensions with $40 per month in 2021, New York raised the contribution requirement with 3 percent following the financial crisis in 2008, and Austria has engaged in several pension reforms over the past 30 years, some of which shifted the average pension income of individuals by less than 3 percent.[8] Thus, changes to the benefit levels of existing public pension systems are oftentimes of a magnitude similar to that studied in the current paper, and studying the labor supply response to this shock is therefore of particular interest. However, we also acknowledge that retirees will respond to an income shock provided that the income shock is large enough. An interesting avenue for future research is therefore to understand how big the benefit change must be for inducing individuals to unretire, and we encourage future research on this topic.

In addition to the policy implications associated with the null result on labor market behavior, the lack of health care utilization effects suggest that the externalities associated with the ABM approach of ensuring macro-level fiscal sustainability of the pension system may be

[8] For Norway, see Norwegian Labor and Welfare Administration (2021). For Sweden, see Swedish Pension Authority (2020). For New York, see New York Assembly Bill (2012). For Austria, see Haller (2021).

small. That is, the lack of an employment and health utilization response suggest that a reduction in benefit levels may have little impact on individuals in our context while at the same time ensuring financial sustainability of the system. At the height of a global crisis where pension funds are rapidly losing value, these results may be particularly important.

The rest of the paper proceeds as follows: In Section 2, we provide detailed information on the Swedish pension system and the automatic balancing mechanism; In Section 3, we introduce the data, discuss our estimation strategy, and examine our identifying assumptions; In Section 4, we provide our main results on benefit cuts, labor market outcomes, and health utilization: In Section 5, we discuss heterogeneous treatment effects across genders, age, wealth, and prior labor force attachment; In Section 6 we explore the robustness of our results; Section 7 concludes.

2 Background

2.1 The Swedish Pension System

The Swedish pension system consists of a mandatory public pension, an occupational pension, and private savings. Historically, most of the 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 1930s 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 pensionable income) and a pay-as-you-go (PAYG) scheme with a fixed contribution rate (16% of pensionable income).[10] The PAYG benefits are based on notionally defined contribution accounts. Workers pay into the system (based on the fixed contribution rate) and build balances during their entire working lives. These balances are recorded in fictious personal accounts by the pension authority. These balances are used to calculate individuals' public PAYG pensions when they retire, which is equivalent to the total pension balance in the fictious personal account divided by an annuity divisor. This annuity divisor is based on the remaining life expectancy of the birth cohort. The modest defined contribution tier is similar to the 401(k) plans in the US.

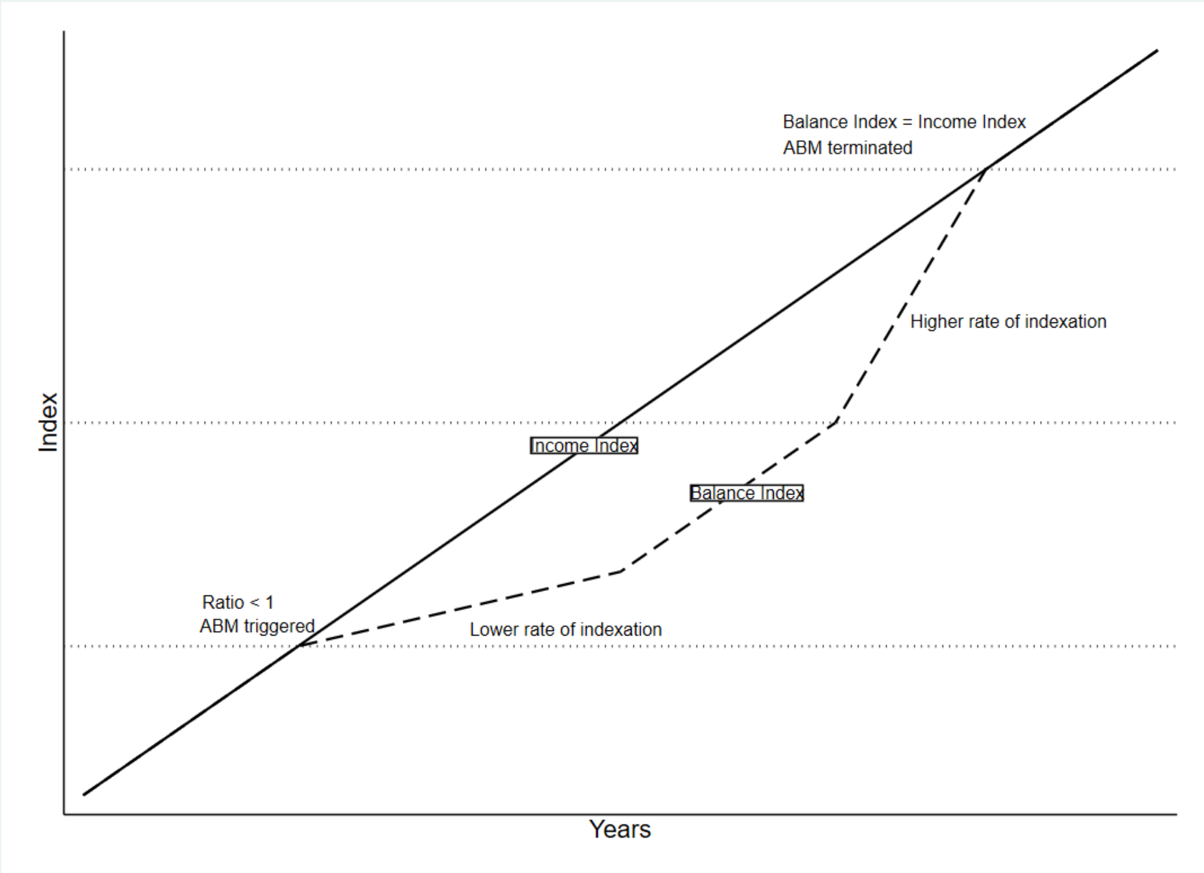
[9] For individuals in our main sample, 85 percent of total income comes from public pensions.
[10] Pensionable income consists of income from employment, income from self-employment, and taxable income from social insurance (such as unemployment benefits, parental leave benefits, and benefits for participating in active labor market policies). Pensionable income must exceed 42.3 percent of a basic amount to count towards an individual's pension. In 2009, one basic amount was equivalent to SEK 42,800 ($4430).

The means-tested guarantee pension is gradually phased-out as the PAYG benefits increase, and is crucial to our identification strategy. We discuss this in detail in Section 2.2 below. 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 each year. Individuals can only withdraw the guarantee pension once they reach the official retirement age of 65.

2.2 The Automatic Benefit-Adjustment Mechanism

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. Figure 1 illustrates how the balancing mechanism works. Note that the ABM activation can lead to a loss in real pension income.

Figure 1. The Automatic Balancing Mechanism.

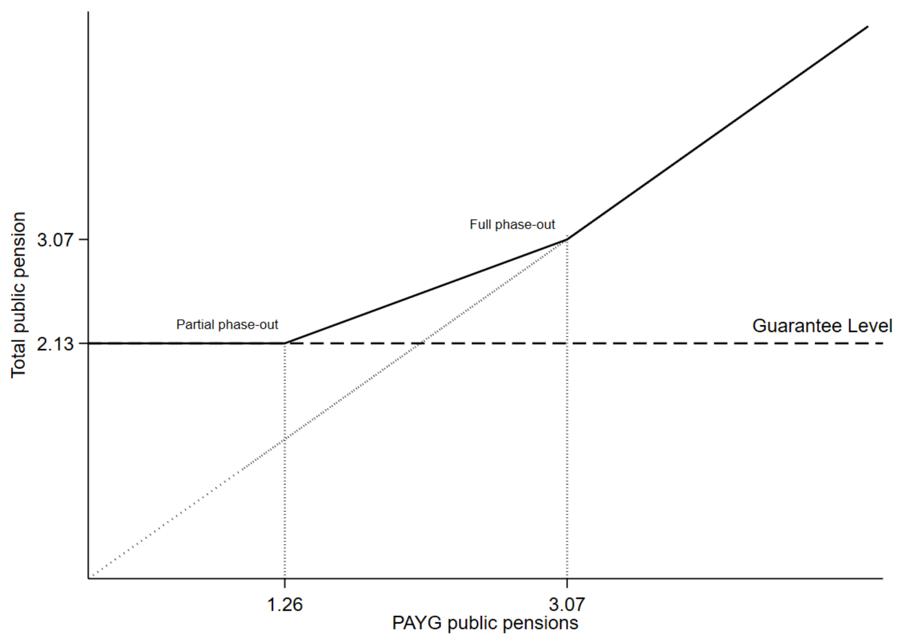


Notes: This figure illustrates how the Automatic Balancing Mechanism is implemented when the pension scheme falls out of balance.

Crucial to our research design, the ABM applies only to the PAYG scheme, and not to the guarantee pension. This 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, individuals who receive part of their pension in the form of guarantee pension will experience a partial reduction, and individuals who receive no guarantee pension will experience a full reduction.

The detailed phase-out of the guarantee pension is shown in Figure 2. The figure plots total public pension (vertical axis) by PAYG public pension (horizontal axis), and illustrates the partial and full phase out of the guarantee pension. Absent the guarantee pension, total public pension would equal the PAYG pension (the 45 degree line). However, for individuals with low amounts of PAYG pension, the guarantee pension supplements the individuals' PAYG pension, such that an individual's total public pension is considerably higher than the PAYG pension (the solid black line). The magnitude of the guarantee pension supplement changes at two distinct points, generating two kinks in the relationship between total public pension and PAYG pension.

Figure 2. Phase-out of the guarantee pension



Notes: The figure plots total public pension by PAYG public pension, illustrating the partial and full phase out of the guarantee pension. The axes measure pension benefits in basic amounts (BA) in the Swedish pension scheme. In 2009, one basic amount was equivalent to SEK 42,800 ($4430). The 45 degree line shows total public pension absent the guarantee pension. The solid black line indicates actual total public pensions which is the sum of PAYG public pensions and the guarantee pension. The guarantee pensions tops up PAYG pensions to ensure that individuals receive a minimum of 2.13 BA in total public pensions. For individuals with 1.26 BA < PAYG pensions < 3.07 BA, the guarantee pension is gradually phased out, such that each additional 1 SEK of PAYG pensions reduces guarantee pensions by 0.48 SEK. Individuals with PAYG pension > 3.07 BA, receive no guarantee pension.

The two kinks shown in Figure 2 generate two discontinuities in the percent of income lost due to the ABM in the event of activation. This occurs because even though the ABM impacts the PAYG pension, the guarantee pension ensures a minimum level of pension benefits irrespective of the ABM. The loss in PAYG pension will therefore be fully or partly compensated for among individuals who receive guarantee pensions. Individuals to the left of the first kink receive the guarantee level of pension benefits prior to ABM activation. These individuals will therefore not be affected by the activation of the ABM, as they will be fully compensated for the loss in PAYG pensions by increased guarantee pensions. Individuals above the first kink but below the second kink will experience only part of the ABM-induced pension shock: The ABM will reduce their PAYG pension, while the guarantee pension will increase in response (compare the 45 degree line and the black solid line in the area between the two kinks). For these individuals, the slope of the black solid line indicates the percent of the individuals' pre-ABM PAYG public pension that would be affected by the ABM (0.52). For individuals above the second kind, there is no guarantee pension supplement, and 100 percent of the individual's pre-ABM PAYG public pension would therefore be affected by the ABM. Note that the axes in Figure 2 measure pension benefits in basic amounts in the Swedish pension scheme. In 2009, one basic amount was equivalent to SEK 42,800 ($4430).

The discontinuities in ABM-induced pension loss that arise as a consequence of the phase-out of the guarantee pension are shown in Figure 3.[11] Individuals below the first phase-out threshold of the guarantee pension (*Non-Treated*) will not experience a cut in benefits as they receive the guarantee level of pension benefits already prior to ABM activation. Individuals between the two phase-out thresholds (*Partly Treated)* will be partly affected, as each dollar cut from the PAYG pension will only be compensated by a 0.48 dollar increase in the guarantee pension. Individuals to the right of the second phase-out threshold (*Fully Treated)* have no guarantee pension and will experience a full reduction in pension benefits.

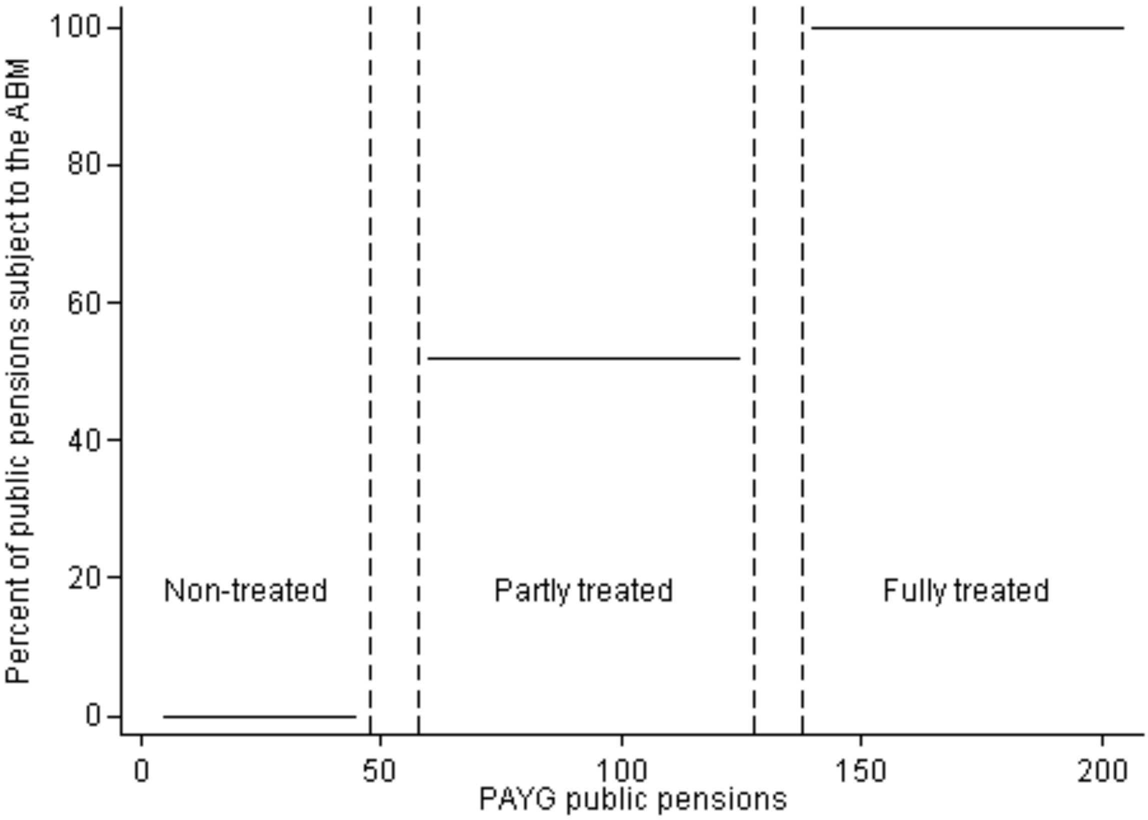
In other words, the ABM affects pensioners differently based on certain thresholds, which in turn depend on individuals' total pension balance in the fictious personal accounts that reflect life-cycle earnings and cannot be manipulated following retirement. This provides us with an ideal setting for 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 care utilization outcomes of pensioners.[12]

Although 33 percent of pensioners in Sweden receive some amount of guarantee pension (Pension Authority 2020), it is worth noting that our study population 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 we will have more statistical power to identify precise effects around the second discontinuity.

[11] A negative shock to the pension income of individuals just above the thresholds will push them below the thresholds. Thus, an individual one dollar above the lower threshold will only experience a 0.52 dollar drop in income. We eliminate these individuals from the estimation through a donut-hole RD design. See Section 3.

[12] Note that there is no discontinuity in neither the mapping of earnings history into PAYG pensions or the tax schedule through the thresholds.

Figure 3. The discontinuous exposure to ABM-induced income losses.



Notes: This figure 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 x-axis measures PAYG public pension in 2009 (000s SEK). 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.

2.3 The ABM Activation 2010-2018

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 is a substantial amount, equivalent to the annual expenditure on health care and social welfare by the national government in any given year (2018/19:SoU1). Figure 4 demonstrates the average individual loss over the full period of ABM activation. The grey line represents the public pension that would have been received in the absence of ABM activation and the black line represents the public pension actually received.

The largest loss occurred in 2011, in which already retired individuals lost between 0 and 7 percent of their total annual pension benefits (the average pensioner lost approximately $1100 in annual income this year). This substantial loss is equivalent to more than 9 months of the average pensioner's total food consumption in that year (MinPension 2020), and we rarely see larger pension cuts in international comparisons.

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 ABM activated 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).

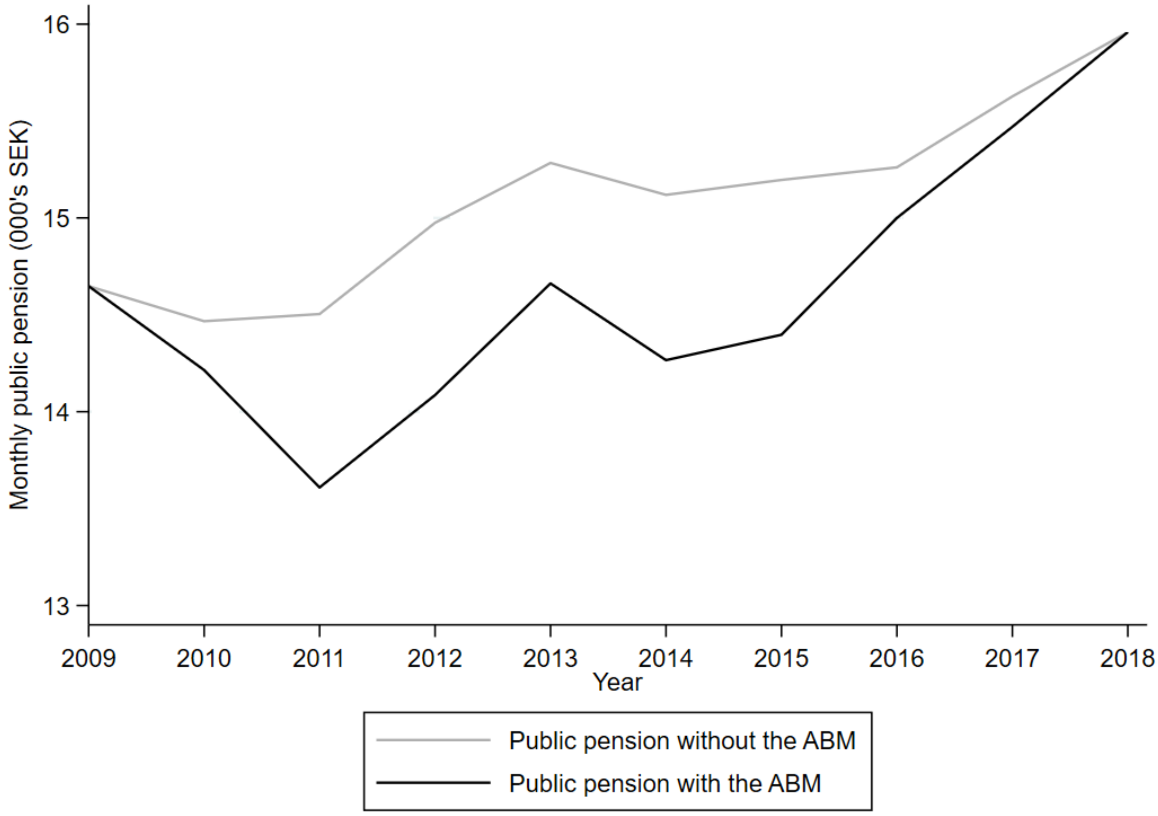
Once the ABM got activated in 2010, pensioners quickly realized that the reduction in pension payouts would be of a more persistent nature.[13] The largest pension union in the country began pushing for a reform of the ABM already in 2011, anticipating that the reduced payouts would persist for several years. The union also established a website on which seniors could calculate their future expected loss based on relatively modest assumptions.[14] In addition, several media outlets reported, as early as 2010, that the ABM likely would hit pensioners a number of times in the foreseeable future (e.g. GP 2010, 2011; Avanza 2011; SR 2011; SvD 2013). Finally, the Swedish government distributes a yearly pension report to every resident containing exact information on pension loss caused by ABM activation (Appendix Figure A1). This report includes a discussion of the expected development of the pension fund, and the post-2010 reports made clear that a prolonged benefit cut period was expected. Ultimately, the shock lasted for 8 full years. While this is not a permanent shock, 8 years correspond to almost 50 percent of the remaining life expectancy of the individuals in our sample as measured prior to the shock. 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.

---

[13] At the same time, there is little evidence to suggest that the activation of the ABM was anticipated 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, did it become clear how the ABM would affect pensions in 2010. We therefore find it highly unlikely that there was perfect foresight and perfect information such that retirees would have been able to incorporate the ABM shock into their optimization problem when they decided to retire in 2008.

[14] http://www.pensionsbromskalkylatorn.se/

Figure 4. Average income losses due to the ABM over the period 2010 to 2018.



Notes: This figure 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.

3 Data and Method

3.1 Data

We rely on population-wide administrative data drawn from several registries of the Institute for Evaluation of Labour Market and Education Policy (IFAU) database, originally collected by Statistics Sweden. The first registry is the longitudinal database on education, income and employment (*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 individuals across different 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.

We focus on individuals who have entered full-time retirement prior to the activation of the ABM, restricting the sample to individuals aged 65 to 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. We condition on retirement in 2008 because we need to know the individuals' complete earned public pension in the year prior to ABM activation (2009) to identify which treatment group they belong to (Figure 3). If we only condition on retirement in 2009, the reported 2009 pensions will not represent their full annual pension unless they retired on January 1, and we would therefore not be able to fully identify their value of the running variable. We do not look at individuals older than 74 because the register stops tracking individuals after this age. We do not look at individuals below the age of 65 because individuals cannot withdraw the guarantee pension until age 65.

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 significant to individuals with low wealth (they cannot compensate the income loss through increased use of savings), 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. It is important to note that we focus on health care utilization, and that the mechanisms underlying health care utilization behavior is oftentimes different from those underlying an individual's general health condition. As health care services are provided free-of-charge by the Swedish state, we do not expect the income shock to drive health care utilization directly through financial constraints. Still, we acknowledge there could be other reasons for a disconnect between health care and health care utilization, and we thus encourage caution in using our health care utilization results as a proxy for general wellbeing.

To eliminates the issue of spousal responses and isolate the individual response to the shock, we restrict the sample to one-person households.[15] In addition, we exclude individuals who have private pension insurance to hone in on those who are most affected by the income shock. Finally, we eliminate retirees in the right-tail of the pension distribution and restrict the analysis to individuals that fall within the pension range shown in Figure 3.[16] We do this to ensure a balanced set of individuals across the three groups.[17] In Section 6, we show that the results are robust to relaxing all these sample restrictions.

Table 1 provides descriptive statistics on out main variables of interest by treatment groups, both in the year of the largest cut (2011) as well as a few years prior to the individuals in our sample having retired (2005).

For our main sample, almost 85% of the average individual's income comes from public pensions. The high dependence on public pensions among individuals in our sample is a consequence of the ABM disproportionately affecting low-income individuals. This observation is particularly interesting when comparing our results to those in other papers that explore changes in public pensions or welfare benefits, where such changes often make up a much smaller share of the affected individuals' total income. The focus on low-income retirees also means that only a limited set of workers have sufficient savings to absorb the negative shock induced by the ABM. Specifically, median financial wealth (i.e., wealth excluding housing) in our sample is 12,368 SEK ($1,276). This modest amount is considerably smaller than the overall average income loss induced by the ABM between 2010 and 2018; 55,000 SEK ($5,676). This descriptive statistic supports the argument that most individuals in our sample who are affected by the shock cannot resort to savings to absorb the shock, making the shock even more salient.

As shown in Figure 4, the ABM lowered pension benefits in 2010, 2011 and 2014. In our main analysis, we focus on labor market outcomes in 2011. This represents the year with the

[15] Spousal responses to pension policies have been well documented in the literature (e.g., Johnsen, Vaage and Willén 2021).
[16] The individuals who are eliminated due to this restriction are those with pension incomes greater than 208,864 SEK, 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. 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.
[17] The restrictions we impose means that our sample does not contain the full population of the birth year cohorts we study. 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. In Section 6, we show that the results are robust to relaxing all these sample restrictions.

largest shock, 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). One potential concern with focusing on 2011 is related to the *"förhöjt grundavdrag,"* a 2010 tax policy which increased the take-home pay of retirees. However, the tax cut was very modest in size, providing the average retiree in our sample with less than $150 extra in annual income. Bearing in mind that the ABM activation in 2011 led the average pensioner in our sample to lose more than $1100, and that many lost much more than this amount, this only has a modest impact on the effect. In Section 4.4, we also show cumulative effects for the entire period for which we have data (2010-2014).

Table 1. 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			
Pension 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.

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. 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:

$$PL_i = \alpha + \beta_1 Above_i + \beta_2 \mathrm{PAYG}_i + \beta_3 (Above_i * \mathrm{PAYG}_i) + \tau X_i + \varepsilon_i, \quad (1)$$

where PL_i represents the pension loss experienced by individual i in 2011 as a percent of the individual pension in the year prior to ABM activation.[18] $Above_i$ indicates whether individual i is above the threshold. $PAYG_i$ is the PAYG pension income and represents our running variable. The inclusion of the interaction term between $Above_i$ and $PAYG_i$ means that we allow the slope to be different on the two sides of the cutoff. In the result section, we demonstrate that the use of a local quadratic specification, which includes ${PAYG_i}^2$ as well as the interaction between $Above_i$ and ${PAYG_i}^2$ as additional regressors, does not alter the results.[19]

We choose common bandwidths on each side of the cutoffs based on the mean-squared error (MSE) procedure recommended by Calonico et al. (2014). We use a triangular Kernel function to construct the local polynomial estimators. The optimal bandwidth for the RD point estimator with respect to Equation (1) is 10,527 for the partly versus non-treated and 15,145 for the fully versus partly treated. However, note that all bandwidths are data-driven and therefore vary slightly with the outcomes used in the regressions. In Section 5.2, we demonstrate that our results are robust to alternate bandwidth sizes, bandwidth selection procedures, and Kernel functions.

---

[18] 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. For example, a 500 SEK reduction for an individual with 10,000 SEK in monthly benefits (a five percent reduction) is as problematic as a 1,000 SEK reduction for an individual with 20,000 SEK in monthly benefits (also a five percent reduction). If we (incorrectly) modelled the discontinuity in absolute levels, this important distinction would be overlooked. This is the motivation for focusing on percentage loss rather than absolute loss. However, our results are robust to examining absolute losses as well.

[19] In other words, we ensure that our results are robust to estimating the following equation: $PL_i = \alpha + \beta_1 Above_i + \beta_2 \mathrm{PAYG}_i + \beta_3 (Above_i * \mathrm{PAYG}_i) + \beta_4 {\mathrm{PAYG}_i}^2 + \beta_5 (Above_i * {\mathrm{PAYG}_i}^2) + \tau X_i + \varepsilon_i$. We only consider polynomials of degrees 1 and 2 given recent research that strongly discourages the use of higher-order polynomials (e.g., Gelman and Imbens 2019; Cattaneo and Titiunik 2021)

Our coefficient of interest is β_1 ,which measures the pension loss experienced by pensioners just above one of the thresholds shown in Figure 3. Since the pension loss as a percentage of the pension that the individual received in the year prior to ABM activation is fixed below and above each threshold, we do not anticipate any slope effects as measured by coefficients β_2 and β_3. The vector X_i contains gender and birth year fixed effects.

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 care utilization effects of, negative income shocks.[20] We rely on the same regression discontinuity design as above, estimating versions of Equation (1) using earnings, employment, and health outcomes as dependent variables. We inflation-adjust all values using 2009 as the base year.

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 the impact shock will be muted by an increase in their guarantee pension. 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 Figure 3, such that they now receive some guarantee pension. 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 reduced-form design discussed above, we also provide results using an alternative identification approach in which we instrument pension loss using Equation (1) as the first stage in a local linear regression approach, with the following second stage:

$$Y_i = \theta + \gamma_1 \widehat{PL}_i + \gamma_2 \text{PAYG}_i + \gamma_3 (Above_i * \text{PAYG}_i) + \tau X_i + e_i, \quad (2)$$

[20] In terms of the potential labor market response, we speculate that very few employers would allow an individual to work only for a couple of hours each month over an extended period of time – corresponding to the labor supply required to absorb the negative income shock. We therefore believe that any labor market response likely is driven by temporary short-term stints that retirees pursue for a few months to offset the negative income shock induced by the ABM.

where $\widehat{PL}_i$ is the predicted pension loss obtained through estimation of Equation (1). All other variables are defined as before. Our coefficient of interest is γ_1, which measures the effect of a 1 percent loss of public pensions on the specified outcome. When the outcome is labor earnings, this coefficient provides the response elasticity to a negative income shock. This approach, based on a fuzzy regression discontinuity design, has the benefit of directly providing our response elasticity of interest. In the result section, we demonstrate that using a local quadratic regression specification, in which we include ${PAYG_i}^2$ as well as the interaction between ${PAYG_i}^2$ and $Above_i$ as additional regressors in Equations (1) and (2), does not alter the results. Similar to our reduced-form design, our fuzzy regression discontinuity design is implemented with common bandwidths on each side of the cutoffs based on the MSE procedure recommended by Calonico et al. (2014).[21]

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. Local labor markets with low unemployment rates are more likely to experience labor shortages, which should make employers in these regions more willing to hire pensioners. In addition, as retirees with low prior labor force attachment may lack the experience and network to find a job, we also estimate our model restricting the sample to pensioners who were employed at the age of 60. Finally, full-time retirees that more recently left the labor force may be more willing and able to return in response to a negative income shock. To examine this potential effect heterogeneity, we conduct auxiliary analysis in which we (1) restrict our sample to those who retired in 2007, and (2) restrict our sample to the youngest age cohort in our sample (aged 65 in 2008).

3.3 Balance and Identifying Assumption

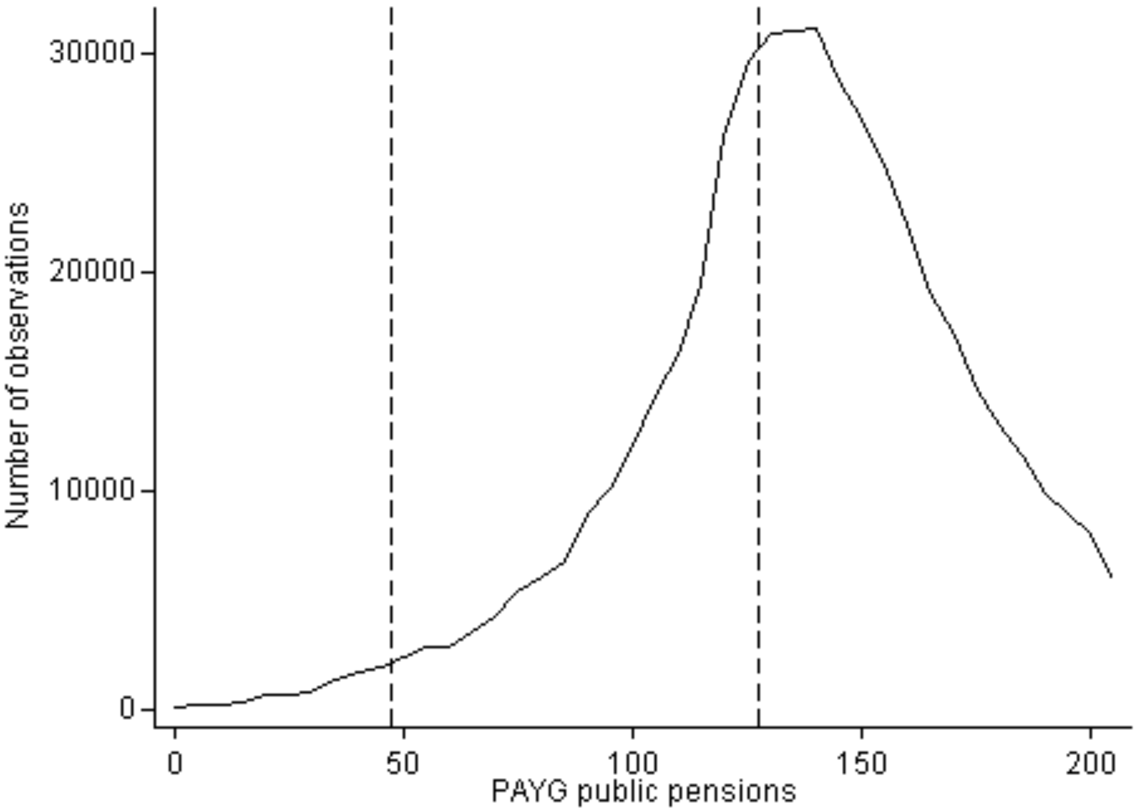
The identifying assumption underlying our Regression Discontinuity Design is that treatment assignment is as good as random around the thresholds, such that those who are just to the right of the thresholds are comparable to those who are just to the left of the thresholds. As an individual's public pension is determined by an individual's entire work history, and as our

[21] When looking at the effect of pension loss on earnings, the optimal bandwidth in the fuzzy RD design implemented by the local linear regression approach is 14,570 for the partly vs. non-treated and 11,500 for the fully vs. partly treated. However, as noted earlier, all bandwidths are data-driven and therefore vary slightly by regression outcomes. In Section 5.2, we demonstrate that our results are robust to alternate bandwidth sizes.

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 – we perform a number of exercises to obtain suggestive evidence in favor of the required assumption.

First, we verify that individuals are not manipulating treatment status by bunching on either side of the thresholds. Figure 5 shows that there are no discontinuities in the density of observations around the thresholds. Using formal density tests (McCrary, 2016; Cattaneo et al., 2020), we fail to reject the null hypothesis of no manipulation around the two thresholds (p-values of 0.292 and 0.379, respectively).

Figure 5. Density of observations.



This figure shows the number of observations by PAYG public pension (rounded to the nearest 5000 SEK) for our main sample of single-person households aged 65 to 74 who were full-time retirees in 2008 (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 examine the continuity of our outcomes through both thresholds in 2005, a few years 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 this would invalidate our empirical approach. In Table 2, we show that individuals just above the thresholds are not systematically different from those just below the thresholds (excluding individuals who fall inside the donut hole), supporting a causal interpretation of our results. For example, the results in Table 2 demonstrates that there are no discontinuous changes in the underlying determinants of the PAYG pension (earnings and employment) at the thresholds. Graphical evidence corresponding to the results in this table are provided in Appendix Figures A2 (employment and earnings) and A3 (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 2. 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)
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 more health care utilization. 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. Individuals in the donut holes, as described in Section 3, are excluded from the analysis.

With respect to our instrumental variable approach, the main underlying assumption required for causal inference is the exclusion restriction.[22] This restriction requires that for

[22] The instrumental variable approach also requires that the relevance criterion is satisfied. That is, the thresholds in the PAYG pension system must be predictive of the income loss generated by the ABM. We show that this criterion is satisfied in Section 4.

individuals close to the discontinuities, being above one of the two treatment thresholds – conditional on pre-ABM pension earnings, gender fixed effects, and cohort fixed effects – has no impact on the labor market outcomes except through the adverse ABM-induced income shock. While there is no formal test that allows us to examine this assumption in detail, we note that the results in Table 2 and Figure 5 are consistent with the notion that being just above or below the threshold has no impact on the labor market outcomes except through the adverse ABM-induced income shock. In addition, the institutional context discussed in Section 2 provides no reason to suspect that being just above one of the two treatment thresholds – conditional on pre-ABM pension earnings, gender fixed effects, and cohort fixed effects – is correlated with unobserved characteristics that also correlate with later-in-life labor market outcomes.

4 Results

4.1 Pension Income

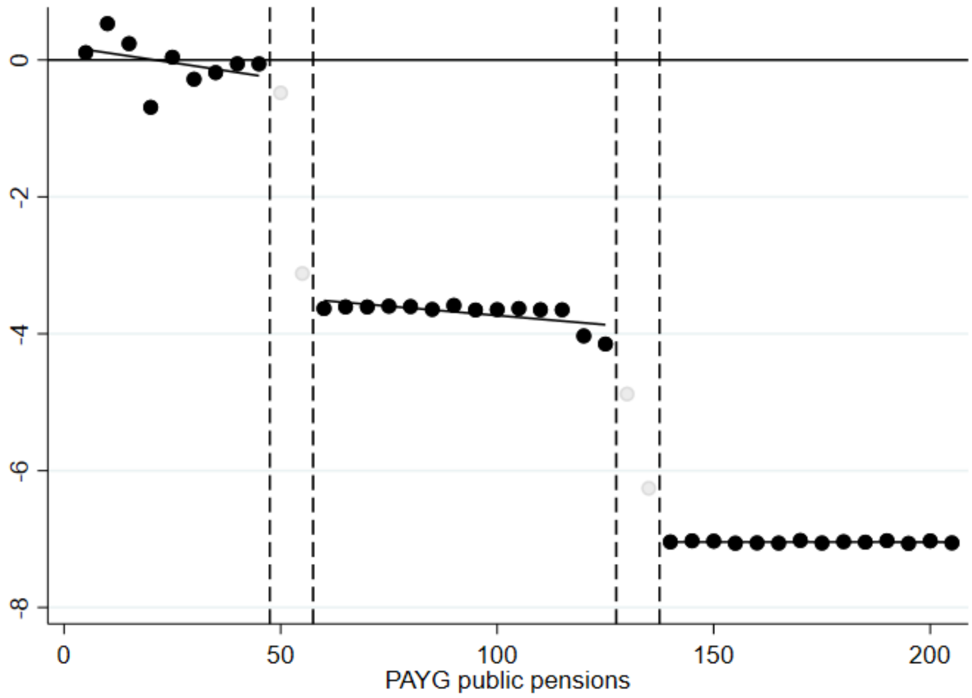
Figure 6 provides preliminary evidence on the pension loss experienced by individuals as a share of their pre-ABM PAYG pension.[23] The dots show mean loss of pension income in 2011 as a percent of the total pre-ABM pension income, grouping individuals into 5000 SEK bins by their pre-ABM PAYG pension. The dashed vertical lines represent the thresholds in the PAYG system and the corresponding donut-holes. 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 bin width of 5000 SEK.

Figure 6 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.[24] The magnitude of this drop is non-negligible. For example, according to the Swedish National Pension Authority, a 7 (3.5) percent drop in pension benefits amounts to 9 (4.5) months of the average Swedish pensioner's *annual* food spending (MinPension 2020). Thus, unless the affected pensioners spend significantly below their means, they must respond to the shock by acquiring additional income, consuming potential savings, and/or reducing consumption. In addition, as mentioned above, a number of prior studies on financial work incentives among older workers close to the normal retirement age have found significant labor

[23] Panels A and B in Appendix Figure A4 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.
[24] 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 large (e.g. Saez et al. 2012).

market effects induced by similarly-sized incentives (Snyder and Evans 2006; Mullen and Staubli 2016; Gelber et al. 2020b; Haller 2021).

Figure 6. Descriptive evidence on public pension loss.



Notes: This figure plots public pension income loss in 2011 as a percent of total public pension received in 2009. The x-axis measures PAYG public pension in 2009 (000s SEK), grouping individuals into 5000 SEK ($516) bins. The dashed vertical lines 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 Table 3 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 Figure 6. Individuals just above the first threshold experienced a 3.5 percent reduction in pension income, and individuals just above the second threshold experienced an additional 3.1 percent reduction in pension income.[25]

[25] Due to data limitations, we examine the impact on gross pension income. While the impact on net pension income is smaller as it is a non-linear transformation of gross pension income, it is important to emphasize that the other main welfare programs to individuals in full retirement in Sweden (e.g., the housing allowances for elderly), the EITC for older individuals, or the income tax for retirees, 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 counteract the effects of the ABM.

Table 3. 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. Labor supply response (RD)				
Employment	0.004	0.000	-0.001	0.000
	(0.007)	(0.003)	(0.005)	(0.006)
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. Individuals in the donut holes, as described in Section 3, are excluded from the analysis.

4.2 Labor Market Response

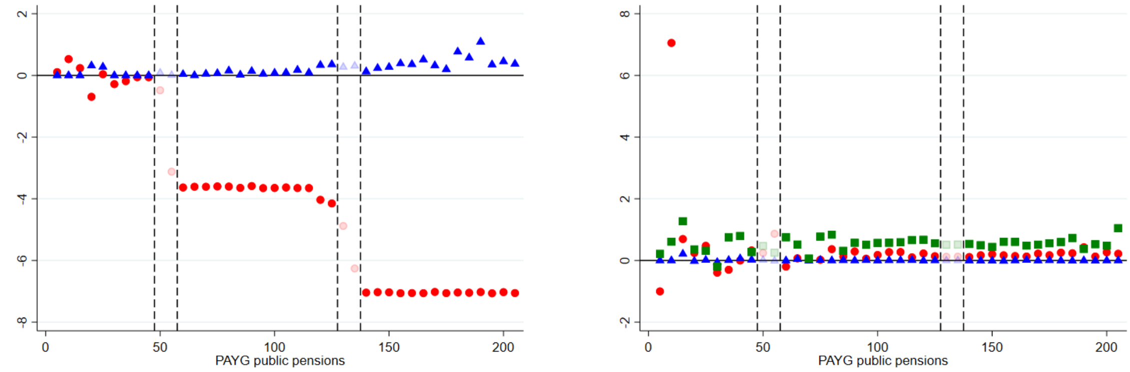
Panel A of Figure 7 plots both the pension loss and the earnings response as a percent of baseline pension income.[26] The dots show the 2009 to 2011 change in mean pension income (red) and employment earnings (blue) as a percent of the total pre-ABM pension income, grouping individuals into 5000 SEK bins by their pre-ABM PAYG pension. The dashed vertical lines represent the thresholds in the PAYG system and the corresponding donut-holes.

Panel A of Figure 7 makes clear that there is no labor market response to the pension loss, demonstrating that the negative income shocks did not induce retired pensioners to reenter the workforce. The point estimates and standard errors in Panel B of Table 3, obtained through estimation of Equation (1), provide results consistent with this figure. The standard errors we obtain are small, and our 95 percent confidence intervals allow us to reject earnings responses larger than 0.15 percent of baseline pension income. In Section 5, we study if these results apply

[26] Panels C to F in Appendix Figure A4 provides graphical evidence of the continuity in employment and earnings as a percent of baseline pension income for each of the two thresholds separately.

to all retirees in our sample, or if there is heterogeneity in the labor response across certain subgroups.

Figure 7. Descriptive evidence: Labor market response and health outcomes



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

Notes: The x-axes in all panels measure PAYG public pension in 2009 (000s SEK), grouping individuals into 5000 SEK ($516) bins. Panel A) plots public pension loss (red dots) and earnings (blue squares) in 2011 as a percent of total public pension received in 2009; and Panel B) plots GP visits (red dots), hospital visits (blue triangles), and prescriptions (green squares). The health outcomes in Panel B) 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.

In Table 4, we report estimates from the IV approach, in which we estimate the potential earnings gain as a function of the estimated pension loss. The second row provides the first estimates in the literature on the response elasticity to a negative income shock in retirement. Depending on whether we examine the discontinuity between partly vs. non-treated or fully vs. partly treated, and the functional form of the control function, this elasticity varies between -0.015 and 0.007. Our 95 percent confidence intervals allow us to rule out elasticities larger than 0.051. Our novel finding of a precise 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 4. The effect of a 1 percent public pension loss on labor market and health outcomes: Instrumenting pension loss in a fuzzy regression discontinuity design.

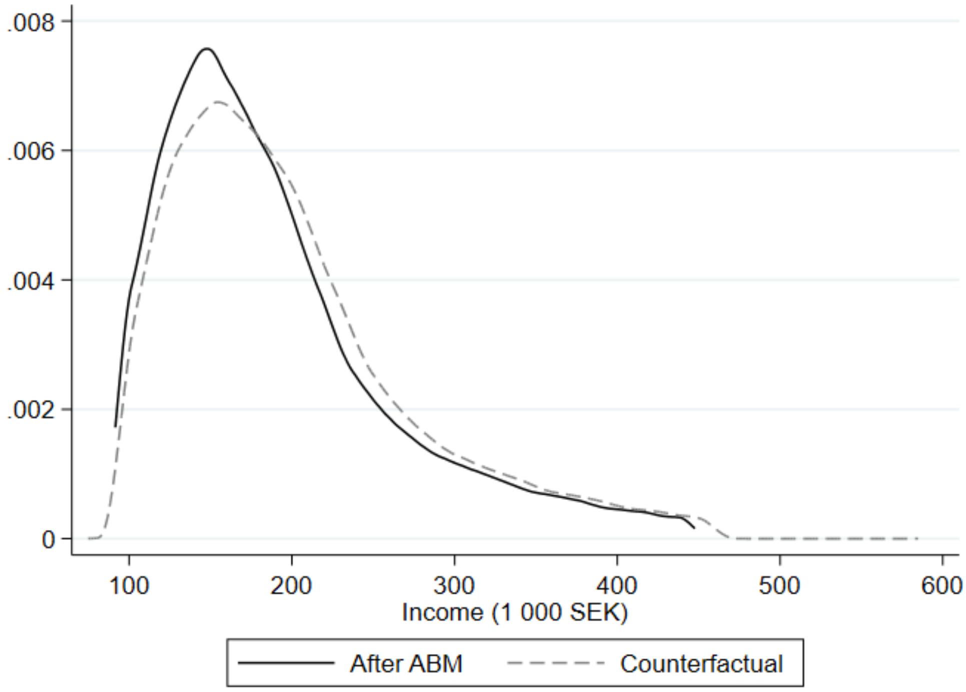
	Partly vs non-treated		Fully vs partly treated	
	(1)	(2)	(3)	(4)
Panel A. Labor supply response (RD)				
Employment	-0.000	0.002	-0.000	-0.000
	(0.002)	(0.001)	(0.002)	(0.002)
Earnings (in % of baseline pensions)	-0.015	-0.007	-0.003	0.007
	(0.027)	(0.010)	(0.036)	(0.044)
Panel B. Health outcomes (RD-DiD)				
GP visits (difference from baseline)	-0.044	0.042	-0.037	-0.035
	(0.226)	(0.287)	(0.039)	(0.060)
Hospital visits	0.009	0.009	-0.001	-0.002
(difference from baseline)	(0.010)	(0.011)	(0.003)	(0.004)
Prescriptions (difference from baseline)	0.005	-0.134	0.043	0.052
	(0.113)	(0.173)	(0.043)	(0.054)
Gender FE	✓	✓	✓	✓
Cohort FE	✓	✓	✓	✓
Linear control function	✓		✓	
Quadratic control function		✓		✓
N	17 435		38 882	

Notes: The table reports the γ_1 coefficients from Equation (2), which measure the effect of a 1 percent loss in public pension benefits on earnings (Panel A), and health outcomes (Panel B) in 2011. Pension loss is defined as total public pension loss in 2011 as a percent of total public pension in 2009, and is instrumented in a fuzzy regression discontinuity design around each discontinuity. 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. Individuals in the donut holes, as described in Section 3, are excluded from the analysis.

Given the discontinuous losses in pension income, and the lack of significant labor market responses, we investigate whether the ABM reduced income inequality among pensioners. In Figure 8, 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.[27]

[27] 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.

Figure 8. Income distribution and inequality.



Notes: The solid line shows the 2011 income (the sum of pension, labor 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.

4.3 Health Effects

Given the existing evidence on the positive relationship between income and health, the negative income shock may translate into changes in the health of retirees. To examine this in more detail, we estimate Equation (1) using the number of GP and hospital visits and the number of unique prescription drugs used by the individual as dependent variables. To facilitate interpretation of our results and better isolate the effect of the income shock on health care utilization, we investigate first-differenced health outcomes from the pre-ABM activation year (2009) to 2011. This allows us to net out any preexisting relationship between income and health care utilization.[28]

Panel B of Figure 7 shows the difference in prescriptions and GP and hospital visits from 2009 to 2011.[29] The figure shows that the negative income shock had little impact on the

[28] This is equivalent to a RD-DiD approach. However, all our results are robust to using the RD approach. These results are provided in Appendix Figure A5 and Appendix Table A1.

[29] Panels A through F in Appendix Figure A6 provides graphical evidence of the continuity in GP visits, hospital visits, and prescriptions across the thresholds.

health care utilization outcomes of pensioners: there are no visible discontinuities at the thresholds.

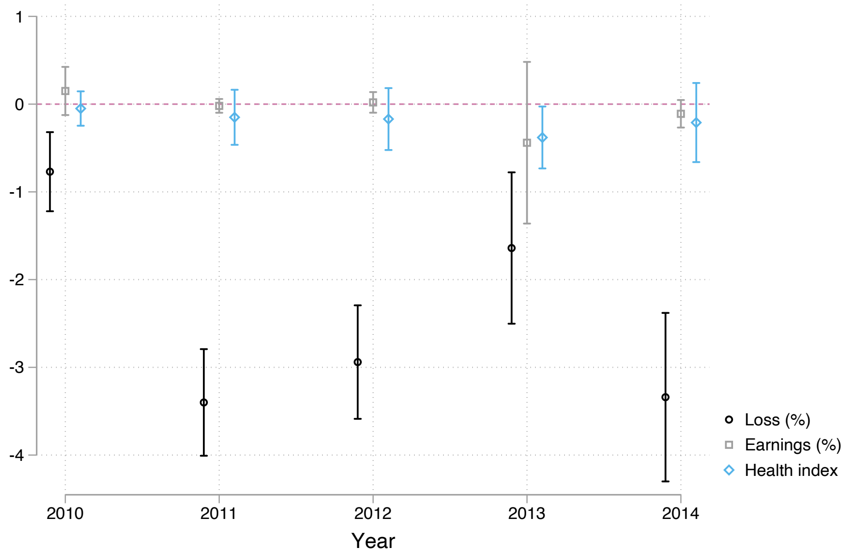
The results from estimating Equation (1) with the above health care utilization outcomes as dependent variables are shown in Panel C of Table 3, and mirror the visual evidence in Figure 7. Similarly, we find no effect of the negative income shock on health care utilization outcomes using the instrumental variable approach, as shown in rows three to five of Table 4. While this is consistent with the existing literature documenting a lack of health effects associated with income changes among older individuals (e.g., Adams et al. 2003; Lindahl 2005; Michaud and van Soest 2008), we are the first to show that this holds for full-time retirees.

4.4 Cumulative Effects

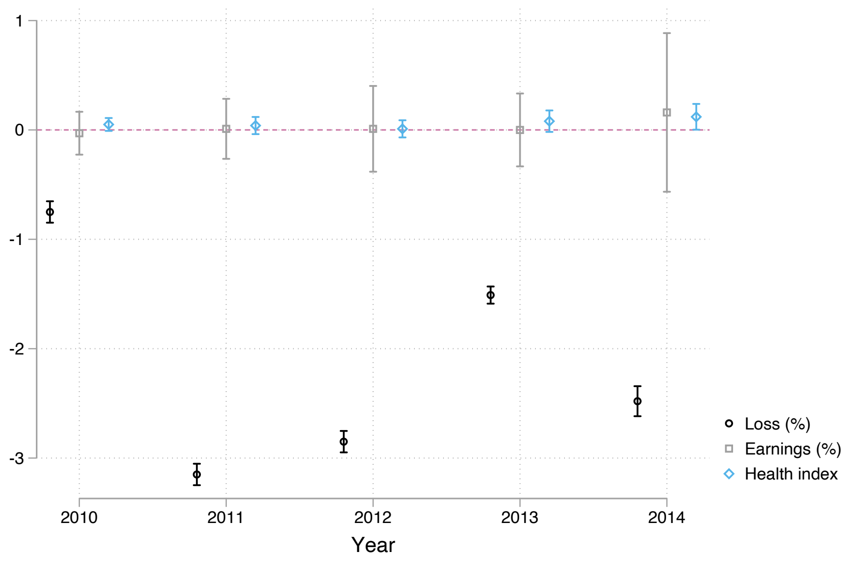
One potential reason for the lack of any economically meaningful and statistically significant labor and health effects in 2011 could be that it takes time for these effects to emerge. Specifically, returning to work might be a too costly response to a short-term income shock, but if the income loss 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 figure, we combine all health care utilization outcomes into a health index as described in Section 3. An increase in the health index represents more health care utilization.

The results from this exercise are shown in Figure 9. These results do not differ from the main estimates displayed in Table 3, and suggest that the lack of effects in our baseline analysis is not simply due to a delayed response.

Figure 9. Main results for each year, 2010 to 2014.



A) Partly vs non-treated



B) Fully vs partly treated

Notes: The figures plot 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. Individuals in the donut holes, as described in Section 3, are excluded from the analysis. Note that the drop in sample size over time is driven by individuals aging out of the register.*

5 Heterogeneity and Sensitivity

5.1 Heterogeneity Analyses

The overall effects identified in Section 4 may miss important effect heterogeneity. 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. Third, retirees may face certain demand-side obstacles, such as age discrimination. Finally, younger retirees and individuals who just recently retired may be more willing and able to return to work.

In Table 6, we show results from a number of stratifications 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; Panel E provides results for the youngest age cohort in our analytical sample.[30] Looking across the panels in Table 6, there are no systematic effects of the ABM shock on earnings or health care utilization for the different subgroups. This suggests that the results obtained in Table 3 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, age, or wealth accumulation.[31]

[30]Panels G and H in Appendix Figure A5 provides graphical evidence of the continuity in the health index outcome for each of the two thresholds.

[31] 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 6, with a point estimate of 0.17 and a standard error of 0.25.

Table 6. 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)
Employed in 2007	-0.039	0.011	0.217	0.014
(N = 1 184 / 3 652)	(0.062)	(0.522)	(0.556)	(0.099)
Panel E. By age				
Youngest cohort (aged 68 in 2011)	-0.000	-0.380	0.391	-0.112
(N = (2 892 / 5 559)	(0.000)	(0.360)	(0.295)	(0.081)
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 more health care utilization from 2009 to 2011. 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. Individuals in the donut holes, as described in Section 3, are excluded from the analysis.

5.2 Robustness and Sensitivity Analyses

To perfectly identify the value of the running variable, and to zoom in on the subgroup of the population that likely is the most affected by the policy, our main analysis is restricted to single households with no private pension insurance. The lack of a labor supply response among these individuals suggests that there likely is no effect for individuals with private pension insurance and spouses either, as these individuals are less dependent on their public pension. Table 7 demonstrates that including individuals with private pension insurance (columns 1 and 2), or restricting the sample to married individuals (columns 3 and 4), has no impact on the estimated effects. In addition, there is no spousal response among partners of individuals affected by the ABM. Note that the analysis for married individuals is performed separately, rather than combined with the single-household individuals, as the phase-out thresholds of the guarantee pension differs between single and married individuals (such that they are subject to different RD thresholds).

Table 7. Sensitivity analysis.

	Sample including individuals with private pensions		Sample = married individuals	
	Partly vs non-treated	Fully vs partly treated	Partly vs non-treated	Fully vs partly treated
	(1)	(2)	(3)	(4)
Panel A. Loss (RD)				
Pensions loss (in % of baseline pensions)	3.47***	3.14***	2.46***	3.03***
	(0.28)	(0.05)	(0.67)	(0.06)
Panel B. Earnings response (RD)				
Earnings (in % of baseline pensions)	-0.35*	0.08	0.17	-0.15
	(0.20)	(0.10)	(0.23)	(0.21)
Panel C. Health outcomes (RD-DiD)				
GP visits (difference from baseline)	0.20	-0.25	-0.16	-0.12
	(1.02)	(0.17)	(0.84)	(0.16)
Hospital visits (difference from baseline)	0.01	-0.00	-0.03*	0.01
	(0.04)	(0.01)	(0.02)	(0.01)
Prescriptions (difference from baseline)	-1.27*	0.11	0.42	-0.16
	(0.72)	(0.12)	(0.44)	(0.13)
Panel D. Household earnings response				
Household earnings (% of baseline pensions)	N/A	N/A	34.30	-10.45
			(21.41)	(11.92)
Gender FE	✓	✓	✓	✓
Cohort FE	✓	✓	✓	✓
Quadratic control function	✓	✓	✓	✓
Observations	22 733	58 049	43 960	66 546

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), health outcomes (Panel C), and household earnings in 2011. Pension loss is defined as total public pension loss in 2011 as a percent of total public pension in 2009. Earnings and household earnings are 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 for columns 1 and 2 consists of single men and women aged 65 to 74 who were full-time retired prior to the ABM-activation in 2010. Our sample for columns 3 and 4 consists of married 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. Individuals in the donut holes, as described in Section 3, are excluded from the analysis.

The causal interpretation of the regression discontinuity results relies on the assumption that individuals just above the thresholds are comparable to those just below the threshold. To obtain support for this assumption, we have conducted both balance tests as well as density analyses (Section 3.3). Another helpful exercise is to examine the sensitivity of the results to alternative bandwidth choices and kernel options. As mentioned above, our main specification uses the mean-squared error procedure to select common bandwidth sizes on both sides of the cutoffs. In Appendix Table A2, we show that our results are robust to using half or twice the size of this bandwidth size. In Appendix Table A3, we show that our results are robust to using alternative bandwidth selection procedures. In Appendix Table A4, we show that our results are robust to using alternative Kernels. In Appendix Tables A5 through A7, we show that the results from our fuzzy RD design are robust to the same alternative choices of bandwidth size, bandwidth selection procedures, and alternative Kernels.

6 Discussion and Conclusion

This paper exploits the balancing mechanism in the Swedish pension system to provide the first estimates in the literature on the labor supply response to income shocks among full-time retirees. Understanding the labor supply behavior of fully-retired individuals is of great interest as their behavior likely differs from working individuals for many reasons, and because they represent a particularly vulnerable group that cannot adjust their labor market behavior on the intensive margin. In addition, between 6 and 14 percent of Swedish retirees reverse their retirement decision after having exited the labor force (Pettersson 2014).[32] Retirement should therefore not be considered an absorbing state, and understanding to what extent unretirement is linked to financial aspects is of great importance to policymakers.

We present two sets of results. First, we estimate precise null effects of the income shock on the labor market outcomes of full-time retirees, and conclude that pensioners in retirement do not return to work despite losing a meaningful percent of their annual income. Specifically, we rule out income elasticities larger than 0.051. This estimated null effect also extends to retirees who have limited savings, who face little demand-side obstacles to reentering the labor force, and to younger individuals who just recently entered retirement. Thus, once individuals have entered full-time retirement, it is unlikely that benefit cuts will induce them to unretire. This is an interesting result given (1) existing studies which have used similarly-sized shocks to identify meaningful income effects on the decision to postpone retirement, (2) a large number of recent changes to pension benefits across the globe that are of a similar size to those studied in the current paper, (3) the growing evidence on both intensive and extensive margin effects of the AET in the US, and (4) recent trends among full-time retirees to unretire and reenter the

[32] The unretirement behavior is even greater in other countries. For example, in the US more than 26 percent of retirees reverse their retirement decision (Maestas 2010).

labor market. However, we also acknowledge an interesting avenue for future research is to understand how big the benefit change must be for inducing individuals to unretire, and we strongly encourage future research in this area.

Our second key result is that the negative income shock has no effect on the health of retirees, as measured by health care utilization. While this is consistent with papers documenting a lack of health effects associated with income changes among older individuals (e.g. Adams et al. 2003; Lindahl 2005; Michaud and van Soest 2008), we are the first to show that this also holds for retired pensioners.

Taken together, 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 likely not induce them to return to work; at least not at the margin relevant to policymakers and social planners. In addition, the lack of health care utilization effects suggest that the externalities associated with the ABM approach of ensuring macro-level fiscal sustainability of the pension system may be small. That is, the lack of an employment and health care utilization response suggest that a reduction in benefit levels may have little impact on individuals in our context while at the same time ensuring financial sustainability of the system. Thus, while the ABM mechanism managed to ensure macro-level fiscal sustainability of the pension system by cutting retirement benefits, there is little micro-level impact on retirees' labor market behavior and health outcomes. At the height of a global crisis where pension funds are rapidly losing value, these results may be particularly important.

References

Adams, Peter, Michael Hurt, Daniel McFadden, Angela Merril, and Tiago Ribeiro (2003). "Healthy, wealthy, and wise? Tests for direct causal paths between health and socioeconomic status" *Journal of Econometrics* 112: pp. 3-56

Avanza (2011). *Pensionsbromsen väntas slå till igen [The pension break is expected to activate once again]*. Retrieved May 29, 2020 from https://www.avanza.se/placera/redaktionellt/2011/10/31/pensionsbromsen-vantas-sla-till-igen.html

Behaghel, Luc, and David Blau (2012). "Framing social security reform: Behavioral responses to changes in the full retirement age" *American Economic Journal: Economic Policy* 4: pp. 41-67

Brown, Kristine (2013). "The link between pensions and retirement timing: Lessons from California teachers" *Journal of Public Economics* 98: pp. 1-14

Cattaneo, Matias D., and Rocio Titiunik (2021). "Regression Discontinuity Designs." *arXiv preprint arXiv:2108.09400.*

Calonico, Sebastian, Matias Cattaneo, and Rocio Titiunik (2014). "Robust Nonparametric Confidence Intervals for Regression-Discontinuity Designs" *Econometrica* 82: pp. 2295-

2326
Cattaneo, Matias, Michael Jansson, and Xinwei Ma (2020). "Simple Local Polynomial Density Estimators", *Journal of the American Statistical Association*115(531), 1449-1455.
Chetty, Raj, Adam Guren, Day Manoli, and Andrea Weber (2013). "Does indivisible labor explain the difference between micro and macro elasticities? A meta-analysis of extensive margin elasticities" *NBER Macroeconomics Annual* 27: pp. 1-56
ESV (2005). "Tema: Ingen pensionsbroms i huvudscenariot" *Retrieved November 20, 2020, from: https://www.esv.se/contentassets/756da9c5cbf84940a1e9337a122572bc/ingen-pensionsbroms-i-huvudcenariot-2005-4.pdf*
Gelber, Alex, Damon Jones, and Dan Sacks (2020a). "Estimating earnings adjustment frictions: method and evidence from the earnings test" *American Economic Journal: Applied Economics* 2020, 12(1), pp. 1-31
Gelber, Alex, Damon Jones, and Dan Sacks (2020b). "The Employment Effects of the Social Security Earnings Test" Journal of *Human Resources*, forthcoming
Gelman, Andrew, and Guido Imbens (2019). "Why high-order polynomials should not be used in regression discontinuity designs." *Journal of Business & Economic Statistics,* 37(3), pp. 447-456.
GP (2010). *Pensionsbroms måste justeras* [the pension break must be adjusted]. Retrieved May 24, 2020, from: https://www.gp.se/ekonomi/pensionsbroms-måste-justeras-1.1035371
GP (2011). *Pensionsbromsen ligger i – år efter år* [The pension break remains activated – year after year]. Retrieved May 28, 2020, from: https://www.gp.se/debatt/pensionsbromsen-ligger-i-år-efter-år-1.867875
Haller, Andreas (2021). "Welfare Effects of Pension Reforms" *mimeo*
Jensen, Robert, and Kasper Richter (2004). "The health implications of social security failure: evidence from the Russian pension crisis" *Journal of Public Economics* 88: pp. 209-236
Johansson, Per, Lisa Laun and Mårten Palme (2016). "Pathways to retirement and the role of financial incentives in Sweden" *NBER Chapters, in: Social Security programs and Retirement Around the World: Disability Insurance Programs and Retirement*, pp. 369-410
Johnsen, Julian, Kjell Vaage and Alexander Willén (2021). "Interactions in Public Policies: Spousal Responses and Program Spillovers of Welfare Reforms" *NHH Working Paper No. 2020/20*
Laun, Lisa (2017). "The effect of age-targeted tax credits on labor force participation of older workers" *Journal of Public Economics* 152: pp. 102-118
Lindahl, Mikael (2005). "Estimating the effect of income on health and mortality using lottery prizes as an exogenous source of variation in income" *The Journal of Human Resources* 40: pp. 144-168
Maestas, Nicole. (2010). "Back to work: Expectations and realizations of work after retirement" *Journal of Human Resources* 45(3): pp. 718-748
Malkova, Olga (2020). "Did Soviet Elderly Employment Respond to Financial Incentives? Evidence from Pension Reforms" *Journal of Public Economics* 182
MinPension (2020). " Hur mycket pengar behöver en pensionär 2020?" [*How much money does a pensioner need 2020?*] Retrieved from: https://www.minpension.se/allt-om-pensioner/paverka-din-pension/hur-mycket-pengar-behover-en-pensionar
Manoli, Day, and Andrea Weber (2016). "Nonparametric evidence on the effects of financial incentives on retirement decisions" *American Economic Journal: Economic Policy* 8: pp. 160-182
McCrary, Justin (2016). "Manipulation of the running variable in the regression discontinuity design: A density test" *Journal of Econometrics* 142: pp. 698-714

Michaud, Pierre-Carl, and Arthur van Soest (2008). "Health and wealth of the elderly: Causality tests using dynamic panel data models" *Journal of Health Economics* 27: pp. 1312-1325

Mullen, Kathleen and Stefan Staubli (2016). "Disability benefit generosity and labor force withdrawal" *Journal of Public Economics* 143: pp. 49-63

New York Assembly Bill (2012). "Laws of the State of New York – Chapter 18 of 2012." Accessed via https://nysosc9.osc.state.ny.us/product/mbrdoc.nsf/0f9d113765ae06b58525666700653b6d/6ccdce8d71d665d2852579c30065b612?OpenDocument

NIH (2016). World's older population grows dramatically. Retrieved February 25, 2020, from: https://www.nih.gov/news-events/news-releases/worlds-older-population-grows-dramatically

Norwegian Labor and Welfare Administration (2021). "Økt pensjon til enslige minstepensjonister fra 1. mai 2020." Accessed via https://www.nav.no/no/person/pensjon/alderspensjon/nyheter/okt-pensjon-til-enslig e-minstepensjonister-fra-1.mai-2020

OECD (2013). *Pension at a Glance 2013*: *OECD and G20 Indicators*. Accessed March 2020, from: http://www.oecd.org/pensions/public-pensions/OECDPensionsAtAGlance2013.pdf

OECD (2015). *Pension at a Glance 2015*: *OECD and G20 Indicators*. Accessed March 2020, from: https://www.oecd-ilibrary.org/docserver/pension_glance-2015-4-en.pdf?expires=1584523312&id=id&accname=guest&checksum=5CC4B03F1CF79F40505BE1D55A8D07EF

OECD (2017). *Pension at a Glance 2017*: *OECD and G20 Indicators*. Accessed May 2021, from: https://www.oecd-ilibrary.org/social-issues-migration-health/pensions-at-a-glance-2017_pension_glance-2017-en

PA (2009). "Nu slår bromsen till" *Retrieved November 20, 2020, from:* https://www.privataaffarer.se/articles/2009/03/12/nu-slar-pensionsbromsen-ti/

Pension Authority (2020). "Korta Pensionsfakta" *Retrieved March 20, 2020, from:* https://www.pensionsmyndigheten.se/nyheter-och-press/pressrum/kortapensionsfakta

Pettersson, Jan (2014). "Instead of bowling alone? Unretirement of pensioners in Sweden" *International Journal of Manpower* 35(7): pp. 1016-1037

Saez, Emmanuel, Joel Slemrod, and Seth Giertz (2012). "The Elasticity of Taxable Income with Respect to Marginal Tax Rates: A Critical Review" *Journal of Economic Literature* 50(1): pp. 3-50

SR (2011). *Pensionsbromsen kan slå i när börsen faller* [The pension break may hit as the market falls]. Retrieved May 28, 2020, from: https://sverigesradio.se/sida/artikel.aspx?programid=83&artikel=4636712

SvD (2013). *Storförlust för pensionärerna* [big loss for pensioners]. Retrieved May 26, 2020, from: https://www.svd.se/storforlust-for-pensionarerna

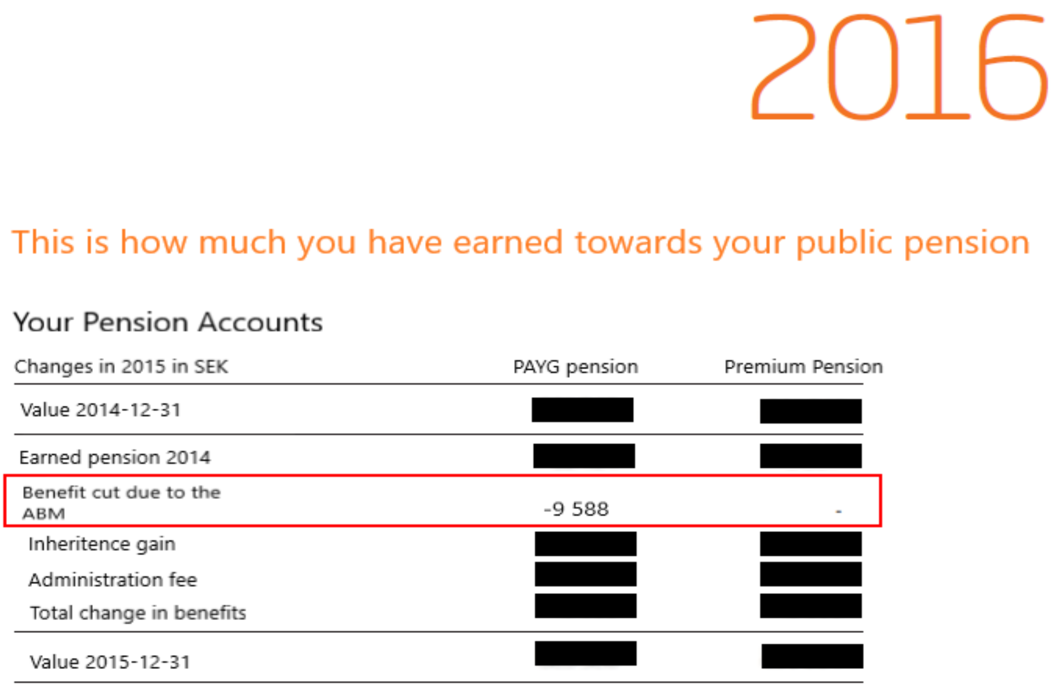
Swedish Pension Authority (2020). "Förslaget om inkomstpensionstillägg – så här kommer det att fungera." Accessed via https://www.pensionsmyndigheten.se/nyheter-och-press/nyheter/inkomstpensionstillagg-sa-kommer-det-att-fungera

Sørensen, Ole, Assia Billig, Marcel Lever, Jean-Claude Menard, and Ole Settergren (2016). "The interaction of pillars in multi-pillar pension systems: A comparison of Canada, Denmark, Netherlands and Sweden" *International Social Security Review* 69(2): pp. 53-84

2018/2019 SoU1 (2018). "Utgiftsomrade 9 Hälsovård, sjukvård och social omsorg" *Socialutskottets betänktande*. Retrieved May 28, 2021 from: https://riksdagen.se/sv/dokument-lagar/arende/betankande/utgiftsomrade-9-halsovard-sjukvard-och-social_H601SoU1

Online Appendix

Figure A1. Salience of the ABM



2016

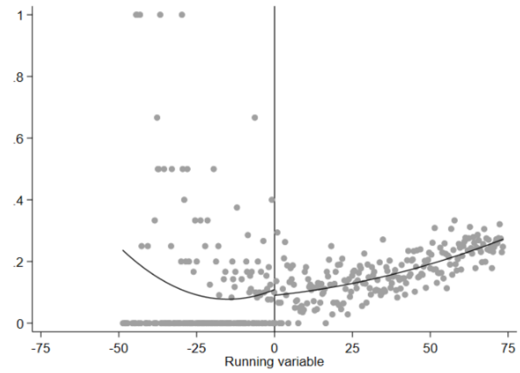
This is how much you have earned towards your public pension

Your Pension Accounts

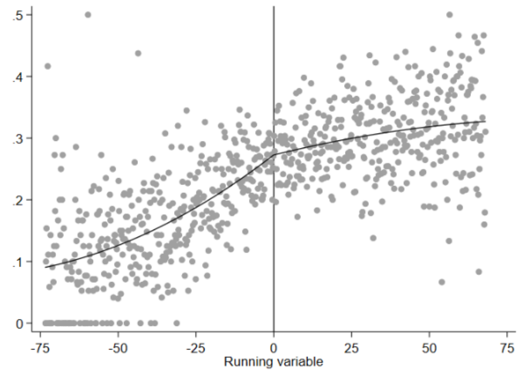
Changes in 2015 in SEK	PAYG pension	Premium Pension
Value 2014-12-31	[redacted]	[redacted]
Earned pension 2014	[redacted]	[redacted]
Benefit cut due to the ABM	-9 588	-
Inheritence gain	[redacted]	[redacted]
Administration fee	[redacted]	[redacted]
Total change in benefits	[redacted]	[redacted]
Value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

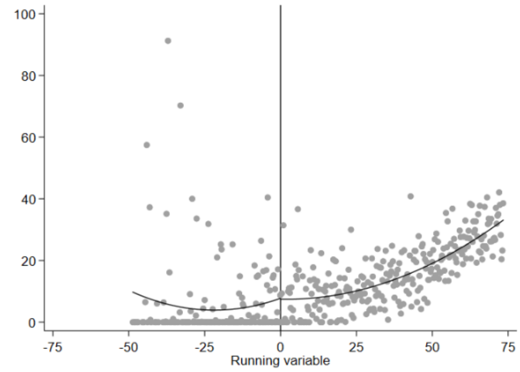
Figure A2. Balance check, employment and earnings in 2005.



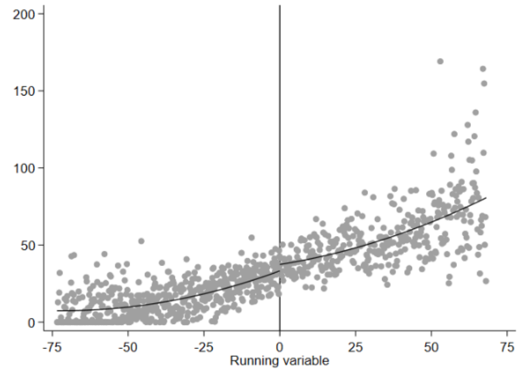
A) Employment,
partly vs non-treated



B) Employment,
fully vs partly treated



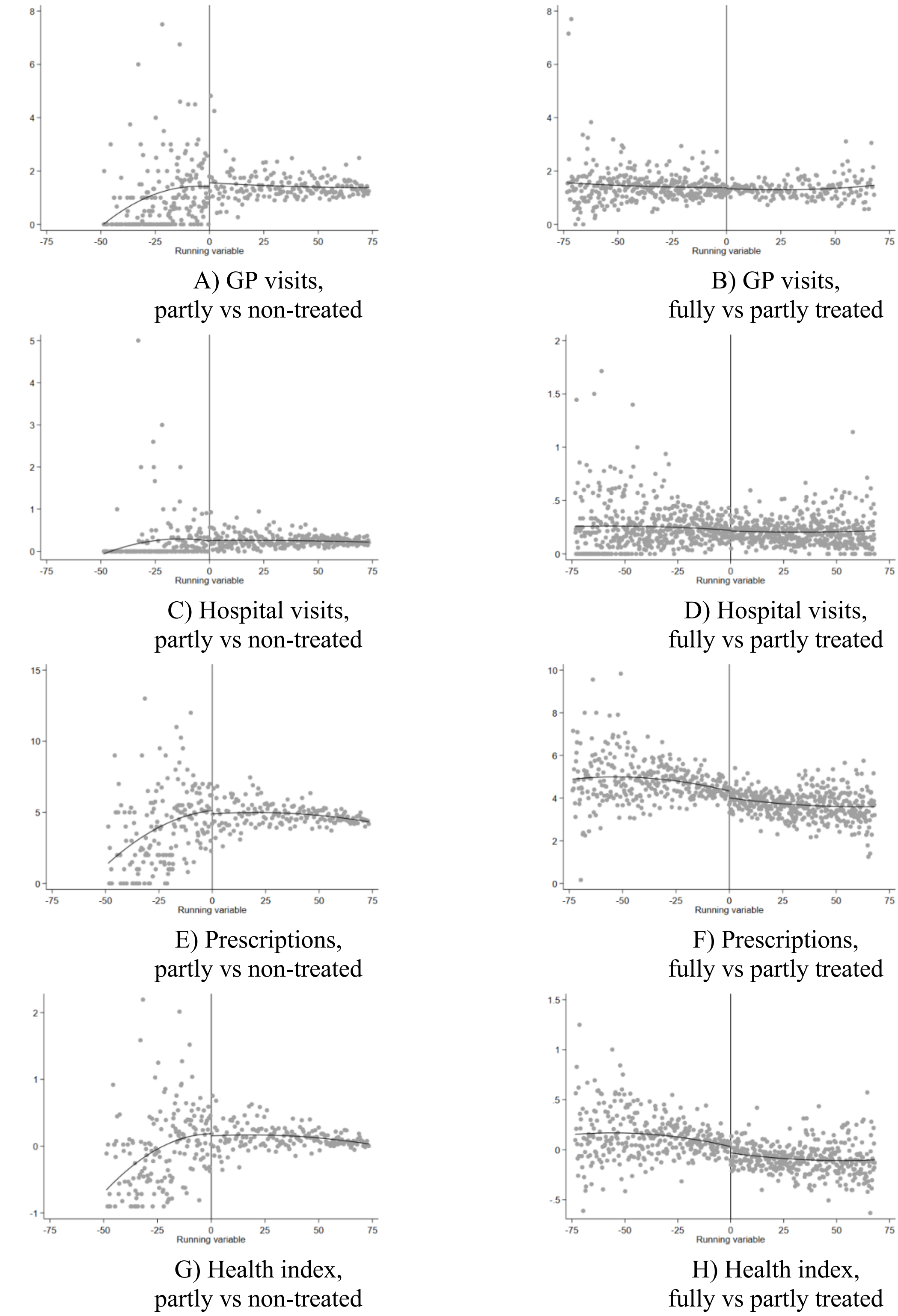
C) Earnings,
partly vs non-treated



D) Earnings,
fully vs partly treated

Notes: The x-axes in all panels measure the distance (in 1 0000 SEK) from the relevant phase-out threshold of the guarantee pension. The figure plots employment and earnings in 2005 for partly versus non-treated pensioners (Panels A and C) and for fully versus partly treated pensioners (Panels B and D). Employment is defined as labor earnings > 0, and earnings is measured in 1 000 SEK. 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 A3. 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

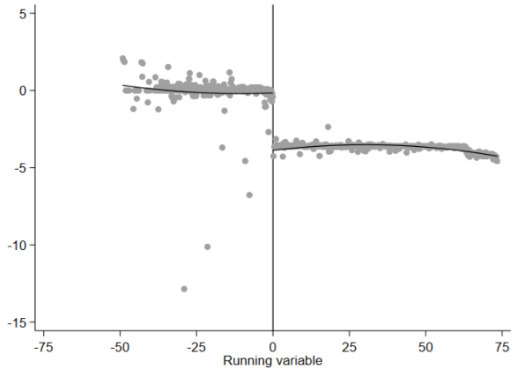
F) Prescriptions, fully vs partly treated

G) Health index, partly vs non-treated

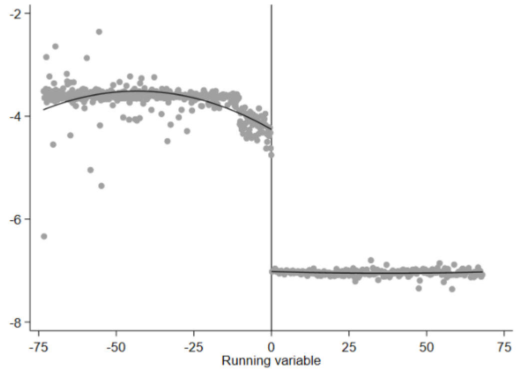
H) Health index, fully vs partly treated

Notes: The x-axes in all panels measure the distance (in 1 0000 SEK) from the relevant phase-out threshold of the guarantee pension. The figure plots GP visits, hospital visits, prescriptions, and a composite health index (consisting of prescriptions and hospital and GP visits) in 2005 for partly versus non-treated pensioners (Panels A, C, E, and G) and for fully versus partly treated pensioners (Panels B, D, F, and H). 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 source: Statistics Sweden and the Swedish Pension Authority.

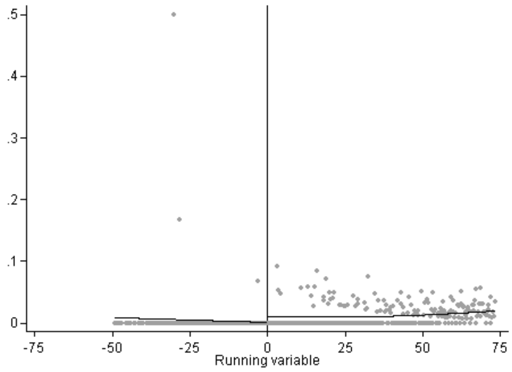
Figure A4. RD plots for Loss and Earnings in 2011



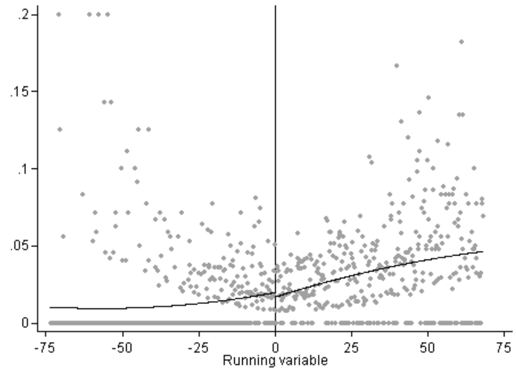
A) Change in public pensions (%),
partly vs non-treated



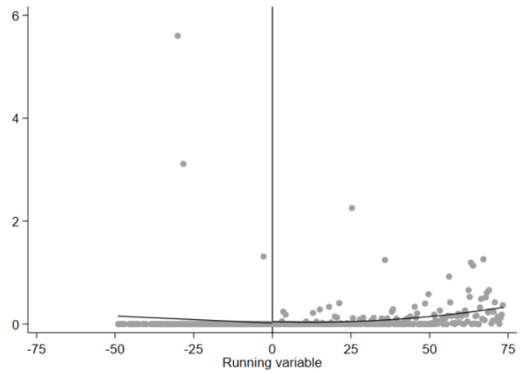
B) Change in public pensions (%),
fully vs partly treated



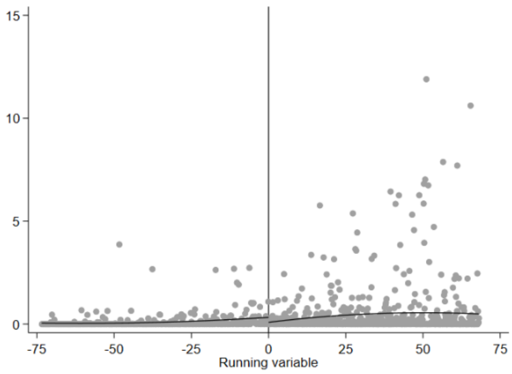
C) Employment ,
partly vs non-treated



D) Employment ,
fully vs partly treated



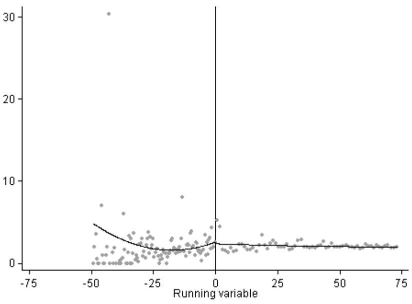
E) Earnings (%),
partly vs non-treated



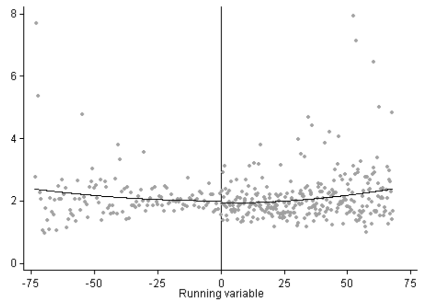
F) Earnings (%),
fully vs partly treated

Notes: The x-axes in all panels represent the distance (in 1 0000 SEK) from the relevant phase-out threshold of the guarantee pension. The figure plots change in public pensions, employment, and earnings in 2011 for partly versus non-treated pensioners (Panels A, C, and E) and for fully versus partly treated pensioners (Panels B, D, and F). Change in public pensions and earnings are measured in percent of total public pension received in 2009. Employment is defined as labor earnings > 0. 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 source: Statistics Sweden and the Swedish Pension Authority.

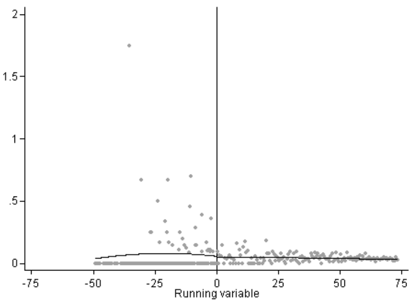
Figure A5. RD plots for GP visits, hospital visits, Prescriptions, and health index in 2011



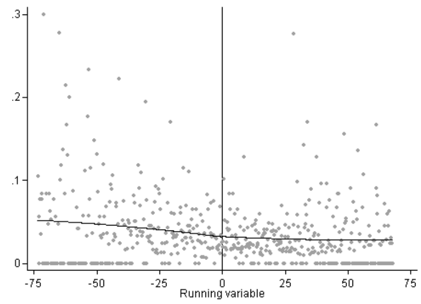
A) GP visits, partly vs non-treated



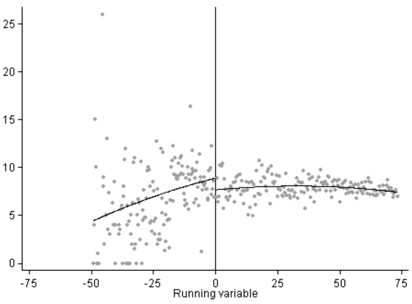
B) GP visits, fully vs partly treated



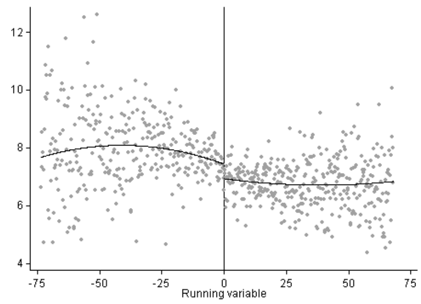
C) Hospital visits, partly vs non-treated



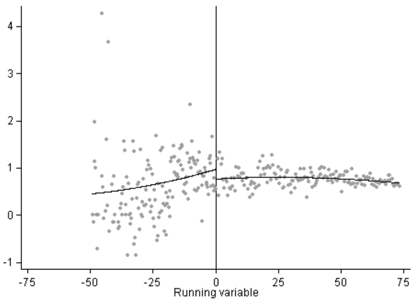
D) Hospital visits, fully vs partly treated



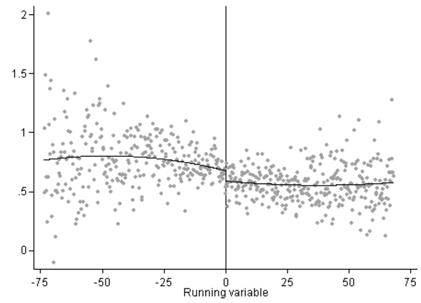
E) Prescriptions, partly vs non-treated



F) Prescriptions, fully vs partly treated



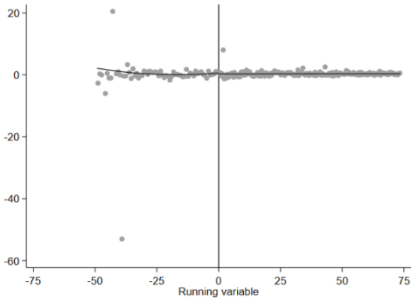
G) Health index, partly vs non-treated



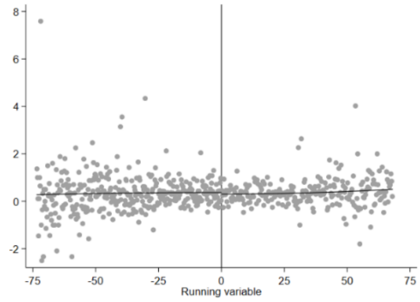
H) Health index, fully vs partly treated

Notes: The x-axes in all panels measure the distance (in 1 0000 SEK) from the relevant phase-out threshold of the guarantee pension. The figure plots GP visits, hospital visits, prescriptions, and a composite health index (consisting of prescriptions and hospital and GP visits) in 2011 for partly versus non-treated pensioners (Panels A, C, E, and G) and for fully versus partly treated pensioners (Panels B, D, F, and H). 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 source: Statistics Sweden and the Swedish Pension Authority.

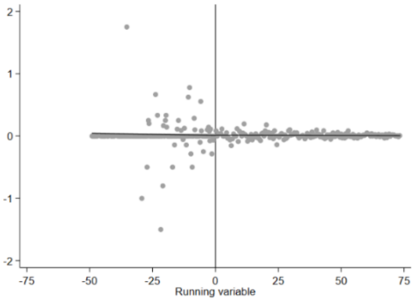
Figure A6. RD-DiD plots for GP visits, hospital visits, Prescriptions, and health index in 2011 relative to 2009.



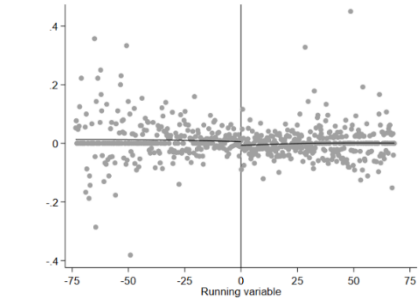
A) GP visits, partly vs non-treated



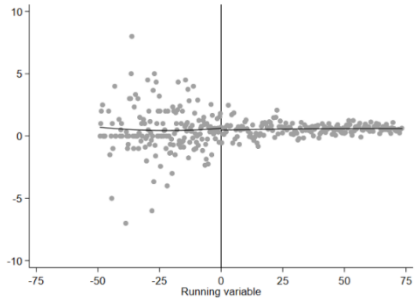
B) GP visits, fully vs partly treated



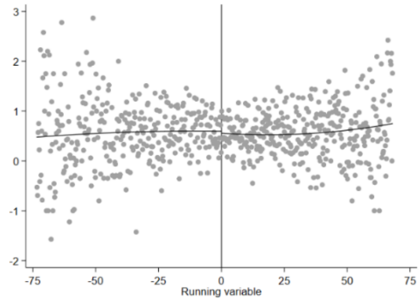
C) Hospital visits, partly vs non-treated



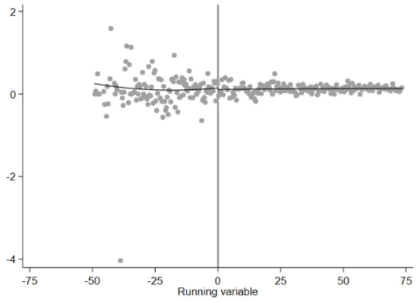
D) Hospital visits, fully vs partly treated



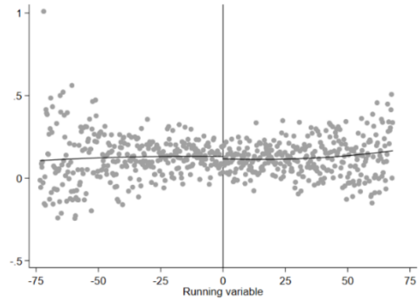
E) Prescriptions, partly vs non-treated



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. The figure plots the change from 2009 to 2011 in GP visits, hospital visits, prescriptions, and a composite health index (consisting of prescriptions and hospital and GP visits) for partly versus non-treated pensioners (Panels A, C, E, and G) and for fully versus partly treated pensioners (Panels B, D, F, and H). 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 source: Statistics Sweden and the Swedish Pension Authority.

Appendix Table A1. RD results, health utilization

	Partly vs non-treated		Fully vs partly treated	
	(1)	(2)	(3)	(4)
GP visits	1.894	2.236	0.049	0.103
	(1.704)	(2.026)	(0.202)	(0.237)
Hospital visits	0.025	0.033	0.013	0.014
	(0.049)	(0.052)	(0.011)	(0.012)
Prescriptions	0.054	-0.650	-0.350	-0.412*
	(0.920)	(1.201)	(0.233)	(0.246)
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 health outcomes in 2011. 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. Individuals in the donut holes are excluded from the analysis, as described in Section 3.*

Appendix Table A2. Robustness of reduced-form results to halving or doubling bandwidth sizes selected by the mean-squared error procedure.

	Partly vs non-treated		Fully vs partly treated	
	(1)	(2)	(3)	(4)
Panel A. Bandwidth size = half of size selected by mean-squared error procedure				
Pensions loss (in % of baseline pensions)	3.618***	3.652***	2.967***	2.909***
	(0.477)	(0.492)	(0.079)	(0.108)
Employment	-0.006	0.009	-0.006	-0.007
	(0.007)	(0.006)	(0.010)	(0.011)
Earnings (in % of baseline pensions)	0.059	0.064	-0.324	-0.383
	(0.108)	(0.052)	(0.250)	(0.273)
GP visits (difference from baseline)	0.418	0.416	-0.260	-0.280
	(1.212)	(1.238)	(0.244)	(0.257)
Hospital visits	0.005	-0.017	0.004	0.016
(difference from baseline)	(0.050)	(0.060)	(0.014)	(0.024)
Prescriptions (difference from baseline)	-1.132	-1.140	0.205	0.212
	(0.823)	(1.288)	(0.230)	(0.260)
Panel B. Bandwidth size = twice the size selected by mean-squared error procedure				
Pensions loss (in % of baseline pensions)	3.475***	3.439***	3.068***	3.118***
	(0.263)	(0.277)	(0.037)	(0.047)
Employment	-0.003	0.004	-0.002	-0.002
	(0.008)	(0.005)	(0.005)	(0.005)
Earnings (in % of baseline pensions)	-0.057	-0.023	-0.003	0.010
	(0.099)	(0.059)	(0.115)	(0.123)
GP visits (difference from baseline)	-0.229	-0.124	-0.080	-0.080
	(0.731)	(0.823)	(0.130)	(0.139)
Hospital visits	0.031	0.013	-0.008	-0.003
(difference from baseline)	(0.035)	(0.038)	(0.008)	(0.012)
Prescriptions (difference from baseline)	-0.106	-0.635	0.079	0.122
	(0.405)	(0.626)	(0.121)	(0.136)
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, employment, earnings, and health care utilization outcomes in 2011. We use the mean-squared error procedure to select an initial bandwidth size, as in the main specification reported in Table 3, but then replace this bandwidth size with half of the selected size in Panel A and twice the selected size in Panel B. 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 care utilization 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. Individuals in the donut holes, as described in Section 3, are excluded from the analysis. Data source: Statistics Sweden and the Swedish Pension Authority.

Appendix Table A3. Robustness of reduced-form results to alternative bandwidth selection procedures

	Partly vs non-treated		Fully vs partly treated	
	(1)	(2)	(3)	(4)
Panel A. Bandwidth sizes selected by mean-squared error procedure, but allowed to differ below/above cutoff				
Pensions loss (in % of baseline pensions)	3.242***	3.321***	3.094***	3.146***
	(0.276)	(0.290)	(0.041)	(0.056)
Employment	0.000	0.004	-0.001	-0.001
	(0.007)	(0.006)	(0.006)	(0.006)
Earnings (in % of baseline pensions)	-0.029	-0.061	0.006	0.002
	(0.069)	(0.041)	(0.114)	(0.136)
GP visits (difference from baseline)	-0.152	0.012	-0.101	-0.127
	(0.669)	(0.847)	(0.143)	(0.171)
Hospital visits	0.018	0.007	-0.002	-0.004
(difference from baseline)	(0.031)	(0.032)	(0.010)	(0.011)
Prescriptions (difference from baseline)	-0.218	-0.477	0.137	0.185
	(0.457)	(0.685)	(0.139)	(0.154)
Panel B. Bandwidth sizes selected by the one common coverage error-rate optimal bandwidth selector				
Pensions loss (in % of baseline pensions)	3.324***	3.234***	3.100***	3.000***
	(0.345)	(0.385)	(0.049)	(0.072)
Employment	0.003	-0.006	-0.000	0.001
	(0.006)	(0.008)	(0.006)	(0.008)
Earnings (in % of baseline pensions)	-0.035	0.060	-0.103	-0.143
	(0.058)	(0.106)	(0.137)	(0.170)
GP visits (difference from baseline)	0.271	0.494	-0.094	-0.150
	(1.058)	(1.196)	(0.168)	(0.212)
Hospital visits	0.022	-0.015	-0.002	-0.003
(difference from baseline)	(0.033)	(0.042)	(0.012)	(0.013)
Prescriptions (difference from baseline)	-0.449	-1.204	0.104	0.142
	(0.516)	(0.894)	(0.148)	(0.192)
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, employment, earnings, and health care utilization outcomes in 2011. In Panel A, we use the mean-squared error procedure to select bandwidth sizes, but unlike in our main specification, we allow bandwidth sizes to differ above/below each cutoff. In Panel B, we use the one common coverage error-rate optimal bandwidth selector to select bandwidth sizes. 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 care utilization 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. Individuals in the donut holes, as described in Section 3, are excluded from the analysis. Data source: Statistics Sweden and the Swedish Pension Authority.

Appendix Table A4. Robustness of reduced-form results to choice of Kernel function used to construct the local polynomial estimators in the Regression Discontinuity design.

	Partly vs non-treated		Fully vs partly treated	
	(1)	(2)	(3)	(4)
Panel A. Kernel function = Epanechnikov				
Pensions loss (in % of baseline pensions)	3.468***	3.455***	3.107***	3.157***
	(0.311)	(0.335)	(0.042)	(0.056)
Employment	0.004	-0.000	-0.001	0.001
	(0.008)	(0.004)	(0.006)	(0.006)
Earnings (in % of baseline pensions)	-0.045	-0.028	0.003	0.040
	(0.077)	(0.030)	(0.118)	(0.140)
GP visits (difference from baseline)	-0.008	0.277	-0.113	-0.134
	(0.921)	(1.103)	(0.143)	(0.174)
Hospital visits	0.027	0.016	-0.005	-0.001
(difference from baseline)	(0.038)	(0.050)	(0.011)	(0.011)
Prescriptions (difference from baseline)	-0.005	-1.035	0.131	0.190
	(0.474)	(0.726)	(0.133)	(0.158)
Panel B. Kernel function = uniform				
Pensions loss (in % of baseline pensions)	3.583***	3.445***	3.118***	3.185***
	(0.310)	(0.338)	(0.043)	(0.051)
Employment	0.002	-0.010	-0.001	-0.001
	(0.009)	(0.009)	(0.006)	(0.006)
Earnings (in % of baseline pensions)	-0.073	0.003	-0.008	0.033
	(0.101)	(0.070)	(0.117)	(0.139)
GP visits (difference from baseline)	0.309	0.407	-0.094	-0.175
	(1.107)	(1.212)	(0.137)	(0.160)
Hospital visits	0.049	0.017	-0.007	-0.005
(difference from baseline)	(0.044)	(0.048)	(0.011)	(0.012)
Prescriptions (difference from baseline)	-0.091	-1.031	0.158	0.233
	(0.498)	(0.646)	(0.137)	(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, employment, earnings, and health care utilization outcomes in 2011. In Panel A we use an Epanechnikov Kernel function to construct the local polynomial estimators in the Regression Discontinuity design, while in Panel B we use a uniform Kernel function. 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 care utilization 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. Individuals in the donut holes, as described in Section 3, are excluded from the analysis. Data source: Statistics Sweden and the Swedish Pension Authority.

Appendix Table A5. Robustness of IV results to halving or doubling bandwidth sizes selected by the mean-squared error procedure.

	Partly vs non-treated		Fully vs partly treated	
	(1)	(2)	(3)	(4)
Panel A. Bandwidth size = half of size selected by mean-squared error procedure				
Employment	0.001	-0.000	0.002	0.003
	(0.001)	(0.003)	(0.003)	(0.004)
Earnings (in % of baseline pensions)	-0.015	-0.021	0.092	0.131
	(0.029)	(0.023)	(0.076)	(0.091)
GP visits (difference from baseline)	-0.125	-0.130	0.083	0.120
	(0.350)	(0.371)	(0.079)	(0.091)
Hospital visits	-0.001	0.009	-0.004	-0.006
(difference from baseline)	(0.015)	(0.017)	(0.006)	(0.007)
Prescriptions (difference from baseline)	0.297	0.392	-0.067	-0.066
	(0.217)	(0.305)	(0.078)	(0.089)
Panel B. Bandwidth size = twice the size selected by mean-squared error procedure				
Employment	0.001	-0.001	0.001	0.000
	(0.002)	(0.002)	(0.002)	(0.002)
Earnings (in % of baseline pensions)	0.020	0.016	0.007	-0.004
	(0.027)	(0.021)	(0.035)	(0.040)
GP visits (difference from baseline)	0.065	0.040	0.028	0.039
	(0.197)	(0.224)	(0.041)	(0.051)
Hospital visits	-0.010	-0.014	0.001	0.000
(difference from baseline)	(0.010)	(0.011)	(0.003)	(0.003)
Prescriptions (difference from baseline)	0.052	0.011	-0.034	(0.007)
	(0.103)	(0.139)	(0.040)	(0.046)
Gender FE	✓	✓	✓	✓
Cohort FE	✓	✓	✓	✓
Linear control function	✓		✓	
Quadratic control function		✓		✓
N	17 435		38 882	

Notes: The table reports the γ_1 coefficients from Equation (2), which measure the effect of a 1 percent loss in public pension benefits on employment, earnings, and health care utilization outcomes in 2011. We use the mean-squared error procedure to select an initial bandwidth size, as in the IV-specification reported in Table 4, but then replace this bandwidth size with half of the selected size in Panel A and twice the selected size in Panel B. 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 care utilization 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. Individuals in the donut holes, as described in Section 3, are excluded from the analysis. Data source: Statistics Sweden and the Swedish Pension Authority.

Appendix Table A6. Robustness of IV results to alternative bandwidth selection procedures

	Partly vs non-treated		Fully vs partly treated	
	(1)	(2)	(3)	(4)
Panel A. Bandwidth sizes selected by mean-squared error procedure, but allowed to differ below/above cutoff				
Employment	0.000	-0.002	0.000	0.000
	(0.002)	(0.002)	(0.002)	(0.002)
Earnings (in % of baseline pensions)	0.014	0.005	-0.002	-0.001
	(0.026)	(0.006)	(0.037)	(0.042)
GP visits (difference from baseline)	0.044	0.003	0.037	0.037
	(0.192)	(0.247)	(0.046)	(0.060)
Hospital visits (difference from baseline)	-0.006	-0.000	0.001	0.001
	(0.010)	(0.012)	(0.003)	(0.004)
Prescriptions (difference from baseline)	0.089	0.156	-0.044	-0.057
	(0.147)	(0.204)	(0.044)	(0.051)
Panel B. Bandwidth sizes selected by the one common coverage error-rate optimal bandwidth selector				
Employment	-0.001	0.002	0.000	-0.000
	(0.002)	(0.002)	(0.002)	(0.003)
Earnings (in % of baseline pensions)	0.012	-0.013	0.020	0.046
	(0.021)	(0.027)	(0.043)	(0.056)
GP visits (difference from baseline)	-0.051	-0.136	0.030	0.057
	(0.285)	(0.346)	(0.055)	(0.075)
Hospital visits (difference from baseline)	-0.008	-0.007	0.001	-0.002
	(0.010)	(0.011)	(0.004)	(0.005)
Prescriptions (difference from baseline)	0.101	0.276	-0.041	-0.055
	(0.133)	(0.216)	(0.051)	(0.066)
Gender FE	✓	✓	✓	✓
Cohort FE	✓	✓	✓	✓
Linear control function	✓		✓	
Quadratic control function		✓		✓
N	17 435		38 882	

Notes: The table reports the γ_1 coefficients from Equation (2), which measure the effect of a 1 percent loss in public pension benefits on employment, earnings, and health care utilization outcomes in 2011. In Panel A, we use the mean-squared error procedure to select bandwidth sizes, but unlike in our main specification, we allow bandwidth sizes to differ above/below each cutoff. In Panel B, we use the one common coverage error-rate optimal bandwidth selector to select bandwidth sizes. 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 care utilization 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. Individuals in the donut holes, as described in Section 3, are excluded from the analysis. Data source: Statistics Sweden and the Swedish Pension Authority.

Appendix Table A7. Robustness of IV results to choice of Kernel function used to construct the local polynomial estimators in the Regression Discontinuity design.

	Partly vs non-treated		Fully vs partly treated	
	(1)	(2)	(3)	(4)
Panel A. Kernel function = Epanechnikov				
Employment	0.001	-0.002	0.000	0.000
	(0.002)	(0.002)	(0.002)	(0.002)
Earnings (in % of baseline pensions)	0.019	0.010	0.002	-0.016
	(0.030)	(0.014)	(0.036)	(0.044)
GP visits (difference from baseline)	0.063	-0.032	0.037	0.030
	(0.217)	(0.280)	(0.046)	(0.060)
Hospital visits	-0.009	-0.010	0.001	0.002
(difference from baseline)	(0.010)	(0.012)	(.003)	(0.004)
Prescriptions (difference from baseline)	-0.038	0.017	-0.042	-0.051
	(0.118)	(0.162)	(0.043)	(0.054)
Panel B. Kernel function = uniform				
Employment	0.001	-0.002	0.001	-0.001
	(0.003)	(0.002)	(0.002)	(0.002)
Earnings (in % of baseline pensions)	0.015	0.012	-0.002	0.006
	(0.029)	(0.018)	(0.045)	(0.042)
GP visits (difference from baseline)	-0.123	-0.121	0.036	0.055
	(0.305)	(0.350)	(0.048)	(0.052)
Hospital visits	-0.015	-0.014	0.001	0.002
(difference from baseline)	(0.013)	(0.013)	(0.003)	(0.004)
Prescriptions (difference from baseline)	-0.045	-0.085	-0.028	-0.069
	(0.127)	(0.153)	(0.045)	(0.053)
Gender FE	✓	✓	✓	✓
Cohort FE	✓	✓	✓	✓
Linear control function	✓		✓	
Quadratic control function		✓		✓
N	17 435		38 882	

Notes: The table reports the γ_1 coefficients from Equation (2), which measure the effect of a 1 percent loss in public pension benefits on employment, earnings, and health care utilization outcomes in 2011. In Panel A we use an Epanechnikov Kernel function to construct the local polynomial estimators in the Regression Discontinuity design, while in Panel B we use a uniform Kernel function. 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 care utilization 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. Individuals in the donut holes, as described in Section 3, are excluded from the analysis. Data source: Statistics Sweden and the Swedish Pension Authority.