The Economic Consequences of Retirement: Connecting Impacts on Workers and Firms *

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Abstract

This paper investigates the economic consequences of retirement. We leverage variation in statutory retirement ages, joint retirement, and tax policy to analyse how different shocks affect retirement for different workers, and how these workers' retirement decisions then affect firm-level outcomes. We do so using a novel UK-based employer-employee dataset and three distinct sources of variation in retirement timing: increases in the statutory retirement age, spousal retirement decisions, and the introduction of a 50 pct. tax rate on high incomes in the UK. We show that changes in statutory ages significantly influence retirement decisions, in line with previous literature, and we present evidence that increasing the top tax rate does not significantly impact retirement. [Analysis on the consequences of retirement for firms in progress and results under clearance]. This evidence is essential for understanding the consequences of demographic changes and for guiding policymakers in designing and evaluating policies that directly or indirectly target such changes.

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1 Introduction

Rapidly ageing populations are reshaping labour markets worldwide (OECD (2023)). These demographic changes can have trickle-down effects to the entire economy through individual retirement decisions, decisions and outcomes of firms, and fiscal sustainability as the share of retirees grows. Many countries have re-structured pension systems to adapt to these changes and implemented policies to incentivise continued labour force participation of older workers.[1] Investigating how workers and firms respond to such reforms is crucial to assess the welfare impacts and understand the potential of future policies. While important research contributions have been made to examine the effects of policy interventions that influence the timing of retirement on individual outcomes (recent examples include Rabaté, Jongen, and Atav (2024), Kolsrud, Landais, Reck, and Spinnewijn (2024), Lalive, Magesan, and Staubli (2023), Börsch-Supan and Coile (2023), Seibold (2021), and more; see Giupponi and Seibold (2024) for a recent overview), much less is known about the consequences for firms. Furthermore, different retirement policies affect different workers in varying contexts, making it crucial to provide and consolidate evidence on which workers and firms respond to which shocks in order to inform the design of future policies.

This paper combines evidence from three different sources of variation to provide new evidence on workers' retirement patterns and the accompanying responses by firms to worker retirement. We leverage changes in statutory retirement ages, tax policy, and joint retirement to analyse how workers' retirement decisions induced by different policy-driven incentives affect firm-level outcomes, including performance, labour demand, and adaptation strategies. Specifically, we exploit two UK reforms. First, we use the increase in the State Pension age for workers from 2010 to study the firm-level impact of delayed retirement of workers affected by this reform as well as retirement of the spouses choosing to jointly retire with their partners. Second, we use the introduction of a 50 pct. tax rate on high incomes in 2010 to investigate the impacts of tax-induced retirement. This allows us to provide evidence on the economic impacts of retirement from different parts of the population responding to different incentives.

Workers' retirement can have both positive and negative impacts on firms. On the one hand, retirement of experienced and high-skilled workers could lead to decreased productivity in the short run through a loss of human capital (Jäger and Heining (2022); Sauvagnat and Schivardi (2024)). On the other hand, firms may adapt by for example hiring younger, potentially more innovative workers, restructuring wages, or adopting new productivity-enhancing technologies (Engbom et al. (2019)). To test whether retirement positively or negatively impacts firms' outcomes and explore these mechanisms, we use a novel UK-based employer-employee panel based on comprehensive administrative data from HMRC linking the universe of UK workers to the universe of UK businesses. This data allows us to analyse various margins of firm responses to retirement, including performance (e.g., survival, productivity, profits), labour demand (e.g., worker composition, wage structures) and adaptation strategies (e.g., capital demand and R&D), and thus constitutes an ideal setting to provide comprehensive evidence on the economic consequences of retirement.

[1] See, e.g., Giupponi and Seibold (2024) for an overview of recent pension reforms in Europe.

In the first part of the paper, we complement the previous literature on retirement and document the retirement impacts of statutory age changes, tax changes and joint retirement. Combining three sources of variation implies that we can consider the impact of retirement policies in different parts of the income distribution as the policies target different individuals. Furthermore, it allows us to present evidence on the consequences of retirement induced by a reform of statutory ages that was directly aimed at impacting retirement choices and a tax policy that was not directly aimed at impacting retirement but where retirement is a potential margin of response. In the second part of the paper, we present the firm-level effects of the workers who are induced to retire as a consequence of one of the three channels.

Our analysis shows that retirement is sensitive to changes in statutory ages across all affected taxpayers, which is in line with previous literature (e.g. Cribb, Emmerson, and Tetlow (2016)). [Specific results including joint retirement are in progress.] On tax-motivated retirement, we present new evidence on retirement as a potential margin of response to changes in tax rates. Our analysis reveals no overall effects of increasing the top tax rate on retirement. This specific result suggests that tax-motivated retirement should not be a primary concern in tax policy design for high-income individuals.

We then present results on the consequences of retirement on firms. We show that [analysis in progress and results under clearance.]

Our research bridges two strands of literature. First, we contribute to the retirement literature, specifically by complementing the extensive research on the effects of retirement policies on labour supply.[2] In this project, we combine different policy interventions that affect different workers' retirement decisions, and we extend the analyses from this literature beyond individual labour supply to show how firms are affected when workers change their retirement patterns in response to such policies. We also use the statutory age changes for a joint retirement analysis, which complements recent analyses on coordinated retirement responses of couples (see, e.g., Cribb et al. (2016); García-Miralles and Leganza (2024); Johnsen, Vaage, and Willén (2022); Lalive and Parrotta (2017).) Furthermore, a newer strand of the retirement literature provides compelling evidence that changes in statutory ages tend to be more effective in impacting retirement patterns compared to financial incentives (see, e.g., Seibold (2021) and Lalive et al. (2023), or Seibold (2024) for an overview), highlighting the importance of understanding the wider economic impacts of such policies. Lastly, there is little evidence on retirement as a direct margin of response to tax changes, which we show as a separate channel for our investigation of firm responses to retirement. Combining three different sources of incentives driving retirement therefore allows us to go beyond the local nature of a single shock and provide evidence on economic consequences of retirement of different compliers.

Second, our findings also contribute new evidence to the literature on firm responses to labour supply shocks. Previous studies have shown firm-level impacts of labour supply shocks in the

[2]Our analysis of the increase in the State Pension Age in the UK replicates results from Cribb et al. (2016) using administrative data. Other papers investigate similar changes to statutory ages in other countries such as Austria, Denmark, France, Germany, the Netherlands, Switzerland and the US (Behaghel and Blau (2012); Geyer and Welteke (2021); Lalive and Parrotta (2017); Manoli and Weber (2016); Mastrobuoni (2009); Rabaté et al. (2024); Rabaté and Rochut (2020); Sæverud (2024); Staubli and Zweimüller (2013)).

form of worker deaths (Jäger and Heining (2022); Sauvagnat and Schivardi (2024)), parental leave (Brenøe, Canaan, Harmon, and Royer (2024); Ginja, Karimi, and Xiao (2023); Huebener, Jessen, Kuehnle, and Oberfichtner (2021); Johnsen, Ku, and Salvanes (2024)), voluntary quits (Kuhn and Yu (2021)) and emigration (Dicarlo (2022); Jakobsen, Kleven, Kolsrud, Landais, and Muñoz (2024)). Much less attention has been devoted to firm-level impacts of retirement, and this research has primarily focused on how retirement of older workers affect individual outcomes of coworkers (see, e.g., Boeri, Garibaldi, and Moen (2022), Hut (2024), Carta, D'Amuri, and Von Wachter (2024), Badalyan (2024), Bianchi, Bovini, Li, Paradisi, and Powell (2023); Ferrari, Kabátek, and Morris (2023)). The most related papers to ours are Hut (2024) and Carta et al. (2024) who also investigate performance- and wage-related outcomes at the firm level, exploiting variation from statutory age changes in the Netherlands and Italy. In this paper, we provide new evidence on impacts of retirement by comparing firm-level effects across multiple sources of retirement, and the use of a novel employer-employee panel allows us to provide detailed evidence on key dimensions of performance, labour demand, and adaptation strategies.

The paper is organized as follows. In Section 2, we describe the institutional context of the pension system in the UK and present the administrative data and the employer-employee panel that we have constructed and use in the analysis. We also describe how we measure retirement in the UK. In Section 3, we present the empirical framework behind each of the three sources of variation in retirement timing and outline our estimation strategy for studying the firm-level impacts of retirement induced by each of these incentives. Section 4 contains the results on retirement responses, and in Section 5 we present the results on how firms respond when workers retire. Finally, we conclude.

2 Context and Data

2.1 Key Facts on Pensions in the UK, 2003-2021

This section introduces relevant key facts about benefits and eligibility in the UK pension system during the period of interest.

State Pension and private pension. Between 2003 and 2021, the universal State Pension constituted a regular weekly payment of approximately £200, which corresponds to a modest replacement rate of roughly 30% of median weekly earnings (Cribb, Emmerson, and O'Brien (2022)). Eligibility for the standard pension requires 35 years of contributions through National Insurance, caregiving, or specific benefit claims. Individuals with fewer than 35 years of contributions receive a proportionally reduced pension, provided they have at least 10 years of contributions. This pension income is taxed like all other income and is not means-tested, which means that people can work while receiving the State Pension. If they do, they do not need to pay social security contributions.

Throughout the paper, 'private pension' refers to all non-State Pensions (occupational, personal, defined contribution, and defined benefit). Private pension contributions are exempt from income tax up to a maximum, which has changed over time. The limit was above £200,000 before 2011, then dropped to £50,000 from tax year 2011/12, and to £40,000 in 2014/15, before

being increased to £60,000 in 2023/24.[3] Income from private pensions is taxed as regular income, but when individuals start claiming private pensions, they can take up to 25% of the pension pot as a tax-free lump sum.

Eligibility ages. The Early Retirement Age (also commonly referred to as the 'State Pension age', SPA, in the UK) is the earliest age at which State Pensions can be claimed. Before 2010, this was 60 for women and 65 for men, with gradual increases thereafter. When individuals reach the State Pension age, the benefit system changes as they are no longer eligible for the main form of means-tested support, Universal Credit. However, the State Pension amount is larger than the Universal Credit, and it is not means-tested nor subject to job search requirements.[4] The UK government offers a relatively generous incentive for individuals to postpone claiming their State Pension beyond their eligible retirement age as retirees can increase their future payments by 1% every five weeks they delay their pension claim, equivalent to 10.4% per year.

The State Pension age was 60 for women and 65 for men until 2010. As a consequence of the Pension Acts in 1995 and 2011, the State Pension age was increased to 65 for both sexes by December 2018. Specifically, the 1995 Pension Act implemented a gradual increase in the State Pension age for women born between April 1950 and March 1953 such that those born later in this period faced up to two additional months of delay per birth month. The 2011 Pension Act then made the increase steeper for women born between April 1953 and December 1953 such that for each month later a woman was born during this period, the retirement age had increased by four months.

The 2011 Pension Act also increased the State Pension age to 66 for both men and women born between 1953 and 1960 through increases of two months for each later month of birth.[5] The increase in the State Pension Age is still in effect. Under the 2014 Pension Act, the State Pension age is increasing from 66 to 67 for both men and women by increasing by one month for each month of birth such that the State Pension Age will be 67 in 2028.

For private pensions, the minimum pension withdrawal age is 55, which was raised from 50 in April 2010 and will increase to 57 in April 2028. No registered pension scheme pays out to individuals below this age under normal circumstances, with few exceptions. Early withdrawal is possible without additional tax charges if an individual is to retire due to severe ill health or if they joined their pension scheme before April 2006 and their pension scheme explicitly allowed for pension withdrawal before 2005.[6] In all other cases, early withdrawal of pensions before an individual reaches age 55 is known as unauthorised payments, in which case the individual pays up to 55% tax on the withdrawals.[7]

[3] In the United Kingdom, the tax year starts on April 6th and ends on April 5th.

[4] Cribb et al. (2022) reports that in 2020, people eligible to the full State Pension received £175 per week, while the Universal Credit was £74.

[5] This increase did not include the first month, which means that people born between the 6th December 1953 and the 5th January 1954 reached their State Pension age four months later than those born one month before.

[6] Specifically, severe ill health refers to having less than a year to live, being under 75, and having pension savings below the lifetime and death benefit allowance.

[7] The 55% comprises a 40% unauthorised payments charge and an additional 15% charge if annual withdrawals exceed 25% of the pension pot.

2.2 Worker Data

The data used in this project is based on administrative data from HMRC, the UK tax authority. We use Self-Assessment (SA) personal tax returns, which cover the universe of high-income UK tax filers for the period 2001 to 2021. Specifically, individuals with annual income over £100,000 or with income over £35,000 and positive savings income from a UK bank account are required to file SA. The other categories of individuals who are required to file SA include self-employed, partners in a business partnership, taxpayers with foreign income or investment income over £1000, taxpayers paying Capital Gains Tax or High Income Child Benefit Charge, among others.[8] Given these filing requirements, it is unlikely that individuals in our estimation samples as described in Section 3 would be eligible to stop filing whilst remaining resident in the UK. To test that our results are not sensitive to excluding individuals who no longer file SA, we conduct a robustness check of the analysis using an upper bound of the retirement measures, where we assume that anyone who leaves the data set has an income of 0. In this upper bound measure, we are overestimating retirement as people who are no longer in the tax data might have emigrated rather than retired. We find that the results are robust to using this definition of retirement, where we still find a null or very small retirement response to income taxation (see Figure C.2 and more detail in Section 4.3).

We supplement the SA data with 'Pay-As-You-Earn' (PAYE) records, which are third-party reported records on employment income and pensions submitted to HMRC by the employer or pension provider. PAYE data are available for a sample panel covering 10% of the population up to 2014 and for the universe of taxpayers thereafter. We use PAYE data to provide information that is not captured on SA returns, such as the taxpayer's industry of employment.

An advantage of our data is that we can directly observe the taxes paid by each taxpayer. We measure pre-tax fiscal income - all income that is assessable for income tax - prior to the deduction of income tax and National Insurance Contributions (NICs) levied at the personal level.

2.3 Firm Data [Full Description in Upcoming Version of Paper]

For our main analysis, we have constructed a new employer-employee panel by linking the universe of UK workers to the universe of UK businesses from 2001 to 2021. Leveraging various datasets, a unique feature of this panel is that it allows universal coverage of all business types and sizes that are all linked to individual workers and that include information on key metrics of, e.g., firm decisions and outcomes. [A full and detailed description will be provided in the next version of the paper.]

2.4 Measuring Retirement

The primary focus of our analysis is retirement behaviour. Measuring retirement can be challenging as individuals often transition into retirement gradually, which means there may not be a cleanly identified retirement year, and retirement is not necessarily a permanent state. In the

[8] These were the filing criteria between 2003 and 2013, which change over over time reflecting changes to income tax policy and administration (https://www.gov.uk/government/publications/self-assessment-tax-return-sa100)

UK, individuals with higher educational attainment and individuals in high-paying positions prior to retirement are particularly likely to continue working while receiving pension income (Kanabar (2015)), which means that defining retirement based on pension claims may not be sufficient.

We therefore develop two main measures of retirement. To do so, we combine information on both pensions income and changes in labour income (defined as the sum of employment, self-employment, partnership and trading income).

1. **Full retirement:** To capture full retirement, we first identify exits from the labour market where individuals experience a drop of 80% of their labour income, and their labour income stays below 80% of the previous income for the next five years. We then consider them fully retired if they experience such a drop and either (i) increases their pension income in the same year or (ii) experiences a drop in labour income to less than £17,500 (half of the threshold for the basic rate of income tax). Furthermore, a taxpayer is also considered fully retired if their pension income exceeds 75% of their total combined pension and labour income in the first year they appear in our longitudinal dataset (2001-2021).
2. **Partial retirement:** We consider an individual partially retired the first year they experience a labour income drop while receiving pensions income of more than 50% of their pensions and labour income combined.

As robustness checks, we include measures based on pension income alone to proxy partial retirement. Specifically, we also define partial retirement based on the first instance of receiving State Pension payments and the first receipt of private pension income.[9] Furthermore, we incorporate a measure of retirement based exclusively on labour income, where we define exit from the labour market as an 80% reduction in labour income for 5 years, regardless of pension income. [Descriptives on measures will follow in the next version of the paper]

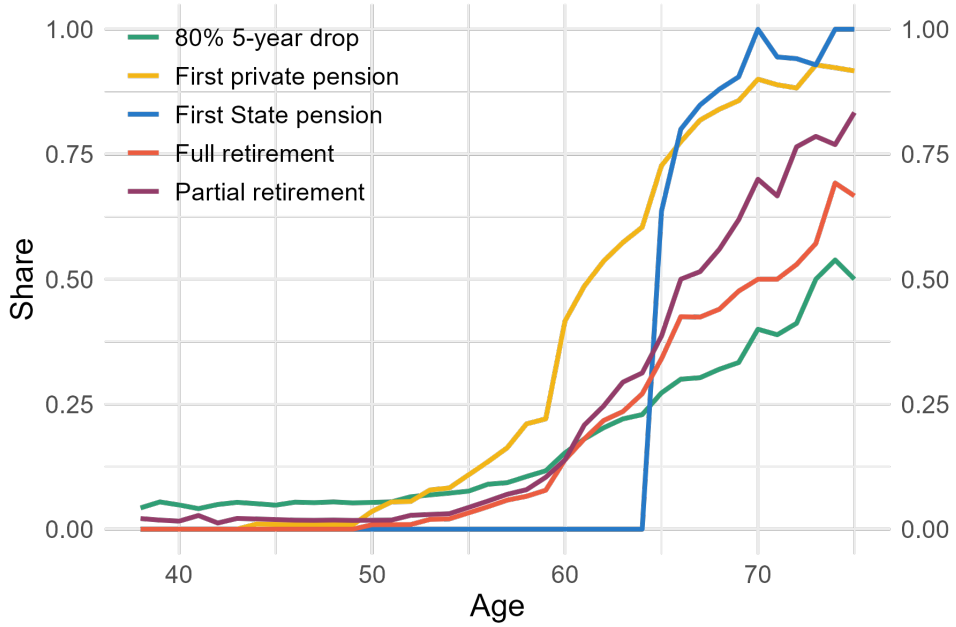
Figure 2.1 presents the cumulative distribution of these different definitions of retirement by age, focusing on the sample that is used for the tax-induced retirement analysis, which is taxpayers with total income between £120,000 and £225,000.[10] [Descriptive results on the full population of taxpayers are in progress.] All definitions disregard individuals who died, emigrated or were ever on disability benefits, which is also a negligible share in our population given the low and stringently conditional nature of such benefits. We include taxpayers who are non-residents, but excluding them does not change our results.

The figure shows that 38% of the population are at least partially retired, and that 34% are fully retired at age 65. These figures are lower than estimates for the entire UK population (Cribb (2023)), which likely reflects the fact that the sample depicted consists of a population in the top income percentile who tend have higher employment rates at older ages compared to the broader population. This is for example evidenced by Figure 2.2, which shows the relatively high

[9] Taxpayers can also start receiving pensions by withdrawing a portion of their pension pot as a tax-free lump sum, which we currently cannot observe in our tax data. We are working on additional analyses using the English Longitudinal Survey of Ageing and the Family Resources Survey to include the tax-free lump sum in the first year of pension receipt.

[10] The absolute distribution is shown in Figure C.1

Figure 2.1: Cumulative Distribution of Retirement Definitions by Age (2010)



Notes: This figure shows the share of retired taxpayers by age according to different definitions of retirement. The sample includes taxpayers with total income between £120,000 and £225,000 in 2009, for whom we display the observed retirement behaviour in 2010. '80% 5-year drop' is constructed by following taxpayers over time and marking the year in which their labour income - defined as sum of employment, self-employment and partnership and trading income - drops to 80% of the level in the year before, and remains under such a threshold for 5 years. 'First private pension' and 'First State Pension' mark the year the taxpayer gets their first private and State Pension, respectively. 'Full retirement' marks the year in which the taxpayer experience an 80% 5-year drop, together with a pension increase at the same moment, or they experience an 80% 5-year drop and their income remains below £17,500 - half of the threshold for the lower rate of the tax income. 'Partial retirement' marks the first year in which the taxpayer experiences a labour income drop (of any amount and duration) while receiving pensions income of more than 50% of their pensions and labour income combined.
Source: Authors' calculations based on HMRC administrative datasets.

share of taxpayers with positive labour and employment income at old ages in our sample. Just before age 70, about half the population of taxpayers have positive employment income, which is significantly higher than the between 20 and 30 pct. of people aged 66-69 who report being in paid work in the wealthiest quintile between 2003 and 2019 in Cribb (2023). [Descriptive results on the full population of taxpayers are in progress.]

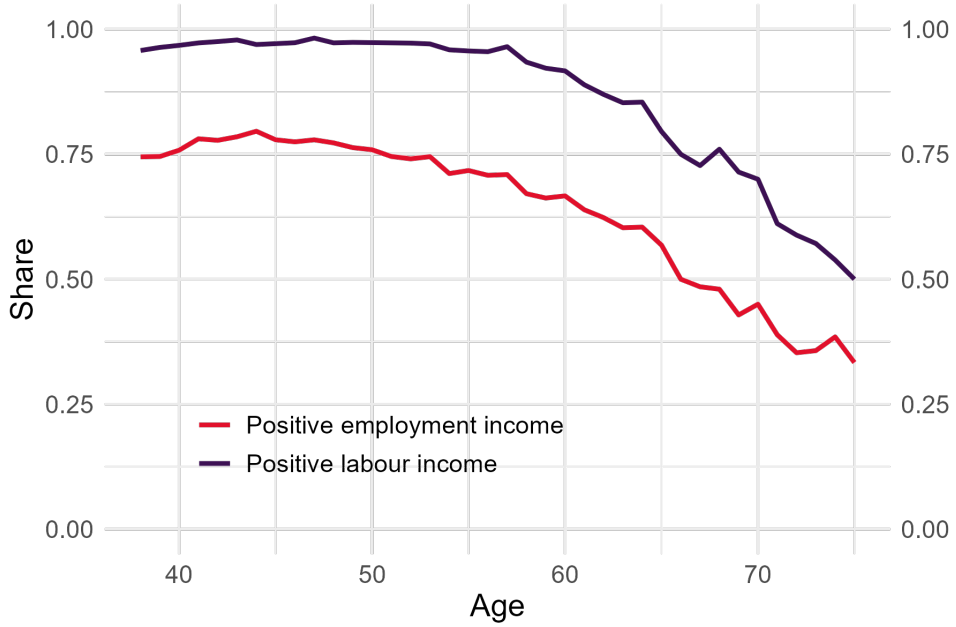
3 Empirical Framework

In this section, we first present the empirical strategies that we use to document the retirement impacts of changes in statutory ages, joint retirement, and tax rates. Second, we outline our empirical approach to study the firm-level impacts of retirement arising from each of these channels.

3.1 Statutory Age

To measure the direct impact of changes in the statutory retirement age (the Early Retirement Age / State Pension age), recent literature compares individuals just above and just below

Figure 2.2: Employment Rates of Taxpayers by Age (2010)



Notes: This figure shows the employment rates, defined as the share of taxpayers with positive labour income or positive employment income, by age in 2010. The sample includes taxpayers with total income between £120,000 and £225,000 in 2009. We observe their labour and employment income in 2010. Labour income is defined as the sum of employment, self-employment and partnership and trading income. The age is measured in tax years. **Source**: Authors' calculations based on HMRC administrative datasets.

the threshold for the new State Pension age using either regression discontinuity designs (Geyer and Welteke (2021); Rabaté et al. (2024); Sæverud (2024)) or difference-in-differences comparing close cohorts (Cribb et al. (2022, 2016); Rabaté and Rochut (2020)). In our analysis, we focus on the UK Pension Acts that implemented gradual increases in the State Pension age for men and women from 2010. To only include comparable cohorts, we restrict our sample to women born between 1948 and 1953 to evaluate the increase for women, and to all people born between 1953 to 1960 to evaluate the increase from 65 to 66 for everyone.

We employ a difference-in-differences design, defining treatment as being above the State Pension age ($Above_{it}$):

$$R_{it} = \beta_{SPA} Above_{it} + \lambda_t + \gamma_a + \epsilon_{it} \tag{1}$$

where R indicates retirement, i is the individual, t the tax-year and a the age. We include time and age fixed effect so that $Above_{it}$ represents the variation in the policy change in the State Pension age, holding age and time constant. β_{SPA} is the coefficient of interest. We consider various alternative specifications with only age and cohort or only time and cohort fixed effects in our robustness section. [Further details will be provided in upcoming version of the paper] We cannot include fixed effects at the cohort level, given the age-period-cohort problem (Glenn (2005); Yang (2013)).

3.2 Joint Retirement

A growing number of reduced-form studies have provided evidence of joint retirement spillovers driven by an increase in the retirement age of one of the two spouses (Bloemen, Hochguertel, and Zweerink (2019); Carta and De Philippis (2024); Coile (2003); Cribb et al. (2022); García-Miralles and Leganza (2024); Hospido and Zamarro (2014); Johnsen et al. (2022); Lalive and Parrotta (2017); Selin (2017)). We perform a similar analysis and exploit the 1995 and 2011 Pension Acts which increased the retirement age of women, and focus on opposite-sex couples only. This allows us to avoid the reflection problem, as it would be difficult to determine which partner's retirement decision influenced the other if both were affected by the policy change simultaneously. Specifically, we estimate the effect of the partner's retirement on own retirement, by instrumenting the wife's retirement with the increase in women's State Pension age using an instrumental variable approach.

The reduced-form estimate (ITT) follows from the regression:

$$R_{it} = \beta_{joint} Above_{lt} + \lambda_t + \gamma_a + v_{it}, \tag{2}$$

where i indexes the male partner, and l the woman who is affected by the increase in the State Pension age. We first estimate this equation on the full population and then restrict the sample to couples in which the male partner has not yet retired. Men are older than their female partners in the majority of couples (ONS (2024)) and may thus have already retired, but their later retirement age in the period (65) may also push them to retire later. We therefore consider both samples as having a retired partner may influence women to retire earlier, even before they can claim their State Pension. [Further details will be provided in upcoming version of the paper]

3.3 Tax Changes

On tax-induced retirement, we leverage the introduction of an additional tax rate on incomes over £150,000 in a UK tax reform in 2010 to estimate the semi-elasticity of retirement with respect to the net-of-average-tax rate.

3.3.1 The 2010 Tax Reform

The UK's personal income tax system covers both labour and capital income (except capital gains and dividends) and has a progressive structure. In 2010, income above the personal allowance of £6,475 was taxed at a basic rate of 20% up to £37,400 and a higher rate of 40% that applied to all income above that threshold.

The 2010 reform introduced significant changes. A new 50% tax rate was established for annual incomes exceeding £150,000, which raised the marginal tax rate from 40% in the 2009-2010 tax year to 50% in 2010-2011. Additionally, the reform introduced a gradual reduction of the personal allowance for high earners at a rate of £1 for every £2 earned, creating a 60% effective marginal rate for income between £100,000 and £113,000. Taxpayers earning above

£113,000 lost their personal allowance entirely, which resulted in an additional tax burden of £2,590, equivalent to a 40% tax rate on the £6,475 that was previously tax-free. The reform thus substantially altered both marginal and average tax rates, with larger increases for higher-income taxpayers. The scale of the reform makes it particularly valuable in the context of studying high-income taxpayer behaviour, as all affected individuals were in the top 0.66% of the income distribution in 2010 (Browne and Phillips (2017)).

In November 2008 (tax year 2008-2009), a 45% rate for incomes above £150,000 was announced. The announcement of a 50% rate for the same taxpayers came in April 2009, thus the last year before any announcement is 2007-2008, which we use as our reference year. The 50% rate remained in effect for three years before being reduced to 45% in April 2013 (tax year 2013-2014). Such reduction was announced in March 2012.

3.3.2 Empirical Strategy

We exploit three sources of variation: variation in statutory tax rates, income bands, and age.

Time and income variation. The 2010 UK reform affected all taxpayers earning over £150,000 by increasing their marginal tax rate from 40% to 50%. We estimate the impact of the reform on the probability of retiring of affected taxpayers with an event-study approach, where we compare a treatment group consisting of taxpayers above the threshold (earning £165,000-£225,000) to taxpayers below the threshold (earning £120,000-£135,000).

These income bands were chosen to have similar treatment and control groups in terms of individual characteristics. Table C.1 shows comparisons between treated and control group across various dimensions. By construction, the income figures are higher for the treated group. While the differences in individual characteristics are mostly statistically significant, they are not large in magnitude, and we present a similar evolution of the outcomes before the reform in the two groups (Graphs 4.4, A.2, A.1 and A.3).

When defining the income bands, we exclude individuals who are close to the threshold for two reasons. First, the relevant tax rate measure for extensive margin decisions like retirement is the average tax rate rather than the marginal tax rate. There is little variation in the average tax rate between individuals close to the £150,000 threshold for the new tax rate. Second, individuals with income above £120,000 exhibit substantial income volatility. Table 3.1 shows that among individuals who were either above or below the £150,000 threshold in 2007, only 77% of those with income above £150,000 had income above this threshold in 2008, with similar patterns observed across all years. Therefore, choosing individuals who are not too close to the threshold reduces the risk of individuals transitioning between treatment and control groups from one year to the next.

The income volatility is also the reason why we choose to work with repeated cross-section rather than panel data. Saez, Slemrod, and Giertz (2012) show that using repeated cross-section rather than panel data is an efficient way of dealing with year-on-year variability of income for high-income individuals. However, we also present robustness to using a panel definition instead in Table C.3.

Table 3.1: Taxpayer Transitions Across the £150,000 Income Threshold.

Total income in 2007	Total income in 2008	N	%
Above 150k	**Above 150k**	**161,150**	**0.77**
Above 150k	Below 150k	41,300	0.20
Above 150k	Not in data	6,550	0.03
Below 150k	**Below 150k**	**529,850**	**0.84**
Below 150k	Above 150k	61,300	0.10
Below 150k	Not in data	39,750	0.06

Notes: This table shows how the number of taxpayers (rounded to the nearest 50) above and below the £150,000 threshold in 2007 changes in 2008. The sample includes taxpayers with total income between £120,000 and £225,000 in 2007. Total income is constructed using SA and PAYE records.
Source: Authors' calculations based on HMRC administrative datasets.

We assign individuals to the treatment and control group based on their income in the year before the reform. A potential issue with this definition could arise from the fact that there is some evidence of forestalling between the announcement and the implementation of the reform (Browne and Phillips (2017); HMRC (2012)), showing that some individuals bring forward their dividends and employment income in 2010. However, our results are robust to assigning groups based on their income two and three years before the reform, as well as to excluding owner-managers or people who ever had capital gains, who have greater freedom in timing their remuneration and are thus more likely to forestall their income between the announcement and the implementation of the reform.

The equations we estimate are the following:

$$\text{First stage: } log(1-\tau_i) = \sum_{\substack{j=2003 \\ j\neq 2008}}^{2013} \theta_t Treated_i \times \mathbb{I}\{j=t\} + \delta Treated_i + \lambda_t + \varepsilon_{it} \tag{3}$$

$$\text{Second stage: } R_{it} = \beta_{tax} log(1-\tau_i) + \lambda_t + \eta_{it} \tag{4}$$

The coefficient of interest, β_{tax}, captures the effect of the log net-of-tax rate. We instrument the log net-of-tax rate with the interaction of time and treatment group. λ_t are year fixed effects.

$R_{i,t}$ is a retirement indicator taking value 1 in the year the individual retires according to our different measures. It takes value 0 in the years after the retirement such that we use a non-absorbing measure of retirement.[11]

The reduced form results are thus estimated using equation (5):

[11]For all measures of retirement, we only select the first year in which the individual fulfils the conditions, so that each individual can retire at most once. Results are similar when retirement is defined as an absorbing state, where the retirement variable remains set to 1 in all subsequent years after the retirement.

$$\text{Reduced form: } R_{it} = \sum_{\substack{j=2003 \\ j\neq 2008}}^{2013} \beta_t Treated_i \times \mathbb{I}\{j = t\} + \delta Treated_i + \lambda_t + e_{it} \tag{5}$$

The coefficients of interest are the β_t. If they are consistently close to 0 before the reform, we cannot reject the assumption of parallel pre-trends and attribute their value after the reform to the dynamic impact of the reform on the treatment group.

Time, income and age variation. As we aim to investigate the impact of higher income tax rates on retirement, another option is to explore how financial disincentives interact with established retirement age reference points. Specifically, we examine how increased marginal tax rates interact with established retirement age reference points. We want to test whether higher marginal tax rates for example reinforce existing retirement norms or nudge individuals toward atypical retirement ages.

To investigate these timing effects, we first select the subsample of taxpayers who retire and estimate an event-study specification of the average retirement age. Currently, we only observe age in years, but we are in the process of obtaining monthly birth data for each taxpayer. This will enhance our estimates' precision and allow us to account for changes in the State Pension Age for women during our study period. Women comprise approximately 15% of our sample, and our results remain robust when excluding them, as they are to including controls for the industry, to account for different standard ages of retirement.[12]

$$\text{Reduced form: } A_{it} = \sum_{\substack{j=2003 \\ j\neq 2008}}^{2013} \delta_t Treated_i \times \mathbb{I}\{j = t\} + \gamma Treated_i + \lambda_t + w_{it} \tag{6}$$

Our coefficients of interest are the δ_t. If they are not significantly different from 0 before the reform, it means that we cannot reject parallel pre-trends in retirement age for taxpayers in the treatment and control group before the reform. A positive (negative) coefficient means that the treated group retires later (earlier) than the control group.

To refine our analysis of retirement timing effects induced by tax rate changes, we compare closely aged cohorts. Figure 2.1 shows that age 60 represents the peak year for first private pension withdrawals, despite the absence of explicit financial retirement incentives. Consequently, we select 60 as the primary age for examining the interaction between retirement norms and tax changes. We focus on taxpayers who turn 60 in the year of the reform, 2011, who are thus born in 1951, and those who turn 60 one year earlier (born in 1950). This approach enables us to examine whether individuals in the treated group are more likely to conform to retirement norms during the reform year compared to those in the control group:

[12] We plan on using industry-specific retirement age norms as well.

$$\text{Reduced form: } R_{it} = \sum_{\substack{t=2003 \\ t\neq 2008}}^{2013} \beta_t Cohort_i \times Treated_i \times \mathbb{I}\{j=t\} + \alpha Cohort_i + \gamma Treated_i + \mathbb{I}\{j=t\} + u_{it} \tag{7}$$

The coefficients of interest are the β_t, while $\mathbb{I}\{j=t\}$ are tax year fixed effects. This methodology also allows us to contribute to the existing literature on financial incentives and reference points. While prior research has primarily concentrated on comparing statutory retirement ages and actuarial benefit adjustments in pension amounts (Rabaté (2019); Rabaté et al. (2024); Reck and Seibold (2023); Seibold (2021)), our study explores financial incentives from a policy whose objective is not to influence the retirement decisions. We also conduct supplementary analyses at ages 55 and 65, which correspond to the earliest possible private pension withdrawal and State pension eligibility, respectively. These additional ages thus represent a mix of eligibility criteria and social norms.

3.4 Connecting the Dots: Firm Responses

In this paper, we aim to provide evidence on both immediate and long-term firm-level effects of changes in retirement patterns in the workforce. We focus on both direct effects of retirement on firms as well as the mechanisms through which firms respond to retirement of key workers. For example, investigating workforce composition and hiring outcomes presents evidence on labor market adjustments of both firms and incumbent workers and what this implies for firms in terms of wage and cost structures. Additionally, firm performance, profits and investments can provide evidence on how retirement affects activity of firms as well as firms' strategies to adapt to the changing workforce.

We therefore estimate the causal effects of retirement on firms in both the short run and the longer run. This analysis is in progress, but we split our analysis in three categories: 1) Performance and productivity, 2) Worker composition and labour demand, 3) Adaptation, investment and innovation. This section outlines our empirical strategy, focusing on changes in the statutory age.

First, we restrict the sample to firms who have employees in the treatment and control group for each reform. We measure the number of treated workers in the firm in the year before the relevant reform, since any adjustment in the workforce later can be caused by the reform.

Following a similar approach to Hut (2024), we estimate firm-level impacts of retirement in a generalized difference-in-differences framework with continuous treatment, where we use variation in the share of workers in firms affected by each source of variation. Specifically, we regress the interaction of the share of treated workers and the year on firm-level outcomes Y:

$$Y_{ft} = \sum_j \psi_t Share_{f,treated} \times \mathbb{I}\{j=t\} + \sum_j \phi_t Share_{f,band} \times \mathbb{I}\{j=t\} + \alpha_f + \lambda_t + \epsilon_{ft} \tag{8}$$

Here, f indexes the firm and t the year. $Share_{f,treated}$ captures the proportion of workers affected by the reform, and $Share_{f,band}$ is the proportion of workers in the treatment and control group, which in the case of the State Pension age reform is women born between 1947 and 1953.[13] α_f and λ_t constitute firm fixed effects and tax year fixed effects. The errors ϵ_{ft} are clustered at the firm level.

The coefficients of interest are the ψ_t, which captures the effect of a marginal increase in the share of treated workers in the firm, keeping the share of workers in the band around the threshold constant. This holds under the identifying assumption that the exact position on either side of the threshold is quasi-random and would not have affected the firm outcome evolution absent the reform. As usual, we can assess the parallel trends assumptions when investigating whether the coefficients of interest are statistically different from zero.

We perform several robustness checks to assess the validity of the design. For example, if firms with different shares of treated workers are affected by different macroeconomic trends or shocks, this could pose a threat, so to test this, we perform a placebo test by artificially moving the threshold from 1950 to 1947 such that all cohorts are untreated.

First, we present results on performance and output measures of the firm. This includes productivity, value-added, profits, turnover as well as firm closure and survival. We investigate the impacts of both any retirement in the firm as well as retirement of key workers such as owners. Second, we present the impacts of retirement on worker composition and labour demand. Specifically, we investigate the impact on hiring patterns and the age composition of workers within firms, as well as detailed information on wage structures. Lastly, we present the effects of retirement on firms' adaptation strategies, specifically investment patterns for capital and technology demand and costs as well as R&D and innovation. The results are shown in Section 5.

4 Results: Retirement Responses

4.1 Statutory Age

This section presents the results on retirement impacts of changes to the State Pension age (SPA) for women. To get a first idea of the effect of increasing the State Pension age on retirement behaviour, we consider the share of taxpayers who claim State Pensions by age. In Figure 4.1, panel (a) shows how large a share of taxpayers in each age group claim State Pension for the first time, by birth cohort. The figure shows that there is a spike in the timing of State Pension claims at age 60 for the 1950 cohort compared to other ages. This was in fact the State Pension age for the 1950 cohort, corresponding to a retirement year of 2010. For the 1951 cohort, we see that the timing of first State Pension claims begins to shift towards age 61, and equally towards age 62 for the 1952 cohort.

Panel (b) shows the employment share (defined as receiving positive employment income) by age for the same cohorts. Prior to age 59, we see similar employment shares for the three

[13] We consider various alternative specifications in our robustness section, including using the number of workers instead of the share to estimate the impact of an additional treated worker

cohorts. Between age 59 and age 60, the employment share decreases for the 1950 cohort, while it stays unchanged for the 1951 and 1952 cohorts. The employment share begins to decrease at age 61 for the 1951 cohort and at age 62 for the 1952 cohort. Both panels thus descriptively suggest that the timing of retirement was affected by the change in the State Pension age.

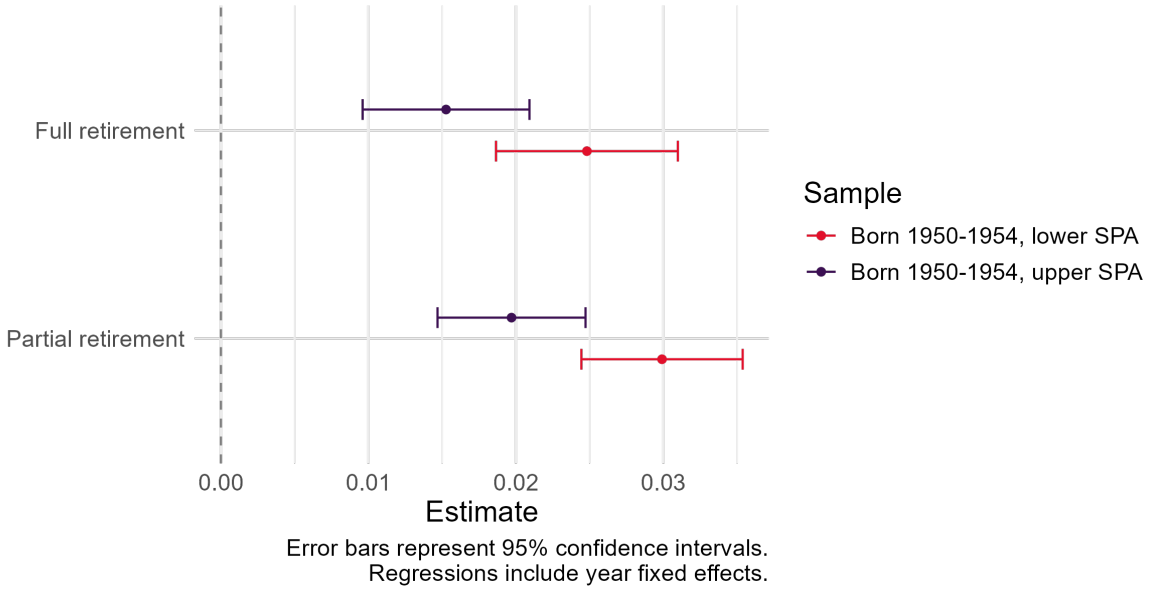
Figure 4.1: State Pension Claims and Employment Rates by Age (Women)

Notes: This figure presents first time state pension claims and employment rates by age for three birth cohorts of women (1950, 1951, and 1952). The sample includes taxpayers earning £120,000-225,000 in the year before. The left panel shows the timing of first claims of State Pension by age, and the right panel shows the employment share by age, where employment is defined as having positive employment income.
Source: Authors' calculations based on HMRC administrative datasets.

Figure 4.2 then presents the results from estimating equation (1) on our measures of full retirement and partial retirement. As we do not yet have access to the month of birth for each taxpayer, which would allow us to calculate the exact SPA, we present results using a "lower-bound" SPA and an "upper-bound" SPA, where we assume that all individuals are born either at the end or at the beginning of the year. [We expect to update these results with the exact timing in the next version of the paper.]

We find that that being above the State Pension age significantly increases the probability of being fully retired by 1.5 percentage points and the probability of being partially retired by 2.0 percentage points. For the lower-bound SPA, the increase amounts to 2.5 percentage points for full retirement and 3 percentage points for partial retirement. In comparison Cribb et al. (2016) finds an increased employment probability of being under the State Pension age of 6.3 percentage points, which is thus a greater increase compared to our results. However, we focus on a sample of female taxpayers earning £120,000-225,000, which means that our results concern a population of high earners and are therefore not directly comparable. [We expect to update these results to include all taxpayers in the next version of the paper.] We also update the analysis using administrative data instead of survey data and use different outcome measures of retirement to explore the impacts of the change in the SPA.

Figure 4.2: State Pension Age Increase: Regression Results for Full and Partial Retirement



Notes: This figure presents the coefficients and associated standard errors from estimation equation (1) on retirement. The sample includes female taxpayers born between 1950 and 1954 with taxable income of £120,000-225,000. 'Full retirement' marks the year in which the taxpayer experience an 80% 5-year drop, together with a pension increase at the same moment, or they experience an 80% 5-year drop and their income remains below £17,500 - half of the threshold for the lower rate of the tax income. 'Partial retirement' marks the first year in which the taxpayer experiences a labour income drop (of any amount and duration) while receiving pensions income of more than 50 of their pensions and labour income combined.
Source: Authors' calculations based on HMRC administrative datasets.

In Appendix Figure C.9, we show that the positive impact of the increase in SPA on retirement generally holds across different measures of retirement. The only exception is the timing of first claiming of private pensions, which is not surprising given that private pensions can be claimed prior to the State Pension. The impact of the increase in SPA is also of similar size across retirement definitions apart from the probability of claiming the State Pension for the first time, which increases by 8 percentage points using the upper-bound SPA. There is thus a larger impact on the propensity to start claiming pensions income while still working.

[Robustness paragraph to be included in upcoming version of the paper]

4.2 Joint Retirement

[Analysis in progress]

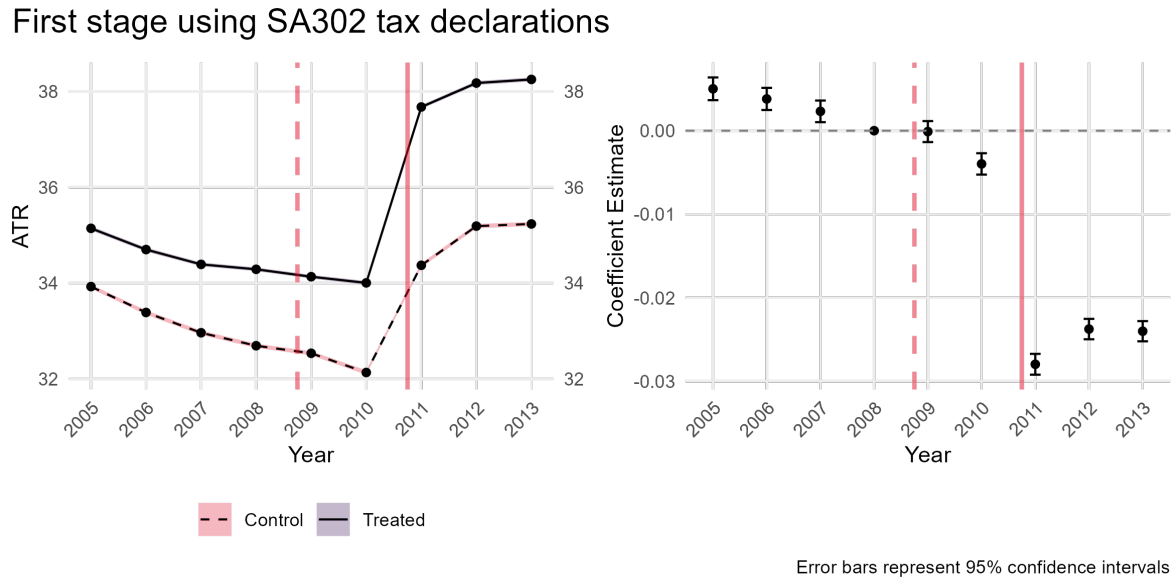
4.3 Tax Changes

This section presents the results on tax-induced retirement using the UK tax reform in 2010.

Figure 4.3 provides evidence for the first stage. The left panel shows a 5pp (13%) increase in the effective average tax rate of the treatment group relative to the control group in the year of the reform. Both the control and the treated group experience an increase in the effective tax rate due to the withdrawal of the personal allowance. The right panel reports the coefficients of the interaction of tax year and treatment group on the log of net tax rate, $log(1 - ATR)$.

The reform decreases the net of tax income for the treated group by 3 percentage points, or 7%. Column 3 of Table 4.1 shows that the first stage is strong.

Figure 4.3: First stage: Evolution of the Average Tax Rate (ATR) and Coefficients of the Event Study on $log(1 - ATR)$.

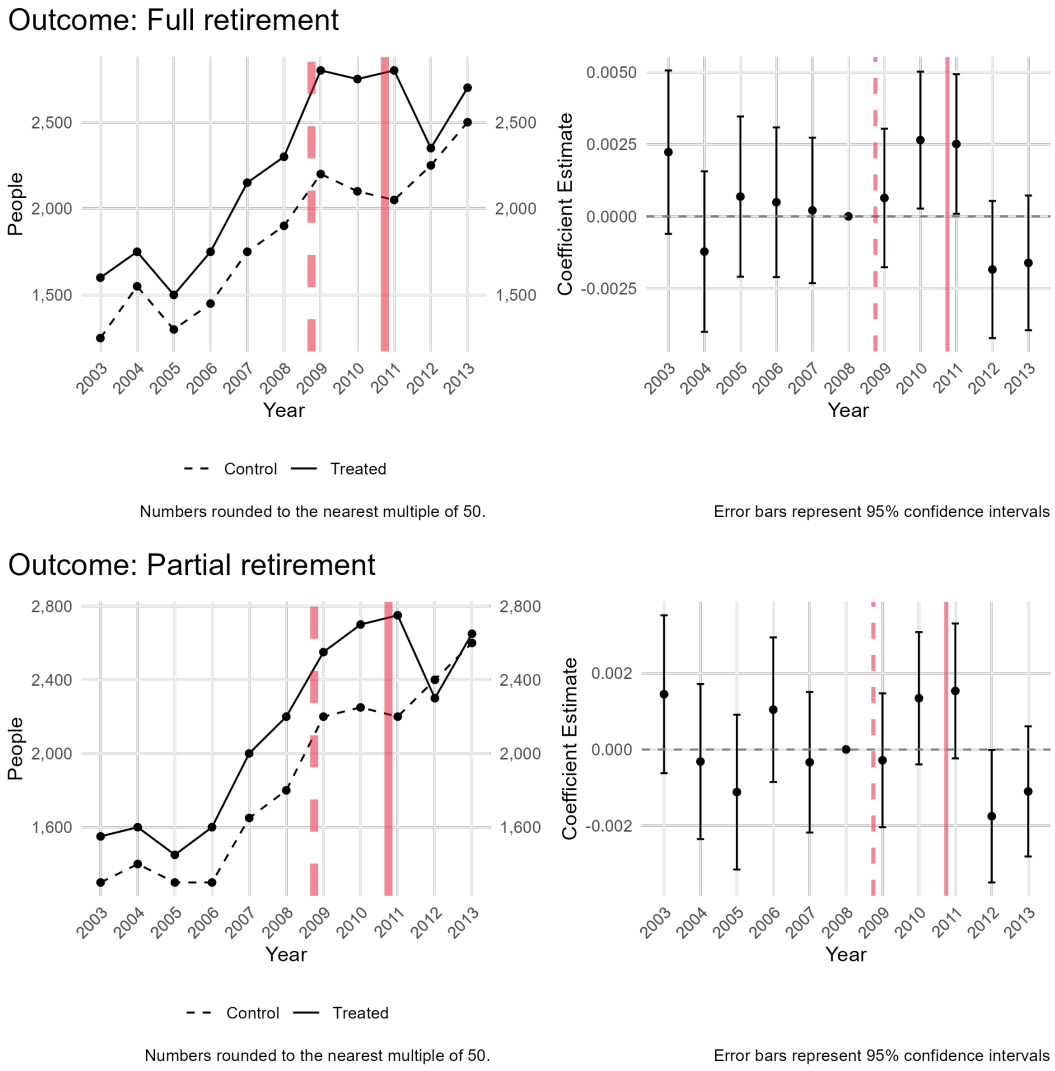


Notes: This figure provides evidence for the first stage. The left panel shows observed average tax rate (ATR) in control and treatment groups from 2008 to 2013. The treated group includes taxpayers earning £165,000-225,000 in the year before, and the control group includes taxpayers earning £120,000-135,000 in the year before. The right panels show the coefficients of the interaction of tax year and treatment group on the log of net tax rate, estimating equation (4).
Source: Authors' calculations based on HMRC administrative datasets.

In Figure 4.4, we present the evolution of the number of people retiring on the left, alongside the coefficients of interest from the event study estimating equation (5) on the right. For the main results, we use data on tax liabilities from HMRC tax calculations, and results are robust to using a different way of calculating tax liabilities (using the Valid View dataset), as shown in Figure C.7. We first note that the treatment and control groups exhibit similar retirement trends prior to the reform across different retirement definitions.

Our analysis shows a precisely estimated zero effect of increased income taxation on retirement decisions. This finding holds for partial retirement measures (panel B of Figure 4.4), as well as pension-based measures of retirement, which proxy partial retirement. Specifically, we find no differential evolution in the timing of first private pension withdrawals, initial State Pension receipts, or the point at which pension income exceeds half of total earned income (Figure A.2). We also find no significant impact of the reform on the pension amount withdrawn in the first year of pension withdrawal, after normalizing pension income to total income. Similarly, we find no significant effects when defining retirement based exclusively on labour income drops (Figure A.1). Using the full retirement definition, we observe an increased retirement propensity during the period from the reform announcement (tax year 2008-2009) through its implementation (tax year 2010-2011). However, this difference amounts to approximately 500 individuals, allowing us to rule out reduced-form effects larger than 0.5 percentage points. When combining drop-based

Figure 4.4: Retirement Impacts of the 2010 Tax Reform.



Notes: This figure displays full and partial retirement around the tax reform. The left panels show the evolution of the number of retired individuals in the treatment and control group over time. The treated group includes taxpayers earning £165,000-225,000 in the year before, and the control group includes taxpayers earning £120,000-135,000 in the year before. The right panels show the coefficients and associated standard errors from equation (5) on full and partial retirement. 'Full retirement' marks the year in which the taxpayer experience an 80% 5-year drop, together with a pension increase at the same moment, or they experience an 80% 5-year drop in income, and their income remains below £17,500, which is half of the threshold for the lower rate of the tax income. 'Partial retirement' marks the first year in which the taxpayer experiences a labour income drop (of any amount and duration) while receiving pensions income of more than 50% of their pensions and labour income combined.
Source: Authors' calculations based on HMRC administrative datasets.

and pension-based retirement measures, we continue to find null or minimal effects. In panel A of Figure A.3, we define retirement as experiencing a 5-year drop to 80% of labour income while receiving any pension income, and again find no effect of the reform on retirement behaviour. In panel B of Figure A.3, we slightly modify the definition to include an 80% drop in labour income (without the 5-year duration requirement) combined with any pension income receipt, finding statistically significant but economically negligible effects on retirement propensity. In panel C of Figure A.3, we further relax the definition of retirement, so that any drop of labour

Table 4.1: Tax-induced Retirement: Regression Results.

	Reduced form		First stage	Second stage	
Variables	Full ret.	Partial ret.	log(1 - ATR)	Full ret.	Partial ret.
Treat × 2005	0.001	-0.001	0.005***		
	(0.001)	(0.001)	(0.001)		
Treat × 2006	0.000	0.001	0.004***		
	(0.001)	(0.001)	(0.001)		
Treat × 2007	0.000	-0.000	0.002***		
	(0.001)	(0.001)	(0.001)		
Treat × 2009	0.001	-0.000	-0.000		
	(0.001)	(0.001)	(0.001)		
Treat × 2010	0.003**	0.001	-0.004***		
	(0.001)	(0.001)	(0.001)		
Treat × 2011	0.003**	0.002*	-0.028***		
	(0.001)	(0.001)	(0.001)		
Treat × 2012	-0.002	-0.002**	-0.024***		
	(0.001)	(0.001)	(0.001)		
Treat × 2013	-0.002	-0.001	-0.024***		
	(0.001)	(0.001)	(0.001)		
log(1 - ATR)				0.024***	0.014***
				(0.005)	(0.004)
Observations	1,318,800	1,318,800	1,318,800	1,318,800	1,318,800
F-stat			8,641.74		

Notes: This table presents the regression results for the effects of the 2010 tax reform on retirement. The treated group includes taxpayers earning £165,000-225,000 in the year before, and the control group includes taxpayers earning £120,000-135,000 in the year before. 'Full retirement' marks the year in which the taxpayer experience an 80% drop in income lasting for 5 years, together with a pension increase at the same moment, or they experience an 80% 5-year drop in income, and their income remains below £17,500, which is half of the threshold for the lower rate of the tax income. 'Partial retirement' marks the first year in which the taxpayer experiences a labour income drop (of any amount and duration) while receiving pensions income of more than 50% of their pensions and labour income combined.
Source: Authors' calculations based on HMRC administrative datasets.

income (not necessarily of 80%, not necessarily for 5 years) combined with any pension receipt counts as retirement, and we find similar null effects.

In the second stage, we measure the semi-elasticity of retirement with respect to changes in income tax. This captures the percentage point change in the retirement rate in response to a 1% increase in the net-of-average-tax rate. Our estimates suggest that full retirement increases by 0.024, allowing us to rule out responses larger than 0.035. The elasticity of partial retirement is smaller, allowing us to rule out responses larger than 0.02. To the best of our knowledge, this paper is the first to estimate the semi-elasticity of retirement with respect to income tax. Laun (2017) focuses on tax credits targeting old workers' labour force participation and finds an elasticity of participation with respect to the net-of-participation tax rate of 0.22.

The results are robust to different definitions of the treatment group. First, while in our main specification we define the treatment group as people with total income between £135,000 and

£225,000, we extend the treated group to all taxpayers with total income above £135,000 in the year before, up to the 99.99 percentile of the total income distribution. The results are similar when including up until the 99.9, the 99.95 or the 99.99 percentile.

When including people with higher incomes, the reduced-form coefficients are larger for most retirement definitions, but the groups are less comparable, with some violations of the pretrends assumption (Table C.2). However, the coefficients of the first stage are larger as well, since the average tax rate of taxpayers with higher income is larger (Graph C.3) than in the baseline sample. For this reason, the second-stage coefficient is similar or only marginally larger for the higher incomes sample compared to the baseline one (Graph 4.5).

The results are also robust to using a panel definition of the dataset, rather than a cross-sectional one. Table C.3 reports the results using a balanced panel definition of the dataset, where we select individuals with total income between £120,000 and £225,000 in 2008 and follow them over time. Last, results remain robust when we restrict the sample to only include individuals over 53 years old.

We then investigate the mechanisms underlying the observed low elasticity of retirement behaviour with respect to income taxation. We first analyse the interaction between tax-induced financial incentives and statutory retirement age thresholds. Then, we decompose the reform's impact into income and substitution effects.

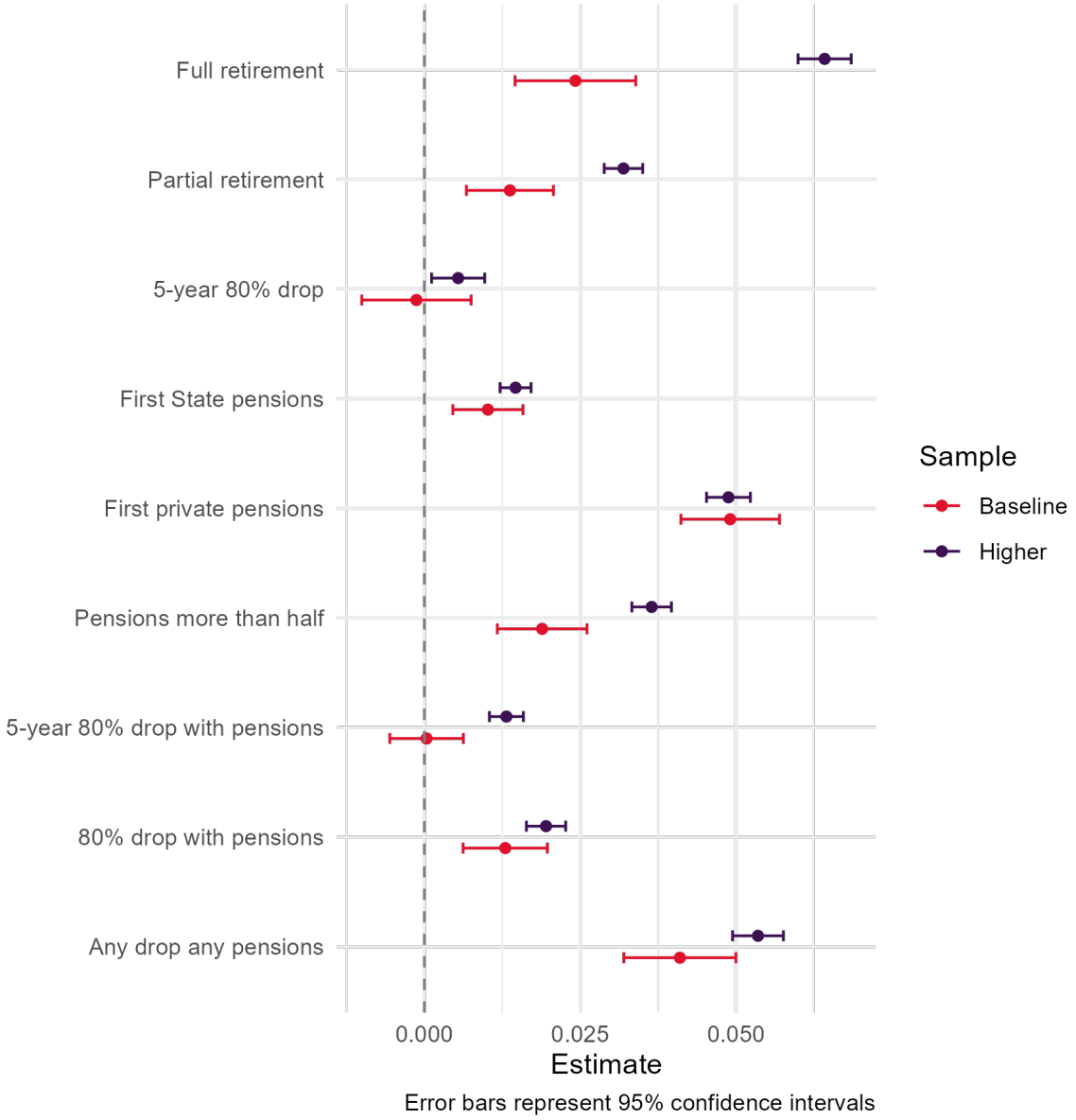
Examining the raw means evolution of full retirement (panel A of figure 4.4), the number of people retiring in the treated group increases from the control group trend during the tax years 2008-2009 to 2010-2011, and subsequently drops to a level similar to the 2008 baseline in the tax year 2011-2012, coinciding with the announcement of the reform's rollback. This suggests that the small, statistically significant positive effect could be driven by timing effects: taxpayers who would have retired in the tax year 2011-2012 may have instead chosen to retire earlier.

To investigate this hypothesis, we apply the event study specification to the average retirement age across different retirement definitions. The results are presented in appendix B. Consistent with our baseline results, we find no reform-related effects on the average retirement age across most retirement definitions.

We then examine whether individuals in the treated group are more likely to conform to retirement norms during the reform year. Table C.5 reports our coefficients of interest, the interaction between turning 60 in the year of the reform, being 60 and in the treated group. We find no impact on additional retirement at age 60.

The second mechanism we explore is the income and substitution effects of the reform. While the income tax applies to earned and unearned income alike, people who get most of their income from investment would reduce their tax burden less by retiring compared to people who get most of their income from employment and thus have a smaller incentive to retire. We investigate this by assigning taxpayers to bins of £5000 based on their total taxable income. In every bin, we compute the median share of total investment income over the total taxable income. We then assign people to a "Below" group if their share of total investment is below the median, i.e. if they rely more on earned income than the median taxpayer in their bin.

Figure 4.5: Retirement Impacts of the 2010 Reform Across Definitions and Samples.



Notes: This figure presents the second-stage regression results for all definitions of retirement for both the baseline sample (taxpayers with total income between £120,000 and £225,000) and a sample of taxpayers with higher incomes (all taxpayers with total income above £135,000). '80% 5-year drop' is constructed by following taxpayers over time and marking the year in which their labour income - defined as sum of employment, self-employment and partnership and trading income - drops to 80% of the level in the year before, and remains under such a threshold for 5 years. 'First private pension' and 'First State Pension' mark the year the taxpayer gets their first private and State Pension, respectively. 'Full retirement' marks the year in which the taxpayer experience an 80% drop in income lasting for 5 years, together with a pension increase at the same moment, or they experience an 80% 5-year drop in income, and their income remains below £17,500, which is half of the threshold for the lower rate of the tax income. 'Partial retirement' marks the first year in which the taxpayer experiences a labour income drop (of any amount and duration) while receiving pensions income of more than 50% of their pensions and labour income combined.
Source: Authors' calculations based on HMRC administrative datasets.

Those who have more investment income than the median are assigned to the "Above" group. We note that results are robust to using the average instead of the median and to different sizes of the bins.

We then estimate our event study equation (equation (5)) separately for people in the "Above" and "Below" groups. We expect people relying more on earned income to react more to the reform through retirement. Figure C.8 does not show significantly different coefficients for people who rely more on earned income ("Below") compared to the ones who rely on it less ("Above").

Overall, the analysis displays no statistically significant evidence that the marginal tax rate increase substantially influences retirement behaviour for high-income individuals. In a companion paper (Advani, Poux, and Summers (2024)), we estimate no effect of the reform on the migration response of natives, and a small migration elasticity of -0.2 for migrants. Overall, this suggests that the total extensive margin responses of the 2010 reform introducing a higher tax rate is driven by the emigration response of foreigners. Our results themselves also suggest that tax-motivated retirement considerations should not be a major concern for tax policy design of high-income individuals.

5 Main Results: Economic Effects of Retirement

[Analysis in progress and results under clearance]

5.1 Firm Responses

5.2 Heterogeneity

5.3 Robustness

6 Concluding Remarks

[Analysis in progress]

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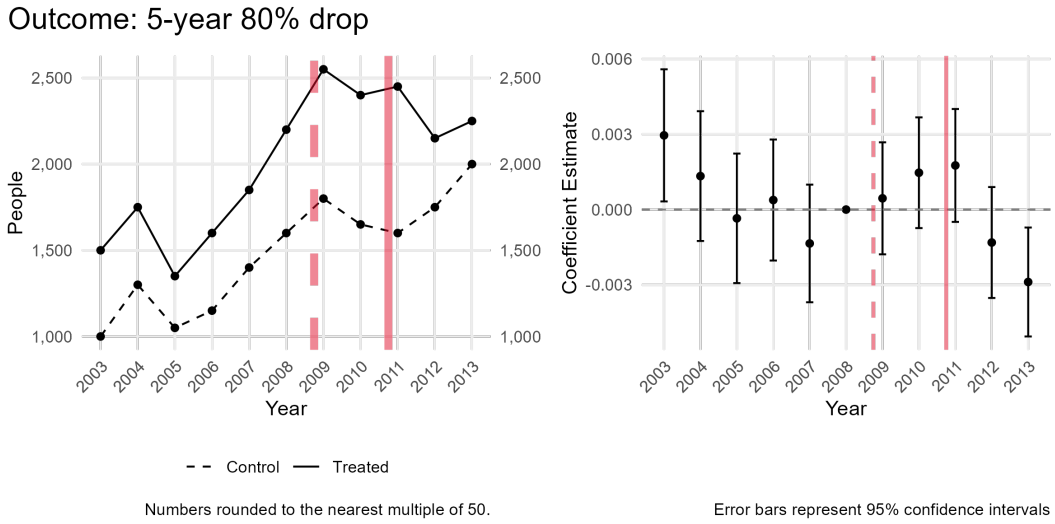
Appendix

A Tax Changes: Other Measures

Figure A.1: Raw means and regression results of the event study for labour-based definition of retirement.



Notes: On the left-hand side, evolution of the number of retired individuals in the treatment and control group over time. Treated group includes taxpayers earning £165,000-225,000 in the year before, control group taxpayers earning £120,000-135,000 in the year before. On the right-hand side, we show the coefficients and associated standard errors from Equation (5) on a labour-based definition of retirement. '80% 5-year drop' is constructed by following taxpayers over time and marking the year in which their labour income - defined as sum of employment, self-employment and partnership and trading income - drops to 80% of the level in the year before, and remains under such a threshold for 5 years.
Source: Authors' calculations based on HMRC administrative datasets.

B Tax Changes: Average Age

To investigate the hypothesis that the small, statistically significant positive effect could be driven by timing effects, we apply the event study specification to the average retirement age across different retirement definitions.

For our primary outcomes, we observe no effect in partial retirement, indicating that the ages of individuals partially retiring in the treatment and control groups do not differ significantly, both before and after the reform.

Consistent with the increase in retirement numbers shown in Figure 4.4, Figure B.1 shows that treated individuals retiring in the tax years 2009-2010 and 2010-2011 tend to be approximately 1 year younger than comparable retirees in the control group during the same period. Overall, this points to a potential retiming effect of the marginal income tax increase on retirement decisions. For the broader economy, the impact of around 500 individuals retiring roughly one year earlier than anticipated is unlikely to produce significant real effects.

Consistent with our baseline results, we find no reform-related effects on the average retirement

age across most retirement definitions — including pension-based measures (Figure C.4), labour-based measures (Figure C.5), and combinations of pension and labour-based measures (Figure C.6).

C Additional Tables and Figures

Table C.1: Table of characteristics of treatment (total income between £165,000 and £225,000 in 2007) and control (£120,000-£135,000 in 2007) in 2008.

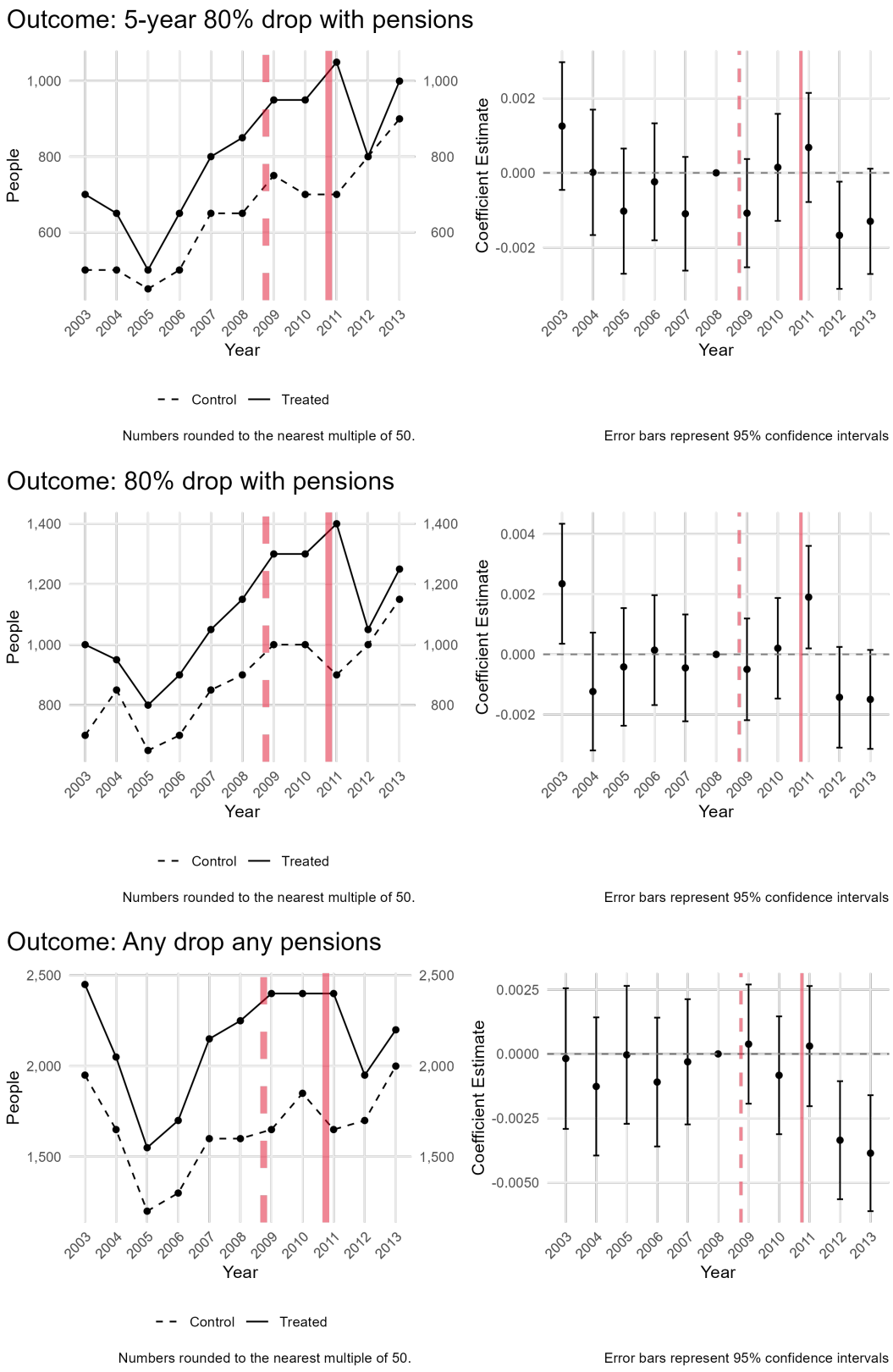
	Control Mean	Control Std. Dev.	Treated Mean	Treated Std. Dev.	Diff. in Means	Std. Error
			Income and capital gains			
Total income	132452.93	75457.99	316880.43	258129.10	184427.51	746.62
Total earned income	114459.57	72979.12	270024.09	244896.63	155564.51	709.59
Total investment income	17993.35	48708.76	46856.35	119586.76	28862.99	349.62
Employment income	81049.50	82026.91	177322.89	230373.00	96273.39	709.08
Self-employment income	9170.11	33629.50	21676.68	84565.95	12506.58	241.39
Part.-trade income	18008.12	47011.69	61767.46	172984.38	43759.34	453.54
Pensions	6221.12	21468.59	9248.09	39897.01	3026.97	127.19
Property income	1920.10	10291.01	4307.74	28426.79	2387.64	79.04
Savings income	4484.81	15047.56	13713.77	45851.75	9228.96	124.06
Dividends income	10673.84	41106.20	25073.30	90022.53	14399.46	270.60
Other inv. income	914.60	10693.23	3761.53	35458.46	2846.93	92.69
Capital gains	24873.82	352565.78	113033.54	1281215.22	88159.73	3281.44
			Personal characteristics			
% with pensions	0.15	0.36	0.14	0.35	-0.01	0.00
Private pensions contributions	4036.84	12007.29	9634.36	31252.49	5597.52	88.36
% in SA	0.92	0.28	0.96	0.19	0.04	0.00
% in PAYE	0.14	0.35	0.10	0.30	-0.05	0.00
% non-resident	0.01	0.10	0.01	0.12	0.00	0.00
Female	0.18	0.38	0.13	0.34	-0.05	0.00
Age	49.15	11.02	49.42	10.85	0.27	0.07
Migrant	0.15	0.36	0.18	0.38	0.03	0.00
Employee	0.54	0.50	0.50	0.50	-0.04	0.00
Finance	0.02	0.13	0.03	0.18	0.02	0.00
Medical	0.43	0.49	0.25	0.43	-0.18	0.00
Scientific-technical	0.27	0.44	0.40	0.49	0.13	0.00
N	59,600		179,750			

Notes: The sample includes taxpayers with total income between £120,000 and £225,000 in 2007. We observe their characteristics in 2008. Income variables are constructed using SA and PAYE records. The industry variables (finance, medical, scientific-technical) are constructed using PAYE data.
Source: Authors' calculations based on HMRC administrative datasets.

Figure A.2: Raw means and regression results of the event study for measures of retirement based on pensions exclusively.

Notes: On the left-hand side, evolution of the number of retired individuals in the treatment and control group over time. Treated group includes taxpayers earning £165,000-225,000 in the year before, control group taxpayers earning £120,000-135,000 in the year before. On the right-hand side, we show the coefficients and associated standard errors from Equation (5) on first private pension and first stage pension receipt. 'First private pension' and 'First State Pension' mark the year the taxpayer gets their first private and State Pension, respectively.
Source: Authors' calculations based on HMRC administrative datasets.

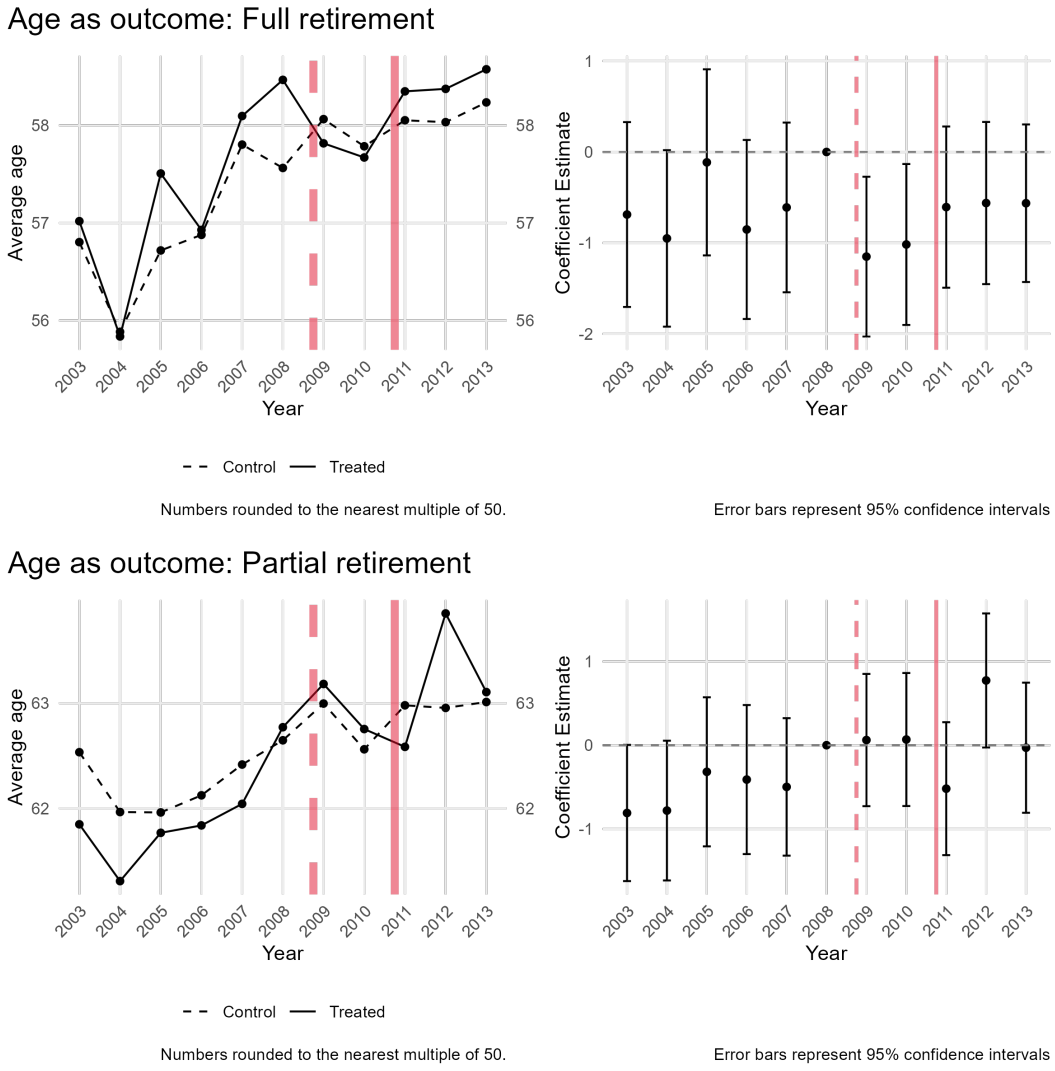
Figure A.3: Raw means and regression results of the event study for other measures of retirement combining pensions and labour income drops.



Notes: On the left-hand side, evolution of the number of retired individuals in the treatment and control group over time. Treated group includes taxpayers earning £165,000-225,000 in the year before, control group taxpayers earning £120,000-135,000 in the year before. On the right-hand side, we show the coefficients and associated standard errors from Equation (5) on different measures of retirement based on labour income drops and pension receipt.

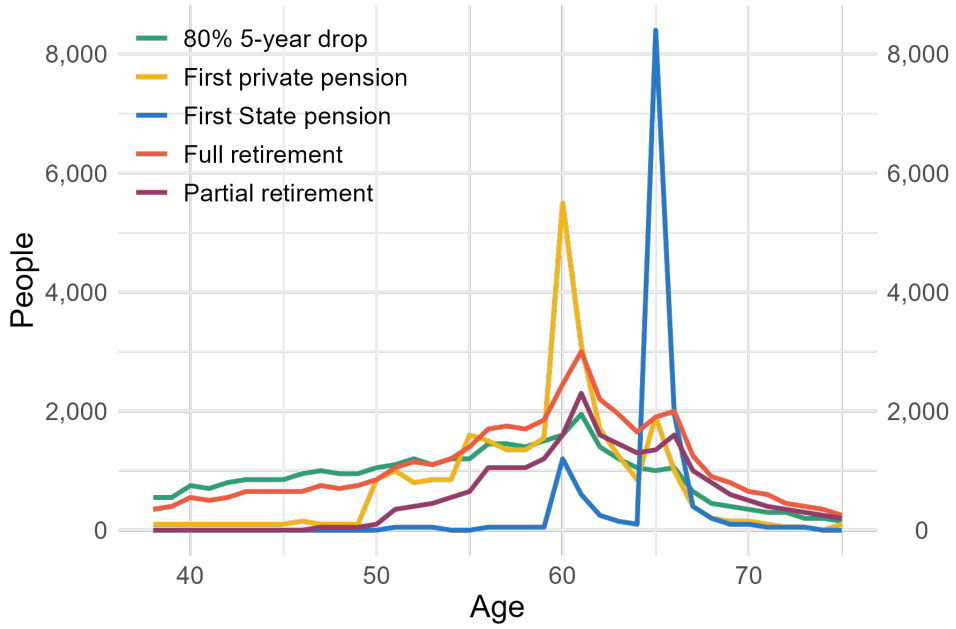
Source: Authors' calculations based on HMRC administrative datasets.

Figure B.1: Raw average age at retirement and regression results of the age event study for full retirement and partial retirement.



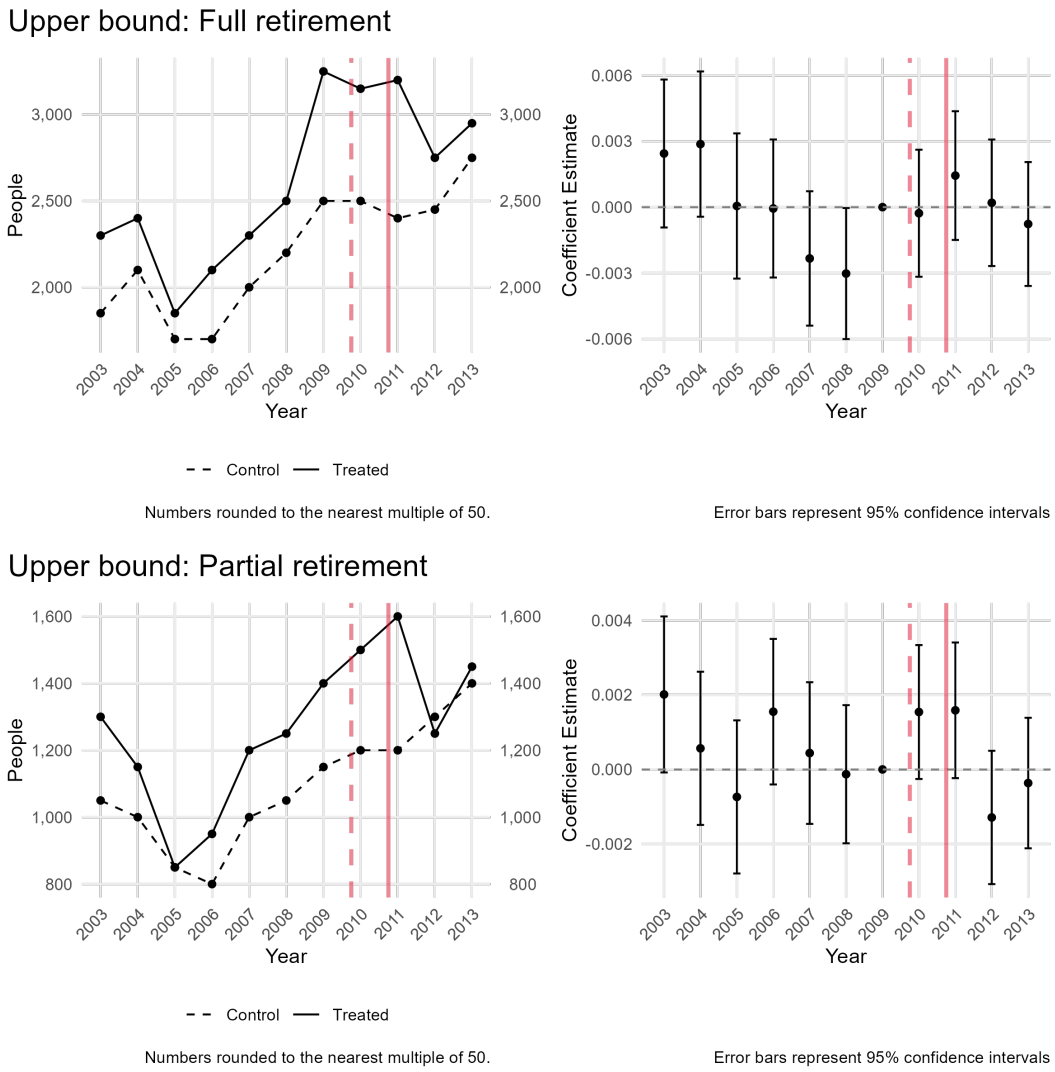
Notes: On the left-hand side, evolution of the average age at retirement for individuals in the treatment and control group over time. Treated group includes taxpayers earning £165,000-225,000 in the year before, control group taxpayers earning £120,000-135,000 in the year before. On the right-hand side, we show the coefficients and associated standard errors. 'Full retirement' marks the year in which the taxpayer experience an 80% 5-year drop, together with a pension increase at the same moment, or they experience an 80% 5-year drop and their income remains below £17,500 - half of the threshold for the lower rate of the tax income. 'Partial retirement' marks the first year in which the taxpayer experiences a labour income drop (of any amount and duration) while receiving pensions income of more than 50% of their pensions and labour income combined.
Source: Authors' calculations based on HMRC administrative datasets.

Figure C.1: Absolute distribution of different definitions of retirement, by age, in 2003-2013.



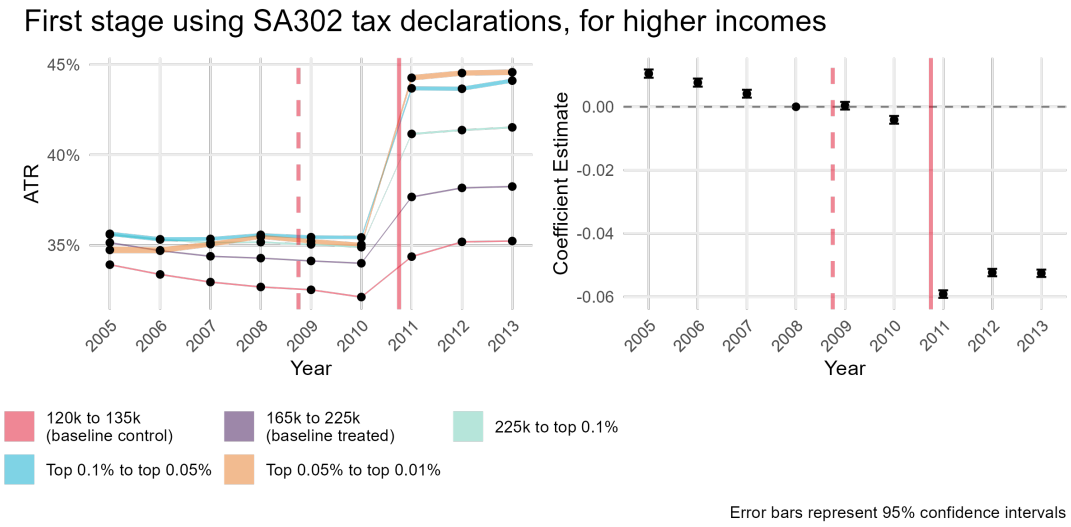
Notes: This figure shows the share of retired taxpayers by age according to different definitions of retirement. The sample includes taxpayers with total income between £120,000 and £225,000 in 2003 to 2013. '80% 5-year drop' is constructed by following taxpayers over time and marking the year in which their labour income - defined as sum of employment, self-employment and partnership and trading income - drops to 80% of the level in the year before, and remains under such a threshold for 5 years. 'First private pension' and 'First State Pension' mark the year the taxpayer gets their first private and State Pension, respectively. 'Full retirement' marks the year in which the taxpayer experience an 80% 5-year drop, together with a pension increase at the same moment, or they experience an 80% 5-year drop and their income remains below £17,500 - half of the threshold for the lower rate of the tax income. 'Partial retirement' marks the first year in which the taxpayer experiences a labour income drop (of any amount and duration) while receiving pensions income of more than 50% of their pensions and labour income combined.
Source: Authors' calculations based on HMRC administrative datasets.

Figure C.2: Upper bound of the retirement definition. Raw means and regression results of the event study for full retirement and partial retirement.



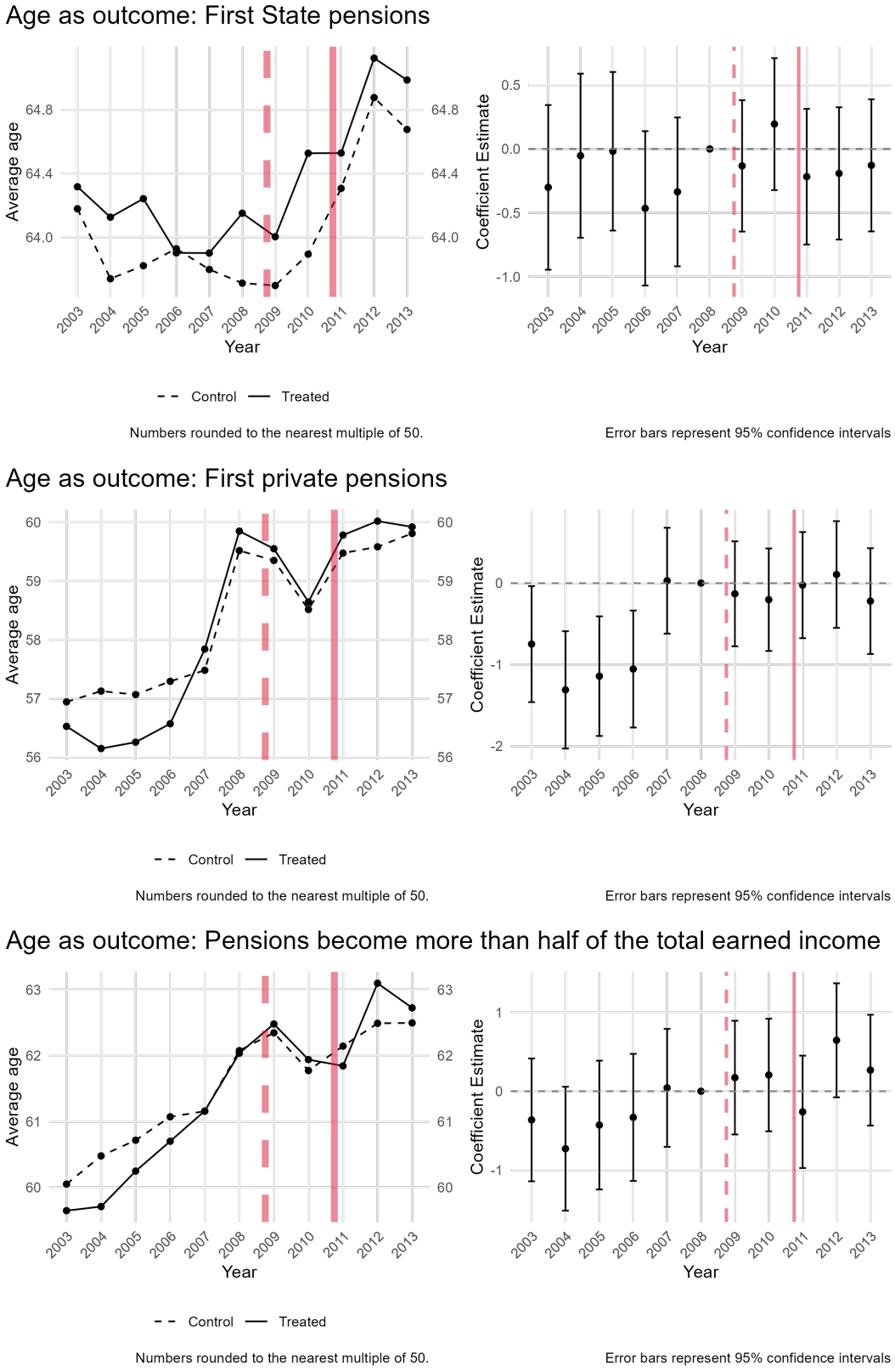
Notes: On the left-hand side, evolution of the number of retired individuals in the treatment and control group over time. Treated group includes taxpayers earning £165,000-225,000 in the year before, control group taxpayers earning £120,000-135,000 in the year before. On the right-hand side, we show the coefficients and associated standard errors from Equation (5) on full and partial retirement. 'Full retirement' marks the year in which the taxpayer experience an 80% 5-year drop, together with a pension increase at the same moment, or they experience an 80% 5-year drop and their income remains below £17,500 - half of the threshold for the lower rate of the tax income. 'Partial retirement' marks the first year in which the taxpayer experiences a labour income drop (of any amount and duration) while receiving pensions income of more than 50% of their pensions and labour income combined. The 'upper bound' definition of the sample imputes 0 income for everyone who is no longer in the tax data.
Source: Authors' calculations based on HMRC administrative datasets.

Figure C.3: First stage. Evolution of the average tax rate (ATR) for different income bands and coefficients of the event study on log(1-ATR), defining the treatment group as people with income above £225,000.



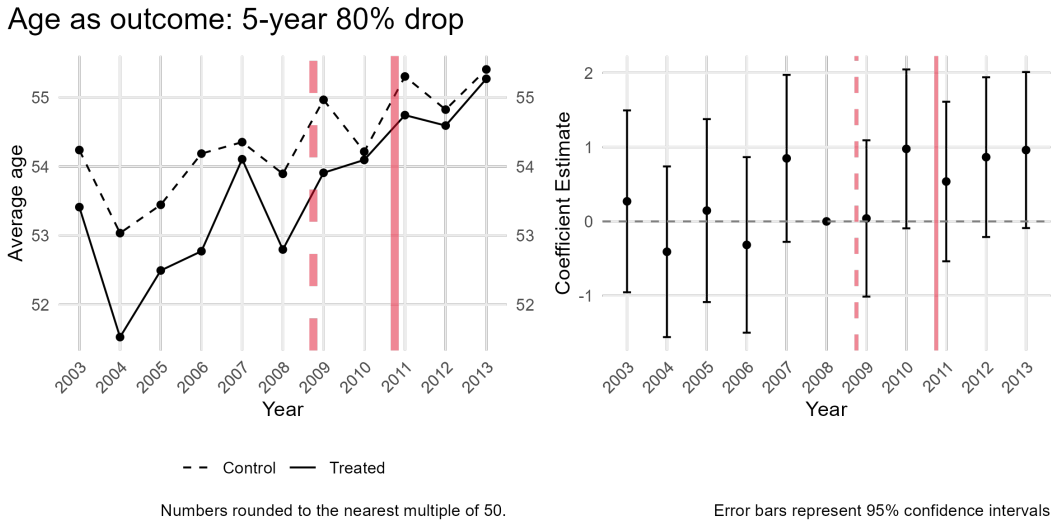
Notes: The sample includes taxpayers with total income between £120,000 and £225,000 in 2009. We observe their retirement behaviour in 2010. '80% 5-year drop' is constructed by following taxpayers over time and marking the year in which their labour income - defined as sum of employment, self-employment and partnership and trading income - drops to 80% of the level in the year before, and remains under such a threshold for 5 years. 'First private pension' and 'First State Pension' mark the year the taxpayer gets their first private and State Pension, respectively. 'Full retirement' marks the year in which the taxpayer experience an 80% 5-year drop, together with a pension increase at the same moment, or they experience an 80% 5-year drop and their income remains below £17,500 - half of the threshold for the lower rate of the tax income. 'Partial retirement' marks the first year in which the taxpayer experiences a labour income drop (of any amount and duration) while receiving pensions income of more than 50% of their pensions and labour income combined. 'First private pension' and 'First State Pension' mark the year the taxpayer gets their first private and State Pension, respectively.
Source: Authors' calculations based on HMRC administrative datasets.

Figure C.4: Raw average age at retirement and regression results of the age event study for pension-based measures.



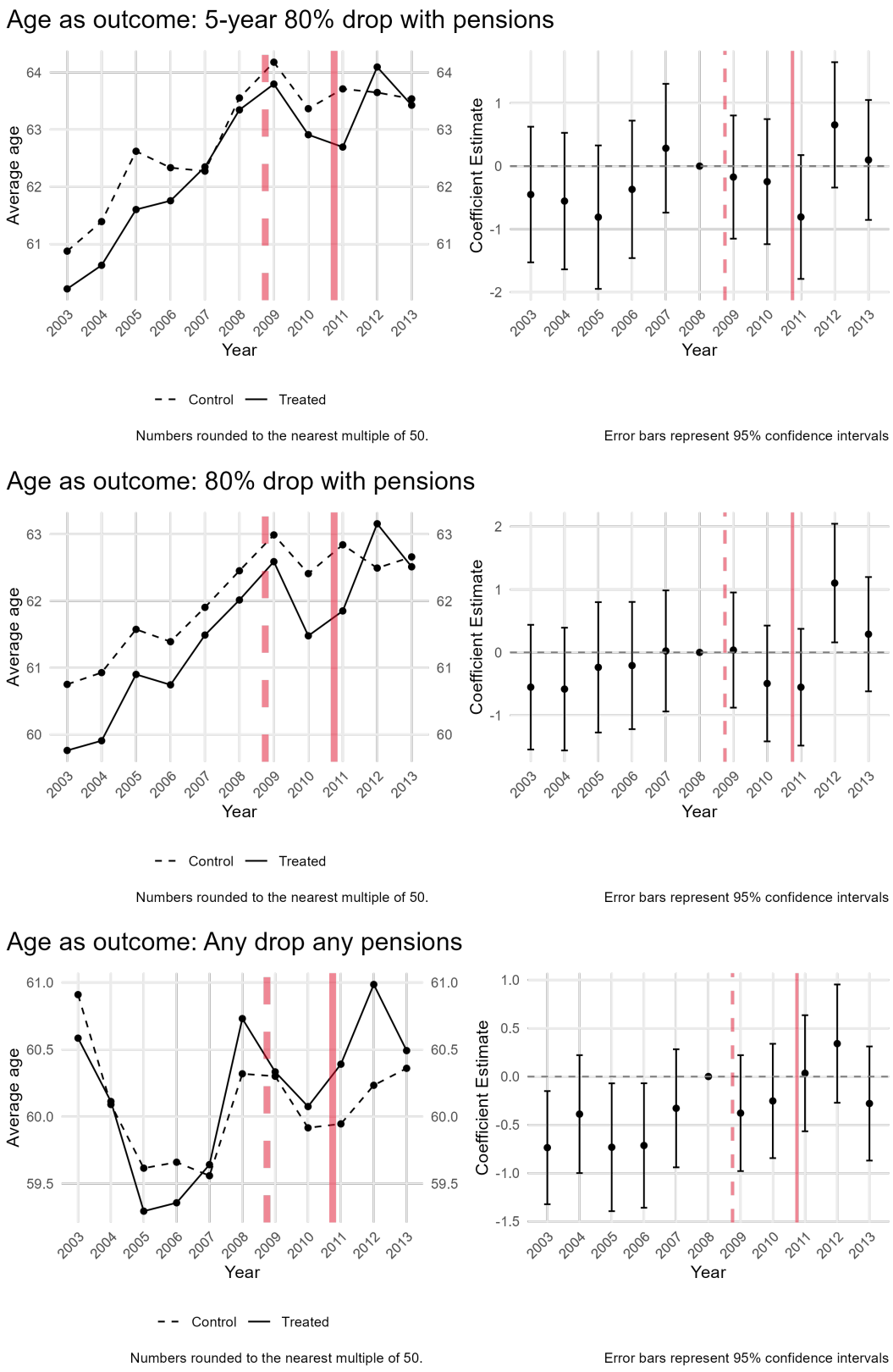
Notes: On the left-hand side, evolution of the average age at retirement for individuals in the treatment and control group over time. Treated group includes taxpayers earning £165,000-225,000 in the year before, control group taxpayers earning £120,000-135,000 in the year before. On the right-hand side, we show the coefficients and associated standard errors. 'First private pension' and 'First State Pension' mark the year the taxpayer gets their first private and State Pension, respectively.
Source: Authors' calculations based on HMRC administrative datasets.

Figure C.5: Raw average age at retirement and regression results of the age event study for labour-based definition of retirement.



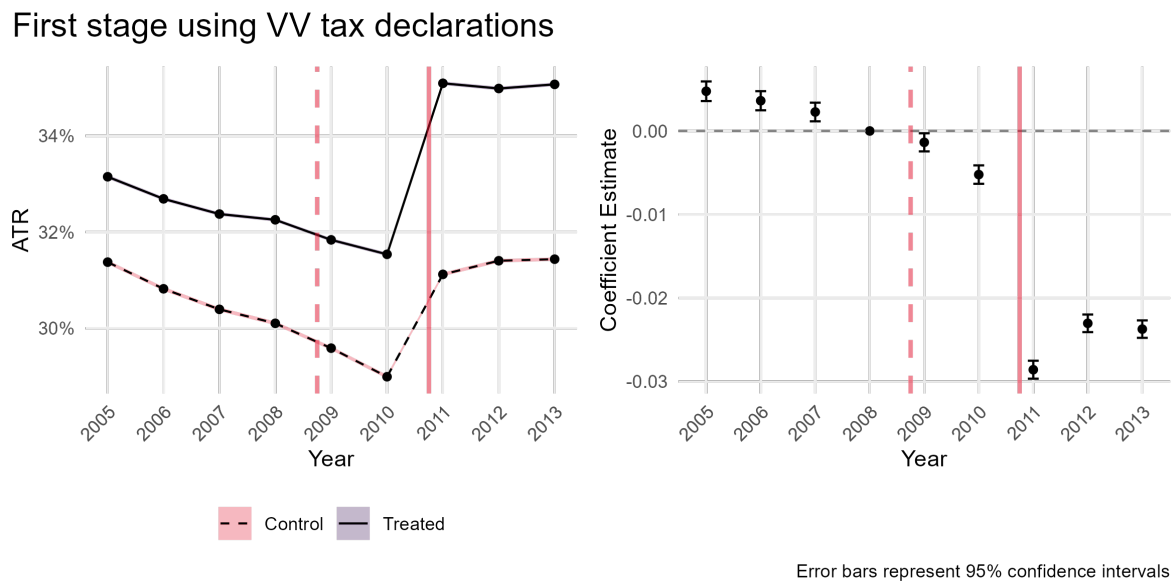
Notes: On the left-hand side, evolution of the average age at retirement for individuals in the treatment and control group over time. Treated group includes taxpayers earning £165,000-225,000 in the year before, control group taxpayers earning £120,000-135,000 in the year before. On the right-hand side, we show the coefficients and associated standard errors. '80% 5-year drop' is constructed by following taxpayers over time and marking the year in which their labour income - defined as sum of employment, self-employment and partnership and trading income - drops to 80% of the level in the year before, and remains under such a threshold for 5 years.
Source: Authors' calculations based on HMRC administrative datasets.

Figure C.6: Raw average age at retirement and regression results of the age event study for other measures of retirement combining pensions and labour income drops.



Notes: On the left-hand side, evolution of the average age at retirement for individuals in the treatment and control group over time. Treated group includes taxpayers earning £165,000-225,000 in the year before, control group taxpayers earning £120,000-135,000 in the year before. On the right-hand side, we show the coefficients and associated standard errors.
Source: Authors' calculations based on HMRC administrative datasets.

Figure C.7: First stage, evolution of the average tax rate (ATR) and coefficients of the event study on $log(1 - ATR)$.



Notes: The left panel shows observed average tax rate (ATR) in control and treatment groups from 2008 to 2013. Treated group includes taxpayers earning £165,000-225,000 in the year before, control group taxpayers earning £120,000-135,000 in the year before. The right panel show the coefficients of the interaction of tax year and treatment group on the log of net tax rate, estimating equation (4).
Source: Authors' calculations based on HMRC administrative datasets.

Figure C.8: Substitution vs. income effects in the tax-induced retirement analysis.

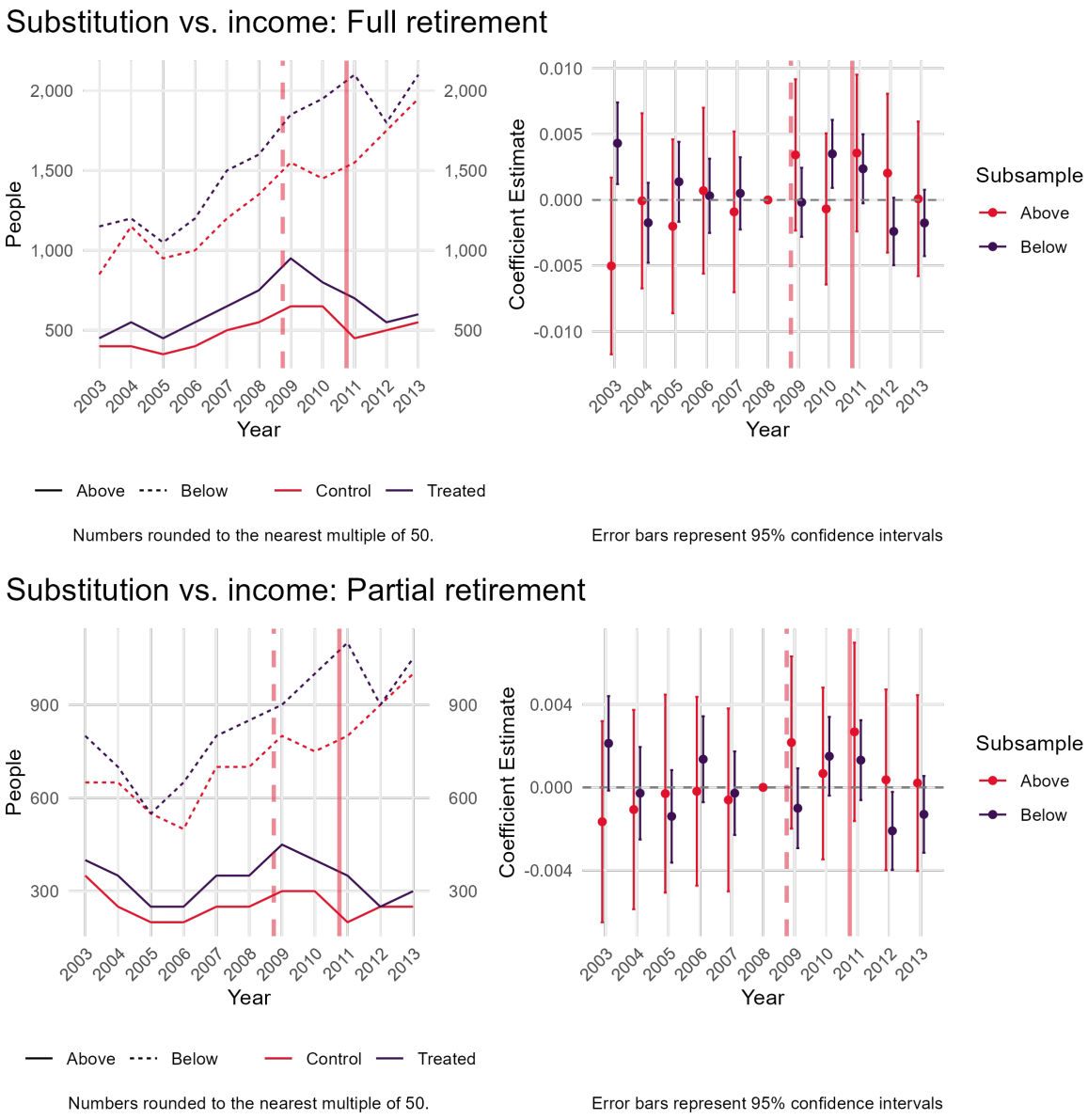


Table C.2: Main results of tax-induced retirement analysis including individuals with total income above £225,000 in the treatment group

	Reduced form		First stage	Second stage	
Variables	Full ret.	Partial ret.	log(1 - ATR)	Full ret.	Partial ret.
Treat × 2005	0.001	0.001	0.010***		
	(0.001)	(0.001)	(0.001)		
Treat × 2006	0.000	0.003***	0.008***		
	(0.001)	(0.001)	(0.001)		
Treat × 2007	0.000	-0.000	0.004***		
	(0.001)	(0.001)	(0.001)		
Treat × 2009	0.001	0.000	0.000		
	(0.001)	(0.001)	(0.001)		
Treat × 2010	0.003**	0.002**	-0.004***		
	(0.001)	(0.001)	(0.001)		
Treat × 2011	0.003**	0.003***	-0.059***		
	(0.001)	(0.001)	(0.001)		
Treat × 2012	-0.002	-0.003***	-0.052***		
	(0.001)	(0.001)	(0.001)		
Treat × 2013	-0.002	-0.002***	-0.053***		
	(0.001)	(0.001)	(0.001)		
log(1 - ATR)				0.064***	0.032***
				(0.002)	(0.002)

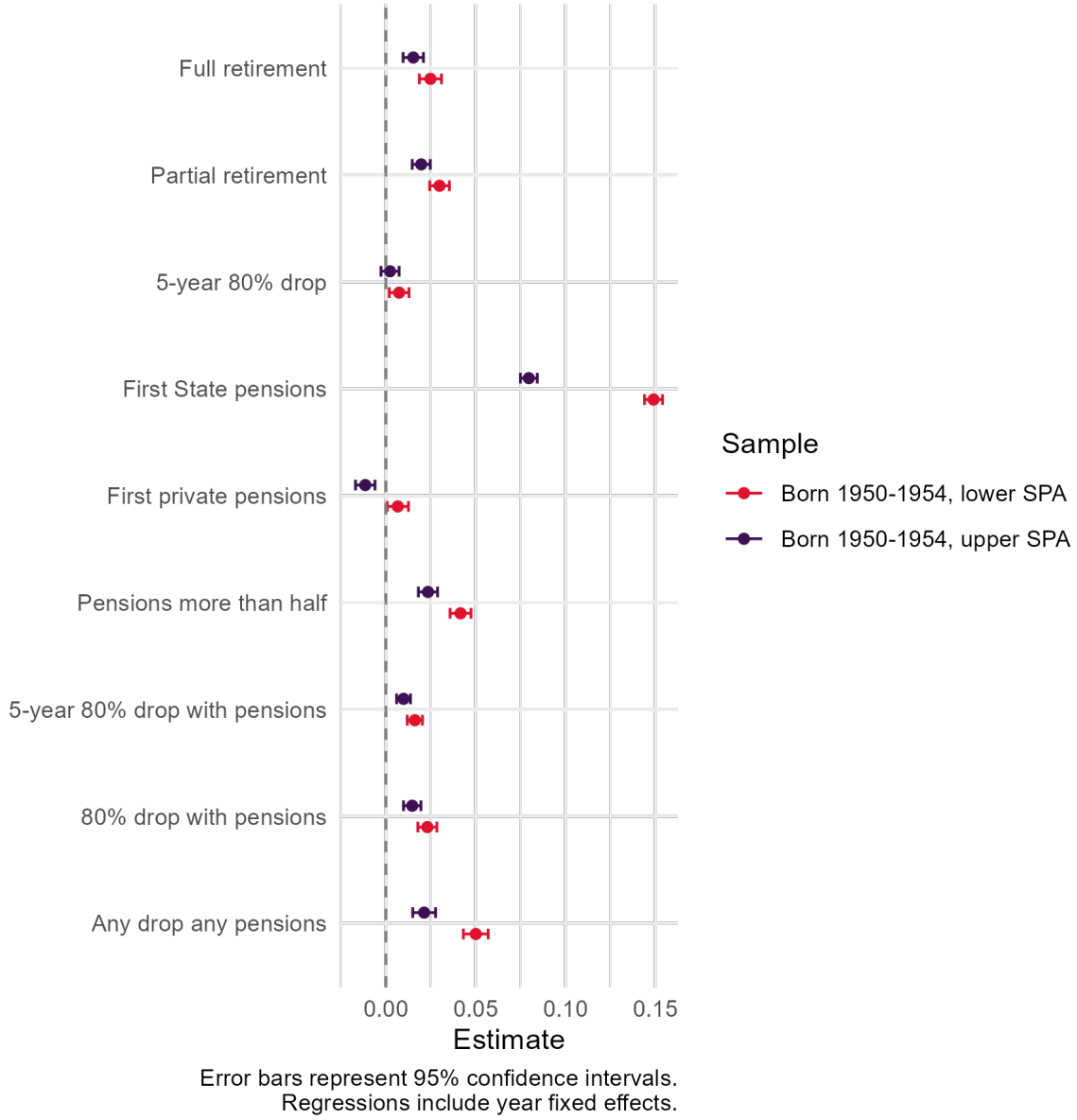
Notes: Treated group includes taxpayers earning more than £165,000 in the year before, control group taxpayers earning £120,000-135,000 in the year before. 'Full retirement' marks the year in which the taxpayer experience an 80% 5-year drop, together with a pension increase at the same moment, or they experience an 80% 5-year drop and their income remains below £17,500 - half of the threshold for the lower rate of the tax income. 'Partial retirement' marks the first year in which the taxpayer experiences a labour income drop (of any amount and duration) while receiving pensions income of more than 50% of their pensions and labour income combined.
Source: Authors' calculations based on HMRC administrative datasets.

Table C.3: Reduced-form event-study results for the panel specification of the dataset

	Main outcomes		*Pension-based*			*Labour-based*	*Other pension- and labour-based*		
Dependent variables:	Full retirement	Partial retirement	First State pensions	First private pensions	Pensions become more than half of total income	5-year 80% drop	5-year 80% drop with pensions	80% drop with pensions	Any drop any pensions
2003 × Treated	0.0004	-0.0015*	0.0002	-0.0004	-0.0004	-0.0003	0.0004	-0.001	-0.0042***
	(0.0009)	(0.0008)	(0.0008)	(0.0011)	(0.0008)	(0.0008)	(0.0006)	(0.0007)	(0.0013)
2004 × Treated	0.0006	0.0004	-0.0003	-0.0009	-0.0002	-0.0011	0.0009	-0.0002	-0.0009
	(0.001)	(0.0008)	(0.0008)	(0.0011)	(0.0008)	(0.0008)	(0.0006)	(0.0007)	(0.0012)
2005 × Treated	0.0021**	0.0003	0.0008	0.0009	0.0000	0.0007	0.0013**	0.0002	-0.0004
	(0.0009)	(0.0007)	(0.0009)	(0.0011)	(0.0007)	(0.0008)	(0.0006)	(0.0007)	(0.0011)
2006 × Treated	0.0014	0.0006	-0.0001	0.0001	0.0005	0.0002	0.0012**	-0.0002	-0.0011
	(0.0009)	(0.0007)	(0.0009)	(0.0011)	(0.0007)	(0.0008)	(0.0006)	(0.0007)	(0.0011)
2007 × Treated	0.0006	-0.0001	0.0004	0.0005	-0.0001	0.0003	0.0009	-0.0006	0.0006
	(0.0009)	(0.0007)	(0.0009)	(0.0012)	(0.0007)	(0.0008)	(0.0006)	(0.0006)	(0.0011)
2009 × Treated	0.0012	0.0002	-0.0003	0.0002	-0.0006	0.0032***	-0.0002	-0.0004	0.0038***
	(0.0013)	(0.001)	(0.001)	(0.0012)	(0.001)	(0.0012)	(0.0008)	(0.0009)	(0.0013)
2010 × Treated	0.0000	-0.0001	-0.0007	-0.0001	-0.0007	0.0017	-0.0002	-0.0017*	-0.0013
	(0.0014)	(0.001)	(0.001)	(0.0013)	(0.001)	(0.0012)	(0.0008)	(0.0009)	(0.0013)
2011 × Treated	**0.0043*** **	**0.002***	**-0.0008**	**-0.0002**	**0.0009**	**0.0048*** **	**0.0009**	**0.0004**	**0.0017**
	(0.0014)	**(0.001)**	**(0.001)**	**(0.0013)**	**(0.0011)**	**(0.0012)**	**(0.0009)**	**(0.001)**	**(0.0013)**
2012 × Treated	0.0029**	0.0008	0.0004	0.0022*	0.0000	0.0013	0.0004	-0.0008	0.0008
	(0.0014)	(0.001)	(0.0011)	(0.0013)	(0.0011)	(0.0011)	(0.0009)	(0.0009)	(0.0012)
2013 × Treated	0.005***	0.002*	-0.0008	-0.0011	0.0013	0.0031***	0.0011	0.0000	0.0002
	(0.0014)	(0.0011)	(0.0011)	(0.0013)	(0.0011)	(0.0012)	(0.0009)	(0.001)	(0.0013)
2003	-0.0021***	0.0049***	-0.0037***	-0.0037***	0.0007	-0.0002	-0.0006	0.0023***	0.0089***
	(0.0008)	(0.0007)	(0.0007)	(0.0009)	(0.0006)	(0.0006)	(0.0005)	(0.0006)	(0.001)
2004	-0.002***	0.0019***	-0.0037***	-0.004***	0.0001	0.0008	-0.0012***	0.0014***	0.0028***
	(0.0008)	(0.0006)	(0.0007)	(0.0009)	(0.0006)	(0.0007)	(0.0005)	(0.0005)	(0.0009)
2005	-0.0037***	0.0005	-0.0035***	-0.0056***	-0.0009	-0.0019***	-0.0017***	0.0005	-0.003***
	(0.0007)	(0.0006)	(0.0007)	(0.0008)	(0.0006)	(0.0006)	(0.0004)	(0.0005)	(0.0009)
2006	-0.0036***	-0.0008	-0.003***	-0.006***	-0.0012**	-0.0022***	-0.0017***	0.0004	-0.0028***
	(0.0007)	(0.0006)	(0.0007)	(0.0008)	(0.0006)	(0.0006)	(0.0004)	(0.0005)	(0.0009)
2007	-0.002***	-0.0001	-0.0023***	-0.0015*	-0.0002	-0.0015**	-0.0012***	0.0006	-0.0025***
	(0.0007)	(0.0006)	(0.0007)	(0.0009)	(0.0006)	(0.0006)	(0.0005)	(0.0005)	(0.0009)
2009	0.0224***	0.01***	0.0024***	0.0028***	0.0098***	0.019***	0.0089***	0.0108***	0.007***
	(0.001)	(0.0008)	(0.0008)	(0.0009)	(0.0008)	(0.0009)	(0.0007)	(0.0007)	(0.001)
2010	0.026***	0.0123***	0.0038***	0.0062***	0.0133***	0.0191***	0.009***	0.0128***	0.0089***
	(0.0011)	(0.0008)	(0.0008)	(0.001)	(0.0008)	(0.0009)	(0.0007)	(0.0007)	(0.001)
2011	0.0259***	0.014***	0.0039***	0.0051***	0.0149***	0.0196***	0.0104***	0.0151***	0.0072***
	(0.0011)	(0.0008)	(0.0008)	(0.001)	(0.0008)	(0.0009)	(0.0007)	(0.0008)	(0.001)
2012	0.0246***	0.0131***	0.0076***	0.0045***	0.0152***	0.0161***	0.0093***	0.0129***	0.0044***
	(0.0011)	(0.0008)	(0.0008)	(0.001)	(0.0008)	(0.0009)	(0.0007)	(0.0007)	(0.001)
2013	0.0259***	0.0143***	0.0095***	0.0065***	0.0175***	0.0159***	0.0104***	0.0144***	0.0059***
	(0.0011)	(0.0008)	(0.0009)	(0.001)	(0.0009)	(0.0009)	(0.0007)	(0.0008)	(0.001)
Control	0.0144***	0.0075***	0.0112***	0.0183***	0.0079***	0.009***	0.0053***	0.0056***	0.0176***
	(0.0006)	(0.0004)	(0.0005)	(0.0006)	(0.0004)	(0.0005)	(0.0003)	(0.0004)	(0.0006)
Treated	0.011***	0.0057***	0.0103***	0.0181***	0.0065***	0.0078***	0.0037***	0.0048***	0.017***
	(0.0004)	(0.0003)	(0.0004)	(0.0005)	(0.0003)	(0.0004)	(0.0002)	(0.0003)	(0.0005)

Notes: The table shows the coefficients and associated standard errors from estimating equation (5) on the panel definition of the sample. Treated group includes taxpayers earning £165,000-225,000 in 2008, control group taxpayers earning £120,000-135,000 in 2008. 'Full retirement' marks the year in which the taxpayer experience an 80% 5-year drop, together with a pension increase at the same moment, or they experience an 80% 5-year drop and their income remains below £17,500 - half of the threshold for the lower rate of the tax income. 'Partial retirement' marks the first year in which the taxpayer experiences a labour income drop (of any amount and duration) while receiving pensions income of more than 50% of their pensions and labour income combined. '80% 5-year drop' is constructed by following taxpayers over time and marking the year in which their labour income - defined as sum of employment, self-employment and partnership and trading income - drops to 80% of the level in the year before, and remains under such a threshold for 5 years. 'First private pension' and 'First State Pension' mark the year the taxpayer gets their first private and State Pension, respectively.
Source: Authors' calculations based on HMRC administrative datasets.

Figure C.9: State Pension Age Increase: Regression Results for All Retirement Definitions



Notes: This figure presents the coefficients and associated standard errors from estimation equation (1) on retirement. The sample includes female taxpayers born between 1950 and 1954 with taxable income of £120,000-225,000. 'Full retirement' marks the year in which the taxpayer experience an 80% 5-year drop, together with a pension increase at the same moment, or they experience an 80% 5-year drop and their income remains below £17,500 - half of the threshold for the lower rate of the tax income. 'Partial retirement' marks the first year in which the taxpayer experiences a labour income drop (of any amount and duration) while receiving pensions income of more than 50 of their pensions and labour income combined. '80% 5-year drop' is constructed by following taxpayers over time and marking the year in which their labour income - defined as sum of employment, self-employment and partnership and trading income - drops to 80% of the level in the year before, and remains under such a threshold for 5 years. 'First private pension' and 'First State Pension' mark the year the taxpayer gets their first private and State Pension, respectively.
Source: Authors' calculations based on HMRC administrative datasets.

Table C.4: Balance table of characteristics of treatment (total income above £165,000 in 2007) and control (£120,000-£135,000 in 2007) in 2008.

	Control Mean	Control Std. Dev.	Treated Mean	Treated Std. Dev.	Diff. in Means	Std. Error	
			Income and capital gains				
Total income	132452.93	75457.99	316880.43	258129.10	184427.51	746.62	***
Total earned income	114459.57	72979.12	270024.09	244896.63	155564.51	709.59	***
Total investment income	17993.35	48708.76	46856.35	119586.76	28862.99	349.62	***
Employment income	81049.50	82026.91	177322.89	230373.00	96273.39	709.08	***
Self-employment income	9170.11	33629.50	21676.68	84565.95	12506.58	241.39	***
Part.-trade income	18008.12	47011.69	61767.46	172984.38	43759.34	453.54	***
Pensions	6221.12	21468.59	9248.09	39897.01	3026.97	127.19	***
Property income	1920.10	10291.01	4307.74	28426.79	2387.64	79.04	***
Savings income	4484.81	15047.56	13713.77	45851.75	9228.96	124.06	***
Dividends income	10673.84	41106.20	25073.30	90022.53	14399.46	270.60	***
Other inv. income	914.60	10693.23	3761.53	35458.46	2846.93	92.69	***
Capital gains	24873.82	352565.78	113033.54	1281215.22	88159.73	3281.44	***
			Personal characteristics				
% with pensions	0.15	0.36	0.14	0.35	-0.01	0.00	***
Private pensions contributions	4036.84	12007.29	9634.36	31252.49	5597.52	88.36	***
% in SA	0.92	0.28	0.96	0.19	0.04	0.00	***
% in PAYE	0.14	0.35	0.10	0.30	-0.05	0.00	***
% non-resident	0.01	0.10	0.01	0.12	0.00	0.00	***
Female	0.18	0.38	0.13	0.34	-0.05	0.00	***
Age	49.15	11.02	49.42	10.85	0.27	0.07	
Migrant	0.15	0.36	0.18	0.38	0.03	0.00	***
Employee	0.54	0.50	0.50	0.50	-0.04	0.00	***
Finance	0.02	0.13	0.03	0.18	0.02	0.00	***
Medical	0.43	0.49	0.25	0.43	-0.18	0.00	***
Scientific-technical	0.27	0.44	0.40	0.49	0.13	0.00	***
N	59,600		179,750				

Notes: The sample includes taxpayers with total income between £120,000 and the 99.99% percentile in the total income population in 2007. We observe their characteristics in 2008. Income variables are constructed using SA and PAYE records. The industry variables (finance, medical, scientific-technical) are constructed using PAYE data.
Source: Authors' calculations based on HMRC administrative datasets.

Table C.5: Results using time, income and cohort variation.

	Dependent Variables	
Variables	Full ret.	Partial ret.
(Intercept)	0.039*** (0.006)	0.023*** (0.005)
53	-0.010 (0.009)	-0.006 (0.007)
54	-0.002 (0.009)	-0.002 (0.007)
55	-0.010 (0.009)	-0.002 (0.007)
56	-0.004 (0.008)	-0.002 (0.007)
58	0.006 (0.008)	0.002 (0.007)
59	0.007 (0.008)	0.001 (0.007)
60	0.024*** (0.008)	0.015** (0.007)
61	0.069*** (0.009)	0.059*** (0.007)
62	0.039*** (0.009)	0.045*** (0.007)
Turn 60 in 2011	-0.005 (0.008)	-0.008 (0.006)
Treated	0.010 (0.008)	0.009 (0.006)
53×Turn 60 in 2011	0.015 (0.012)	0.007 (0.010)
54×Turn 60 in 2011	-0.009 (0.012)	0.003 (0.010)
55×Turn 60 in 2011	0.007 (0.012)	0.003 (0.009)
56×Turn 60 in 2011	0.009 (0.012)	0.014 (0.009)
58×Turn 60 in 2011	-0.005 (0.012)	0.005 (0.009)
59×Turn 60 in 2011	0.001 (0.012)	0.007 (0.009)
60×Turn 60 in 2011	0.011 (0.012)	0.013 (0.009)
61×Turn 60 in 2011	-0.010 (0.012)	0.008 (0.010)
62×Turn 60 in 2011	0.027** (0.012)	0.007 (0.010)
53×Treated	-0.004 (0.012)	-0.008 (0.010)
54×Treated	-0.008 (0.012)	-0.008 (0.009)
55×Treated	0.004 (0.012)	-0.010 (0.009)
56×Treated	-0.005 (0.011)	-0.001 (0.009)
58×Treated	-0.012 (0.011)	-0.009 (0.009)
59×Treated	0.000 (0.011)	-0.001 (0.009)
60×Treated	-0.010 (0.011)	-0.014 (0.009)
61×Treated	-0.015 (0.012)	-0.024*** (0.009)
62×Treated	-0.016 (0.012)	-0.028*** (0.009)
Turn 60 in 2011×Treated	-0.006 (0.011)	-0.002 (0.009)
53×Turn 60 in 2011×Treated	-0.007 (0.017)	0.005 (0.013)
54×Turn 60 in 2011×Treated	0.027* (0.016)	0.006 (0.013)
55×Turn 60 in 2011×Treated	-0.007 (0.016)	0.004 (0.013)
56×Turn 60 in 2011×Treated	-0.003 (0.016)	-0.008 (0.012)
58×Turn 60 in 2011×Treated	0.011 (0.015)	0.006 (0.012)
59×Turn 60 in 2011×Treated	-0.001 (0.015)	-0.002 (0.012)
60×Turn 60 in 2011×Treated	0.015 (0.016)	0.008 (0.012)
61×Turn 60 in 2011×Treated	0.022 (0.016)	0.011 (0.013)
62×Turn 60 in 2011×Treated	0.007 (0.016)	0.025* (0.013)
Observations	59,600	59,600
Dep. variable mean	0.053	0.033

Notes: Treated group includes taxpayers earning £165,000-225,000 in the year before, control group taxpayers earning £120,000-135,000 in the year before. 'Turning 60 in 2010' is the cohort born in 1950, which turn 60 in the year before the tax reform, while 'Turning 60 in 2011' is the cohort born in 1951, which turn 60 in the year of the reform. 'Full retirement' marks the year in which the taxpayer experience an 80% 5-year drop, together with a pension increase at the same moment, or they experience an 80% 5-year drop and their income remains below £17,500 - half of the threshold for the lower rate of the tax income. 'Partial retirement' marks the first year in which the taxpayer experiences a labour income drop (of any amount and duration) while receiving pensions income of more than 50% of their pensions and labour income combined.
Source: Authors' calculations based on HMRC administrative datasets.