How Do Workers Adjust to Higher Pension Ages? Evidence on Labor Supply, Welfare Spillovers, and Savings [*]

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Abstract

We study the long-run effects of a 6-month increase in the early, incentivized, and full pension ages in Denmark—previously set at 60, 62, and 65—using a regression discontinuity design. We estimate dynamic responses over 12 post-reform-announcement years across multiple margins, including labor supply, public benefit claims, and savings. We find strong employment effects and a 3.3-month increase in the average retirement age, driven by large responses in the newly restricted months after the pre-reform eligibility ages, persistent effects thereafter, and no anticipatory responses before the affected ages. Investigating mechanisms, responses around the two early eligibility ages likely reflect financial incentives, while those near the full pension age appear behavioral. With limited spillovers from retirement into alternative welfare programs, the reform yields a substantial positive net fiscal effect. Finally, we document positive savings responses during periods of extended employment and higher labor income, a pattern suggestive of consumption smoothing but also consistent with passive accumulation through default occupational pension contributions.

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1 Introduction

The long-term sustainability of public pension systems has become a pressing challenge in many countries, driven by rising life expectancy and declining fertility, which together lead to rapidly aging populations. As a consequence, governments around the world are implementing pension reforms that extend individuals' working lives to alleviate the fiscal pressure. One common reform is to increase the ages at which individuals become eligible for early and full retirement benefits, a policy currently being pursued in more than half of the OECD countries (OECD, 2025).

Understanding the consequences of raising pension eligibility ages is crucial for optimal pension policy. While such reforms mechanically reduce pension expenditures, their overall fiscal impact depends critically on how individuals adjust their behavior. Responses can be wide ranging. Some workers may postpone retirement, whereas others may substitute forgone pension income with benefits from alternative programs, such as disability insurance (DI) or unemployment insurance (UI). Such substitution may be passive, when individuals remain on existing welfare benefit receipts until reaching the new eligibility age, or active, when they transition from employment into alternative programs in response to postponed pension eligibility (Staubli and Zweimüller, 2013; Rabaté et al., 2024). Individuals may also adjust along other margins, including hours worked and private saving, with important implications for labor supply, household wealth accumulation, and public finances.

Importantly, responses are not necessarily limited to the immediate claiming window affected by the reform. Individuals may adjust at different points in time following the reform announcement. Responses can emerge upstream, in the period between the announcement and the start of the newly restricted claiming window, or downstream, after the new eligibility age becomes binding. When multiple eligibility ages, such as the early retirement age (ERA) and the full retirement age (FRA), are raised, it is also important to consider what we term midstream responses, which occur between successive claiming windows.

Our main contribution is to provide a comprehensive assessment of both the behavioral margins through which individuals adjust and the timing of their responses to a reform that shifts multiple pension eligibility ages. To this end, we extend the analysis beyond extensive labor supply and pension claiming responses in two ways. First, we examine spillovers into alternative welfare programs. Second, we analyze intensive-margin responses through labor supply and private saving, exploiting administrative data on individuals' full asset portfolios, including pension wealth. In addition, we study how these responses unfold not only within the immediate claiming windows but also upstream, midstream, and downstream, thereby characterizing the full dynamic adjustment to changes in pension eligibility ages. Finally, we investigate the mechanisms underlying these responses.

We exploit the 2011 Danish pension reform that provides an ideal setting for our analysis. In 2011, Denmark implemented a reform that introduced stepwise increases in pension eligibility ages of six months for individuals born on or after January 1, 1954. The reform unexpectedly extended the earlier 2006 Welfare Agreement to older cohorts that had previously been exempt from its retirement-age increases. This institutional feature generates quasi-experimental birthdate cutoffs: individuals born just before and just after the threshold are highly comparable yet face different eligibility ages. We leverage this discontinuity in eligibility rules to identify causal effects by comparing outcomes around the birthdate cutoff using high-quality Danish administrative register data.

The reform simultaneously raised three key eligibility ages in the Danish pension system: the ERA, the incentivized early retirement age (IERA), and the FRA. The ERA marks the age at which individuals first become eligible for early retirement benefits. Two years later, at the IERA, benefit levels increase and the means test against private pension wealth is lifted. The FRA denotes the age at which individuals transition from the early retirement pension (ERP) scheme into the old-age pension (OAP) scheme. These eligibility ages were previously set at 60, 62, and 65, respectively, and the reform introduced stepwise increases of six months for successive half-year birth cohorts. It is precisely this parallel shift that we leverage to examine responses not only in the upstream and downstream periods of the newly restricted claiming windows, but also in the intermediate midstream periods between successive eligibility thresholds.

To structure our empirical analysis, we develop a life-cycle model calibrated to the Danish reform context that serves as a theoretical benchmark. We extend the model of consumption, saving, and endogenous retirement in Hurd et al. (2012) by allowing workers to exit the labor market either through pension benefits or alternative welfare programs such as UI and DI. Individuals choose consumption, saving, retirement timing, and exit route, valuing post-retirement leisure and facing a stigma cost from welfare claiming. We calibrate retirement and benefit-claiming incentives to the Danish institutional setting to derive testable predictions about behavioral responses to the reform. In particular, we incorporate strong financial incentives to retire at the ERA and IERA: at the ERA, retiring earlier implies losing five years of ERP benefits, while at the IERA, benefits increase and cease to be means-tested against private pension wealth. In contrast, there are no comparable financial notches to retire at the FRA.

The model delivers several testable predictions. First, retirement is predicted to bunch at the ERA and the IERA, where financial notches create strong incentives to exit, but not at the FRA. Following the reform, this bunching should shift to the new eligibility thresholds, with otherwise limited employment effects outside the directly affected windows. Second, following this extension of careers, lifetime resources increase, which due to the consumption-smoothing desire leads to lower upstream savings because of higher consumption, higher asset accumulation in newly restricted claiming windows and at retirement, and faster asset decumulation thereafter. Third, delayed pension eligibility induces substitution from pension to welfare benefits. Passive substitution arises mechanically as individuals already on welfare remain there until reaching the new pension eligibility age. Active substitution reflects individuals switching from employment to welfare and is predicted to be strongest at the ERA, weaker at the IERA, and absent at the FRA.

We apply a regression discontinuity design (RDD) to the first birthday cutoff created by the reform to test these predictions. This cutoff is distinctive because it offers an unaffected control group: individuals born just before January 1, 1954, who can be compared to those born just after, whose eligibility ages were raised from 60, 62, and 65 to 60.5, 62.5, and 65.5. At later cutoffs, by contrast, all cohorts are exposed to higher eligibility ages, differing in the intensity of treatment.

We highlight five main findings. First, we find no significant upstream responses in employment or benefit claims in the years between the reform announcement and ERA. Second, consistent with the broader pension-reform literature, we find large adjustments in the critical windows directly affected by the reform: employment increases and retirement is postponed at each postponed eligibility age. Third, we document economically meaningful spillovers into alternative welfare programs within these windows, partly driven by active substitution at the ERA, consistent with the institutional incentives embedded in our theoretical model. Fourth, behavioral adjustments extend beyond the immediate claiming windows. We find positive midstream and downstream labor-supply responses, implying that analyses focusing solely on the newly restricted claiming windows may miss an important part of the overall adjustment process. Finally, we document findings that point to mechanisms beyond our theoretical benchmark. We observe pronounced retirement bunching at the FRA, even though neither the public pension schedule nor second- and third-pillar pensions feature discrete financial notches at that age. Our evidence suggests that this pattern is best explained by a behavioral tendency to retire at salient reference points, consistent with the reference point theory of Seibold (2021), rather than demand-side constraints or liquidity frictions. In addition, we find large savings responses concentrated in occupational pension accounts and occurring primarily during periods of extended employment. While these patterns are consistent with standard consumption smoothing, they are also compatible with passive wealth accumulation through default occupational pension contributions.

Quantitatively, the reform generates sizable and persistent effects. Over the period 2011–2022 (ages 57–68), labor earnings increase by 19,438 USD, driven by large responses in the critical years when eligibility is postponed as well as continued effects after the FRA. The reform also increases private savings by 10,608 USD, with occupational pension wealth alone rising by 9,707 USD, driven by higher contributions, deferred withdrawals, and associated capital gains. Finally, we estimate a substantial positive fiscal effect, with net taxes increasing by 10,580 USD, driven by both higher tax revenues (4,068 USD) and lower transfer payments (6,460 USD). Overall, the results indicate that raising pension eligibility ages generates substantial gains in employment, wealth accumulation, and public finances.

An important question we address is who drives the behavioral responses—and, in turn, the positive fiscal externality. To shed light on this, we study heterogeneity by employment type, liquid wealth, and private pension wealth (second and third pillar). First, we find that the self-employed respond substantially less than salaried workers, consistent with greater flexibility in adjusting hours, weaker attachment to statutory eligibility thresholds, and different exposure to employer-administered pension contributions. Second, among salaried workers, the reform is more effective for individuals with low liquid wealth, with the response concentrated around postponed early retirement. This pattern suggests that liquidity constraints contribute to the bunching observed at the ERA. From a welfare perspective, this may be costly if financially fragile individuals are forced to delay retirement relative to their preferred timing or face stigma when resorting to alternative benefits. Third, we find stronger responses among individuals with low private pension wealth than among those with high pension wealth. In a setting where many countries are expanding funded second-pillar pension schemes, this heterogeneity raises a broader question about the effectiveness of future increases in statutory retirement ages. As pension-wealth-rich individuals can increasingly finance retirement from private resources, they may respond less to statutory eligibility changes and instead retire on their own means (see, e.g., Andersen et al. (2026)).

Literature. Our paper contributes to several strands of literature. First, we build on a large empirical literature that evaluates the labor supply effects of increases in the ERA and FRA. Numerous studies document how individuals adjust their retirement timing in response to shifts in pension eligibility rules. These include analyses of retirement incentives, behavioral responses to retirement-age reference points, and overall employment effects across a variety of countries (Duggan et al., 2007; Mastrobuoni, 2009; Behaghel and Blau, 2012; Staubli and Zweimüller, 2013; Vestad, 2013; Manoli and Weber, 2016; Fetter and Lockwood, 2018; Seibold, 2021; Haller, 2021; García-Miralles and Leganza, 2024; Deshpande et al., 2024).

Second, we contribute to research on spillover effects from pension reforms to alternative social insurance programs, such as UI and DI. When retirement eligibility is postponed, individuals unable or unwilling to work longer may turn to these alternatives. For instance, Staubli and Zweimüller (2013) show that raising the early retirement age in Austria increased both employment and unemployment. Geyer and Welteke (2021) report similar findings in Germany, with a substantial rise in employment accompanied by a smaller increase in UI claims. In the Netherlands, Rabaté et al. (2024) find that an increase in the FRA led to a substantial rise in employment and a largely mechanical but significant increase in participation in social insurance programs, particularly DI. Despite higher social insurance expenditures, they document a substantial net fiscal gain driven by reduced pension payouts and higher tax revenues from extended employment. Similar patterns of increased employment, spillovers into alternative benefit have been documented in Australia, the UK, and France (Atalay and Barrett, 2015; Cribb et al., 2016; Rabaté and Rochut, 2020).

In a comparable setting to ours, in which the reform is announced shortly before taking effects, Rabaté (2019); Staubli and Zweimüller (2013) find no upstream effects. Mastrobuoni (2009) finds no upstream effects for a reform of the NRA in the United States announced almost 20 years in advance, and Geyer and Welteke (2021) find no upstream effects for a reform of the ERA in Germany announced 10 years in advance. However, Carta and De Philippis (2021) do find significant upstream effects on labor supply for middle-aged women for a reform of the ERA in Italy.

Third, we relate to the small literature on how private savings respond to changes in pension eligibility ages. Based on survey data, Etgeton et al. (2023) find that raising the ERA for German women from 60 to at least 63 led affected couples, in which the woman was aged 47 or younger at the time of the reform, to expect longer working lives and higher lifetime income, inducing them to reduce their savings rate to smooth consumption. Using Japanese survey data of the critical years in which pension claiming was restricted post-reform, Nakazawa (2025) find positive savings responses in non-pension accounts but do not examine anticipatory savings responses. While these two papers, are consistent with standard consumption smoothing theory, García-Miralles and Leganza (2024) in a closely related paper, find evidence of saving inertia. They study responses to the same 2011 Danish reform around the ERA and IERA and argue that the continuation of pre-existing saving behavior through employer-sponsored pension arrangements is the primary mechanism. We extend their analysis by incorporating capital gains into our measure of total savings and by following individuals through the FRA and three downstream years. Consistent with their findings, we document positive savings responses, largely driven by occupational pension wealth, during periods in which careers are extended. However, unlike them, we obtain a negative upstream savings estimate, which is suggestive of forward-looking consumption smoothing. The estimate is, however, imprecisely estimated and therefore does not allow us to distinguish conclusively between standard consumption smoothing and savings inertia.

The remainder of the paper is structured as follows. Section 2 provides institutional background on the Danish pension and social welfare system, with a particular focus on the 2011 retirement reform. Section 3 develops the life-cycle model used to derive testable predictions. Section 4 describes the data and presents descriptive statistics. Section 5 outlines the empirical strategy. Section 6 presents the main results, including effects on labor supply, benefit claims, savings, and public finance outcomes. Section 7 discusses the determinants of the responses. Finally, Section 8 concludes.

2 Institutional Details

2.1 Pension and Other Social Insurance Schemes

The Danish pension system has three pillars combining public pensions, occupational pensions, and private savings. The first pillar consists of the Early Retirement Pension (ERP, Efterløn) and the Old-Age Pension (OAP, Folkepension). The OAP is a pay-as-you-go, tax-financed benefit available at the FRA and conditional on residency history. It consists of a universal base amount of roughly 13,000 USD per year and a supplement of up to 13,500 USD, which, after a deductible, is means-tested at a 31% taper rate against old-age income outside the public pension system. Specifically, the supplement is means-tested against pension income from the second and third pillars, other capital income, and labor earnings.[1] Beyond these core components, the system includes additional benefits targeted at the poorest retirees and only available to individuals with very low wealth. Finally, deferred claims of OAP are actuarially adjusted.

The ERP scheme functions as an insurance-based pathway to early labor market exit. Eligibility requires membership in an UI fund and regular contributions. While partially funded through individual premiums, the ERP is heavily subsidized by the state and provides access to benefits from the ERA. Among the cohorts we study, 61% of individuals make regular contributions and are therefore eligible to claim ERP upon reaching the ERA. The earliest claiming age is the ERA, which was 60 for pre-reform cohorts. Individuals claiming before the IERA receive benefits equal to 91% of the maximum UI benefit and are subject to a means-test on second- and third-pillar pension wealth. At the IERA, benefit levels increase to 100% of the UI benefit and the pension wealth means-test is removed for individuals satisfying work-hour requirements over the preceding two years. Deferring claims beyond the IERA yields small

[1] The labor income test was abolished in 2024.

tax-free lump-sum bonuses. Throughout the ERP period, benefits remain means-tested against labor and capital income. Unlike the OAP, the ERP lacks actuarial adjustments, creating strong incentives to claim at the ERA or IERA rather than defer retirement.

The second pillar is the main source of retirement income for most recent retirees. It consists of funded, defined-contribution occupational pension schemes, similar to 401(k) plans in the United States. Participation is widespread, with sector-level collective bargaining agreements typically requiring contributions of 11–17% of earnings through payroll deductions jointly financed by employers and employees. Pension wealth is invested through pension funds and can be accessed from age 60[2]. Second-pillar savings are paid out as annuities and provide insurance against longevity risk.[3]

Third-pillar arrangements consist of voluntary, tax-favored, individual pension plans, similar to individual retirement accounts (IRAs) in the US, that offer flexible contributions and tax advantages. These plans are offered either by the same pension funds that administer the employer-sponsored schemes—typically as top-ups to the mandatory contributions—or by banks and life-insurance companies. Contributions can be directed to different payout products, including annuity-based pensions as well as plans that allow lump-sum withdrawals at retirement.

Beyond the pension system, Denmark provides a range of welfare schemes offering income insurance. These include UI for individuals satisfying recent employment and contribution requirements, sickness benefits covering temporary health-related work incapacity, and disability pensions for individuals with permanent work limitations. Cash assistance programs function as residual support for individuals with minimal income and assets. Collectively, these programs provide alternative pathways out of the labor market and may substitute for pension benefits when pension eligibility is postponed.

2.2 The 2011 Retirement Reform

To ensure long-term fiscal sustainability in the face of population aging, Denmark linked statutory retirement ages to life expectancy in the 2006 Welfare Reform. In 2011, the government accelerated this transition by increasing retirement eligibility ages for

[2] Early withdrawals before age 60 are heavily penalized. All pension accounts established before May 1, 2007 can be accessed without a penalty as early as age 60, whereas accounts opened after that date may have a higher, often cohort-dependent, early-access age. The vast majority of individuals in our sample opened their accounts before this cutoff and can therefore access them at 60. The only reason to open a new account is a job change into a sector with a different pension fund; in that case, contributions to the new account may not be accessible at age 60, while balances in the original pre-2007 account remain accessible at 60.

[3] Individuals can typically deviate from the default by converting up to 30% of balances into annuities with payout periods as short as ten years. Lump-sum withdrawals are not permitted.

cohorts previously expected to remain unaffected by the 2006 reform. Specifically, the 2011 reform introduced six-month increases in retirement eligibility ages for successive half-year birth cohorts born in 1954 and 1955.

Our analysis focuses on the first birthdate cutoff on January 1, 1954, which offers a clean quasi-experimental setting. Specifically, individuals born on or after January 1, 1954, learned in 2011 that their ERA would rise to 60.5, their IERA to 62.5, and their FRA to 65.5. In contrast, those born just one day earlier kept the original retirement ages of 60, 62, and 65. Our identification strategy therefore exploits the sharp discontinuity at the cutoff, comparing individuals born immediately on either side who are comparable in all respects except for the reform-induced changes in their retirement incentives. Because subsequent birthdate thresholds introduced by the reform involve treatment changes on both sides of the cutoff, we restrict our analysis to this first and cleanest discontinuity.

To analyze the reform at the first cutoff, we distinguish between upstream, midstream, and downstream periods surrounding the critical years in which eligibility differs across birth cohorts, as illustrated in Figure 1. Identification exploits the discontinuity at the January 1, 1954 cutoff. For individuals born on January 1, age aligns exactly with calendar years, such that in year t they are $t - 1954$ years old throughout the year (e.g., age 60 in 2014). The upstream period (2011–2013) spans the years between the reform announcement and the pre-reform ERA, when affected individuals could adjust behavior in anticipation of delayed eligibility. The critical eligibility years occur in 2014, 2016, and 2019. In each of these years, individuals born just before the cutoff are eligible for the full year, while individuals born just after are eligible only for the second half of the year, creating sharp discontinuities in access. The midstream period (2015, 2017, and 2018) captures responses between successive eligibility thresholds. The downstream period begins after the FRA (2020 onward), when all cohorts have passed the eligibility thresholds. This decomposition allows us to separately identify anticipatory responses, adjustments at eligibility thresholds, and longer-run behavioral effects, thereby providing a comprehensive assessment of the reform's consequences.

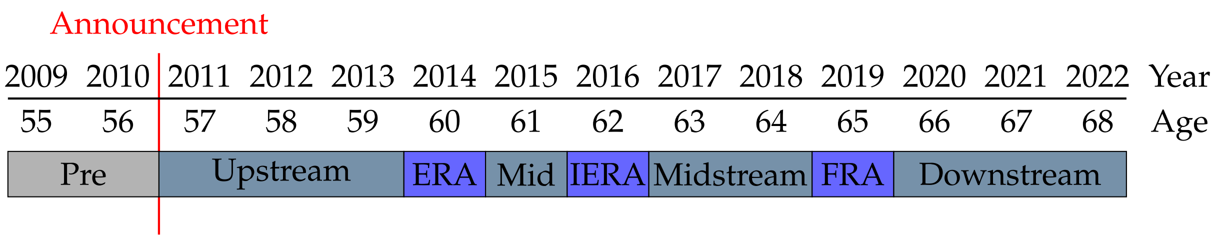


Figure 1: Reform Timeline and Classification of Analysis Periods

Notes: The figure illustrates the timing of the 2011 retirement reform relative to age and calendar year for individuals born on January 1, 1954. Shaded areas define the pre-reform, upstream, midstream, and downstream periods, as well as the critical years in which the ERA, IERA, and FRA increased by six months.

3 Model

We use a parsimonious life-cycle model of consumption and endogenous retirement to guide the empirical analysis. Building on Hurd et al. (2012) and the Danish adaptation in García-Miralles and Leganza (2024), we extend the framework by allowing individuals to exit the labor market either through pension claiming or alternative welfare programs. This extension captures substitution from pension benefits into programs such as UI, sickness benefits, and DI when pension eligibility ages increase. For tractability, we model the welfare route as an unemployment-type exit and abstract from health dynamics.

3.1 Setup and Optimality Conditions

Primitives. Time is continuous and indexed by age, $t \in [0, T_{max}]$, with terminal age T_{max}. We normalize $t = 0$ to age 57, when the reform was announced for individuals born on the birthday cutoff. The interest and discount rates are denoted by r and ρ. The pension system features three eligibility ages: the ERA, IERA, and FRA, ordered $T_{\text{ERA}} < T_{\text{IERA}} < T_{\text{FRA}}$. Before retirement, labor supply is inelastic and generates constant after-tax income $y_t \equiv y$. Agents face no borrowing constraints and leave no bequests. Let $x \in \{P, W\}$ index the pension and welfare exit routes, respectively, and let R^x denote the corresponding labor-market exit age.

Benefits. Let $b^{\text{ERS}}(t; R^P)$ denote after-tax early retirement benefits, $b^W(t; R^W)$ after-tax welfare benefits, and $b^{\text{OAP}}(t; R^x)$ old-age pension benefits after the FRA. For exit route $x \in \{P, W\}$ with $R^x < T_{\text{FRA}}$, the present value of benefits is[4]

$$B^x(R^x) = \int_{R^x}^{T_{\text{FRA}}} e^{-rt} b^x(t; R^x)\, dt + \int_{T_{\text{FRA}}}^{T_{\max}} e^{-rt} b^{\text{OAP}}(t; R^x)\, dt$$

.

This PV of benefits features notches or kinks at T_{ERA}, T_{IERA}, and T_{FRA}. Consequently, the marginal present value of benefits with respect to the labor-market exit age,

$$B^{x\prime}(R^x) \equiv \frac{dB^x(R^x)}{dR^x}$$

is piecewise smooth, with discrete changes at the eligibility ages.

[4] For $R^x \geq T_{\text{FRA}}$, the exit route is irrelevant because individuals receive only OAP benefits, which remain a function of R^x through actuarial adjustments for deferred claiming.

Preferences. Individuals derive utility from consumption and retirement, while welfare claiming entails a stigma cost. Preferences over consumption are represented by a standard increasing and concave utility function $u(c)$. Retirement yields utility from leisure, captured by an individual-specific preference parameter $\Gamma_i > 0$, which is continuously distributed across individuals.

Claiming welfare benefits before the FRA entails a stigma cost

$$s_i^x(t) = \begin{cases} 0, & x = P, \\ \theta_i \, \bar{s}(t) \cdot \mathbf{1}\{t < T_{\text{FRA}}\}, & x = W, \end{cases}$$

where $\bar{s}(t)$ is a smooth age-dependent stigma profile satisfying $\bar{s}'(t) \leq 0$, and $\theta_i > 0$ is an individual-specific loading capturing heterogeneity in stigma intensity. We assume θ_i is orthogonal to leisure preferences Γ_i (i.e., $\theta_i \perp \Gamma_i$). For notational simplicity, individual subscripts i are suppressed below.

Household problem. Agents choose consumption, the labor-market exit age R^x, and the labor-market exit route $x \in \{P, W\}$. The life-time utility is given by the upper envelope of the exit-route-specific value functions,

$$U = \max\{V^P, V^W\},$$

where the value associated with exit route x is

$$\begin{aligned} V^x = & \max_{R^x, \{c_t\}, \{a_t \geq 0\}} \int_0^{T_{\max}} e^{-\rho t} \left[u(c_t) + \Gamma \, \mathbf{1}\{t \geq R^x\} - s^x(t) \mathbf{1}\{x = W\} \right] dt \\ & \text{s.t.} \\ & \dot{a}_t = \begin{cases} r a_t + y - c_t, & t < R^x, \\ r a_t + b^x(t; R^x) - c_t, & R^x \leq t < T_{\text{FRA}}, \\ r a_t + b^{\text{OAP}}(t) - c_t, & t \geq T_{\text{FRA}}, \end{cases} \qquad a_0 = 0, \; a_{T_{\max}} = 0. \end{aligned} \tag{1}$$

Optimality conditions. The Euler equation is

$$\dot{u}'(c_t) = (\rho - r) u'(c_t),$$

and holds independently of the exit route. When $\rho = r$, consumption is perfectly smoothed over the life cycle. Lifetime resources under exit route $x \in \{P, W\}$ are therefore

$$Y^x(R^x) = \int_0^{R^x} e^{-rt} y \, dt + B^x(R^x),$$

implying constant optimal consumption under CRRA utility:

$$c^* = \frac{r}{1 - e^{-rT_{max}}} Y^x(R^x). \tag{2}$$

For interior retirement choices (with $R^x < T_{\text{FRA}}$), the first-order condition is

$$\left(y + B^{x\prime}(R^x)\right) u'(c_{R^x}) = \begin{cases} \Gamma, & x = P, \\ \Gamma - \theta\, \bar{s}(R^W), & x = W, \end{cases} \tag{3}$$

where the left-hand side of the above FOCs captures the marginal utility gain from postponing exit: the effective marginal return to working longer multiplied by the marginal utility of consumption, given by current labor income plus the marginal increase in the present value of future benefits. The right-hand side reflects the marginal utility value of leisure, equal to Γ under the pension exit path and reduced by stigma costs when claiming welfare benefits before the FRA.

3.2 Behavioral Incentives

We now use the model to characterize retirement and savings incentives before and after the reform.

Pre-reform incentives. The FOC for retirement in (3) implies that retirement behavior is governed by the slope of the benefit schedule, $B^{x\prime}(R^x)$: the larger is $B^{x\prime}(R^x)$, the stronger the incentive to postpone retirement. Between statutory eligibility ages, benefits are differentiable and retirement incentives therefore vary smoothly with age, implying a continuous mapping from individual types to retirement ages.

However, Figure 2 shows that the present value of pension benefits, $B^P(R^P)$, is not differentiable at the statutory eligibility ages. For individuals unaffected by the reform (solid blue line), pension wealth exhibits a large notch at the ERA, reflecting the loss of ERP benefits from retiring earlier. A second notch arises at the IERA, where the ERP benefit level increases from 91% to 100% of UI benefits and the means test on private pension wealth is removed. Beyond the IERA, small lump-sum bonuses partially offset the decline in pension wealth until the FRA.

These discontinuities in $B^P(R^P)$ generate spikes in lifetime resources and consumption, as shown in Figure 3. Because crossing the ERA or IERA yields a discrete increase in pension wealth, individuals whose optimum lies just before an eligibility age optimally postpone retirement until reaching it, generating bunching at the ERA and IERA. By contrast, the FRA features only a kink arising from actuarial adjustments to OAP benefits. As a result, the model predicts no bunching at the FRA.

Turning to the welfare exit route, the red solid line in Figure 2 shows that before the IERA the PV of welfare benefits, $B^W(R^W)$, calibrated to UI benefits,[5] exceeds the pension alternative because ERP benefits amount to only 91% of UI benefits. After the IERA, however, ERP benefits rise to 100% and include lump-sum bonuses, causing the pension route to dominate. Consequently, for sufficiently low stigma costs, some individuals optimally substitute into welfare programs prior to the IERA, whereas welfare exits largely disappear thereafter.

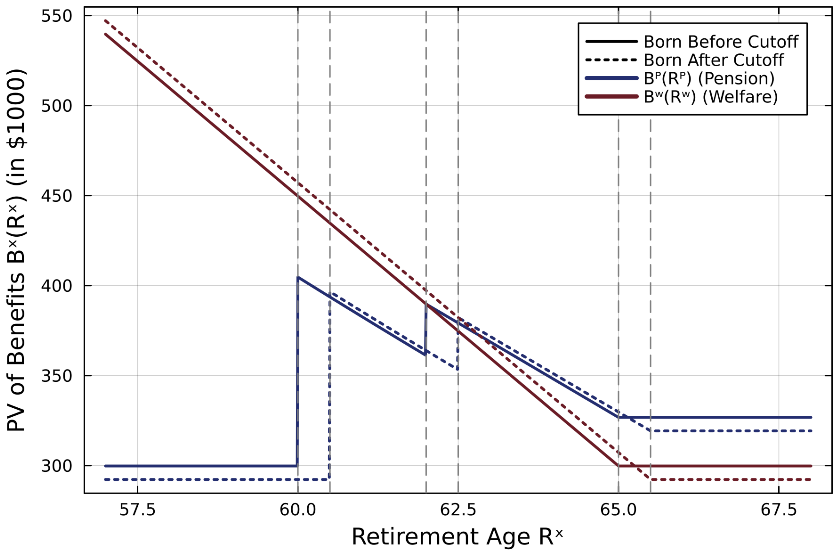


Figure 2: PV of benefits by retirement age and labor market exit path.

Notes: The figure plots the PV of benefits under the pension exit path $B^P(R^P)$ (blue) and welfare exit path $B^W(R^W)$ (red) as a function of the exit age. Solid lines correspond to individuals born before the birthday cutoff (control), while dashed lines correspond to individuals born after the cutoff (treated). Discrete jumps at the ERA and IERA in $B^P(R^P)$ reflect eligibility thresholds and changes in benefit rules within the ERP program, generating financial notches. At the FRA, the schedule exhibits a kink due to actuarial adjustment of OAP benefits, which is absent in ERP benefits. The reform shifts all eligibility ages upward by 0.5 years for treated cohorts, delaying benefit access and reducing pension wealth at earlier exit ages. The y-intercept of $B^P(R^P)$ corresponds to the PV of OAP benefits; the higher level of $B^P(R^P)$ after the FRA reflects the lump-sum bonus for postponing ERP claims beyond the IERA. The calibration assumes annual old-age pension benefits of 15,000, ERP benefits of 27,000 before the IERA (subject to wealth taper) and 30,000 thereafter, welfare benefits of 30,000, private assets of 250,000, terminal age of 85, annual labor income of 40,000, and a discount rate equal to zero.

Post-reform incentives. The reform raises all eligibility ages by 0.5 years, shifting benefit schedules and optimal consumption accordingly, as illustrated by the dotted lines in Figures 2 and 3. By reducing lifetime resources at a given exit age, the reform increases the marginal utility of consumption and therefore the incentive to postpone retirement. Individuals who would previously have retired at a given age optimally shift toward later exit within the same route, generating a rightward shift in retirement around the affected eligibility thresholds.

[5] For tractability, we calibrate the welfare route to UI benefits. In practice, individuals may also exit through DI, which is somewhat more generous, or cash assistance, which is somewhat less generous. Our reduced-form welfare route should therefore be interpreted as representing an intermediate benefit schedule.

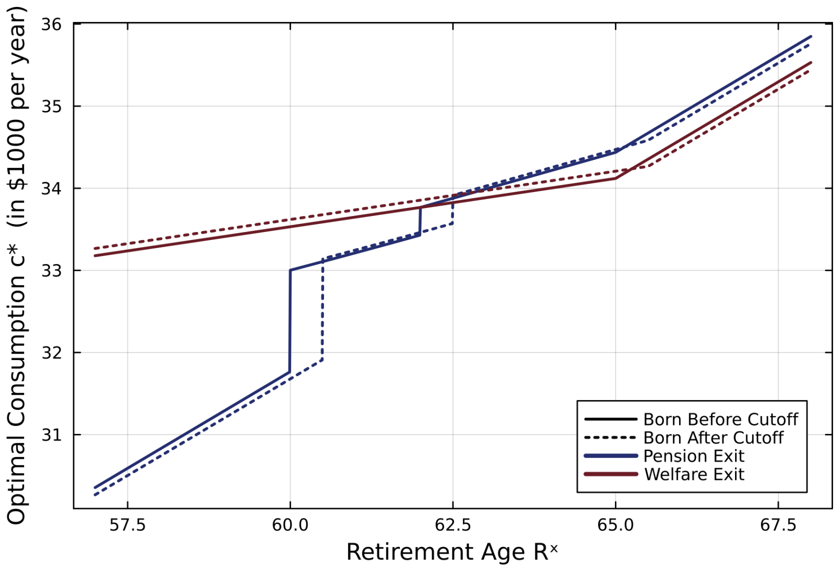


Figure 3: Consumption by retirement age and labor market exit path.

Notes: The figure plots optimal constant consumption c^* defined in equation (2) as a function of the retirement age under the pension exit path (blue) and welfare exit path (red). Solid lines correspond to individuals born before the birthday cutoff (control), while dashed lines correspond to individuals born after the cutoff (treated). Consumption equals the annuity value of lifetime resources, consisting of discounted labor income and the present value of benefits. Jumps in consumption mirror the financial notches in $B^P(R^P)$ at the ERA and IERA, while the kink at the FRA reflects actuarial adjustment of OAP benefits. The reform shifts eligibility ages upward by 0.5 years for treated cohorts, reducing lifetime resources and consumption at earlier exit ages within the affected windows. The calibration is identical to that used in Figure 2.

Figure 3 shows that consumption differs mainly within the restricted windows around the ERA, IERA, and FRA, implying limited changes in retirement behavior outside these periods, that is up-, mid- , and downstream. Treated individuals planning to retire between the old and new ERA may either postpone retirement or substitute into welfare programs, depending on the trade-off between leisure and welfare stigma. The model therefore predicts active substitution into welfare programs around the ERA, with weaker effects approaching the IERA as the PV differential of benefits between the welfare and pension exit route narrows. After T_{IERA}, pension benefits dominate welfare benefits, implying no further exits into welfare benefits. Nevertheless, passive substitution persists because individuals remain on welfare benefits for longer when pension eligibility is delayed.

Given the post-reform financial notches at the new ERA and IERA, we expect retirement bunching shifts to the new eligibility thresholds. More generally, when replacement rates are below 100%, delayed retirement increases lifetime resources because labor income exceeds retirement benefits: $\Delta Y^x = \Delta R^x \cdot y \cdot (1 - \text{replacement rate})$. Optimal consumption equals the annuity value of lifetime resources, implying

$$\Delta c^* = \frac{r}{1 - e^{-rT}} \Delta Y^x.$$

Consumption therefore rises immediately after the reform announcement, reducing upstream savings while individuals continue working. Because careers are extended, retirement wealth nevertheless increases, followed by faster asset decumulation after retirement.

For example, with a 60% replacement rate, annual earnings of 60,000 USD, and a 0.5-year postponement of retirement, lifetime resources increase by roughly 12,000 USD. With $\rho = r = 0.02$ and remaining lifetime $T = 28$, optimal annual consumption rises by approximately 550 USD, implying an equivalent reduction in upstream savings while the individual continues working. Because the career is extended by half a year, retirement wealth is nonetheless higher. After retirement, consumption remains higher by the same amount, so annual dissaving increases by about 550 as well, exactly offsetting the higher retirement wealth over the remaining lifetime.

3.3 Testable Model Predictions

The pre- and post-reform incentive structure yields the following empirically testable implications, under the maintained assumption that stigma is sufficiently strong such that welfare claiming does not become the dominant exit route.

Employment responses. The model predicts excess mass in retirement at the ERA and the IERA, but not at the FRA, reflecting the presence of financial notches at the former ages and only a kink at the latter. Following the reform, this bunching mass should shift to the new eligibility thresholds. Outside the eligibility windows directly affected by the reform, employment responses are predicted to be modest, as lifetime incentives change only marginally.

Spillovers to welfare programs. The reform generates two distinct forms of spillovers into welfare programs. First, passive substitution arises mechanically when delayed pension eligibility prolongs reliance on alternative benefits within the affected windows. Second, active substitution occurs when individuals optimally substitute from employment into welfare in response to the changed relative generosity of exit paths. This active substitution is predicted to be strongest around the ERA, weaker around the IERA, and absent around the FRA, where pension benefits strictly dominate welfare benefits in present value terms.

Savings and wealth dynamics. By extending careers in the restricted windows between the old and new ERA and IERA, the reform raises lifetime resources through additional earnings. Under consumption smoothing, this induces higher consumption upon reform announcement, implying lower savings upstream, midstream, and downstream. At the same time, savings increase during the career-extension periods, leading to higher wealth at retirement due to continued labor income and delayed retirement.

Fiscal effects. The reform affects public finances through three channels. First, a savings channel operates as postponed eligibility delays pension payments and reduces the present value of pension expenditures. Second, a substitution channel arises if individuals finance delayed pension access through welfare programs, either mechanically via longer spells or behaviorally via new take-up. Third, a revenue channel emerges from extended employment and higher labor income tax payments. The net fiscal effect is theoretically ambiguous and depends on the strength of stigma and the extent of welfare substitution. For moderate to high stigma, the savings and revenue channels are predicted to dominate, implying an improvement in public finances.

4 Data

4.1 Administrative Data

The analysis relies on Danish population-wide administrative register data covering 2001–2022, linked at the individual level through anonymized personal identifiers.

We use the population register (BEF) to obtain the demographic characteristics: as age, gender, region of residence, marital status, birthplace and citizenship. To account for attrition, we link the data to death (DOD) and migration (VNDS) registers. Educational attainment is obtained from the education register (UDDA) and grouped into four categories: below high school, high school, bachelor, and master or higher.[6] Pre-reform self-employment status is obtained from the work classification register (AKM). Information on all non-pension wealth, personal income, taxes, and transfers is sourced from the income register (IND). Pension contributions to second- and third-pillar accounts are recorded in the pension payments register (INPI), pension payouts in the pension withdrawal register (INHP), and pension wealth in the pension wealth register (FORMPERS).

In addition to the annual registers described above, we use monthly registers on salaried labor income (BFL) and government transfers (ILME) to construct monthly labor market states.

4.2 Outcome Variables

We construct both monthly and annual outcome variables to analyze labor supply, retirement behavior, savings, and fiscal effects of the reform.

[6] For the 788 individuals for whom educational attainment is unobserved, we assign them to the lowest education group. Following the data restrictions described in Section 4.3, only 65 of these individuals remain in the final sample.

Monthly outcomes. Our primary monthly outcome is labour market status. Using monthly labour-income and transfer registers, we classify each individual-month into one of six mutually exclusive labor market states: (1) employment, (2) retirement, (3) UI, (4) DI, (5) other benefits, and (6) no income. Individuals are assigned to the category corresponding to their primary income source in a given month. Retirement income primarily consists of ERP and OAP benefits[7], UI includes unemployment benefits and cash assistance, while DI consists of disability pensions and sick leave benefits. Other benefits comprise a broad range of public transfers, including leave-related benefits, activation programs, and wage-subsidy schemes. Individuals classified as having no income are assumed to rely on private savings.

Annual outcomes. Annual outcomes include labour earnings, pension benefits, welfare benefits, contributions to retirement accounts, total savings, and net taxes.

Annual labour earnings are defined as earnings subject to labour market contributions.[8] Pension benefit receipts are measured using the retirement income variable underlying the definition of retirement labour market status, aggregated from monthly to annual frequency. Similarly, welfare benefit receipts are measured as the sum of UI, DI, and other transfer benefit payments underlying the definition of monthly labour market status, aggregated to annual frequency.

With regards to saving, we primarily focus on total savings, measured as annual changes in net wealth, including pension wealth held in second- and third-pillar retirement accounts.[9] Non-pension wealth includes bank deposits, stocks, property assets, and foreign assets, net of liabilities. This measure captures both pension and non-pension wealth accumulation and incorporates capital gains and losses.

To better understand the mechanisms underlying changes in total savings, we also examine contributions to second- and third-pillar retirement accounts. These contributions include both employer-sponsored occupational pensions and alternative private pension plans. Retirement contributions can further be divided into annuity-based plans and plans allowing lump-sum withdrawals at retirement. The latter consist exclusively of voluntary third-pillar savings, whereas annuity-based plans are predominantly quasi-mandatory second-pillar occupational pensions, although they may also include voluntary third-pillar retirement savings.

[7] We also include smaller schemes such as civil servant pensions, *tidlig pension*, *delpension*, survivor pensions, deferred-claiming bonuses, and ATP.

[8] This includes wages and salaries, bonuses and fringe benefits, self-employment and business income, honoraria and fees for personal work, certain taxable employee benefits, and employer contributions to labour-market pension schemes.

[9] Pension wealth from the pension register (FORMPERS) is available only for 2014–2022. For 2009–2013, we impute pension wealth using observed contributions and pension wealth returns, as described in Appendix A.

Net taxes are defined as taxes paid net of public transfers received.

All monetary outcome variables are deflated to 2010 prices. To reduce the influence of outliers in the regression analysis, we winsorize net taxes and total savings at the 1st and 99th percentiles, and labour earnings and retirement contributions at the 99th percentile.

4.3 Data Restrictions

The sample selection process is detailed in Table 1. We begin with the universe of individuals born within six months of the cutoff date. Then, the sample is further restricted to native Danes—defined as individuals with at least one parent who is both a Danish citizen and born in Denmark—to ensure comparability in institutional exposure. Next, we restrict the sample to individuals who made voluntary contributions to the ERP scheme in at least seven years between 2001 and 2010, making them likely to be eligible, as eligibility requires contributions in 25 of the previous 30 years. Finally, we require a balanced panel from 2006 to 2019. To achieve this, we exclude individuals who died, resided abroad for more than two years, or have missing data for earnings or labor market contributions in any year during this period. The following section provides summary statistics on this analysis sample as well as the unrestricted population.

Table 1: Sample Selection

	Number of Individuals
Restriction 1: Born around the cutoff date	73,875
Restriction 2: Only native Danes	67,740
Restriction 3: Regular contributions to the ERS	44,826
Restriction 4: Balanced sample	41,748

Notes: The table reports the number of individuals remaining after each sample restriction: birth within ± 6 months of the January 1, 1954 cutoff; native Danes (at least one parent born in Denmark and holding Danish citizenship); at least seven years of voluntary ERP contribution during 2001-2010; and a balanced panel over 2006–2019.

4.4 Descriptive Statistics

Summary Statistics. To assess the potential implications of sample selection, we examine descriptive statistics for two different sampling choices, focusing on the pre-reform year of 2010. The unrestricted sample contains all people born within six months of the relevant cutoff. The analysis sample applies the data restrictions outlined above. Table 2 presents summary statistics on individual characteristics across the different samples.

Table 2: Summary Statistics

	Analysis Sample		Unrest. Sample	
	Mean	SD	Mean	SD
Demographics				
Age	56.99	0.29	56.99	0.29
Male	0.48	0.50	0.51	0.50
Married	0.73	0.45	0.66	0.47
% of People with a Bachelor education or higher	0.31	0.46	0.27	0.45
Treated	0.52	0.50	0.52	0.50
Labor Market Status				
Earnings	61,408	40,733	53,068	53,594
Share of self-employed	0.08	0.26	0.08	0.27
Share collecting welfare benefits	0.17	0.37	0.34	0.47
Savings and Wealth				
Any Contribution to Retirement Plans	0.92	0.27	0.75	0.43
Contributions to Retirement Plans	8,672	9,417	6,769	11,842
Contributions to Annuities	7,240	9,245	5,687	11,573
Contributions to Lump-sum Withdrawables	1,431	2,335	1,081	2,116
Total Wealth	284,129	338,971	237,899	900,796
Number of individuals	41,748		73,875	

Notes: Summary statistics are measured in the pre-reform year 2010. Earnings, contributions, and wealth are reported in USD. The share collecting welfare benefits includes individuals receiving unemployment. Treated indicates indicates individuals born on or after the birthday cutoff. The unrestricted sample includes all individuals born within six month of the reform cutoff date. The analysis sample applies three additional restrictions described in Section 4.3.

The analysis sample is balanced by gender (48% male) and consists primarily of married individuals (73%). The average age is 56.99 years. Mean annual earnings amount to 61,408 USD, and 8% are self-employed[10]. Welfare benefit receipt is limited, with 17% collecting benefits. Average total retirement contributions equal 8,672 USD, and mean total wealth is 284,129 USD. Finally, the treated share is 52%.

Our analysis sample is broadly similar to the unrestricted sample in terms of observed characteristics. The main differences are earnings and wealth, which are higher in the analysis sample. In addition, individuals in the analysis sample are more likely to be married, slightly less likely to be male, and more likely to contribute to retirement plans.

Effective Retirement Age. Next, we present the distribution of the effective retirement age in Figure 4. This measure captures when individuals stop working and

[10] We classify individuals as self-employed if self-employment constituted their primary source of income in at least one year during the pre-reform period 2006–2010.

therefore may not coincide with when they claim pension benefits.[11] We find retirement bunching at the ERA, IERA and the FRA and the reform moves the bunching by six months. While there are clear financial incentives to delay retirement until the ERA or IERA – since public pension wealth rises sharply at these thresholds, as shown in Figure 2 – no such jump occurs at the FRA. Yet, bunching patterns around the FRA are similar to those observed at earlier eligibility ages.

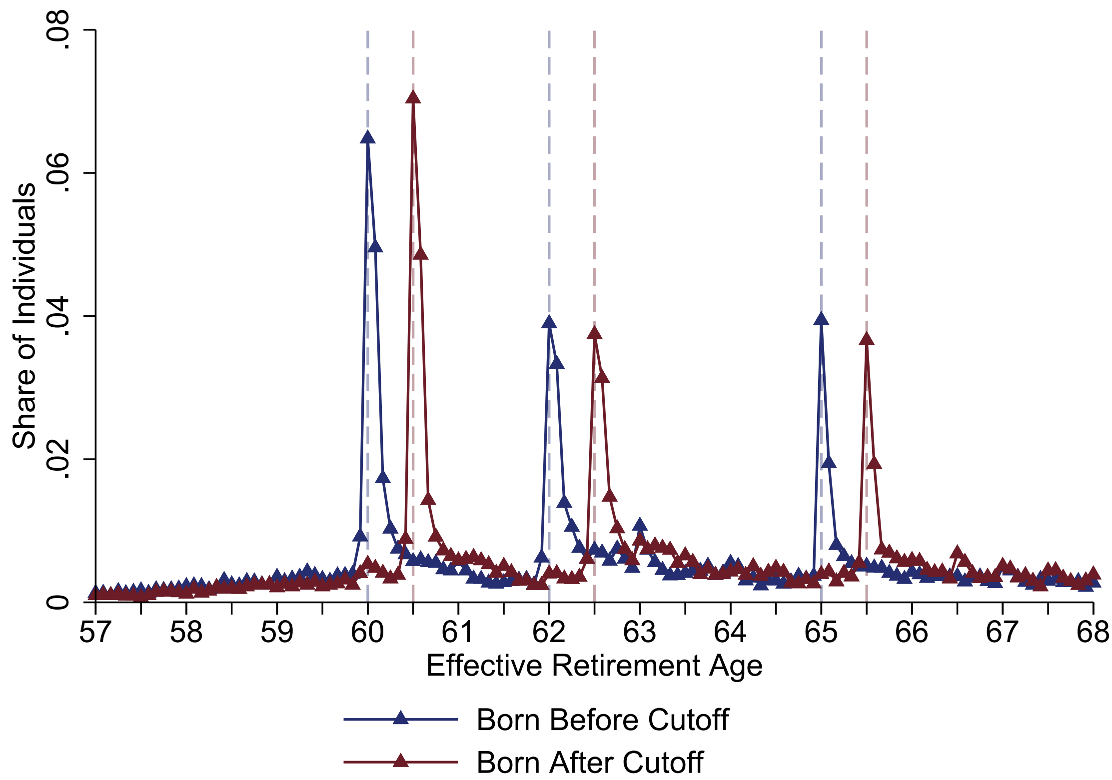


Figure 4: Effect of the Reform on the Effective Retirement Age Distribution
Notes: This figure shows the distribution of effective monthly retirement age for two groups: those born within the six months before and those born within the six months after the January 1, 1954 birthday cutoff. Effective monthly retirement age is defined based on the timing of when individuals stop receiving labor income, as described in detail in Appendix B.

Labor Market States. Figure 5 plots the share of individuals in each labor market state by age and birth cohort, separately for those born before and after the cutoff. Panel 5a shows that employment falls sharply at each eligibility age, with the entire exit profile for the treated cohort shifted to the right in line with the six months increase in eligibility ages. Correspondingly, Panel 5b shows that entry into retirement is concentrated at these same ages, with the treated group's transition occurring six months later. Turning to alternative non-employment states, Panel 5c indicates that UI participation rises initially, drops discretely at the ERA, then declines gradually before falling to near zero at the FRA, which is a patterns consistent with transitions from

[11] See Appendix B for a detailed definition of the effective retirement age.

UI into pension benefits once these pathways become available. Panel 5d shows that DI participation rises gradually up to the ERA, declines slightly once early-retirement benefits become available, and then increases again through the early 60s before dropping sharply to zero at the full retirement age. Panel 5e shows that claims of other benefits remain quantitatively small and fairly stable, but decline around the ERA and fall to zero at the FRA. Finally, Panel 5f shows that the share with no recorded income, that is, living off savings—remains, roughly constant at about 2% and falls to near zero at the FRA, indicating that only a tiny fraction postpone claiming OAP.

Overall, the figure suggests that the reform primarily delays retirement entry and extends employment. The age profiles in Panels 5c–5e also point to substitution from pension receipt toward alternative welfare benefits: when access to early and full pension benefits is postponed by six months, the treated cohort remains on UI, DI, and other benefits for correspondingly longer before transitioning into retirement. This is also evident in the combined welfare-benefit share—defined as the aggregated shares on UI, DI, and other benefits—as shown in Figure 6. Whether this reflects mainly passive substitution—mechanically extending time on pre-existing benefits—or also active substitution through changes in program take-up and behavior cannot be inferred from the descriptive patterns alone and therefore requires formal regression analysis discussed in the next section.

5 Empirical Strategy

5.1 Regression Discontinuity Design

To estimate the causal impact of the reform on our outcome variables, we exploit the cohort-based rollout of the policy in a regression discontinuity design (RDD). Identification stems from the discrete change in pension eligibility ages at the birthdate cutoff. Specifically, individuals born on January 1, 1954 or in the six months thereafter, face an increase of six months in the ERA, IERA, and FRA—from 60, 62, and 65 to 60.5, 62.5, and 65.5, respectively.

We estimate RDD models of the following form to identify discontinuities in outcomes at the birthdate cutoff:

$$y_{ij} = \alpha + \beta_j \cdot \mathbf{1}[x_i \geq c] + \gamma_j \cdot (x_i - c) + \delta_j \cdot \mathbf{1}[x_i \geq c] \cdot (x_i - c) + Z_i'\theta + \varepsilon_{ij} \tag{4}$$

where y_{ij} denotes an outcome for individual i measured at index j, which captures either calendar time or age (measured in months). The variable x_i is the running variable (birthdate), c is the cutoff date, and Z_i is a vector of categorical controls for gender, education, marital status, and region of residence, all measured in the pre-announcement

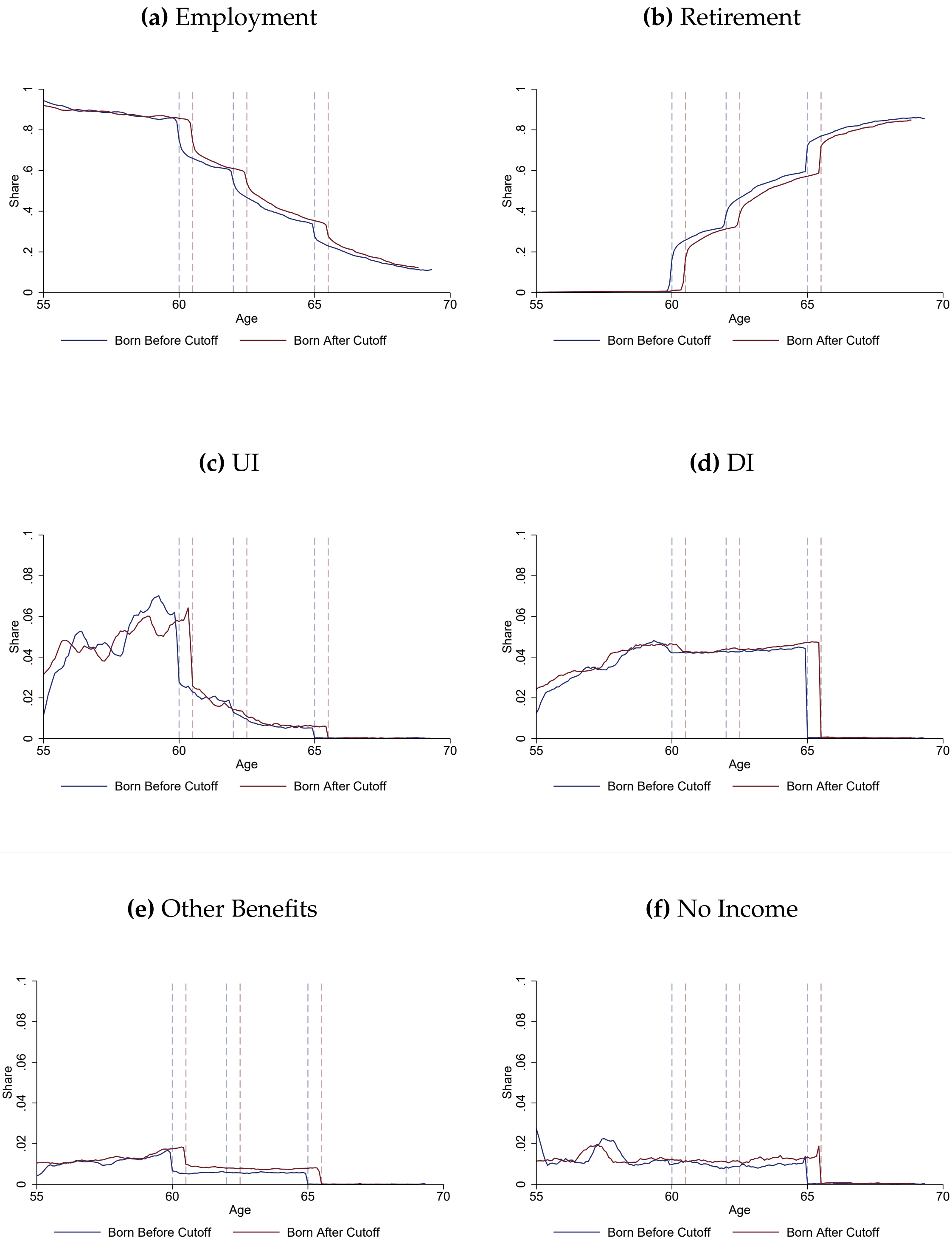


Figure 5: Shares in Different Labor Market States by Age

Notes: This figure shows the share of individuals in each of the six mutually exclusive labor market states by age (in months), as defined in Section 4. Labor market status is assigned based on the individual's main source of income in each month.

year 2010. The error term is denoted by ε_{ij}. The coefficient of interest, β_j, captures the causal effect of the increase in eligibility ages for individuals born just after the cutoff at time (or age) j.

Our baseline specification estimates equation (5) using the full analysis sample,

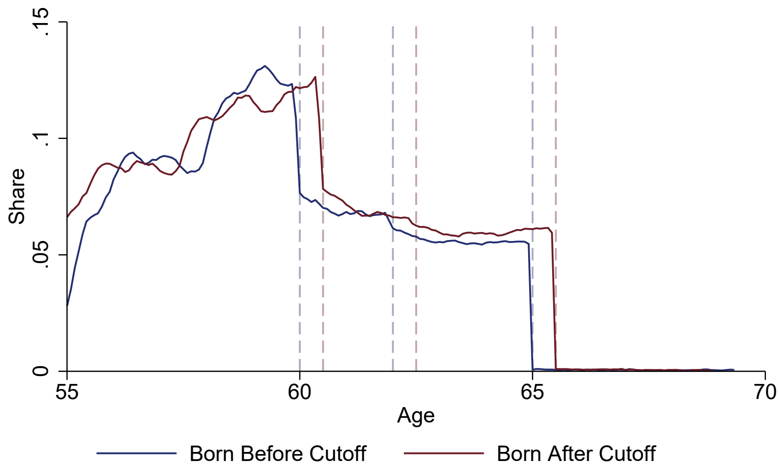


Figure 6: Share on Welfare Benefits by Age

Notes: The figure shows the share of individuals on welfare benefits by age (in months). Individuals are classified as being on welfare if their primary source of income is UI, DI, or other public benefits.

comprising individuals born within six months on either side of the cutoff, together with local linear regressions on either side of the threshold. We assess robustness in two ways. First, we replace the local linear specification with local quadratic regressions, following, for example, Rabaté et al. (2024). Second, we implement the robust bias-corrected estimator of Calonico et al. (2014), using the data-driven optimal bandwidth and triangular kernel weights.

Identification relies on the assumption that individuals born just before and just after the cutoff are comparable in all relevant characteristics, except for the differential incentives induced by the reform. Under this condition, any discontinuities in outcomes at the cutoff can be interpreted as causal effects of the reform.

The validity of the identification strategy is supported by the following considerations. First, manipulation of the running variable around the cutoff—representing the standard threat to identification in an RDD setting—is not a concern, as birthdate is predetermined. A second concern is that other policies or institutional changes may vary discontinuously at the cutoff and thus confound the estimates. We are not aware of any such reform or institutional change at the January 1, 1954, birthdate cutoff. Third, the increase in pension eligibility ages could affect mortality and thereby induce selection bias, once one assumes a balanced panel over some time period. In this context, two Danish studies by Nielsen (2019) and Vejlin et al. (2026) find muted effects of increases in pension eligibility ages on mortality, health, and healthcare utilization.[12] Finally, there is a concern that Danish children are expected (though not required) to

[12] Evidence from Norway, Sweden, and France likewise shows no effects of changes in retirement ages on mortality; see Hernaes et al. (2013), Hagen (2018), and Bozio et al. (2021).

start school in the calendar year in which they turn six. This may create a discontinuity in school starting age at January 1, 1954, which could affect outcomes late in life independently of the reform. While we do not observe school starting age for individuals born around January 1, 1954, we can conduct placebo tests in pre-reform years. These tests reveal no discontinuities in our outcomes of interest (see Appendix C).

6 Results

In this section, we present our main findings on the causal effects of increasing pension eligibility ages. We first examine the effects of the reform on labor market states—the extensive margin—around the three eligibility ages. Second, we analyze the effect on the average retirement age. Finally, we turn to the dynamic responses of labor earnings, pension and welfare benefits, and savings, and assess the implications of these behavioral responses for fiscal externalities.

We present both graphical nonparametric evidence and regression-based estimates of the causal effects of the reform. The graphical analysis plots average outcomes by one-week birth cohorts around the cutoff and overlays local linear fits estimated separately on each side of the threshold using the underlying individual-level data. We complement this visual evidence with formal regression discontinuity specifications to quantify effect sizes and assess statistical significance.

6.1 Effects on labor market status

We use the monthly labor market status measure to study how the reform affected individuals' labor market attachment within the newly restricted claiming windows induced by the higher eligibility ages. Figure 7 presents graphical evidence for employment, retirement, and welfare benefit receipt, where the latter combines UIc, DI, and other benefits. The figure plots the share of individuals in each state three months after the pre-reform eligibility age by one-week birth cohorts around the cutoff. With one exception, all panels display clear discontinuities at the birthdate cutoff and otherwise smooth trends, consistent with a causal effect of the reform. Across all eligibility ages, the reform increases employment and reduces retirement, while welfare benefit receipt also rises at the ERA and FRA.

The estimated results confirm the graphical evidence in Figure 7: the reform increases employment at all three postponed eligibility ages and correspondingly reduces retirement. At the ERA, employment rises by 17.1 pp while retirement falls by 22.3 pp. Given a pre-threshold employment rate of 86% (the population at risk), this corresponds to a retirement hazard (conditional retirement response) of around 10%

and implies retirement bunching at the eligibility threshold of roughly 8% of employed individuals. Most of the reduction in retirement is absorbed by continued employment, although welfare benefit receipt also increases by 5.2 pp, reflecting spillovers into alternative programs. Overall, roughly three-fourths of the decline in retirement is offset by higher employment, while about one-fourth translates into higher welfare receipt.

At the FRA, employment increases by 8.8 pp and retirement declines by 15.8 pp. Relative to the substantially lower pre-threshold employment rate of 35%, this implies a larger retirement hazard of around 14%, despite the smaller absolute employment response. Welfare benefit receipt rises by 5.6 pp, suggesting more pronounced spillovers at this threshold. The composition of these spillovers also differs: at the ERA, they are primarily driven by UI and other benefits, whereas at the FRA they mainly reflect increased DI receipt.

By contrast, we find no economically or statistically meaningful spillovers to welfare benefits at the IERA, where the 10.7 pp decline in retirement is almost entirely absorbed by a 10.3 pp increase in employment. This is consistent with the institutional setting, as treated individuals remain eligible for early retirement benefits at the old IERA and therefore do not forgo access. Instead, the reform delays the exemption from means-testing, which applies only from the new IERA. With a pre-threshold employment rate of 61%, the implied retirement hazard is around 9%, corresponding to bunching of approximately 6% at the eligibility age.

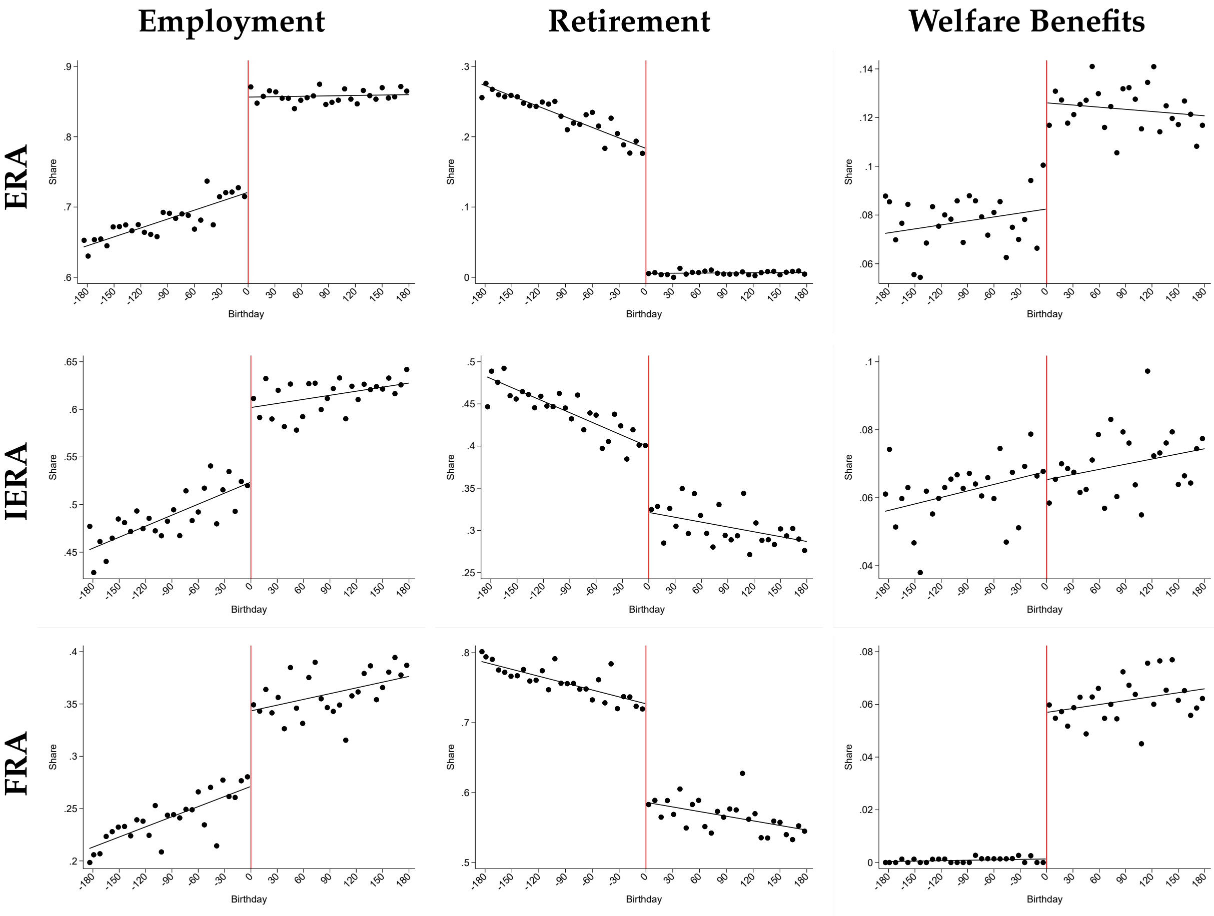


Figure 7: RDD Plots of Labor Market Responses at Eligibility Thresholds

Notes: This figure plots the average share of individuals in employment, retirement, and receipt of welfare benefits in the month three months after the pre-reform eligibility ages, by one-week birth cohorts. Each dot represents the mean outcome within a weekly cohort. Columns correspond to outcome variables, while rows correspond to the three eligibility ages (ERA, IERA, and FRA). The red vertical lines indicate the January 1, 1954 birth-date cutoff. Local linear regressions are fitted on either side of the cutoff using the underlying (unbinned) data without controls.

Table 3: Labor Market Responses at Eligibility Thresholds

	Results (in percentage points (pp))							At ERA, IERA, or FRA		
	(1) Employment	(2) Retirement	(3) UI	(4) DI	(5) Other Benefits	(6) No Income	(7) Welfare Benefits	(8) Employment rate (%)	(9) Hazard rate (Level)	(10) Bunching (%)
ERA	17.13***	−22.33 ***	4.02***	0.15	1.07***	−0.03	5.23***	86	0.1	8
IERA	10.33***	−10.66 ***	−0.07	0.01	0.14	0.25	0.08	61	0.09	6
FRA	8.78***	−15.82 ***	0.51***	4.45***	0.63***	1.44***	5.60***	35	0.14	5

Notes: The table reports the reform's estimated local treatment effects on individuals' labor market state in the month preceding the post-reform eligbility ages, expressed as the pp change in the probability of being in each state. Columns (1)-(6) report estimates of β_j from the RDD specification in equation (5) for the mutually exclusive labor market states defined in Section 4. Column (7) differs in that it aggregates UI, DI, and other benefits into a single indicator for welfare benefit. Columns (8)-(10) summarize economic magnitudes at each eligibility threshold, reporting the pre-threshold employment rate, the implied hazard (the discrete drop in employment at the threshold), and bunching, defined as the share of employed individuals retiring at that age. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

These spillovers to welfare programs at the ERA and FRA may reflect both passive and active substitution. Passive substitution arises mechanically when delayed pension eligibility prolongs the duration of existing welfare benefit receipt until pension benefits become available. To test for active substitution—that is, transitions from employment into welfare receipt induced by the reform—we estimate equation (5) using transition indicators as outcomes. Specifically, we compare individuals' labor market status in the month preceding the old eligibility age with their status five months later, before the new eligibility threshold. The coefficient β_j therefore captures the causal effect of the reform on transitions from employment into welfare programs.

Table 4 provides evidence of active substitution at the ERA: among individuals employed just before the old ERA, the treated cohort is 0.62 pp more likely to receive welfare benefits four months later. This implies that around 12% of the total welfare spillover (+5.23 pp) reflects active substitution, while the remainder is driven by passive substitution among individuals already receiving benefits before the cutoff. By contrast, we find no significant active substitution at the IERA or FRA, suggesting that welfare spillovers at those thresholds mainly reflect mechanical delays in pension claiming rather than new take-up of welfare programs.

Table 4: Active Substitution into Welfare Benefits

	Active Substitution (in pp)				At ERA, IERA, or FRA		
	(1) Welfare Benefits	(2) UI	(3) DI	(4) Other Benefits	(5) Employment rate (%)	(6) Hazard rate (Level)	(7) Bunching (%)
ERA	.62***	.23***	.31	.08	86	.1	8
IERA	-.07	.02	-.12	.04	61	.09	6
FRA	.12	-.03	.08	.07	35	.14	5

Notes: The table reports the reform's estimated local treatment effects on transitions from employment into welfare receipt around the eligibility ages. Columns (1)-(4) report estimates of β_j from the RDD specification in equation (5) for $j \in \{\text{ERA, IERA, FRA}\}$, where the outcome is a transition indicator equal to one if an individual employed in the month preceding the pre-reform eligibility age transitions into welfare receipt in the month preceding the post-reform eligbility age. Column (1) measures transitions into any welfare benefit and therefore aggregates the specific categories reported separately in columns (2)-(4): DI, UI, and other benefits. Columns (5)-(7) report the corresponding pre-threshold employment rate, the implied hazard (the discrete drop in employment at the threshold), and bunching, defined as the share of employed individuals retiring at that age. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Overall, the reform increases employment and reduces retirement at all eligibility ages. Spillovers into welfare programs are economically meaningful at the ERA and FRA, but absent at the IERA, and appear to be driven mainly by passive substitution, with a smaller but non-negligible active component at the ERA.

Effect on Average Retirement Age. While the RDD estimates identify local effects at specific ages, they do not directly capture the effect on average retirement age. Following Mastrobuoni (2009) and Rabaté et al. (2024), we recover this effect by aggregating the age-specific employment responses in Figure 8. Under the assumption that the reform affects retirement behavior only within the estimated age intervals from 57 to 68, these responses map into changes in the retirement age distribution and hence into average retirement age. Using this approach, which is further detailed in Appendix D, we estimate that a six-month increase in eligibility ages raises the average retirement age by 3.3 months, implying an elasticity of 0.55. Figure 8 shows that the increase in retirement age is driven mainly by higher employment between the old and new eligibility ages, with some midstream and downstream effects and limited evidence of upstream responses.

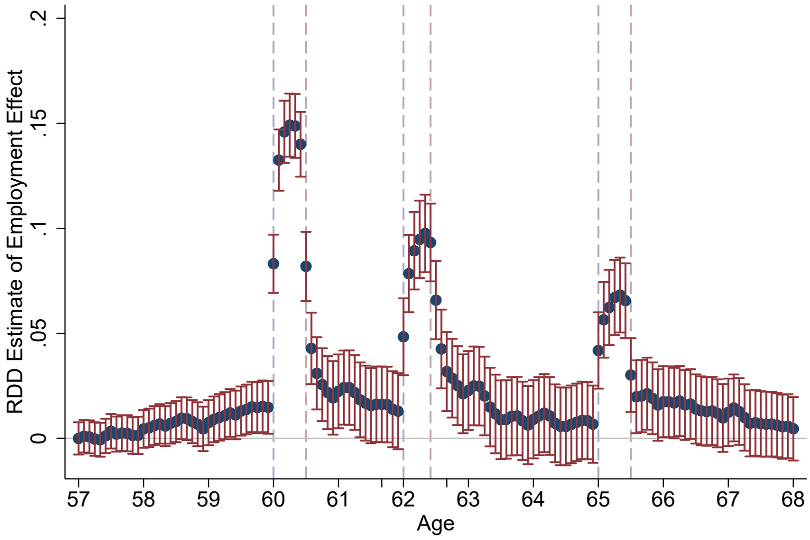


Figure 8: RDD Employment Effect by Age (in months)

Notes: The table reports the reform's estimated local treatment effects β_j from the RDD specification in equation (5) on employment, defined as one minus effective retirement, in percentage-point changes in the probability of being employed. We show the 95% confidence band around the estimates.

6.2 Dynamic responses

Next, we examine dynamic responses to the reform over the 12 years following its 2011 announcement using the annual outcome variables. For individuals born on January 1—for whom age aligns exactly with calendar years—we can trace outcomes from ages 57 to 68 over 2011–2022. In the critical years 2014, 2016, and 2019, these individuals are aged 60, 62, and 65, respectively, and face a six-month increase in eligibility ages relative to adjacent pre-cutoff cohorts.

Figure 9 illustrates the dynamic responses in four key outcomes: labor earnings, welfare benefit receipt, total savings, and net taxes. The figure plots average USD amounts over the relevant subperiods by one-week birth cohorts. For example, consistent with the extensive-margin results above, the labor earnings panels at the critical ages 60, 62, and 65 exhibit clear upward discontinuities at the birth-date cutoff, alongside smooth patterns on either side.

Table 5 reports corresponding estimates β_j of the RDD specification in equation (5) for these key variables as well as pension benefits and contributions to retirement plans. For reference, the control-group means are shown in gray beneath each coefficient estimate of the table. While this table (and Figure 9) presents estimates aggregated over the upstream, midstream, and downstream periods, Figure 10 reports the year-specific estimates.

Upstream. The first column of Table 5 shows no significant upstream responses across any outcomes. Labor earnings, benefit receipt, savings, and fiscal variables remain essentially unchanged prior to the affected eligibility ages, consistent with limited anticipatory behavior.

Critical Ages (Years). Columns (2)–(4) show sharp responses at the eligibility ages directly affected by the reform. At ages 60 and 62, when the ERA and IERA increase by six months, labor earnings rise by 5,722 USD (+13% relative to the mean) and 4,730 USD (+14%), respectively, while pension benefits decline by 3,847 USD and 2,697 USD, consistent with delayed retirement and postponed benefit claiming.

At age 65, when the FRA increases by six months, earnings rise by 3,979 USD (+24%), while the decline in pension benefits is more modest. This reflects a composition effect: treated individuals often receive a mix of ERP and OAP within the calendar year, whereas adjacent pre-cutoff cohorts typically receive a full year of OAP. Since ERP benefits are more generous on average, the decline in annual pension income is dampened.

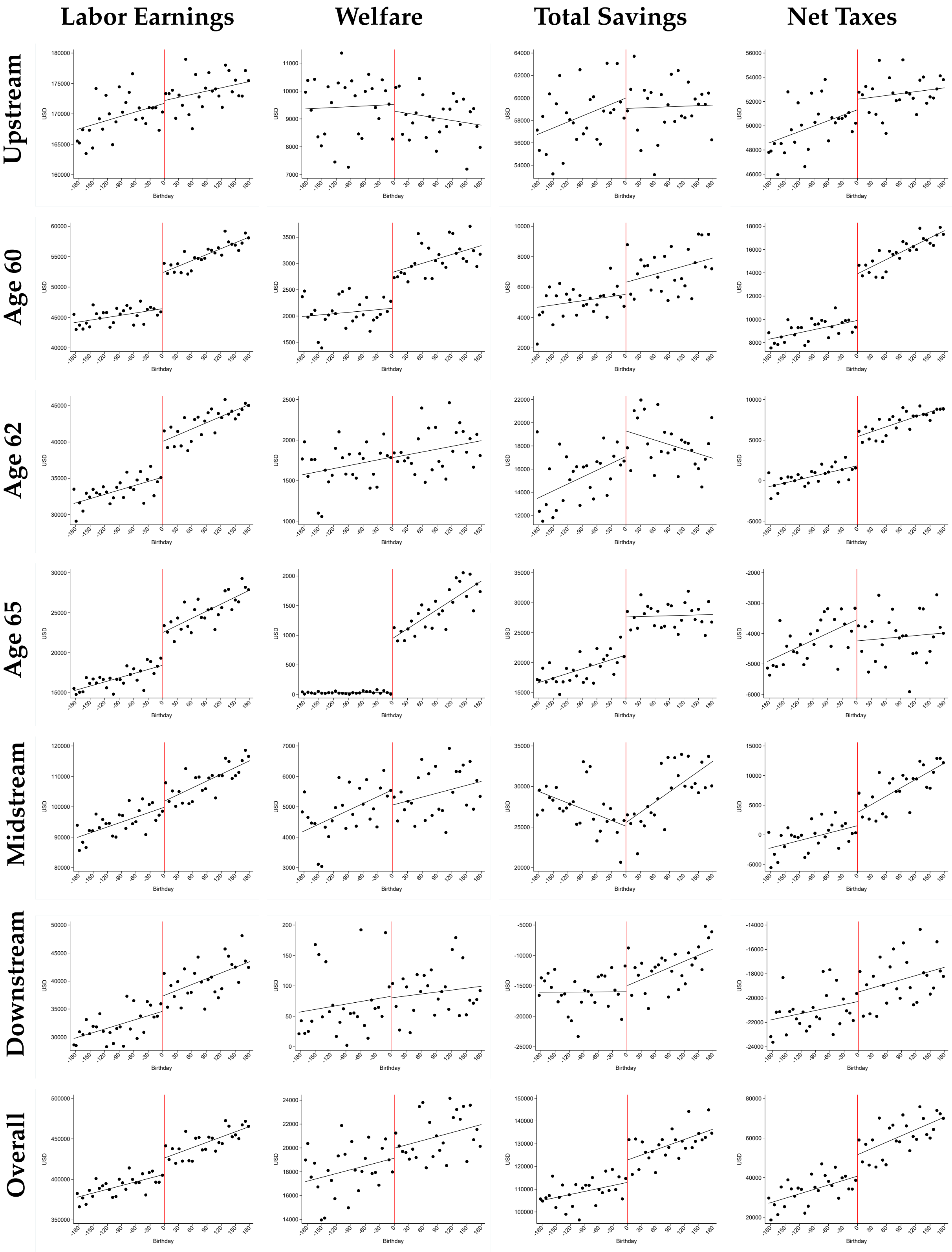


Figure 9: RDD Plots of Dynamic Responses

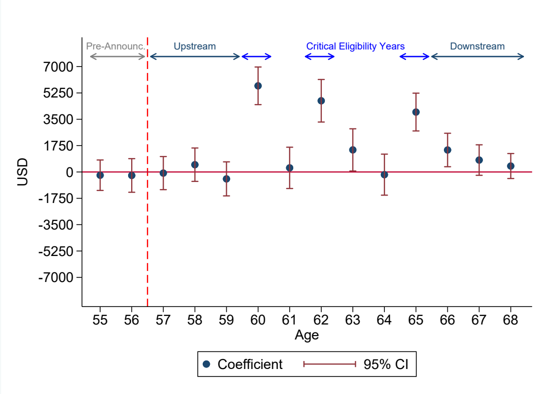
Notes: This figure plots the average USD amounts of outcome variables by one-week birth bins. Each dot represents the mean outcome within a weekly cohort. The red vertical lines correspond to the January 1, 1954, birth date cutoff. Local linear regressions are fitted on either side of the cutoff using the underlying (unbinned) data without controls. Outcomes (columns) are aggregated over different phases of the adjustment period following the reform (rows): upstream (ages 57–59; years 2011–2013), midstream (ages 61, 63–64; years 2015, 2017–2018), downstream (ages 66–68; years 2020–2022), and the full period (ages 57–68; years 2011–2022). For these periods, coefficients represent cumulative effects within indicated years. In contrast, panels for the critical years (ages 60, 62, and 65; years 2014, 2016, and 2019) report point-in-time outcomes for those specific years, in which treated individuals face a shorter eligibility duration.

Table 5: Dynamic Response to the Reform

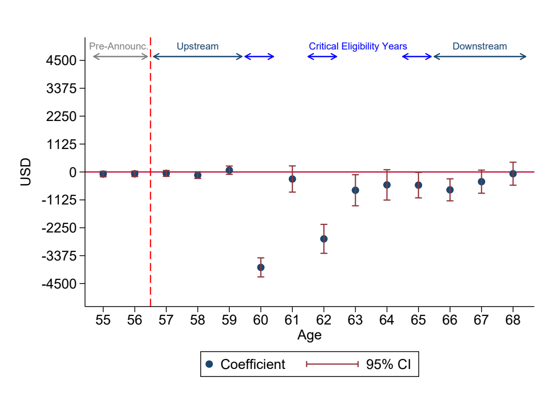
	Upstream	Critical Years			Midstream	Downstream	Overall Response
Years	2011–13	2014	2016	2019	2015, 2017–18	2020–22	2011-22
Ages	57–59	60	62	65	61, 63–64	66–68	57-68
Column	(1)	(2)	(3)	(4)	(5)	(6)	(7)
A. Labor supply							
Labor Earnings	-36	5,722***	4,730***	3,979***	1,510	2,645*	19,438***
	169,558	45,283	33,314	16,811	94,813	32,134	391,914
B. Public Benefits Claiming							
Pension Benefits	-112	-3,847***	-2,697***	-530**	-1,507*	-1,138*	-9,813***
	2,716	8,378	16,393	21,888	50,431	71,379	171,185
Welfare Benefits	-89	721***	11	916***	-456	-2	928
	9,436	2,067	1,680	30	4,857	70	18,141
C. Saving							
Contributions to Retirement Plans	-209	586***	698***	704***	325	448*	2,911***
	22,931	6,188	4,864	2,757	14,297	5,117	56,154
Annuities	-100	578***	694***	518***	385	225	2,564**
	19,972	5,785	4,267	1,978	11,951	3,630	47,583
Lump-sum Withdrawable	-90	14	14	190***	-50	188*	359
	2,934	398	591	771	2,327	1,480	8,501
Total Savings	-1,134	899	2,221**	6,492***	46	1,476	10,608***
	58,335	5,091	15,247	18,887	27,332	-15,997	108,895
D. Fiscal Externalities							
Net Taxes	617	3,901***	3,490***	-765*	1,984	695	10,580***
	49,927	9,089	522	-4,241	-412	-21,048	33,836
Taxes	-43	890***	813***	1,005***	156	838	4,068*
	64,080	19,930	18,740	15,656	55,115	43,230	216,751
Transfers	-639	-2,991***	-2,691***	1,745***	-1,835**	200	-6,460***
	13,993	10,799	18,201	19,869	55,434	64,134	182,430

Notes: The table reports the reform's estimated local treatment effects from the RDD specified in equation (5), where the estimation sample includes all individuals born within six months on either side of the cutoff. Outcomes are aggregated over different phases of adjustment period following the reform: upstream (2011-2013), midstream (2015,2017,2018), downstream (2020-2022), and the full period (2011-2022). For these periods, coefficients represent cumulative effects within indicated years. In contrast, the estimates reported for critical years (2014, 2016, and 2019) are point-in-time effects for those specified years and are not cumulative. Control-group means are shown in gray. *** $p < 0.01$,** $p < 0.05$,* $p < 0.1$.

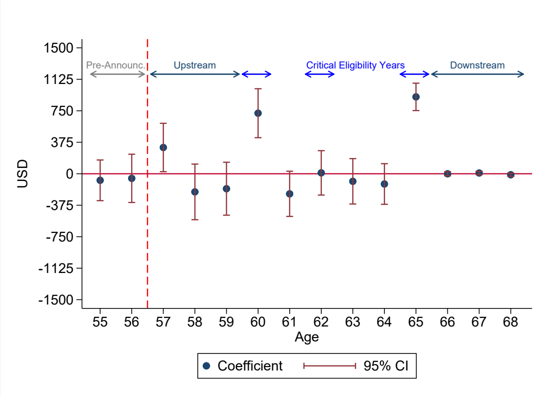
(a) Labor Earnings



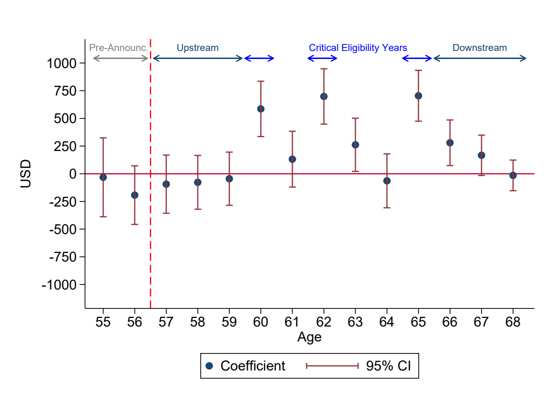
(b) Pension Benefits



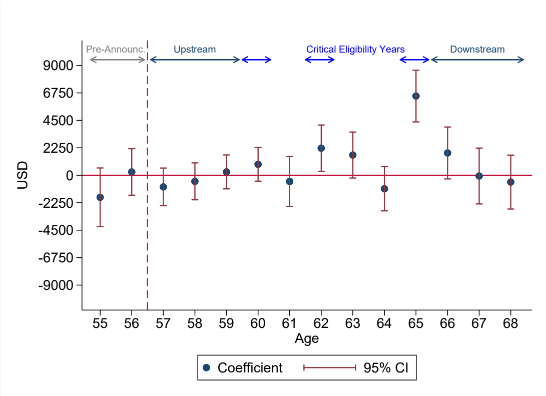
(c) Welfare Benefits



(d) Contributions to Retirement Plans



(e) Total Savings



(f) Net Taxes

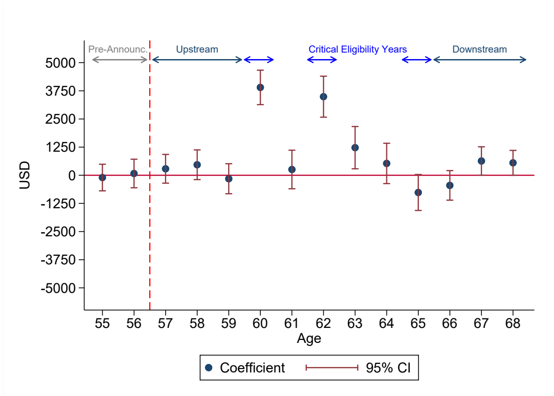


Figure 10: Year Effects for Key Outcome Variables

Notes: The figure reports estimates of β_j from the annual RDD specification in equation (5) by outcome variable and year. Each coefficient measures the discontinuity, in USD, at the January 1, 1954, birthdate cutoff, comparing individuals born just after the cutoff with those born just before it.

Consistent with the rise in welfare benefit receipt at the newly restricted ages (5.2 pp at the ERA and 5.6 pp at the FRA), average welfare benefit amounts increase by 721 USD at age 60 and 916 USD at age 65.

Contributions to retirement plans increase significantly at all critical ages and closely mirror the rise in labor earnings, consistent with quasi-mandatory occupational pension contribution rates of roughly 10–17% of earnings. Accordingly, the increase is driven primarily by employer-administered contributions to annuity-based pension accounts, while voluntary saving in lump-sum-withdrawable accounts remains limited.

Total savings rise in the critical years, particularly at ages 62 and 65, and by more than retirement contributions alone, indicating broader increases in wealth accumulation during the delayed retirement period.

Together, these responses generate positive fiscal externalities at ages 60 and 62 through higher tax payments and lower transfers. At age 65, however, the fiscal effect turns slightly negative, as weaker earnings responses and greater welfare receipt more than offset lower OAP payments.

Midstream. Column (5) shows more moderate and less precisely estimated responses during the midstream period. Labor earnings increase, although the estimate is not statistically significant. Panel 10a, however, reveals a significant increase in labor earnings at the isolated midstream age of 63, suggesting that the reform's effects extend beyond adjustments within the newly restricted pension claiming windows. This increase in labor supply coincides with further postponement of pension claiming, helping to explain the continued decline in pension benefits. Overall, the midstream period appears to reflect a continuation of the adjustments observed during the critical years, albeit with smaller magnitudes and less precise estimates.

Downstream. In the downstream period reported in column (6), labor earnings further increase by 2,645 USD, while pension benefits continue to decline due to further postponement of claiming. However, Figure panel 10a shows heterogeneity across downstream ages: the earnings response is concentrated in the earliest downstream years—particularly at age 66—and largely disappears by ages 67–68. Similar patterns emerge for savings and fiscal outcomes.

Overall Response. Column (7) summarizes the cumulative effects over the full period. The reform leads to a substantial and statistically significant increase in total labor earnings of 19,438 USD, accompanied by a reduction in pension benefits of 9,881 USD. Net tax payments rise by 10,580 USD, reflecting both higher earnings and lower transfer receipt. Total savings increase by 10,608 USD. As shown in Table 6 and in Figure 11, nearly all of this increase is accounted for by higher pension wealth accumulation. Of the total savings increase, 9,707 USD (91.5%) reflects additional pension wealth accumulation, driven by higher contributions (2,911 USD), postponed pension withdrawals (3,662 USD), and associated return (2,529 USD), calculated as the difference between the total change in pension wealth and the sum of contributions and reduced withdrawals. In contrast, non-pension wealth rises by a more modest and statistically insignificant 1,252 USD. Overall, the results indicate that the reform leads to a meaningful reallocation from public transfers toward labor income and private savings, with most of the additional saving occurring within retirement accounts.

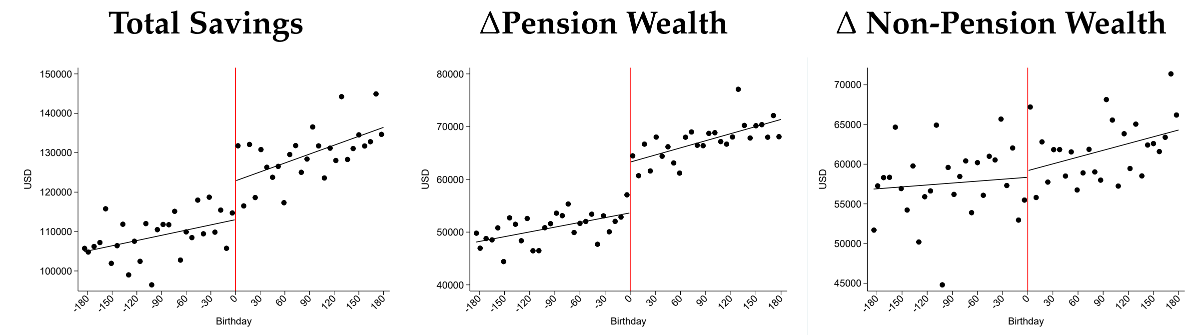


Figure 11: RDD Plots of Overall Saving Response (Ages 57–68)

Notes: This figure presents RDD plots for total savings and its decomposition into pension wealth and non-pension wealth over ages 57–68. Each dot represents the average outcome within a one-week birth cohort. The vertical red line marks the January 1, 1954 birth-date cutoff. The fitted lines show local linear regressions estimated separately on either side of the cutoff using the underlying individual-level data without controls.

Table 6: Decomposition of the Overall Saving Response (Ages 57–68)

	Response	Decomposition (%)
Total Savings	10,608***	100.0
Change in Pension Wealth	9,707***	91.5
Contributions	2,911***	
Reduced Withdrawals	3,662***	
Capital Gains	2,529*	
Change in Non-Pension Wealth	1,252	11.8
Residual	-351	-3.3

Notes: The table decomposes the estimated cumulative increase in total savings over ages 57–68 (2011–2022). Shares are calculated relative to the overall effect on total savings of 10,608 USD. The contribution of withdrawals is reported as the reduction in withdrawals (i.e., $-1\times$ the estimated effect on withdrawals), implying that delayed withdrawals increased accumulated pension wealth by 3,662 USD. The residual reflects that the reported components are estimated separately rather than derived from a common accounting identity, and, therefore, do not mechanically equal the sum of the reported components. Returns are calculated as the difference between the total change in pension wealth and the sum of contributions and reduced withdrawals.

Robustness. Appendix E demonstrates that our results are robust to alternative specifications. First, we replace the baseline local linear specification with local second-degree polynomial regressions on either side of the cutoff (see, e.g., Rabaté et al. (2024)). Second, we implement the robust bias-corrected estimator of Calonico et al. (2014) using optimal bandwidths and triangular kernel weights. The corresponding estimates, reported in Tables 12 and 13, remain very similar to the baseline results.

6.3 Heterogeneity in the Dynamic Response

This section examines how dynamic responses to the reform vary across economically meaningful subgroups. Table 7 summarizes the results across three dimensions: liquid wealth (Panel A), pension wealth (Panel B), and worker type (Panel C).

Liquid wealth. Panel A shows stronger short-run responses among individuals with low liquid wealth. At age 60, their earnings increase more than for high-liquid-wealth individuals, consistent with tighter liquidity constraints. They also exhibit a larger rise in welfare benefit receipt, indicating greater reliance on transfers when retirement is delayed. Differences narrow at later ages: earnings responses and cumulative earnings are similar across groups, suggesting that liquidity constraints matter primarily at early eligibility thresholds.

Pension wealth. Panel B shows that responses align with institutional incentives. Individuals with low pension wealth respond most strongly at the ERA, while those with high pension wealth respond more at the IERA, when means-testing is relaxed. Overall, cumulative earnings responses are substantially larger for the low-pension-wealth group, indicating greater career extension. Welfare reliance also increases more for this group. These findings suggest that private pension wealth dampens labor-supply responses to higher public retirement ages.

Self-employed vs. salaried workers Panel C reveals differences in timing and magnitude across worker types. Salaried workers respond more strongly at earlier eligibility thresholds (ERA and IERA), while the self-employed exhibit their largest response at the FRA. Overall, cumulative labor-earnings responses are larger for salaried workers, indicating a greater extension of working lives. This is mirrored in fiscal outcomes, with substantially higher increases in net taxes among salaried workers.

Table 7: Heterogeneity in Responses to the Reform

	Upstream	Critical Years			Midstream	Downstream	Overall Response
Years	2011–13	2014	2016	2019	2015, 2017–18	2020–22	2011-22
Ages	57–59	60	62	65	61, 63–64	66–68	57-68
Column	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Panel A: By Liquid Wealth							
Labor Earnings							
Bottom quintile	1,182	5,721***	4,155***	3,685***	3,171	28	16,032
Top quintile	-2,769	3,397**	3,748**	3,800**	-3,937	4,662	9,881
Welfare Benefits							
Bottom quintile	665	1,249***	486	1,577***	1,091	-51	5,581**
Top quintile	-1,500*	702**	-138	636***	-1,017	-35	-1,602
Total Savings							
Bottom quintile	-2,365	1,733	2,111	4,419**	-5,437*	5,079*	5,391
Top quintile	-3,496	939	1,758	13,914***	1,869	2,347	18,243
Net Taxes							
Bottom quintile	500	3,850***	2,805***	-271	1,488	-745	6,168
Top quintile	907	3,060***	3,768***	-586	1,927	3,857*	13,788
Panel B: By Pension Wealth							
Labor Earnings							
Bottom quintile	2,381	8,803***	3,044**	3,327***	4,200	2,551	25,989***
Top quintile	-5,537	4,114**	5,373***	4,588**	611	3,580	11,690
Welfare Benefits							
Bottom quintile	640	1,514***	134	1,758***	215	-11	3,971
Top quintile	-176	135	231	725***	-217	23	968
Total Savings							
Bottom quintile	1,885	2,910**	535	4,257**	-3,048	1,915	8,511*
Top quintile	-3,977	-224	6,620**	2,674	1,711	6,660	13,487
Net Taxes							
Bottom quintile	669	5,947***	2,096**	-568	2,229	657	11,873*
Top quintile	-695	2,975***	4,044***	-575	1,598	-302	7,281
Panel C: By Worker Type							
Labor Earnings							
Salaried workers	-179	5,986***	5,055***	3,777***	1,899	2,580*	19,865***
Self-employed	1,484	2,180	581	6,382**	-3,304	3,686	15,027
Welfare Benefits							
Salaried workers	-153	754***	19	926***	-396	15	995
Self-employed	704	333	-122	783**	-1,263	-205	-44
Total Savings							
Salaried workers	-1,647	612	2,368**	6,877***	165	1,305	10,218***
Self-employed	4,820	4,523	370	1,497	-1,761	3,840	14,868
Net Taxes							
Salaried workers	562	4,076***	3,782***	-1,065**	2,345*	785	11,053***
Self-employed	1,117	1,516	-383	2,878	-3,011	-464	4,436

Notes: The table reports the reform's estimated local treatment effects from the RDD specified in equation (5), where the estimation sample includes all individuals born within six months on either side of the cutoff. Estimates are shown by subgroups defined by liquid wealth (Panel A), pension wealth (Panel B), and worker type (Panel C). For wealth-based splits, individuals are classified into quintiles based on pre-reform measures (2010), and we report results for top and bottom quintiles. Outcomes are aggregated over different phases of adjustment period following the reform: upstream (2011-2013), midstream (2015,2017,2018), downstream (2020-2022), and the full period (2011-2022). For these periods, coefficients represent cumulative effects within indicated years. In contrast, the estimates reported for critical years (2014, 2016, and 2019) are point-in-time effects for those specified years and are not cumulative. *** $p < 0.01$,** $p < 0.05$,* $p < 0.1$.

7 Determinants of Reform Effects

7.1 Labor Response

Model Consistency and Underlying Mechanisms. The evidence on the labor response is consistent with the model on two dimensions: we do not find upstream responses, and retirement bunching at the ERA and IERA shifts by six months to the new thresholds after the reform. The main deviation concerns dynamics around the FRA, and, thus, no retirement bunching. In the model, there is no discrete retirement incentive at the FRA. Empirically, however, we observe bunching and a corresponding shift in mass at the FRA, which the theoretical framework cannot rationalize. Finally, the model also fails to account for the positive mid- and downstream labor response.

Several mechanisms could account for the excess bunching at the FRA. One potential explanation is that occupational (second-pillar) pensions create retirement incentives at the FRA, through kinks in the budget constraint. However, these pensions are largely annuitized, approximately actuarially fair, and generally lack age-based discontinuities, making this explanation unlikely.

A second possibility is demand-side factors that concentrate retirements at the FRA, such as employer-driven retirement policies (e.g., Rabaté, 2019). While such mechanisms may play a role for some workers, Denmark's age-discrimination legislation suggests they account for only a limited share of the observed bunching.

A third explanation is borrowing constraints. If individuals cannot smooth consumption, delayed eligibility may force them to work until pension access, potentially amplifying bunching. However, our heterogeneity results provide little support for this mechanism at the FRA. Figure 12 shows similar bunching shifts across liquid-wealth groups, and Table 7 reports comparable earnings responses and strong savings adjustments for both groups. By contrast, at the ERA low-liquid-wealth individuals respond more strongly, consistent with tighter liquidity constraints. Overall, borrowing constraints may matter at the ERA but are unlikely to explain much of the bunching at the FRA.

The limited plausibility of these standard non-behavioral explanations points to behavioral mechanisms—such as social norms and reference-dependent preferences—as important drivers of bunching at the FRA, consistent with Behaghel and Blau (2012); Lalive et al. (2023); Seibold (2021). These behavioral channels help explain pronounced bunching at the FRA despite the absence of sharp eligibility incentives. While financial incentives and discrete notches are strong at the ERA and IERA, we cannot rule out that social norms and reference points also contribute to bunching at these ages.

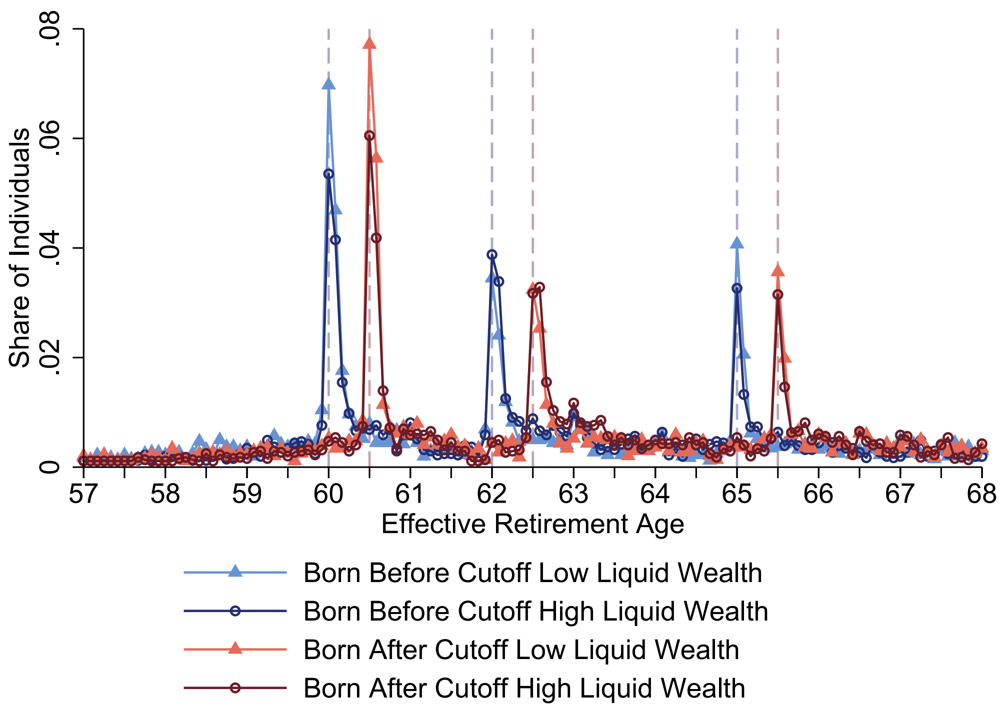


Figure 12: Reform Effect on the Effective Retirement Age Distribution by Liquid Wealth

Notes: This figure shows the distribution of effective monthly retirement age for four groups: individuals born within six months before and within six months after the January 1, 1954 cutoff, each split into low- and high-liquid-wealth individuals. Effective monthly retirement age is defined based on the timing of when individuals stop receiving labor income, as described in detail in Appendix B.

Reconciling with the Literature. Following Rabaté et al. (2024), we present Table 8, which situates our employment results in the restricted periods between old and new eligibility ages within the broader international evidence on retirement age reforms. Two points are worth highlighting.

First, for reforms that increase eligibility ages, the international evidence in Table 8 reports employment effects of roughly +6 to +33 pp. Our estimates fall in the +8.8 to +17.1 pp range across the three Danish eligibility ages, with the largest effect at the ERA (+17.1 pp), placing them near the middle of the international distribution. These level effects partly reflect the relatively high pre-threshold employment rates in our setting, and they imply a comparatively strong response per year of age increase. Second, unlike settings where behavior concentrates around a single early and a single normal or statutory age, the coexistence of three distinct pension eligibility ages, ERA, IERA, and FRA, likely spreads adjustment across margins. Consistent with this interpretation, hazard levels in our setting range from 0.09 to 0.14, and bunching from 5 to 8 percent, which are generally below the substantially higher hazard drops and bunching rates observed in several other countries.

Finally, the reform-induced reductions in retirement rates are of similar order of magnitude to the employment gains, ranging from −10.7 to −22.3 pp. This pattern indicates that the policy largely operated by delaying retirement into continued employment, consistent with its intended purpose.

This evidence primarily concerns behavioral responses around eligibility thresholds. A related question is whether retirement-age reforms generate adjustments outside the newly restricted claiming windows. Consistent with our findings, the literature generally reports limited upstream effects. In settings similar to ours, where reforms occur late in the life cycle, Rabaté et al. (2024) and Staubli and Zweimüller (2013) find little to no upstream employment response. Likewise, Mastrobuoni (2009) and Geyer and Welteke (2021) document negligible upstream adjustments despite long announcement horizons. An important exception is Carta and De Philippis (2021), who finds substantial anticipatory responses. One interpretation is that labor-market frictions and institutional rigidities constrain early adjustment, concentrating behavioral responses within the newly restricted interval between the old and new eligibility ages. In contrast to the limited evidence on adjustments beyond the eligibility thresholds, we find persistent downstream labor-earnings effects and some evidence of midstream responses. Existing studies generally report little adjustment after individuals pass the new eligibility age (Staubli and Zweimüller, 2013; Rabaté et al., 2024). Our findings therefore suggest that retirement-age reforms may affect behavior over a broader segment of the life cycle than is typically documented in the literature.

Table 8: Results of Related Studies on Effects near ERA or FRA

Study	Country	Reform	Method	Results: Employment rate (pp)	Results: Retirement rate (pp)	At ERA, IERA, or FRA: Employment rate[a] (%)	At ERA, IERA, or FRA: Hazard rate[b] (Level)	At ERA, IERA, or FRA: Bunching[c] (%)
Staubli and Zweimüller (2013)	AUT	♂: ERA 60 → 62	DID	9.8	−24.8	28	0.5	14
		♀: ERA 55 → 58+3m	DID	11.0	−25.4	57	0.25	14
Vestad (2013)	NOR	ERA 64 → 62	DID	33.2	×	65	0.46	30
Atalay and Barrett (2015)	AUS	♀: FRA 60 → 65	DID	7.7	×	30–50	×	×
Cribb et al. (2016)	UK	♀: ERA 60 → 62	DID	6.3	−11.5	55	0.25	14
De Vos et al. (2019)	NLD	FRA 65 → 65+6m	DID	10	×	43	0.35	15
Rabaté and Rochut (2020)	FRA	FRA 60 → 61	DID	20.9	−47.8	45	0.5	23
Geyer and Welteke (2021)	GER	♀: ERA 60 → 63	RDD	13.5	−27.6	62	0.19	12
Rabaté et al. (2024)	NLD	ERA 65+m → 66	RDD	21.2	−59.5	29	0.72	21
This paper	DK	ERA 60 → 60+6m	RDD	17.13	−22.33	86	0.1	8
This paper	DK	IERA 62 → 62+6m	RDD	10.33	−10.66	61	0.09	6
This paper	DK	FRA 65 → 65+6m	RDD	8.78	−15.82	35	0.14	5

Notes: The table summarizes estimates from relevant studies examining reforms that increase eligibility ages. Reported employment and retirement effects are measured near the relevant eligibility age.
[a] The employment rate just before the eligibility age.
[b] The drop in the share of employed person at the eligibility age over the share of the employed persons just before it.
[c] The share of employed persons retiring at the eligibility age.

7.2 Spillovers to welfare programs

Model Consistency and Underlying Mechanisms. Overall, the spillover patterns into welfare programs line up closely with the model's qualitative predictions. We observe clear passive substitution in the periods newly constrained by the reform, consistent with delayed pension eligibility mechanically prolonging non-pension benefit spells for individuals who would otherwise have claimed ERP or OAP. Our transition-based estimates further show that induced entry from employment into welfare benefits is concentrated around the ERA, while it is markedly weaker around the IERA and essentially absent around the FRA. This heterogeneity across thresholds likely follows naturally from the reform-induced incentive changes and the institutional setting: conditional on a given exit age, the consumption advantage of the welfare-benefit path relative to the pension-benefit path is largest in the newly restricted window around the ERA, much smaller around the IERA, and can even turn negative around the FRA.

Reconciling with the Literature. A number of related studies document substantial passive substitution, but only limited active substitution into welfare programs following increases in pension eligibility ages (Rabaté et al., 2024; Geyer and Welteke, 2021; Manoli and Weber, 2016; Oguzoglu et al., 2020). Our findings are broadly consistent with this pattern, particularly at the IERA and FRA, where changes in welfare receipt primarily reflect mechanical delays in pension claiming rather than new benefit take-up. At the ERA, however, we find evidence of active substitution from employment into welfare: individuals employed just before the cutoff are 0.62 pp more likely to receive benefits six months later. This active substitution accounts for 12% of the total welfare spillover (+5.23 pp). Duggan et al. (2007) similarly document increased entry into DI following increases in retirement ages in the United States.

7.3 Saving and wealth

Model Consistency and Underlying Mechanisms. Since the reform extends careers and thereby increases lifetime income, the model predicts lower upstream savings and higher upstream consumption as forward-looking individuals smooth the gains from extended employment over the remaining life cycle. Empirically, we obtain a negative upstream savings estimate, although it is not statistically significant. The model further predicts positive savings responses during periods of extended employment and higher labor income. While these responses are expected to be concentrated within the newly restricted claiming windows around the ERA and IERA, the observed labor-supply effects extend beyond these windows into the restricted period around the FRA and the midstream and downstream periods. Accordingly, the consumption-smoothing theory would also predict positive savings responses in these later periods, which is what we observe. Overall, the savings results are broadly consistent with the predictions of standard life-cycle theory.

Reconciling with the Literature. At the same time, the insignificant upstream savings response implies that our results cannot reject the savings inertia hypothesis proposed by García-Miralles and Leganza (2024), who argue that retirement-age reforms affect savings primarily through continued participation in existing retirement-saving arrangements rather than active re-optimization of lifetime consumption. Consistent with this interpretation, the increase in retirement saving is concentrated in annuity-based pension plans, which in Denmark are predominantly quasi-mandatory occupational pensions. Moreover, contribution responses arise primarily during periods of extended employment, suggesting that continued labor-market attachment plays an important role in generating additional retirement wealth. Taken together, the evidence does not allow us to distinguish sharply between savings inertia and standard consumption smoothing. While the observed savings responses are consistent with both mechanisms, the prominence of annuity-based contributions points to an important role for quasi-mandatory pension saving in transmitting the effects of the reform.

8 Conclusion

This paper evaluates the behavioral and fiscal effects of a six-month increase in the ERA, IERA, and FRA in Denmark. Using a regression discontinuity design and following individuals for twelve years after the reform announcement, we provide a comprehensive assessment of labor supply, benefit claiming, saving behavior, and fiscal outcomes.

We find no evidence of anticipatory upstream responses. Instead, employment rises and retirement is postponed around the newly restricted eligibility ages, accompanied by moderate spillovers into alternative welfare programs. We document positive labor-supply responses not only around the eligibility age, but also in the midstream and downstream periods, implying that analyses focused solely on the newly restricted windows may miss an important part of the overall adjustment process.

One finding points to a mechanism beyond our theoretical benchmark. Retirement bunching shifts not only to the new ERA and IERA but also to the new FRA, despite the absence of discrete financial incentives at the latter, suggesting that salient eligibility ages act as behavioral reference points. We also document substantial increases in private savings during periods of extended employment, concentrated in occupational pension accounts, following a small but imprecisely estimated decline before the newly restricted eligibility ages. These savings responses are broadly consistent with the predictions of the life-cycle model, although they are also compatible with passive wealth accumulation through continued participation in default occupational pension arrangements.

Overall, the reform generates sizeable and persistent effects on employment, private wealth accumulation, and public finances. These responses are strongest among salaried workers and individuals with low liquid and private pension wealth, highlighting the importance of heterogeneity when evaluating the effectiveness and distributional consequences of increases in pension eligibility ages.

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Appendix A: Pension Wealth Imputation

This appendix outlines the method used to impute after-tax pension wealth in years prior to 2014 using administrative data. The same approach applies more generally to imputing wealth at the end of year t based on observed values in year $t+1$ and recorded pension flows in year t.

We define w_{post}^{t+1} as the after-tax pension wealth at the end of year $t+1$, as reported in variable `wea_pen_tot_net` (FCGX). For this variable Statistic Denmark applies a 60% weight to pre-tax pension wealth, corresponding to an assumed average withdrawal tax rate of 40%. Contributions to annuity-based (Pillar 2–3) pensions in year t, denoted c_t^{annu}, are recorded as the sum of `QARBPENL`, `QRIPENL`, and `ATPSAML`. Withdrawals from annuities in the same year, inc_t^{annu}, are given by `QANDPENS`. Contributions to non-Roth-style lump-sum accounts, c_t^{lump}, are measured as `QPRIPENK` plus `QARBPENK`, while withdrawals, inc_t^{lump}, are drawn from `KAPPEN`. Roth-style pension contributions in year t, c_t^{roth}, include `PRIPEN33` and `ARBPEN4445`. We assume Roth withdrawals inc_t^{roth} are zero before December 31, 2014. The monthly after-tax return on pension wealth in year t is denoted $r_{m,t}$.

Several assumptions underlie our imputation procedure. First, annuity contributions and withdrawals are assumed to be evenly distributed throughout the year, whereas lump-sum and Roth-style flows occur mid-year. Second, we assume annuity and lump-sum contributions are taxed at 40%, so only 60% enters the account (consistent with Statistics Denmark conventions). Roth contributions are post-tax and enter fully. Withdrawals from annuity and lump-sum accounts are also taxed at 40%, so 60% is retained. Roth withdrawals are tax-free and fully retained. Finally, annuity flows are capitalized over 5.5 months, lump-sum and Roth flows over 6 months, and final wealth is measured at the end of the year (12-month capitalization).

The imputation of after-tax wealth at the end of year t, denoted w^t_{post}, relies on the following identity:

$$w^{t+1}_{post} = w^t_{post} \cdot (1 + r_{m,t})^{12} + \text{net\_flow}_t,$$

which can be rearranged to yield:

$$w^t_{post} = \frac{w^{t+1}_{post} - \text{net\_flow}_t}{(1 + r_{m,t})^{12}}.$$

The term net_flow_t captures the net after-tax contributions to pension wealth during year t, adjusted for timing and returns. Specifically, we construct:

$$\begin{aligned}
\text{net_flow}_t = &\; 0.6 \cdot (c^{annu}_t - inc^{annu}_t) \cdot (1 + r_{m,t})^{5.5} \\
&+ 0.6 \cdot (c^{lump}_t - inc^{lump}_t) \cdot (1 + r_{m,t})^{6} \\
&+ c^{roth}_t \cdot (1 + r_{m,t})^{6}.
\end{aligned}$$

Each term reflects the average time the funds remain in the account and their respective after-tax values. If only annual returns $r_{annual,t}$ are available, we approximate the monthly capitalization as:

$$(1 + r_{m,t})^x \approx (1 + r_{annual,t})^{x/12},$$

where x denotes the relevant capitalization period in months.

The monthly after-tax return $r_{m,t}$ is based on gross annual returns provided by the pension fund P+ and adjusted for the Pension Return Tax (PAL). Table 9 summarizes the applicable rates.

Table 9: Annual and Monthly After-Tax Returns on Pension Wealth

Year	PAL Tax Rate	Annual Return (%)	Annual After-Tax (%)	Monthly After-Tax (%)
2014	15.3%	9.50	8.05	0.644
2013	15.3%	-1.50	-1.50	-0.130
2012	15.3%	4.50	3.81	0.313
2011	15.0%	12.10	10.29	0.816
2010	15.0%	6.60	5.61	0.451
2009	15.5%	-1.60	-1.60	-0.130
2008	15.0%	-5.40	-5.40	-0.460

Appendix B: Effective Retirement Date Imputation

Most of the administrative registers used in this article are available at an annual frequency. However, for employees in salaried jobs, we also observe monthly information from the income register BFL, which allows us to measure the timing of effective retirement more precisely. For these individuals, we define the retirement month as the first month t with zero reported hours worked, conditional on positive hours in month $t-1$. To ensure this transition reflects a persistent labor market exit, we impose two additional forward-looking criteria. First, there must be no subsequent 12-month period in which the average workload exceeds 50 percent. Second, cumulative future earnings from self-employment must not exceed 20,000 USD:

$$\text{ret\_month} \;=\; \min\{\, t \;:\; \text{hours}_t = 0 \;\;\wedge\;\; \text{hours}_{t-1} > 0 \;\;\wedge\;\; \Omega_t \}$$

Where Ω_t represents the forward-looking criteria:

$$\Omega_t \;\equiv\; \left(\max_{R^W \geq t} W_R^W < 0.5\right) \;\;\wedge\;\; \left(\sum_{k \geq \text{year}(t)} \text{SE\_earnings}_k < 20000\right).$$

For any given month R^W following the candidate retirement month t ($R^W \geq t$), we define W_R^W as the rolling workload share over the 12-month period beginning in month R^W. This share is calculated relative to a standard annual Full-Time Equivalent (FTE) benchmark of 1,665 hours (37 hours per week $\times$ 45 weeks). To account for right-censoring, either due to the end of the sample period or the individual's death, we restrict the forward-looking sum to the final observable month T_i. We also proportionally shrink the FTE denominator to match the actual number of months observed in this truncated window:

$$W_R^W \equiv \frac{\sum_{s=R^W}^{\min(R^W+11,T_i)} \text{hours}_s}{(37 \times 45) \times \left(\frac{\min(R^W+11,T_i)-R^W+1}{12}\right)}$$

This baseline definition for salaried workers does not apply to the following three categories of workers:

(1) Strictly self-employed: Individuals who never record positive hours in salaried employment.

(2) Post-salaried self-employment: Individuals who stop providing salaried work but continue in self-employment, generating more than 20,000 USD in future self-employment income.

(3) Right-censored observations: Individuals who do not retire before the end of our sample period in 2022.

For individuals in categories (1) and (2), we apply a modified retirement definition based solely on self-employment income. For these individuals, we identify the retirement year as the final year in the dataset with non-zero self-employment income, provided this year is prior to the end of the sample (2022):

$$\text{ret\_year} = \max\left\{ t : \text{SE\_earnings}_t \neq 0 \right\}, \quad \text{given } t < 2022.$$

To pin down the timing within this retirement year, we rely on the ratio of annual self-employment income in the retirement year relative to the income in the immediately preceding year:

$$\lambda \equiv \frac{\text{SE\_earnings}_{\text{ret\_year}}}{\text{SE\_earnings}_{\text{ret\_year}-1}}$$

The retirement month is then imputed based on this ratio. Because we only observe labor market states at a monthly frequency, we restrict the output to discrete integers. If the ratio implies negative income ($\lambda \leq 0$) or suggests income grew compared to the previous year ($\lambda > 1$), we assign a mid-year retirement month of June (Month 6). Otherwise, the fraction of the year worked is assumed to be proportional to the income ratio, rounded to the nearest whole month:

$$\text{ret\_month} = \begin{cases} 6 & \text{if } \lambda \leq 0 \;\; \vee \;\; \lambda > 1 \\ \text{round}(\lambda \cdot 12) & \text{if } 0 < \lambda \leq 1 \end{cases}$$

To illustrate the empirical coverage of this imputation procedure, Table 10 reports the distribution of individuals across the four resulting classification categories. The majority of the sample consists of wage earners, for whom retirement timing is identified using the monthly hours-worked condition. A smaller share is classified under the self-employment criteria, comprising both strictly self-employed individuals and those transitioning to self-employment, where the annual earnings ratio is applied. Finally, the table accounts for a subset of inactive individuals with no recorded labor market activity after 2007, as well as right-censored observations that do not retire before the end of the observation period in 2022.

Table 10: Retirement Category Distribution for January 2008

Category	**Count**	**Share %**	**Cumulative %**
Wage Earner	33607	80.50	80.50
Selfemployed	979	2.35	82.84
no work post 2007	1224	2.93	85.78
No retirement in 2008-2022	5938	14.22	100.00
Total	41748	100.00	100.00

Notes: This table reports the distribution of the sample across the four main retirement classification criteria defined in Section B.

Appendix C: Placebo Tests

Table 11: Placebo Tests in Pre-reform Announcement Years

	Baseline		Quadratic		RDrobust	
Years	2009	2010	2009	2010	2009	2010
Ages	55	56	55	56	55	56
Column	(1)	(2)	(3)	(4)	(5)	(6)
A. Income						
Labor Earnings	-216	-231	346	191	928	846
	60,723	60,230	60,723	60,230	60,411	59,787
Pension Benefits	-84	-74	-67	-62	-127	-94
	257	298	257	298	272	306
Welfare Benefits	-78	-55	-71	-72	-140	-180
	2,053	2,673	2,053	2,673	2,105	2,701
B. Savings						
Contributions to Retirement Plans	-32	-193	338	-2	251	-28
	9,446	8,430	9,446	8,430	9,164	8,225
Total Savings	-1,807	273	-1,823	780	-1,837	326
	-34,781	1,496	-34,781	1,496	-34,016	879
C. Fiscal Externalities						
Net Taxes	-101	79	165	217	404	650
	19,592	18,242	19,592	18,242	19,508	18,069

Notes: This table reports placebo estimates from the RDD specified in equation (5), using pre-reform announcemnt years (2009-2010) where no treatment effect is expected. Columns (1)-(2) report baseline local linear estimates, columns (3)-(4) allow for local second-degree polynomial regressions on both sides of the cutoff, and columns (5)-(6) report robust bias-corrected estimates following Calonico et al. (2014) using bandwidth selection based on triangular kernel weights. *** $p < 0.01$,** $p < 0.05$,* $p < 0.1$.

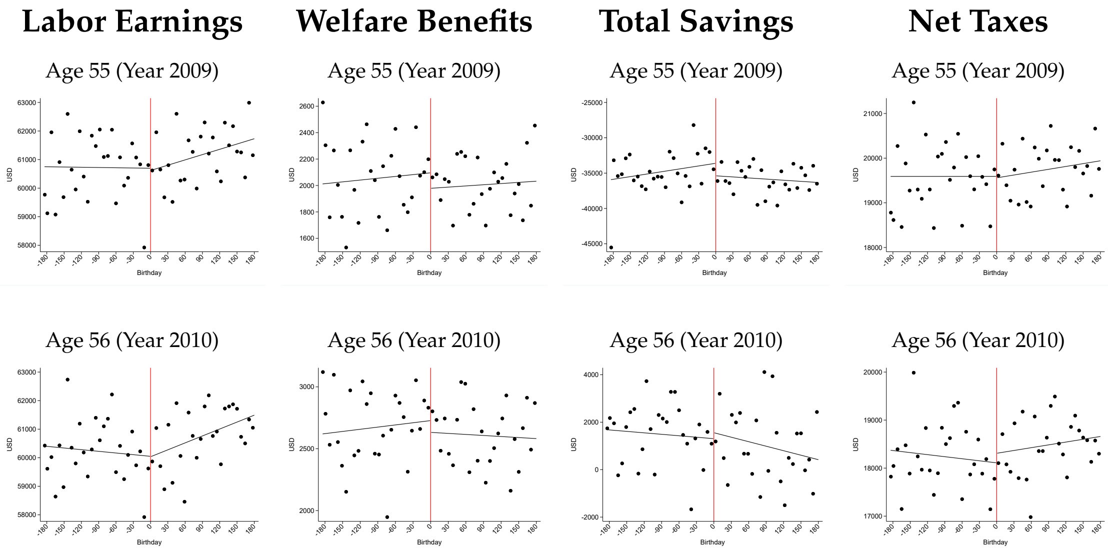

Figure 13: Placebo RDD plots by outcome for pre-reform years 2009 and 2010.

Notes: This figure plots the average USD amounts of outcome variables by one-week birth bins for pre-reform years 2009 and 2010. Each dot represents the mean outcome within a weekly cohort. The red vertical lines correspond to the January 1, 1954, birth date cutoff. Local linear regressions are fitted on either side of the cutoff using the underlying (unbinned) data without controls.

Appendix D: Effect on Average Retirement Age

This appendix outlines the procedure used to aggregate the age-specific employment effects into a single measure representing the change in the average retirement age. The methodological derivation closely follows the approach detailed in Rabaté et al. (2024) and Mastrobuoni (2009). We rely on the estimated coefficients obtained from the RDD specification presented in Section 5.1.

$$y_{ij} = \alpha + \beta_j \cdot \mathbf{1}[x_i \geq c] + \gamma_j \cdot (x_i - c) + \delta_j \cdot \mathbf{1}[x_i \geq c] \cdot (x_i - c) + Z_i'\theta + \varepsilon_{ij} \quad (5)$$

When the dependent variable y_{ij} in Equation (5) is specified as a binary indicator for employment at a given age in months j, the coefficient of interest β_j captures the causal effect of the eligibility age increase on the probability of remaining employed at that specific age.

Thus, β_j represents the reform induced increase in the probability that an individual retires after age j. Let R denote the random variable representing the observed retirement age (in months) for individuals exposed to the reform, and let R^{cf} denote the counterfactual retirement age for the same group had the reform not been implemented. We can express this relationship as:

$$\Pr(R > j) = \Pr(R^{cf} > j) + \beta_j \quad (6)$$

The total effect of the policy on the average retirement age, denoted as Δ, is the difference in the expected value of the retirement age with and without the reform. Summing over our specific period of interest, from the announcement of the reform at age 57 (684 months) up to age 68 (816 months), we get:

$$\Delta = \sum_{j=684}^{816} j \cdot \Pr(R = j) - \sum_{j=684}^{816} j \cdot \Pr(R^{cf} = j)$$

$$\Delta = \sum_{j=684}^{816} j \cdot \left[\Pr(R = j) - \Pr(R^{cf} = j) \right] \tag{7}$$

Using the property of the standard cumulative distribution function, the probability of retiring exactly in month j can be rewritten as the probability of not having retired by month $j-1$ minus the probability of not having retired by month j. That is:

$$\Pr(X = j) = \Pr(X > j - 1) - \Pr(X > j). \tag{8}$$

Substituting this into Equation (7) and applying the relationship from Equation (6) yields:

$$\begin{aligned}\Delta &= \sum_{j=684}^{816} j \cdot \Big[\big(\Pr(R > j-1) - \Pr(R^{cf} > j-1) \big) - \big(\Pr(R > j) - \Pr(R^{cf} > j) \big) \Big] \\ &= \sum_{j=684}^{816} j \cdot (\beta_{j-1} - \beta_j) \end{aligned} \tag{9}$$

Assuming that the reform only affects retirement behavior within this specific age window bounded by 684 and 816 months (meaning $\beta_j = 0$ for all $j \leq 684$ and $j \geq 816$), this expression expands into a telescoping sum:

$$\begin{aligned}\Delta &= \sum_{j=684}^{816} j \cdot (\beta_{j-1} - \beta_j) \\ &= 684(0 - \beta_{684}) + 685(\beta_{684} - \beta_{685}) + \cdots + 816(\beta_{815} - 0) \\ &= \sum_{j=684}^{815} \beta_j \end{aligned} \tag{10}$$

Thus, the overall causal effect of the policy reform on the average retirement age simplifies mathematically to the sum of the age-specific coefficients (β_j) estimated via our RDD models across the relevant age window.

Appendix E: Robustness

Table 12: Robustness to Local Quadratic Specification

	Upstream	Critical Years			Midstream	Downstream	Overall Response
Years	2011–13	2014	2016	2019	2015, 2017–18	2020–22	2011-22
Ages	57–59	60	62	65	61, 63–64	66–68	57-68
Column	(1)	(2)	(3)	(4)	(5)	(6)	(7)
A. Labor supply							
Labor Earnings	2,065	6,031***	4,810***	4,145***	4,128	2,772	24,527***
	169,558	45,283	33,314	16,811	94,813	32,134	391,914
B. Public Benefits Claiming							
Pension Benefits	-118	-3,864***	-2,544***	-726**	-2,023*	-1,019	-10,290***
	2,716	8,378	16,393	21,888	50,431	71,379	171,185
Welfare Benefits	-144	553***	-101	872***	-732	-29	283
	9,436	2,067	1,680	30	4,857	70	18,141
C. Saving							
Contributions to Retirement Plans	256	701***	696***	560***	501	544*	3,490**
	22,931	6,188	4,864	2,757	14,297	5,117	56,154
Annuities	427	709***	728***	442***	563	272	3,293**
	19,972	5,785	4,267	1,978	11,951	3,630	47,583
Lump-sum Withdrawable	-149	-4	-25	120*	-57	241*	201
	2,934	398	591	771	2,327	1,480	8,501
Total Savings	-1,388	1,671*	2,904**	5,416***	-783	1,836	9,968**
	58,335	5,091	15,247	18,887	27,332	-15,997	108,895
D. Fiscal Externalities							
Net Taxes	1,701	4,062***	3,382***	-513	3,076*	389	12,579***
	49,927	9,089	522	-4,241	-412	-21,048	33,836
Taxes	620	826***	742**	1,011***	470	681	4,645
	64,080	19,930	18,740	15,656	55,115	43,230	216,751
Transfers	-1,089	-3,233***	-2,644***	1,501***	-2,668**	330	-7,969***
	13,993	10,799	18,201	19,869	55,434	64,134	182,430

Notes: The table reports the reform's estimated local treatment effectsfrom the RDD specified in equation (5), where we deviate from the baseline local linear specification and instead allow for a local second-degree polynomial regressions on both sides of the cutoff. Outcomes are aggregated over different phases of adjustment period following the reform: upstream (2011-2013), midstream (2015,2017,2018), downstream (2020-2022), and the full period (2011-2022). For these periods, coefficients represent cumulative effects within indicated years. In contrast, the estimates reported for critical years (2014, 2016, and 2019) are point-in-time effects for those specified years and are not cumulative. Control-group means are shown in gray. *** $p < 0.01$,** $p < 0.05$,* $p < 0.1$.

Table 13: Robustness to Bandwidth Choice and Bias Correction

	Upstream	Critical Years			Midstream	Downstream	Overall Response
Years	2011–13	2014	2016	2019	2015, 2017–18	2020–22	2011-22
Ages	57–59	60	62	65	61, 63–64	66–68	57-68
Column	(1)	(2)	(3)	(4)	(5)	(6)	(7)
A. Labor supply							
Labor Earnings	2,755	6,672***	5,650***	3,313**	5,422	2,686	27,183**
	61	72	69	59	71	61	64
B. Public Benefits Claiming							
Pension Benefits	-193	-3,999***	-2,886***	-534	-2,109	-693	-9,452*
	73	74	61	47	53	43	48
Welfare Benefits	2,365***	422	-71	1,021***	-567	-49	1,391
	40	53	61	55	58	64	72
C. Saving							
Contributions to Retirement Plans	37	948***	476	439	345	327	2,921
	35	54	40	61	49	63	44
Annuities	193	964***	617	277	605	150	3,038
	35	53	42	58	53	74	45
Lump-sum Withdrawable	-87	-6	-63	158	-85	162	154
	74	75	63	72	64	54	63
Total Savings	1,535	1,573	-320	5,364**	1,688	3,005	14,568*
	53	73	46	74	52	46	55
D. Fiscal Externalities							
Net Taxes	2,172	4,762***	4,100***	-988	4,451*	548	14,580
	63	66	62	48	57	47	53
Taxes	1,496	1,313***	1,151**	967*	1,431	1,186	7,608*
	60	56	62	60	66	71	60
Transfers	-705	-3,468***	-2,911***	2,010***	-2,917	955	-5,893
	68	62	70	45	57	43	48

Notes: The table reports the reform's estimated local treatment effects from the RDD specified in equation (5), where we implement the robust bias-corrected estimator of Calonico et al. (2014) using an optimal bandwidth around the cutoff with triangular kernel weights. Outcomes are aggregated over different phases of adjustment period following the reform: upstream (2011-2013), midstream (2015,2017,2018), downstream (2020-2022), and the full period (2011-2022). For these periods, coefficients represent cumulative effects within indicated years. In contrast, the estimates reported for critical years (2014, 2016, and 2019) are point-in-time effects for those specified years and are not cumulative. Optimal bandwidths are shown in gray. *** $p < 0.01$,** $p < 0.05$,* $p < 0.1$.

Table 14: LHS Variables Description for RDD Regression

Variable Name *(Final Code Variable)*	Register	Detailed Description & Calculation Steps	Winsorization
A. Labor Supply			
Labor Earnings `inc_lab_earn_y_w`	IND	Derived directly from the `slutbid` variable in the tax register. The raw value is divided by 0.08 to obtain the annual earnings measure (`inc_lab_earn_y`). This includes wages and salaries, bonuses and fringe benefits, self-employment and business income, honoraria and fees for personal work, certain taxable employee benefits, and employer contributions to labour-market pension schemes.	(0 99)
Pension Benefits `pension_bene_y`	ILME	Aggregated annually at the individual level by summing over specific ILME codes (13, 86, 6, 10, 107, 115, 9, 25, 116, 24, 4, 107, 12, 63, 64). It encompasses a wide range of retirement benefits, computed via `rowtotal` of: early retirement (`efterlon`), state pension (`folke`), ATP supplements, civil servant pensions, early/delayed pensions, and specific refunds.	None
Welfare Benefits `total_welfare_y`	ILME	Aggregated annually at the individual level using ILME codes (2, 5, 14, 16, 3, 103, 41, 6, 115). It restricts focus to UI and DI benefits, computed via `rowtotal` of: UI benefits (`dagpenge`, `unemployment`), social assistance (`kontanthjealp`), sickness benefits (`sygedapenge`), and disability pensions (`foertid`).	None
B. Saving			

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Table 14 – continued from previous page

Variable Name ***(Final Code Variable)***	**Register**	**Detailed Description & Calculation Steps**	**Winsorization**
Contributions to Ret. Plans `sav_pens_tot_y_w`	INPI *(excl. ATP)*	Total pension contributions (excluding ATP). Computed as the sum of employer-administered accounts (`sav_pen_empl = quarbpen`), private contributions via banks and insurance (`sav_pens_pri = qpripen`), and Roth-type contributions (`sav_pens_roth`). The Roth component combines contributions to *aldersopsparing* (`pripen33`) and life-long annuities (`arbpen4445`).	(0 99)
Annuities `sav_pens_annu_y_w`	INPI *(excl. ATP)*	Pension contributions specifically directed into annuity schemes. Computed as the sum of employer-administered annuity accounts (`sav_pen_empl_annu = quarbpen1`) and private annuity accounts in banks/insurance companies (`sav_pens_pri_annu = qpripen1`).	(0 99)
Lump-sum Withdrawable `sav_pens_lumproth_y_w`	INPI *(excl. ATP)*	Contributions to lump-sum payout accounts and Roth-type schemes. Computed as the sum of lump-sum contributions (`sav_pen_lump`) and Roth contributions (`sav_pens_roth`). Lump-sum contributions include both employer-administered (`qarbpenk`) and private (`qpripenk`) accounts. The Roth component is derived identically as above (`pripen33 + arbpen4445`).	(0 99)

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Table 14 – continued from previous page

Variable Name *(Final Code Variable)*	Register	Detailed Description & Calculation Steps	Winsorization
Total Savings `dwea_tot_imputed_y_w`	FORMPERS & IND	Measured as the first difference of total imputed wealth ($W_t - W_{t-1}$). Total wealth (`wea_tot_imputed`) is the sum of net wealth (`wea_net = formrest_ny05` from IND register) and pension wealth (`wea_pen_tot_imputed`). *Imputation Method:* Pension wealth relies on the `fgcx` variable from FORMPERS, which is only available from 2014 onwards. For years prior to 2014, values are backward-imputed starting from the 2014 baseline by iteratively subtracting the net pension contributions streams (`sav_pen_tot_net`), adjusted for the interest rate accruals on pension wealth for each respective year.	(1 99)
D. Fiscal Externalities			
Net Taxes `total_net_taxes_y_w`	IND	The net fiscal contribution of the individual to the government. Computed as total taxes paid (`total_taxes_paid`) minus total government benefits received (`total_gov_benefits`).	(1 99)
Taxes `total_taxes_paid_y_w`	IND	The sum of all personal taxes paid by the individual during the year, extracted directly from the `skatmvialt_13` register variable. It includes final personal taxes (state, municipal, health care contributions, property value tax on housing, and taxes on share income/dividends) and labor market contributions (`ARBBIDMVALM`), while strictly excluding church tax (`KISKAT`).	(1 99)

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Table 14 – continued from previous page

Variable Name *(Final Code Variable)*	Register	Detailed Description & Calculation Steps	Winsorization
Transfers `total_gov_benefits_y_w`	IND	The sum of all government benefits received by the individual. Computed as the `rowtotal` of standard public transfers (`off_overforsel_13`) and civil servant pensions (`qtjpens`). `off_overforsel_13` includes all primarily public-financed transfers: temporary benefits (UI, social assistance, sickness benefits), old-age and disability pensions, early retirement (*efterløn*), housing allowances, and child-family benefits. `qtjpens` captures statutory civil servant pensions, including those for surviving spouses and children.	(1 99)

D. Labor Market Status

Variable Name *(Final Code Variable)*	Register	Detailed Description & Calculation Steps	Winsorization
Employment `st_employment`	BFL & IND	Indicator for being employed. First, monthly earnings are calculated as the sum of wage income (`ajo_smalt_loenbeloeb_m` from BFL) and self-employment income (`netovskud_13` from IND). An individual is classified as employed if their monthly earnings are strictly positive and exceed their total combined benefits. Additionally, individuals with negative earnings (e.g., self-employment losses) and exactly zero benefits are also classified as employed.	None (Dummy)
Retirement `st_retirement`	ILME	Indicator for being retired. Initial benefit status is determined by identifying the primary benefit, i.e., the maximum value among disability, unemployment, pension, and other welfare benefits. An individual is classified as retired if pension benefits are their primary benefit *and* their total combined benefits exceed their monthly labor earnings.	None (Dummy)

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Table 14 – continued from previous page

Variable Name *(Final Code Variable)*	**Register**	**Detailed Description & Calculation Steps**	**Winsorization**
Unemployment / Disability / Other `st_unemployment` `st_disability` `st_other`	ILME	Indicators for welfare receipt. Similar to retirement, individuals are assigned a specific sub-status (`st_unemployment`, `st_disability`, or `st_other`) if that specific benefit is the maximum among all received benefits, provided that total benefits exceed labor earnings.	None (Dummy)
No Income `st_noincome`	BFL, IND, & ILME	Indicator for having no registered income source. Assigned when an individual has exactly zero monthly labor earnings and receives zero government benefits.	None (Dummy)

Notes: All final winsorizations are applied globally in the master data preparation file (`prepare_monthly_annual_data_for_regression`). Scripts mentioned refer to intermediate preparation codes (e.g., `prepare_annual_data_for_regression` and `prepare_monthly_data_for_regression`).