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## Pension Wealth and the Timing of Retirement

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# Pension Wealth and the Timing of Retirement\*

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## Abstract

We analyze how pension wealth influences retirement timing using 25 years of Danish administrative panel data on wealth and labor market status. Exploiting early-career variation in firm-specific mandatory pension contribution rates, we study labor supply decisions from age 55 onward. Greater pension wealth accelerates labor market exit: at age 63, the elasticity is about 0.3—an additional 100,000 DKK (15,000 USD) at age 55 reduces earnings by 1% at age 63. Effects intensify near statutory retirement age, driven by self-support and early occupational pension withdrawals. Mandatory savings raise retirement wealth but induce earlier exit, underscoring key behavioral responses for pension policy design.

*Keywords:* Pension wealth, retirement, labor supply, mandated savings

*JEL classification:* J32, J26, J22, D14

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# 1 Introduction

Pension systems face the dual challenges of ensuring adequate pensions and maintaining financial viability, especially in the context of aging populations, see [OECD \(2023\)](#), [European Commission \(2024\)](#). A common policy response is to encourage individuals to save more and retire later, often through mandatory pension contributions or automatic enrollment schemes.<sup>1</sup> While such measures increase retirement savings and reduce reliance on public pensions, they may also induce unintended behavioral responses. Specifically, mandated savings can generate substantial pension wealth, which may influence labor supply decisions in late working life through a (pension) wealth effect. This wealth effect has received limited attention in the literature, despite its potential to offset the intended impact of reforms aimed at prolonging working lives (e.g., retirement age changes).<sup>2</sup> For example, [OECD \(2024a\)](#) notes that Denmark's high pension wealth, driven by mandated savings, may cause individuals to retire early using their own savings, i.e., become self-supporting.

The contribution of this paper is to analyze how mandatory savings requirements - which succeed in increasing pension wealth - affect labor supply and retirement decisions later in the working life. While there is a large theoretical and empirical literature exploring retirement decisions, few studies explicitly link mandatory savings requirements to retirement decisions or quantify (pension) wealth effects. If low voluntary savings are due to some form of present bias, mandated savings may succeed in increasing pension savings, but at the same time induce early retirement, possibly at the earliest age when the savings can be claimed, or some other type of adjustment enables earlier retirement.

Empirically, identifying causal wealth effects is challenging because savings and retirement choices are jointly determined and influenced by preferences, health, and precautionary motives (see e.g., [Blundell et al. \(2016\)](#), [Barczyk et al. \(2022\)](#)). The empirical challenge is to identify plausibly exogenous differences in pension wealth to assess how pension wealth may affect retirement decisions. We exploit the fact that there are occupational, firm-specific, and time-specific variations in mandated pension contributions in the Danish setting. Due to these differences (and subsequent accrued returns), we may expect early and temporary (working) life differences in pension contributions to map into differences

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<sup>1</sup>A common finding in the literature (see e.g., [Andersen \(2025\)](#), [Cottle Hunt and Caliendo \(2022\)](#)) is that individuals, when left to their own devices, tend to save too little for retirement. This, in turn, motivates interventions in the form of, e.g., mandated savings requirements. In many countries, there is a shift from defined benefit (DB) to defined contribution (DC) schemes, see e.g., [OECD \(2023\)](#), implying that individuals will increasingly rely on their accumulated savings for retirement income.

<sup>2</sup>Another behavioral effect is (more immediate) crowding out of savings, e.g., decreasing voluntary savings or increasing debt. Empirical evidence shows that crowding out is generally small (see e.g., [Jensen et al. \(2025\)](#), [Chetty et al. \(2014\)](#), [Madrian and Shea \(2001\)](#), [Choi et al. \(2003\)](#)). But recent evidence highlights that the net-effect may be declining over time in settings allowing for front-loading of retirement savings, e.g., in connection with a change in job, see e.g., [Choukhmane \(2025\)](#), [Choi et al. \(2024\)](#), [Argento et al. \(2015\)](#), [Beshears et al. \(2018\)](#).

in pension wealth later in life. Our empirical strategy aims to isolate and use this type of variation.

We exploit administrative panel data from Denmark, including detailed data on individual pension contributions (for the years 1995-2022) and pension wealth (for the years 2014-2022), along with various socio-economic variables. The key idea is that smaller differences in pension contribution rates across firms where individuals worked in their early career (say around age 40) - more than 15-20 years prior to decisions about late-life labor supply - are not directly influential for these late-life labor market trajectories or earnings dynamics. Nevertheless, these early career differences do accumulate to sizable differences in pension wealth (reinforced by the compound return effect), which may then (indirectly) affect the decision about when to retire.

We compare observationally similar individuals at age 55 in the same jobs, earnings, non-pension wealth, and even firms, but who differ in accumulated pension wealth due to early-career differences in firms' contribution rates (Firm Contribution, FC). In Denmark, these types of pension contributions are largely set by collective agreements that vary across occupations, industries, and time (below, we refer to these contributions as occupational pension contributions/wealth or mandatory savings).<sup>3</sup> These contributions are mandatory for the individual, and hence, there is an automatic accumulation of pension wealth. It is not an active repeated individual choice, and evidence suggests that a large share of individuals have substantial unawareness about their current plan, contribution rates, and/or the implications for later pension wealth.

To validate this empirical design, we show a comprehensive battery of checks and tests. For example, we show that in our preferred empirical specification (which includes controls for earnings, wealth, and jobs at age 55), there is essentially no correlation between the FC at age 40 and the individual contribution rate, yearly savings/debt, or income of the worker at age 55. That is, by securing sufficient spacing (15 years or more) between "early" and "late" life and by conditioning on various observables, the intention is to isolate plausibly exogenous variation in the FC. This temporal distance reduces concerns that temporary early career conditions directly influence late-life labor supply, making it more plausible that the effect operates solely through accumulated wealth.<sup>4</sup> Our empirical design is in alignment with prior literature that documents that most individuals are passive savers, rarely adjusting voluntary contributions or actively managing pension accounts in response to mandatory pension savings requirements. In this context, early differences in mandatory contributions translate into genuine wealth shocks rather

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<sup>3</sup>Occupational pension contributions make up over 85% of all pension contributions in Denmark and correspond to 5% of Danish GDP.

<sup>4</sup>This is also one dimension which differentiates us from other types of more aggregate type wealth shocks papers such as e.g., changes in retirement planning around the Great Recession or house price changes, see e.g., [Goda et al. \(2011\)](#), [Gustman et al. \(2010\)](#).

than reflecting deliberate retirement planning.

Before presenting results, we clarify the treatment and outcomes. The treatment is an increase in *pension* wealth driven by early-career differences in FCs. Occupational pension wealth is largely illiquid until a narrow window near the statutory retirement age and often remains “unknown” to individuals until later in life. This makes the treatment different from more salient wealth shocks such as house price movements or even lottery gains (Golosov et al. (2024), Cesarini et al. (2017), and Gustman et al. (2010)). As retirement approaches, pension wealth becomes more salient, potentially influencing labor supply.<sup>5</sup> Although early withdrawals are restricted, individuals may still adjust, e.g., labor if they perceive that excess pension wealth has been accumulated. Any response may also depend on the ability to adjust by drawing on other assets or borrowing against pension wealth. Our analysis therefore examines labor supply choices several years before official retirement and considers responses along multiple margins.

Empirically, there is a significant positive effect of the FC at age 40 on pension wealth at age 55. A one percentage point increase in the FC (a difference not uncommon in the data where the standard deviation on the residualized FC is 2.45) increases pension wealth by 63,000 DKK, an increase of 3%. As already mentioned, the preferred specification includes a number of control variables in order to isolate plausibly exogenous variation in the FC, including control for firm fixed effects at age 55 and control variables measured at age 55 to ensure individuals are comparable. When exploring the identifying variation further, we find that more than 97% of the variation in (residualized) FCs comes from within-group variation when measuring groups by, e.g., industries, occupations, and earnings deciles around age 40. In other words, the variation in FCs we exploit is largely unrelated to differences in job types at age 40. The strong link between age 40 contributions and pension wealth at age 55 suggests that individuals have not fully offset e.g., a lower contribution rate earlier in their career by higher contributions later in their career or other mean reversion mechanisms. This is to be expected given the Danish institutional setting, where individuals cannot easily withdraw pension wealth prior to their 60s, and where accumulated pension wealth is not affected by job shifts. Our findings are also in line with previous empirical analyses confirming that mandatory savings requirements do increase total retirement savings (Jensen et al. (2025), Chetty et al. (2014), Madrian and Shea (2001), Choi et al. (2003)).

Next, the effects of the FC at age 40 on labor market status are analyzed over the age window from

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<sup>5</sup>All Danes can obtain an overview of all their retirement savings and entitlement via the homepage, [pensionsinfo.dk](https://pensionsinfo.dk). In 2019, 31% of the population above age 18 logged in to check their individual savings (a part of this is likely "mechanical" in connection with house mortgage refinancing, etc.). For the group with less than three years to the statutory retirement age, it is 57%, and with less than one year, it is 68%, see Forsikring & Pension (2020).

56 to 67 (through the lenses of the IV model, this is the reduced form estimates). The FC has a negative impact on earnings and employment for individuals in their 60s. A one percentage point increase in the FC at age 40 decreases earnings at age 65 by 2% and the probability of being employed by 0.6 percentage points (2% relative to the mean). Additionally, the FC at age 40 has a positive effect on being self-supporting (6% increase relative to mean) and receiving non-public pension benefits (which includes early withdrawal of occupational pension wealth) at age 60 onward. After age 65, the effect of the FC on being self-supporting decreases, and at age 67, the effect is zero. This follows from the fact that as individuals age, they become eligible for public pension benefits, and self-support is then dominated by the eligibility for public pensions. Before age 60, there are no significant effects of the FC on earnings, employment, or self-sufficiency. This finding is reassuring, as it aligns with the notion that individuals in the mid-to-late 50s are in a life phase not making active retirement decisions, and that we are comparing individuals who are alike except for their earlier differences in the FC and their pension wealth.

To quantify pension wealth effects, we estimate the effect of pension wealth at age 55 on labor supply at ages 56 to 63 using the FC at age 40 as an instrument.<sup>6</sup> This specification invokes the exclusion restriction that the FC at age 40 only affects choices at ages 56 onward through its effect on pension wealth. Here, we find that an increase of 100,000 DKK ( $\approx$ 15,000 USD) in pension wealth decreases earnings by 1% and the probability of being in employment by 1.2 percentage points (1%) at age 63. For earnings, this implies a pension wealth elasticity of around 0.3 at age 63, highlighting the importance of taking the wealth accumulation effect of mandated retirement savings into account. Furthermore, a 100,000 DKK increase in pension wealth increases the probability of being self-supporting by 0.7 percentage points (15%). To further extend the outcome period and since we find no effect before age 59, we adjust the timing of key measurements and use separate samples for the first and second stage, enabling us to identify the impact of pension wealth at 59 on outcomes from ages 60 to 71. These additional results show that the effects on earnings and employment extend well beyond age 63, but they are generally decreasing around age 65 onward.

Contrasting our findings with previous work, our results (averaged across ages) are actually of a similar size to other types of wealth shocks. However, the age profile of our impacts is important. Impacts are larger the older individuals are, and they mainly materialize from around the age where pension wealth becomes more "liquid" (that is, when individuals can make withdrawals without tax

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<sup>6</sup>Due to data availability, the IV estimates can only cover labor market status until the age of 63 in our baseline specification since we require data on pension wealth at age 55, and the pension wealth information is only available for the years 2014-2022.

penalties). There is no evidence of other types of early adjustment or smoothing via, e.g., other types of assets or uptake of debt. Partly guided by a stylized theoretical model, we further look for heterogeneity in the effects by pension wealth and liquidity constraints. We also discuss the role of information or lack of knowledge about pension wealth. This subsequent (and more informal) analysis finds evidence of threshold effects; that is, the effects of higher pension wealth are mostly present among individuals with higher levels of pension wealth, consistent with potential "over-saving". Moreover, liquidity constraints, pension withdrawal incentives, and potentially differences in information seem to affect the timing of the responses (more liquidity-constrained individuals retire later).

We close the empirical analysis by reporting on a wide variety of robustness checks. These include varying our definition of the FC, sample selection, measuring the FC and pension wealth at other ages, functional form specifications, etc. Our results are robust to these different specifications.

The paper is organized as follows: In Section 2, we briefly discuss related literature. Section 3 offers a short introduction to the Danish pension system. The data used in the analysis is presented in Section 4, and Section 5 details the empirical strategy. The results, including various robustness checks, are presented in Section 6, and Section 7 offers some concluding remarks. Appendix A provides an overview of the Danish pension system, and Appendix B presents a stylized theoretical model with myopic households showing how under-savings and retirement decisions are related in this environment. A mandated pension scheme succeeds in increasing pension savings but also induces earlier retirement via a wealth effect. Appendix C contains sample selection and descriptives, Appendix D presents additional details on baseline results, Appendix E provides additional results, and Appendix F contains various robustness checks.

## 2 Related literature

As discussed above, our paper is related to previous empirical analyses on mandatory pension savings requirements and wealth shocks. For example, [Chetty et al. \(2014\)](#) concluded that “approximately 85% of individuals are passive individuals who save more when induced to do so by an automatic contribution but do not respond at all to price subsidies”. In our analysis, we show that such effects also persist in the longer run in the Danish institutional setting. This begs the question of how this wealth accumulation affects late-career labor supply.

Our paper is also related to a series of empirical papers which look at how late-career labor supply responds to changes in public pension payments or other income sources (see e.g., [Gelber et al. \(2016\)](#)

and [Manoli and Weber \(2016\)](#) for recent evidence and [Gruber and Wise \(1997\)](#) and [Krueger and Meyer \(2002\)](#) for reviews). Other studies have used survey data and reforms to study how private savings relate to public pension benefits ([Attanasio and Rohwedder, 2003](#), [Attanasio and Brugiavini, 2003](#), [Bottazzi et al., 2006](#), [Lachowska and Myck, 2018](#), [Lindeboom and Montizaan, 2020](#)). Our focus and treatment are different. First, we mainly look at changes in labor supply in an age interval prior to reaching the statutory retirement age (SRA) and benefit eligibility. Second, front-loading pension wealth by claiming it earlier implies that later out-payments are reduced (both via the decumulation but also by fewer contributions into the scheme), and hence such a decision has intertemporal implications.

A few recent papers examine how pension reforms affect labor supply through changes in *public* pension wealth. For example, [Artmann et al. \(2023\)](#) analyze a German 2014 reform that increased pension benefits for mothers and convert these to wealth effects. They find that one additional euro of pension wealth reduces cumulative earnings by €0.54 at the intensive margin in middle-age years (they report an implied wealth elasticity of -0.3). The intensive margin wealth response is visible more than 15 years prior to the full retirement age. [Becker et al. \(2022\)](#), using an event-study design, report a pension wealth elasticity of 0.22 for employment (extensive margin). Our study differs in key respects. We focus on responses near the statutory retirement age in a mandatory funded DC system and in a sample with strong labor market attachment. We estimate a complete profile of age-specific effects and show that impacts only materialize when individuals approach retirement. Using Danish register data, we provide detailed evidence on pension wealth accumulation and responses, including labor supply, assets, liabilities, and disposable income. Unlike reform-based studies that exploit contemporaneous policy changes, our variation stems from early-career differences in mandatory contributions, offering a distinct (and individual) source of variation in pension wealth.

Other studies have examined mandated pension savings in Denmark. [García-Miralles and Leganza \(2024\)](#) show that raising the early retirement age increases cumulated occupational and private pension wealth, mainly due to behavioral inertia in contributions. [Fadlon et al. \(2016\)](#) find that a 1999 tax reform shifted savings toward annuity accounts and influenced employer contributions, particularly outside collective agreements. [Andersen et al. \(2023b\)](#) study job switchers and show that moving to public-sector jobs with higher mandatory contributions raises pension assets and debt. Our approach differs by comparing workers within the same firm and exploiting early-career variation in mandatory contribution rates to isolate exogenous pension wealth differences. We also confirm that these early differences do not affect other asset or debt trajectories beyond pension wealth.

Lastly, our paper also relates to work on the salience of pension savings and retirement decisions

(see e.g., [Liebman and Luttmer \(2015\)](#) and [Lusardi and Mitchell \(2007\)](#)). Evidence shows that many individuals lack knowledge about pensions: in Sweden, two-thirds of respondents report insufficient understanding of how choices affect future pensions ([Elinder et al., 2022](#)), and U.S. surveys find that over half cannot state expected benefits or plan type ([Gustman and Steinmeier, 2005](#)). Similar patterns exist in Denmark, where younger workers hold biased beliefs about eligibility, and many adults are unaware of total savings ([Caplin et al. \(2022\)](#); [Sampension \(2024\)](#); [ATP \(2017\)](#)). Such widespread inattention supports our empirical strategy, where early differences in contribution rates affect pension wealth without influencing other behaviors prior to retirement decisions.

### 3 The Danish pension system

The Danish pension system is a three-pillar scheme that includes tax-financed public pensions (flat rate pension for all plus means-tested supplements), occupational pension schemes (the key source of pension wealth in our paper), and voluntary savings (for further details, see Appendix A). For collective agreements, which cover around 80% of workers, unions negotiate salaries, pension contributions, and working conditions with employers for all employees within the professional field. Hence, these schemes are fully funded, collectively negotiated, and mandatory at the individual level. The wage-setting model is similar to the two-tiered bargaining model described in [Bhuller et al. \(2022\)](#). Hence, the central agreements typically state wage floors and pension contribution rates, and subsequent bargaining at the firm level (more pronounced in the private sector) will then determine the final wage structure in the firm.

For jobs not covered by collective agreements (around 20% of workers, primarily white-collar workers in the private sector), firms may offer their own pension scheme to their employees. Employers can choose a pension fund and negotiate contribution rates, portfolio choices, and administrative fees. Hence, even for workers not covered by collective agreements, employers typically set the default occupational pension contribution rate.<sup>7</sup>

The contribution rate is typically split into a part (often 2/3) paid by the employer and the rest (1/3) paid by the employees. The contributions are paid to pension funds (different bargaining areas are associated with different pension funds), and hence pension entitlements are not attached to working for a particular firm, and job shifts and mobility do not affect accumulated pension wealth. The schemes are

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<sup>7</sup>A final source of variation comes from firms which are entering collective agreements through, e.g., membership in the employers' federation. These firms have a phase-in period of several years before they are tied to pension floors described in the agreements.

largely funded DC-schemes (defined contributions). Contribution rates differ across bargaining areas, and total contribution rates are in the range of 12-18%, generally larger for highly educated groups (also having higher longevity). The occupational pensions have a long history, but were extended to the private part of the labor market in a process starting in the late 1980s, and contribution rates have been steady since around 2010 (see [Figure A.2](#)). For occupational pension schemes, decumulation can start in a window (age 60 or five to three years prior to the statutory retirement age, depending on when contributions were made) before reaching the statutory retirement age (currently 67 years but 65 for some of the cohorts in our sample). Withdrawals prior to that face a tax penalty of up to 60%, if possible at all.

Overall, the data set used displays variations across individuals stemming from differences in coverage of collective agreements, industry and occupational differences, firm-specific policies, as well as differences over time.<sup>8</sup> Occupational pension contributions constitute the vast majority of pension contributions. In 2024, total occupational pension contributions had a value of 141 billion DKK, corresponding to 5% of GDP, and accounting for 88% of total pension contributions (own calculations based on GDP data from [Statistics Denmark \(2025\)](#) and data on pension contributions from [Forsikring & Pension \(2025\)](#)). Pension wealth is almost 200% of GDP, the highest rate in the world, which is mainly due to the savings-based schemes. For OECD countries, the average is 55% ([OECD, 2024b](#)).

The SRA determines eligibility for the tax-financed public pension. It has been increased in response to rising longevity and is now formally indexed to longevity, see also [Appendix A](#). There are various options for early exit from the labor market in an age window prior to the SRA, depending on health (disability pension and senior pension), labor market history (“early pension”), and a contribution-based early retirement scheme (VERP, available from age 60, or three years prior to the SRA, if eligible). Working past the SRA does not reduce the entitlement to the public pension, since it is adjusted on actuarial terms to the actual retirement age (and more recently, it is now possible to claim the public pension while still working post the SRA).

### **3.1 Labor supply near retirement in Denmark**

To set the scene, [Figure 1](#) shows how labor market status varies for age groups around the SRA in Denmark<sup>9</sup>. The employment rate declines with age, and about 2/3 of a cohort retires prior to reach-

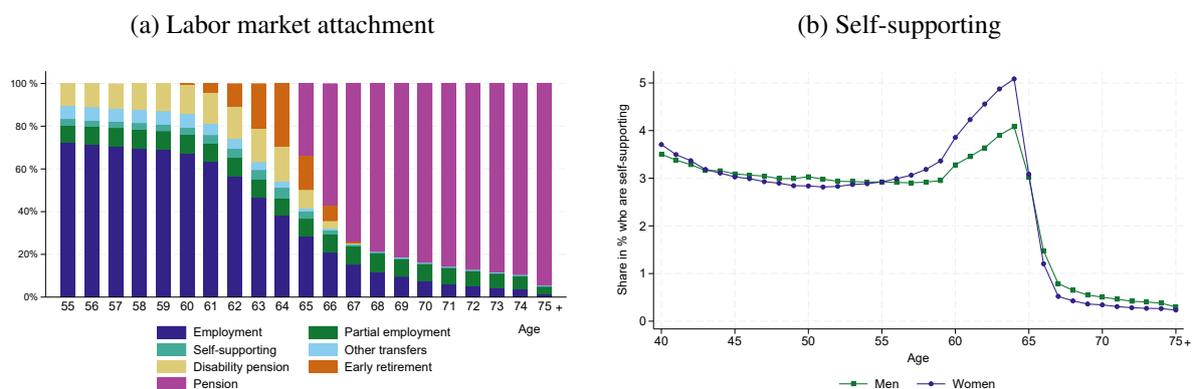
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<sup>8</sup>One additional source is that individuals can choose to add to the occupational savings via individual payments (without firm contributions), e.g., by using funds in the so-called “free choice” accounts. They are growing in importance, but are not of significant importance in our sample period. Furthermore, by focusing on the FC, we avoid using variation from this margin.

<sup>9</sup>We start with the full population but drop civil servant recipients.

ing the statutory retirement age (often using tax-financed exit options, e.g., disability benefits or early retirement, see above), but a significant part retires post the statutory retirement age. There are clear changes in the labor market status around the age thresholds determining eligibility to (early) retirement programs and the statutory retirement age (during most of the sample period, age 60 and 65/67, respectively), but mostly in terms of the type of transfer received. After age 65, many individuals receive the public pension, both because those already retired under other schemes automatically transition into public pensions and because others choose to retire at this age.

Figure 1: Labor Market Attachment by Age



*Notes:* Panel (a) displays labor market attachment by age for the years 2014-2022. Employment is excluding partial employment. Panel (b) displays the share who is self-supporting in % by age for men and women for the years 2014-2022. Sample is the full Danish population excluding civil servant recipients.

The share of an age cohort being self-supporting – defined as neither receiving any public benefits nor being employed – is shown in Panel (b) in [Figure 1](#). Our measure of self-support is not likely to include individuals with a reduced work capability (given the various programs targeting individuals with reduced work capability), but rather includes individuals who could work but actively chose not to. The share who is self-supporting is stable until age 60 and increasing thereafter until age 65. Given the universal entitlement to public pensions, being self-supporting is mainly relevant during an age window prior to reaching the SRA. For both men and women, the share who are self-supporting increases significantly in the age interval 60-64. For women, it is rising from around 3% of the population at age 55 to 5% by age 64, and the increase for men is slightly lower.

[Figure C.1](#) shows a similar breakdown of labor market status for ages 59 to 67, but now separately by pension wealth groups at age 59. Individuals with low pension wealth are more likely to receive disability pension, while those with high pension wealth are much more likely to be employed. To address endogeneity concerns, our empirical strategy exploits plausibly exogenous variation in pension wealth

— arising from early career differences in FC — to identify its causal effect on retirement behavior.

## 4 Data

We use Danish administrative data that contains detailed information on pension wealth (PENSFORM, years 2014-2022), pension contributions (INPI, years 1995-2022), and a wide range of other variables (labor market outcomes, firm characteristics, educational attainment, etc.). For a detailed overview of variables used, see Appendix C. Our initial data covers the full Danish population, and individuals can only exit the sample if they die or move out of the country, hence, attrition is minimal. All monetary values are adjusted to DKK, 2023 prices, using the Consumer Price Index (CPI) from Statistics Denmark. 1 USD was approximately 6.5 DKK in 2023, so this is the currency rate we use throughout. Key non-discrete variables (e.g., pension wealth, firm-specific pension contribution rates, earnings, etc.) are winsorized at the 1<sup>st</sup> and 99<sup>th</sup> percentile to reduce the influence of outliers.

Constructing the data for our analysis involves two different steps. First, the population-wide data is used to construct the Firm pension Contribution rate (FC) for different firms and years. Second, in order to define the main sample used in the analysis, we identify individuals in the relevant age groups and invoke other sample restrictions, which are outlined below.

### 4.1 Constructing the Firm pension Contribution rate (FC)

We construct the FC for each firm in a given year. This step uses all individuals in the population aged 20 to 60 with only one job for the year. This analysis is based on a database on the universe of pension contributions from 1995 to 2022 available through Statistics Denmark (INPI). To construct the FC, we use a two-step approach:

1. Construct the yearly individual occupational pension contribution rate

First, for each individual, we construct the individual occupational pension contribution rate as the sum of all annual occupational pension contributions (either individual payments (see footnote 8) or payments by the firm) divided by annual earnings (annual labor earnings, including overtime, bonuses, and severance payments) for each employee. This is necessary given that the Danish administrative data does not include information on wage contracts or pension contribution rates. As an inspection check, we study how our constructed pension contribution rates for the individual for different occupations (Figure C.3) match those from collective agreements (Figure A.2). We see similar trends for our constructed pension contribution rates and also similar values, although they are lower than the contribution

rates reported in [Figure A.2](#) due to the fact that not all wage elements are included in the base for which the contribution rate applies.<sup>10</sup>

## 2. Construct the yearly FC for each firm

Second, the yearly FC is constructed by taking the median of the occupational pension contribution rate for all employees with only that firm as employer in the given year. We use the median as it is not affected by extreme values nor inflated by extraordinary individual contributions (e.g. due to bonuses) in a given year. Robustness checks repeat the analysis using the mean or by constructing firm and occupation-specific contribution rates. [Figure C.2](#) shows how individual and firm occupational pension contribution rates increased from 1995 until 2009. Hereafter, pension contribution rates stagnated. The evolution aligns well with the description of the system and its evolution as outlined in [Appendix A](#).

## 4.2 Pension wealth, other wealth, and pension income

We also have access to register data on pension wealth from 2014 onward (see [Andersen et al. \(2023a\)](#)). This database is rather unique in relation to the existing literature, which typically relies on imputed wealth variables. We focus on total pension wealth before taxes. Pension wealth consists of occupational and private pension contributions and their accrued interest.

Additional data includes third-party reported detailed wealth data for all adult individuals used to create four financial outcomes: real assets, financial assets, mortgage debt, and other loans, all measured in DKK.<sup>11</sup> The data also includes pension benefits received from non-public pension<sup>12</sup> (voluntary and mandatory) schemes and financial outcomes. First, we study whether individuals have non-public pension income by creating a dummy variable which is 1 if there is positive income paid out from either mandatory occupational pension schemes or private pension schemes and 0 otherwise. Second, we also study the monetary amount claimed from non-public pensions in DKK.

## 4.3 Constructing the analysis sample and descriptives

The analysis sample is selected as individuals (55-year-olds born in 1959-1967) who are employed at ages 40 and 55 in a firm with an estimate of the FC. To limit measurement errors, the sample is restricted

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<sup>10</sup>What wage elements are included in the base depends on the wage contract.

<sup>11</sup>Real assets cover the value of the main residence, vacation home, additional real estate, and cars. Financial assets cover deposits in the bank, bonds, and shares. Mortgage debt covers debt in building societies and banks for the main residence, vacation home, and additional real estate. Other loans are regular bank loans, loans for consumption, and credit card debt.

<sup>12</sup>While we can distinguish between occupational and private pension contributions, we are unable to make this distinction for pension income. Therefore, we refer to it as non-public pension income, as it encompasses income from both occupational and private pension schemes.

to workers having at most one employer in November in a given year. As self-employed individuals are not mandated to save for retirement and may save up in their business instead, individuals who are self-employed at age 40 or 55 are not included. Lastly, the sample also excludes individuals receiving the civil servant pension (*tjenestemandspension*) or individuals with a military occupation at age 55, since they have pension arrangements differing from the general population.

Table C.3 shows the descriptive statistics for the selected sample for pension wealth at age 55, FC at age 40, and control variables measured at age 55. Individuals in the selected sample have an average pension wealth at age 55 of 2.1 million DKK, and the average FC at age 40 is 8%.

In Appendix C, the sample selection is reported in Table C.1, and Table C.4 provides descriptive statistics for the full population and for our selected sample. Compared to the full population, individuals in the selected sample have, on average, seven more years of labor market experience and 400,000 DKK ( $\approx$  55,000 USD) more in pension wealth at age 55.

## 5 Empirical strategy

Our estimating framework consists of three equations. First, we have a "first stage" equation which measures the strength of the relationship between the FC<sup>13</sup> at age 40 and pension wealth later in life. This relationship describes a key channel through which the FC at age 40 may affect individuals later in life.

The first stage equation for  $PW_{i,a,t}$ , i.e., pension wealth for individual  $i$  at age  $a$  in year  $t$ , is:

$$PW_{i,55,t} = \alpha FC_{i,40,t} + X_{i,55,t}\gamma + V_{i,55,t} \quad (1)$$

where  $PW$  is pension wealth measured in 2023 DKK at age 55. The set of control variables,  $X$ , is a set of variables measured at age 55, which ensures that we are indeed focusing on differences in pension wealth for observationally similar individuals around age 55. These variables include firm fixed effects and other controls for the job type and wealth of individuals.<sup>14</sup> Thereby, we aim to ensure that we are indeed comparing individuals on similar career trajectories and with similar non-pension wealth. We motivate our set of control variables further in Section 5.1, and we also report on robustness checks where we change or extend the set of control variables.

<sup>13</sup>FC is the firm pension contribution rate - details on how this variable is generated are explained in Section 4.1.

<sup>14</sup> Throughout our analysis (unless otherwise mentioned) the set of variables (measured at age 55) are: Firm fixed effects (FE), year FE, dummy for payment to VERP scheme, male dummy, education dummies, marriage dummy, children at home dummy, experience, experience squared, tenure, 1-digit occupation dummies, earnings (deciles), and net wealth excluding pension wealth (ventiles).

The "reduced form equation" describes the relationship between our instrument (the FC at age 40) and employment status estimated for each age from age 56 onward. The reduced form equation for individual  $i$  at age  $a$  in year  $t$  is:

$$L_{i,a,t} = \delta FC_{i,40,t} + X_{i,55,t} \xi + \mu_{i,a,t} \quad (2)$$

where  $L$  is a measure of labor market status, which we operationalize in different ways (earnings, employment status, etc., see Section C.2 for precise definitions). The set of control variables,  $X$ , is the same as above and again measured at age 55.

Under the exclusion restriction, we can also directly investigate the link between the FC and pension wealth changes and to labor supply choices. These final IV estimates can be obtained through the second stage equation, which for individual  $i$  at age  $a$  in year  $t$  is:

$$L_{i,a,t} = \beta \widehat{PW}_{i,55,t} + X_{i,55,t} \omega + \varepsilon_{i,a,t} \quad (3)$$

where  $\widehat{PW}$  is the predicted pension wealth at age 55 based on the first stage equation. The empirical model thereby focuses on the relationship between differences in pension wealth generated through differences in early life firm pension contribution rates (net of the role of an extensive set of observables).

Pension wealth and controls are determined at age 55, prior to analyzing labor supply from age 56 onward. This ensures pension wealth is measured before outcomes occur, while avoiding measurement at an age when retirement considerations are still minimal. Age 55 is a conservative baseline, supported by evidence that labor supply responses only emerge several years later; robustness checks consider later measurement ages (age 59).<sup>15</sup>

## 5.1 Identifying assumptions and timing of measurements

A central identifying assumption in our IV analysis (Equation 3) is that early-career differences in firm contribution rates (FCs) influence late-life labor supply only through their effect on accumulated pension wealth. In other words, conditional on observables, variation in FC should not reflect or translate into systematic differences in career trajectories, job mobility, or retirement preferences.

Key for the plausibility of the exclusion restriction is the substantial temporal spacing between the

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<sup>15</sup>These choices constrain the age range we can analyze. In the reduced form, outcomes are observed from 56–67 (we cannot go beyond age 67 as individuals aged 40 in 1995 are 67 in 2022); in the IV setting, from 56–63, as pension wealth is only available from 2014 onward. By moving to age 59 (with FC at 44), we can study IV effects for ages 60–67. Finally, by using different first-stage samples, we can further extend the analysis to ages 60–71, though this entails a trade-off in sample consistency.

measurement of FCs and subsequent retirement decisions. Our preferred FC age is 40, providing more than 15 years of spacing so that short-term dependencies and career-specific effects ‘wash out.’ As a conservative benchmark, we also present versions where we extend this interval to 20 years (FC at age 35) and report results for alternative samples such as passive savers and firm leavers. Empirical checks, which we discuss now, confirm that the correlation between early FCs and contemporaneous contribution behavior (presumably more linked to retirement planning) declines sharply with time and is virtually zero by age 55, supporting the plausibility of our identification strategy.

Figure 2 shows regression estimates of FC at age 40 on the individual pension contribution rate from ages 40 to 55.<sup>16</sup> The unconditional relationship (blue dots) declines from 0.83 to 0.36, suggesting the early differences in the FC do indeed wash out over time. Adding controls (e.g., industry dummies at the 3-digit level and other measures of job types at age 55) reduces the estimate at age 55 to 0.2, and including firm fixed effects lowers it below 0.1. We also report estimates based on a sample of individuals who change firms between ages 40 and 55 (firm leavers), and a sample where we only keep individuals who did not contribute to a private pension scheme at ages 40 and 55 (passive savers). At age 55, the coefficient of the FC at age 40 on the individual occupational pension contribution rate for passive firm leavers (when including firm FE and controls at age 55) is 0.04 and not statistically significant from zero on a 1% level. We interpret estimates from this later subsample (where the dependence on previous FCs is virtually gone) as a conservative estimate of the wealth-employment relationship. Throughout our analysis, we therefore check whether the estimates are different for our main specification (in the full sample and with firm fixed effects and controls age 55) compared to these subsamples.

In Figure E.3, we look at the relationship between the FC at age 35 and the individual occupational pension contribution rate at ages 35 to 55. Using a longer spacing (twenty-year interval compared to fifteen-year interval), the coefficient of the FC at age 35 on the individual occupational pension contribution rate at age 55 is exactly 0.00. Hence, for a longer time period, the positive relationship does indeed “wash out” completely (as we return to later, the downside is a smaller sample and outcome period).

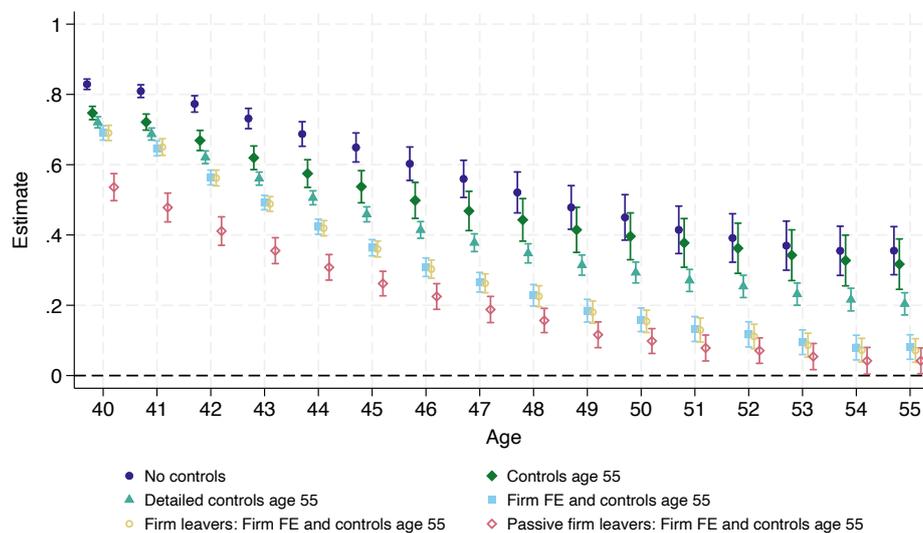
We also consider other outcomes such as the individual private pension contribution rate, pension contributions in DKK, sickness benefits, earnings rank, and change in other types of wealth, in Figure D.1. These correlations are also declining over time and are around 0 at age 55. This result further underlines that any early differences in job types, earnings ranks, etc., do not persist over time when viewed through the lenses of our empirical design.

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<sup>16</sup>The outcome in the regression is the individual contribution rate. This may deviate from the FC due to, e.g., additional individual payments to the pension account or due to measurement errors in the FC, etc.

Overall, these results suggest that the variation isolated in FCs does *not* stem from individuals who plan to retire early and hence choose to work in firms with higher FCs early on and over time. Over time (and conditional on observables at age 55), we see that the correlation between earlier FCs and contemporaneous pension savings behavior vanishes. All in all, we therefore take the results in [Figure 2](#), [Figure D.1](#), and [Figure E.3](#) as evidence in favor of our empirical design which uses early life differences in FCs to isolate plausibly exogenous variations in pension wealth which do not have a direct impact on pension savings behavior later on in the life cycle. With this evidence in mind, we therefore turn attention to whether earlier differences in FCs do in fact predict later differences in pension wealth.

Figure 2: FC Age 40 and Individual Occupational Contribution Rates Ages 40 to 55



*Notes:* This figure shows the estimated effect of the firm-specific occupational pension contribution rate (FC) at age 40 on the individual occupational pension contribution rates at ages 40 to 55. Controls at age 55 are the following baseline controls: year FE, dummy for payment to the VERP scheme, male dummy, education dummies, marriage dummy, children at home dummy, experience, experience squared, tenure, 1-digit occupation dummies, earnings (deciles), and net wealth excluding pension wealth (ventiles). Detailed controls age 55 are our baseline controls age 55 and additionally include three firm characteristics measured at age 55: industry dummies at the 3-digit level, number of employees in the firm, and start year of firm. Firm FE is firm fixed effects at age 55. Firm leavers are defined as individuals who are not employed in the same firm at age 55 as they were at age 40. Passive savers are defined as individuals who did not contribute to a private pension scheme at ages 40 and 55. Standard errors are clustered at the firm level at age 55, and 95% confidence intervals are shown.

## 6 Results

First, we show that the FC at age 40 has a significant impact on pension wealth at age 55 (strong first stage). Second, we report estimates of the reduced form for various labor market outcomes. Third, we discuss estimates of our IV model (instrumenting pension wealth at age 55 using the FC at age 40). Fourth, we repeat the analysis using the FC at age 44 and pension wealth at age 59 in order to estimate

longer-term IV effects. This is followed by a further analysis of mechanisms and heterogeneity. Lastly, to validate the results, multiple robustness checks are presented.

## 6.1 First stage

Table D.1 presents the first stage estimates. The FC at age 40 has a large, positive effect on pension wealth at age 55. In line with the results in Figure 2, the estimate falls when including controls and firm fixed effects at age 55. Taking our preferred estimate in Column (3), a one percentage point increase in the FC at age 40 is associated with an increase in pension wealth at age 55 of 63,000 DKK. This estimate suggests an increase in pension wealth of approximately 3% when the FC is one percentage point higher.

The first stage captures the cumulative effect of higher FC at age 40 on pension wealth at age 55. While FC at 40 correlates with slightly higher FCs in subsequent years (see Figure 2), this fades over time. Contributions accrue interest, so early differences persist and compound. Importantly, workers do not offset e.g., low early FCs through later savings or job changes, consistent with previous evidence that most individuals are passive savers.

What is the identifying variation in FCs we use, and how large are the differences in FCs? In our sample, FC at age 40 averages 8.28 (SD 3.45). After residualizing with controls and firm fixed effects at age 55, the SD is 2.45. We can decompose the residualized FC age 40 into between- and within-group variation (see Table D.2) for firms, industries, occupations, and earnings deciles *at age 40*. We find that for firms, 66% of the variation comes from between-group variation, while 34% comes from within-group variation (the latter being changes in firm policies or workforce over time or, e.g., measurement error). For industries, occupations, and earnings deciles, more than 97% of the variation comes from within-group variation.<sup>17</sup> Overall, these checks confirm that in our baseline model, the variation isolated in the FCs is, to a very large degree, coming from individuals in the same industries, occupations, and earnings deciles.

In Appendix E.3, we also show that the results (first stage, IV) when using FC at age 35 are very similar to using FC age 40 (as shown in Figure E.3, age 35 secures that any direct dependence between the FC measure and individual pension contribution rate age 55 is eliminated, see Subsection 5.1). However, using the FC at age 35 instead of age 40 implies losing observations, and it is only possible

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<sup>17</sup>To further try to analyze the variation in (residualized) FCs and relate it to contemporaneous (age 40) job characteristics, we show the  $R^2$  of the residualized FC on log hourly wages, log earnings, year-by-occupation groups, year-by-industry groups, and year-by-earnings deciles groups all measured at age 40 and FC measured at age 39 in Table D.3 in Appendix D. The first five variables have little explanatory power, while for the FC age 39, the  $R^2$  is 0.37.

to study retirement behavior up until age 62 due to availability of data. Hence, we choose FC at age 40 as our primary specification, but find that the coefficients, where it is possible to compare the two specifications, are alike.

Motivated by a strong first stage, we then move on to reduced form and IV estimates.

## 6.2 Reduced form

Figure 3 displays the reduced form estimates (Equation 2) for a one percentage point increase of the FC at age 40 on key labor market outcomes at ages 56 to 67 (for table with estimates, see Table D.4 in the Appendix, and for details on outcomes, see Subsection C.2). The estimates are small and insignificant for ages 56-59. This is reassuring and supporting of the idea that our research design is not picking up longer-term persistent differences in retirement preferences across individuals (after all, Figure 1 shows that some individuals are opting out of the labor market in these ages as well). Focusing on estimates from age 60 onward, a higher FC decreases total earnings and the probability of being employed. The effects increase with age. At age 66, a one percentage point increase in the FC at age 40 decreases earnings by 3,200 DKK and the probability of being employed by 0.6 percentage points. This corresponds to a 1.8% decrease in earnings and a 1.6% decrease in the probability of being employed at age 66. Furthermore, a higher FC at age 40 has a positive effect on the probability of being self-supporting at age 60 onward, up until age 66. For individuals aged 65, a one percentage point increase in the FC increases the probability of being self-supporting by 0.4 percentage points (6.1% increase). As individuals reach the SRA, it is expected that the share of individuals who choose to be self-supporting decreases since they become entitled to public pension benefits. The effect on the probability of being self-supporting decreases at age 66 compared to age 65, and the effect is approximately zero at age 67. Finally, for the probability of being partially employed, there are no clear effects.

In Figure D.2, we visualize the relationship underlying our reduced form results. We create a bin scatter plot where we plot the FC into 100 equally sized bins and estimate local linear regressions of the FC age 40 and earnings age 63 in panel (a) and the residualized FC and residualized earnings<sup>18</sup> in panel (b). In panel (b), there is a negative relationship and limited evidence of non-linearities. The most striking finding occurs when comparing the residualized version (panel b) to the non-residualized version (panel a). The slope in these figures is clearly different, which further underlines the importance of our control variables as illustrated in Figure 2. In the non-residualized version, we see a clear positive

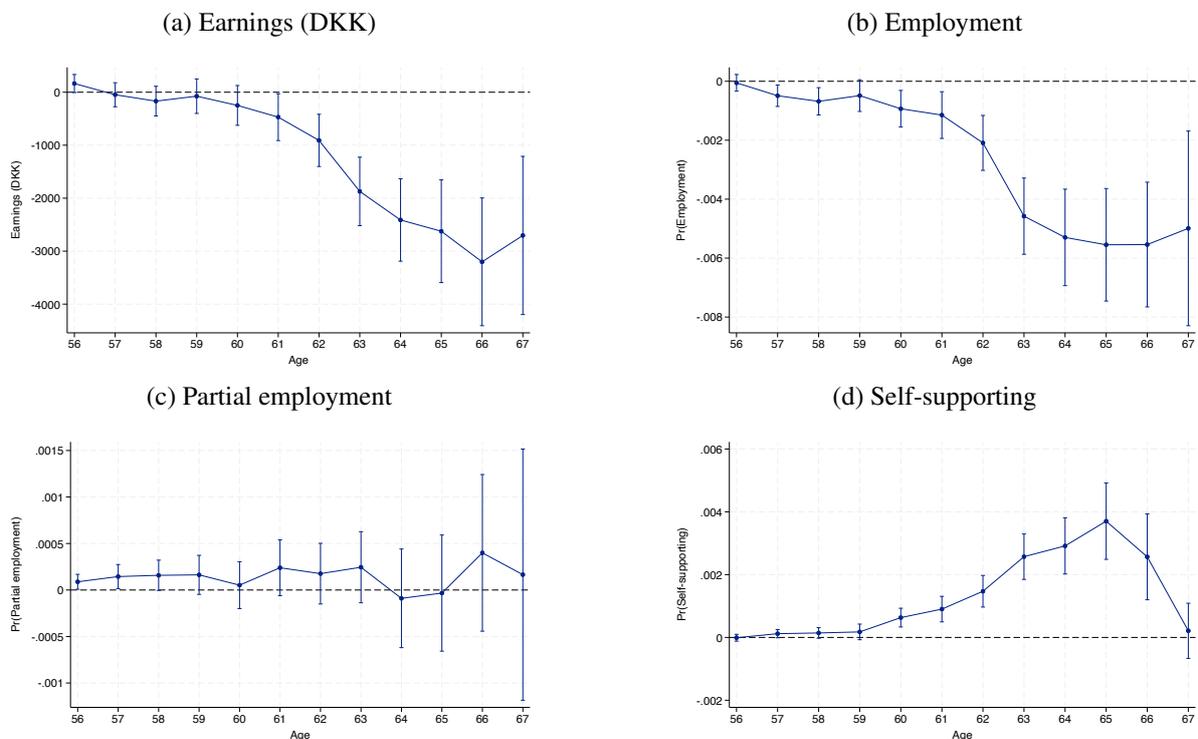
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<sup>18</sup>We regress the FC age 40 and earnings age 63, respectively, on our explanatory variables (see Footnote 14) to obtain the residualized versions.

relationship consistent with, for example, taste bias. This is reversed when we consider our baseline specification.

Lastly, we also consider impacts on other types of margins than labor supply. That is, we analyze how the FC at age 40 relates to other assets and liabilities. As argued earlier, individuals may want to try to adjust to pension wealth differences via adjustments, e.g., running down their financial assets or taking up more debt. However, in [Figure E.11](#), we do not really find any statistically significant effects in changes in real assets, financial assets, mortgage debt, or other loans. Overall, these results suggest that individuals are not changing assets or liabilities in substantial ways as a part of their response. We further discuss the nature of the response further below, but first, we now turn attention to quantifying the wealth effects using our IV model.

Figure 3: Reduced Form Estimates for Labor Market Outcomes



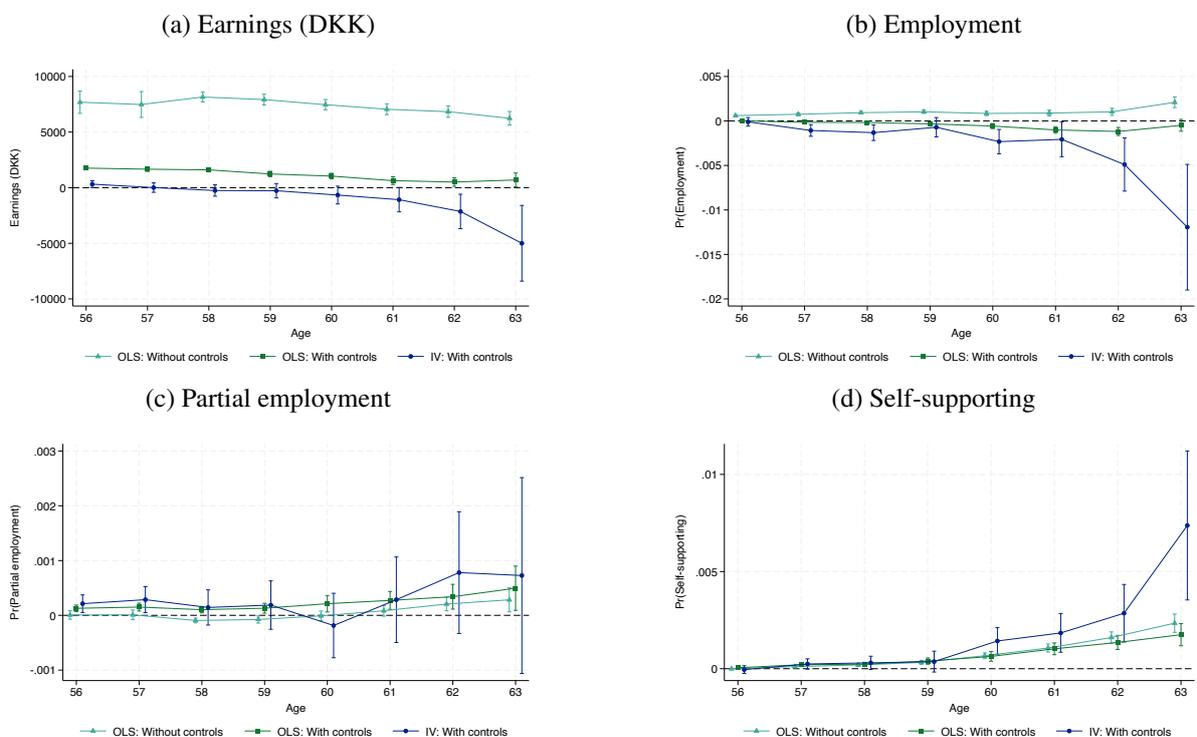
*Notes:* This figure plots reduced form estimates ([Equation 2](#)) for ages 56 to 67. In panel (a), the outcome variable is earnings (DKK), in panel (b) the outcome variable is a dummy for being employed, in panel (c) the outcome variable is a dummy for being partially employed, and in panel (d) the outcome variable is a dummy for being self-supporting. Controls measured at age 55 include firm FE, year FE, dummy for payment to the VERP scheme, male dummy, education dummies, marriage dummy, children at home dummy, experience, experience squared, tenure, 1-digit occupation dummies, earnings (deciles), and net wealth excluding pension wealth (ventiles). All monetary values are in DKK (2023 prices). Standard errors are clustered at the firm level at age 55, and 95% confidence intervals are shown.

### 6.3 Instrumental variables

The effects of pension wealth on key labor market outcomes in our IV model ([Equation 3](#)) are shown in [Figure 4](#) (see [Table D.5](#) in the Appendix for table with IV estimates). For comparison, we also report

estimates from OLS regressions of pension wealth at age 55 on labor market outcomes with/without our baseline set of controls. For earnings, the OLS estimate without controls implies that a 100K DKK ( $\approx 15,000$  USD) increase in pension wealth at age 55 is associated with 6000 DKK higher earnings at age 63. While the OLS estimate including controls and firm fixed effects at age 55 is less than the OLS estimate without controls, it still shows a positive correlation between pension wealth and earnings. However, for the IV estimate, a 100K DKK increase in pension wealth (corresponding to a 4.7% change in pension wealth at age 55, see [Table D.1](#)), has a negative effect on earnings of 5000 DKK (a decrease in earnings of 1.3%) at age 63, implying a wealth elasticity of around -0.3 ( $-1.3/4.7$ ). Taken together, this clearly shows that the OLS estimates do not capture the endogeneity of pension wealth, and hence, an IV approach is necessary.

Figure 4: OLS and IV Estimates for Labor Market Outcomes



*Notes:* This figure plots OLS and IV estimates ([Equation 3](#)) for ages 56 to 63. In panel (a), the outcome variable is earnings (DKK), in panel (b), the outcome variable is a dummy for being employed, in panel (c), the outcome variable is a dummy for being partially employed, and in panel (d), the outcome variable is a dummy for being self-supporting. Controls measured age 55 include firm FE, year FE, dummy for payment to VERP scheme, male dummy, education dummies, marriage dummy, children at home dummy, experience, experience squared, tenure, 1-digit occupation dummies, earnings (deciles), and net wealth excluding pension wealth (ventiles). All monetary values are in DKK (2023 prices). Standard errors are clustered at the firm level at age 55, and 95% confidence intervals are shown.

The IV results also show that at age 63, a 100,000 DKK increase in pension wealth at age 55 decreases the probability of being employed by 1.2 percentage points (a decrease of 1.5%) and increases the probability of being self-supporting by 0.7 percentage points (a substantial increase of 14.9%). We find no significant effects on partial employment.

We also repeat our IV analysis for two sub-samples (see Subsection 5.1): 1) firm leavers, and 2) passive savers in Appendix F.1.2 and F.1.3. We find a similar first stage, and the reduced form and IV results for these subsamples are also very similar to our main results. We, therefore, see alignment in results based on the more conservative specifications (for which we found that the relationship between FC at age 40 and individual pension contribution rates at later ages was gone (Figure 2)).

How do our results compare to previous estimates of wealth effects?<sup>19</sup> Golosov et al. (2024) show that lottery winners in the US (aged 62-64) are more likely to exit the labor force and claim retirement benefits. Their estimates suggest that the exit rate from employment increases by about 5 percentage points (11-14% increase) per 100,000 USD additional wealth won in the lottery. Our results show that at age 63 (the age where the IV estimate is highest), a 100,000 DKK (around 15,000 USD) increase in age 55 pension wealth decreases the probability of being employed by 1.2 percentage points (a decrease of 1.5%). Thus, although our wealth measure – pension wealth – is different, our estimates (at later ages closer to the SRA) are actually not that different from Golosov et al. (2024). Golosov et al. (2024) also report (Appendix Table A.9) estimates from a range of other studies using different sources of wealth shocks and argue that their estimates (and thus ours) are broadly similar to most previous studies.<sup>20</sup> However, there is some tendency for the estimates to be larger, the older the workers – something which is also consistent with our results.

Our estimates also align with recent evidence in Artmann et al. (2023). They also report an implied elasticity around -0.3 despite institutional differences<sup>21</sup> and differences in the empirical setup. In Denmark, responses occur near retirement and primarily along the extensive margin, whereas in Germany they seem to emerge earlier (ages 50-55) and almost entirely at the intensive margin (reductions in hours/full-time work). Differences in timing and adjustment margins may reflect variation in pension system design, liquidity constraints, and the salience of reforms/FC differences.

If pension wealth increases trigger similar responses as other wealth shocks (e.g., lottery prices), this suggests that the two types of wealth may be somewhat substitutable in later ages. However, the age profile of our impacts is important to note here. Impacts are larger the older individuals are, and

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<sup>19</sup>As the pension system is a defined contributions system and we focus on pre-retirement ages (i.e., prior to eligibility for means-tested public pensions), we interpret estimates as wealth effects rather than substitution effects. Occupational pensions are not necessarily conditional on non-work, and early payouts reduce future benefits, making substitution less relevant.

<sup>20</sup>Other types of unanticipated wealth shocks include e.g., lottery prizes (Imbens et al. (2001), Cesarini et al. (2017) ), inheritance (Brown et al. (2010)), and economic shocks, such as the Great Recession (Goda et al. (2011), Gustman et al. (2010)).

<sup>21</sup>Importantly, while the pension wealth studied in this paper is mandatory/institutionalized, it is still individualized and private property. This potentially makes the wealth channel clearer. The occupational pensions are not protected by bankruptcy law (the income flow can be seized, and loans can be made contingent on this wealth), so including them as part of wealth is relevant.

they only materialize from around the age where pension wealth becomes more "liquid" (i.e., when individuals can potentially withdraw some of it). We discuss this further in Section 6.5.

#### 6.4 Pension wealth at age 59

To be able to study retirement behavior at later ages (see Section 5.1), we also repeat our analysis above using pension wealth at age 59 instead of age 55 (our results above support the idea that we can measure pension wealth slightly later, as there is no labor supply response at ages 56 to 59). A 15-year time spacing is retained, and, therefore, the FC at age 44 is used, and we condition on employment and no self-employment income at age 44 and age 59. Measuring pension wealth at age 59 allows us to study reduced form estimates from ages 60 to 71 and IV estimates from ages 60 to 67. In addition, by using different samples for the first and second stages, we can further extend the outcome period and study the IV estimates for ages 60 to 71.

In Table E.1, the first stage results are reported. We find an effect of 2.9% (close to our main estimate of 3.0%). Figure E.1 shows the reduced form results for key labor market outcomes (table estimates in Table E.2).<sup>22</sup> The effect of FC on labor supply decreases after age 67. From age 68, as individuals reach the SRA and qualify for public pension benefits, we find a zero effect on self-supporting. At age 71, there is no statistically significant effect of the FC on any labor market outcomes.

Using pension wealth at age 59, we can study IV estimates at ages 60 to 67. The effects of pension wealth on key labor market outcomes are reported in Figure E.2 (see Table E.3 for table with estimates). The results show that the negative effect of pension wealth on earnings and employment is becoming increasingly more negative by age. For self-supporting, there is a peak at age 65, before the effect decreases due to the fact that individuals reach the SRA and can claim universal public pension benefits. The earnings response at age 64 implies a wealth elasticity of around -0.25 (a 1% earnings reduction in response to a 4.2% change in pension wealth), and this is increasing with age. At age 67, the wealth elasticity is around -1.

To summarize the full age profile of impacts, panels (e) and (f) provide estimates on the cumulative earnings and employment losses for ages 60 to 67. At age 67, a 100,000 DKK increase in pension wealth at age 59 implies an earnings loss of 30,000 DKK (4600 USD) and 0.04 years less of employment (approximately two weeks less of employment since age 60).

To push IV estimates beyond age 67, we use the first stage estimates from Table E.1 in combination

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<sup>22</sup>Note that the sample in this analysis is different than in our main analysis (Subsection 6.3) due to different set of cohorts, and we condition on employment at age 44 and 59 instead of 40 and 55.

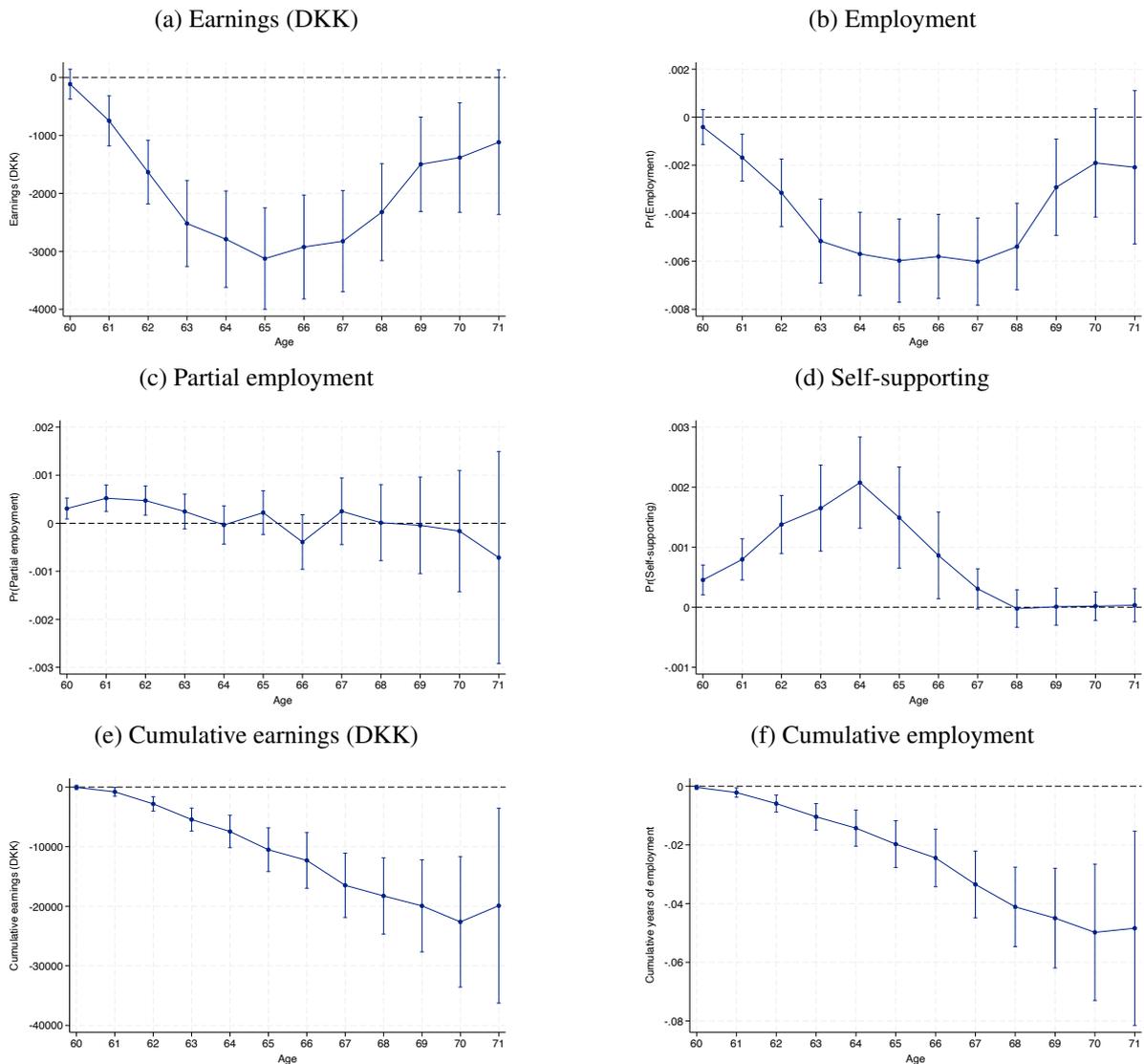
with our reduced form estimates above. By using a different sample for the first stage compared to the reduced form (the reduced form does not require observing pension wealth), it is possible to estimate the effect of pension wealth on labor supply at ages 60 to 71. We then show in [Figure 5](#) the effect of pension wealth at age 59 on our main outcome variables and cumulative earnings and employment from age 60 to age 71. The results show a declining impact of pension wealth on labor supply after age 67 and no statistically significant effects at age 71. The cumulative earnings loss at age 71 is about 20,000 DKK if the pension wealth increases by 100,000 DKK, see panel (e) in [Figure 5](#).

To assess the order of magnitudes for public finances, note that the decision to become self-supporting is a labor market decision at the extensive margin, which is associated with a tax externality since the individual responds to the after-tax consequences of opting out of the labor market. A back-of-the-envelope calculation of lost tax revenue is 9680 DKK per individual (the effective average tax is 48.4% for an average paid employee ([Danish Ministry of Taxation, 2025](#))). From 2014 to 2024, the average pension wealth increased by about 500,000 DKK in real terms according to Statistics Denmark. Using our estimates, this increase implies an earnings reduction of 100,000 DKK and hence a loss in tax revenue of about 50,000 DKK. The cohort size of people aged 60 is in 2024 approximately 80,000 persons, and hence the loss of tax revenue is about 4 bn DKK or roughly 0.15% of GDP or 0.3% of total tax revenue. Hence, the effect is not so large that it overturns the positive effect of higher pension savings for public finances (which mainly results from declining expenditures on public pensions), but still so large that the effects should be taken into account when planning pension and retirement reforms.

## 6.5 Discussion of results and mechanisms

Mandated pension schemes are often rationalized as a response to behavioral imperfections causing individuals to save too little. A key issue in the literature is whether mandates crowd out other types of savings/wealth and thus fail to increase net savings. Evidence discussed in [Section 1](#) and [2](#) generally finds that the crowding out is modest and mandated schemes do increase net savings, a finding that is also supported by the present analysis. However, increases in net-savings (pension wealth) may prompt responses in other dimensions, including late-career labor supply. In [Appendix B](#), we present a stylized model with present-biased (myopic) households that captures these savings responses, specifically showing that individuals tend to save too little and that a mandated pension savings scheme can mitigate this. Crowding out is muted by capital market imperfections (high borrowing rates or outright borrowing constraints), and as a result, the pension wealth is higher, which in welfare terms is an improvement since it mitigates the present bias. However, the present-biased household finds that consumption in the

Figure 5: Longer IV Estimates: Age 59



*Notes:* This figure plots IV estimates (Equation 3) for pension wealth at age 59 for ages 60 to 71. We use first stage estimates from Table E.1. In panel (a), the outcome variable is earnings (DKK), in panel (b) the outcome variable is a dummy for being employed, in panel (c) the outcome variable is a dummy for being partially employed, in panel (d) the outcome is a dummy for being self-supporting, in panel (e) the outcome variable is cumulative earnings (DKK) since age 60, and in panel (f) the outcome variable is years of employment since age 60. Controls at age 59 include firm FE, year FE, dummy for payment to VERP scheme, male dummy, education dummies, marriage dummy, children at home dummy, experience, experience squared, tenure, 1-digit occupation dummies, earnings (deciles), and net wealth excluding pension wealth (ventiles). All monetary values are in DKK (2023 prices). Standard errors are clustered at the firm level at age 59, and 95% confidence intervals are shown.

early life phases is "too low" while it is "too high" during retirement. As a result, they choose to retire earlier without necessarily having to accept a lower consumption level than earlier in the life cycle.

Labor supply responses to mandated retirement savings depend on knowledge of pension wealth, liquidity constraints, and preferences for leisure versus consumption. These factors shape whether individuals can smooth 'excess' pension wealth before retirement, making the size and margin of adjustment an empirical question. Below, we discuss these mechanisms in light of our results, including early de-

accumulation, alternative wealth smoothing, and the role of liquidity and information.

First, we analyze heterogeneity in the effects by pension wealth. After all, adjustments via the retirement margin are only plausible if individuals have more wealth than "planned". We therefore re-estimate our reduced form for different quartiles in the distribution of pension wealth at age 59. In [Figure E.5](#), we show that our effects are concentrated among individuals with higher levels of pension savings. This is consistent with the theory outlining that we should only expect a retirement response among individuals with a high level of retirement savings.

Second, the age profile of our impacts also reveals heterogeneity where the labor market responses increase the closer individuals are to the statutory retirement age (SRA). As outlined earlier, the ability and incentive to decumulate pension wealth is improved when approaching the SRA. Specifically, the rules allow decumulation to start either at age 60 or within a window of three to five years before reaching the SRA<sup>23</sup>, and this is consistent with our finding that the wealth effect appears primarily in later ages (or closer to the SRA).

The link between the labor market response and the ability to withdraw pension savings is highlighted in [Figure E.6](#), which plots the reduced form results on the likelihood and amount claimed from individual pension savings (non-public pension income) at a given age. From age 60, an increase in the FC at age 40 has a positive effect on both the probability of receiving (the extensive margin) and the amount received (the intensive margin). At age 65, a one percentage point increase in the FC increases the probability of receiving non-public pension income by 1 percentage point and the amount by 1800 DKK. The effect of pension wealth on pension income is reported in [Figure E.7](#). A 100,000 DKK increase in pension wealth at age 55 increases the probability of receiving non-public pension income at age 63 by 1.7 percentage points and the amount by 2000 DKK.<sup>24</sup>

Third, to shed light on the full effect on the individuals' budget from e.g., reductions in labor earnings and increasing non-public pension income, we also look at the effect on disposable income, which includes net-of-tax income from labor market earnings, pension payments, and other public transfers. In [Figure E.10](#) we find no statistically significant IV estimates, but for the reduced form we do see an indication of a negative effect (i.e., a reduction in disposable income), but only significant at age 66 (and the estimate is still several orders of magnitude smaller than the earnings estimates). Overall, this suggests that, at least on average, these individuals are smoothing consumption (measured by disposable

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<sup>23</sup>The timing of eligibility for decumulation depends on when the contributions were made, and hence it is rather complicated to work the precise incentives at the individual level, see [Appendix A](#).

<sup>24</sup>We can also split the sample by whether an individual has non-public pension income or not in a given year. See [Figure E.8](#). Here we find that the effect on self-support in [Figure 4d](#) is driven by individuals who also have positive non-public pension income in that year. We also find that the FC age 40 has a positive effect on the probability of early retirement in [Figure E.9](#).

income) to a high degree (although maybe not perfectly). Overall, the age profile of impacts (increase in self-sufficiency with age), the early withdrawal in pension wealth from 60 onward, and the absence of a large reduction in disposable income is consistent with individuals postponing decumulation of pension wealth until reaching the age threshold making this possible without any tax penalties and limited willingness to sacrifice consumption/income prior to this point as captured by the theoretical arguments discussed above.<sup>25</sup>

Finally, one additional explanation behind the gradual decrease in earnings and employment may be a lack of awareness about pension wealth. The closer individuals get to the SRA, the more salient pension wealth becomes and the more likely a response may be. Gradually improved awareness about pension wealth may be one explanation for the gradual increase in employment responses. However, unfortunately, we do not have information about awareness of information sets in our dataset, so it is not possible to push this interpretation further.

## 6.6 Additional results and robustness checks

We close our analysis by discussing some additional results and robustness checks.

First, we look at potential bridging behavior ([Gruber and Wise \(1997\)](#)). [Figure E.13](#) reports reduced form estimates for the probability of receiving disability pension and other transfers. We interpret this exercise as a falsification test, given that we do not expect the FC to influence disability pensions or transfers. Consistent with this expectation, we find little evidence of a positive effect. This is reassuring, as it suggests no relationship between FC and unrelated outcomes, such as health status.

Second, we briefly discuss potential heterogeneity in the effects. By splitting the sample along gender, saver type, homeownership, education, and marital status, it is possible to address important aspects of heterogeneity. [Appendix E.12](#) gives the reduced form estimates on earnings and self-supporting.<sup>26</sup> The results across all dimensions are similar to the findings for the base estimations. For savings behavior, the sample is split into active and passive savers. Passive savers are defined as individuals who at ages 55 and 40 did not contribute to private pensions. It is reassuring that the results are similar for these two groups, as we would expect passive savers to be less aware of their occupational pensions and not to strategically choose firms based on their pension policies.

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<sup>25</sup>To assess the importance of liquidity constraints (i.e., limited ability to consume beyond current means in anticipation of future pension wealth), we estimate our reduced form model separately for individuals grouped by their liquidity level at age 59. In [Figure E.12](#), we show that responses are broadly similar, but there is some tendency for individuals in lower liquidity quartiles to respond later in the life cycle. These findings would be consistent with the interpretation above that the responses appear for individuals who are not financially constrained.

<sup>26</sup>Other results are available upon request.

Third, the validity of the results reported above is checked in Appendix F, which reports a wide variety of robustness checks. These robustness checks can be grouped into four different segments: 1) Role of controls, 2) distance to retirement age and FC definition, 3) functional form and matching, and 4) choice of standard error.

**Role of controls** The first stage, reduced form, and IV regressions are repeated, varying the inclusion of control variables. The results are robust to the inclusion of control variables at age 40 or individual savings controls at age 55, or alternatively, excluding wealth (excluding pension wealth) controls at age 55. In fact, the estimates barely change (see Figures F.1a and F.2a).

**Distance to retirement age and FC definition** In our sample period, the early retirement age (ERA) and the statutory retirement age (SRA) are increasing in Denmark (see Figure A.3). Hence, at the same age, different cohorts have different retirement options. We therefore repeat our analysis using distance to SRA instead of age in Section F.2.1. We find similar results using distance to SRA as using age. Using distance to SRA, the effect of FC becomes insignificant, and the estimate is close to 0 for self-supporting after an individual reaches the SRA and becomes eligible for public pension benefits.

Furthermore, we vary the definition of FC in Section F.2.2. In our main specification, the FC is defined as the median of the occupational pension contribution rate for all employees with only that firm as employer in a given year. Alternatively, it could be defined as the mean of the occupational pension contribution rate for all employees with only that firm as employer in that year. Additionally, the FC is computed for each 1-digit occupation level in the firm, giving the median of the occupational pension contribution rate for all employees within a 1-digit occupation category for a specific firm where the employee is employed in the given year. In Table F.3, the first stage regression is estimated using these alternative measures of the FC. Using the mean FC, we obtain an estimate of 81,000 DKK (an increase of 3.8%), and thus somewhat larger than in the main specification estimate of 63,000 DKK (increase of 3.0%). Hence, taking the median gives a conservative estimate compared to taking the mean. Using the within-occupation FC ("1-digit FC"), we find an estimate of 67,000 DKK (increase of 3.2%). Redoing the reduced form and IV analyses with the alternative definitions, the patterns are similar to those arising with the main specification (using the median).

**Functional form and matching** Different functional forms are analyzed. We use the logarithm of pension wealth as the outcome variable for the first stage regression in Table F.4. For this specification, the effect is a 3.7% increase, which is very comparable to our main estimate of an increase of 3.0%.

We also study the effect of the logarithm of pension wealth instrumented by the FC on outcomes in [Figure F.11](#). Likewise, we find similar effects. Additionally, we study the logarithm of earnings as outcome in [Figure F.12](#) and find a negative effect of mandated savings.

For the first stage estimation, we also investigate whether the use of matching changes the results, see [Section F.3.2](#). We create a dummy variable for having a high FC (having the median or above FC), and we then use Propensity Score Matching (PSM) to match on having a high FC. [Figure F.13](#) shows the propensity scores without restricting the caliper and with a caliper restriction of 0.001, and we show the first stage results in [Table F.5](#). We find very similar results for no matching and matching with and without caliper restrictions.

**Clustering** We vary the level of clustering in our first stage, reduced form, and IV analyses, both clustering on the firm level at ages 55 and 40 and using robust standard errors in [Appendix F.4](#). Choice of standard error does not affect the significance of our results.

## 7 Conclusion

The link between pension wealth and the timing of retirement is analyzed using Danish administrative data and exploiting plausibly exogenous variation in early-career differences in mandatory pension contribution rates across firms.

Our first stage results show that the firm-specific pension contribution rate (FC) has a long-lasting, positive effect on pension wealth. Including a wide variety of control variables and firm fixed effects at age 55, we find that a one percentage point increase in the FC at age 40 increases pension wealth at age 55 by 3%. Early-career differences in mandatory pension contributions thus cause persistent differences in pension wealth, and individuals do not offset these differences later on in their career nor change voluntary retirement savings in response. Therefore, in the Danish context, mandated pension savings requirements have proven to be an effective tool for increasing pension wealth.

However, mandated pension savings may prompt adjustments along other dimensions, notably late-career labor supply, including retirement. Using the variation in (residualized) FCs in early career to instrument for pension wealth, we study the link between pension wealth at age 55 and labor market status. Importantly, the differences in (residualized) FCs do not predict individual differences in, e.g., retirement savings behavior or earnings later in life in our baseline estimation, where we include extensive covariates for the job and firm type at age 55. This suggests that the variation we isolate in pension wealth is not explained by differences in planned retirement motives earlier in life.

Our IV estimates show that in the ages (56-59) leading up to, but just before the age threshold at which withdrawal of mandated pension savings is possible, pension wealth has no effect on earnings, employment, or the probability of being self-supporting (neither being employed nor receiving public transfers). However, in an age window prior to reaching the statutory retirement age, at which there is universal access to public pensions, there is an effect. An increase in pension wealth at age 55 of 100,000 DKK decreases earnings at age 63 by 1%. This implies a significant pension wealth elasticity of around -0.3. For employment, we find that 100,000 DKK more in pension wealth decreases the probability of being employed by 1.2 percentage points (1%). This decrease is counteracted by an increase in the probability of being self-supporting by 0.7 percentage points (15%). There are no sizeable effects on disability pension or other transfers (such as unemployment benefits, cash assistance, etc.). As a mechanism for retirement, we find that individuals with higher pension wealth at age 55 have a higher payout from their retirement savings account at age 60 onward. In further results, we find that the effect on earnings persists beyond the statutory retirement age but then tapers off and disappears around age 71. The effect on self-sufficiency disappears after the statutory retirement age, as self-sufficiency is dominated by public pension payouts.

Our results show that while mandated pension savings can increase pension wealth, the implied wealth accumulation may affect late-career labor supply and, in particular, induce earlier retirement from the labor market. The effects appear in an age window determined by the earliest age at which it is possible without a penalty to start decumulating pension wealth and the statutory retirement age at which all are entitled to public pensions.

Hence, even though (many) individuals are passive savers and mandated savings requirements lead to an increase in net savings, they all have to take a stand on when to retire. Our empirical findings are consistent with theoretical work predicting that some individuals may want to front-load part of the mandated retirement savings by retiring earlier. This is an empirically important effect that has previously been largely overlooked in the literature, and it is important to include it in retirement reform discussions. Clearly, it does not imply that mandated savings requirements are without effect, but it points to a behavioral response that should be integrated into decisions on optimal savings and retirement policies.

At a broader level, our results also have implications for the literature analyzing changes in consumption patterns and other behaviors around the time of retirement. We find that individuals do, to some extent, adjust the timing of their retirement, and this mode of adjustment should be included to understand household behaviors around retirement ages.

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# Online Appendix to Pension Wealth and the Timing of Retirement

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## A The Danish pension system

This section complements Section 3 with further information about the Danish pension system. The cornerstones of the Danish pension system are tax-financed public pensions and occupational pension schemes.

The public pension consists of a base amount and means-tested supplements. Eligibility for public pension is universal when reaching the statutory pension age, subject to a residence requirement.<sup>27</sup> The basic structure is illustrated in Figure A.1 for the two most important supplements, *pensionstillæg* and *særlig pensionsydelse/ældrecheck*. The figure applies to a single-person household, as couples are somewhat more complicated due to means-testing. It is possible to claim the public pension while working beyond the statutory pension age, but for our sample period (up to and including the year 2022) labor income offsets public pension benefits.<sup>28</sup> However, there is a possibility to postpone the payment on actuarial terms post the statutory pension age. The public pensions are indexed to private sector wage developments ("Satsreguleringsloven"). If wage increases are above 2%, growth in pensions is 0.3 percentage points lower. This reduction finances contributions to a mandated pension arrangement (*obligatorisk pension*) for recipients of social transfers.

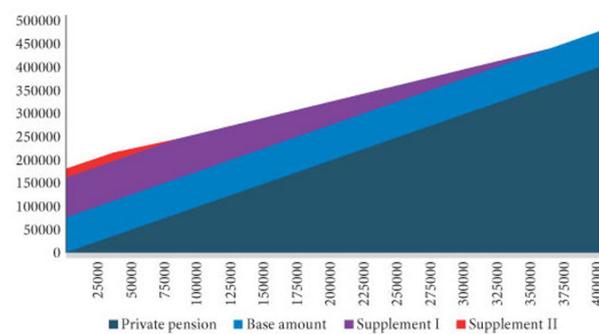
Occupational pensions consist mainly of collectively bargaining pension arrangements. About 82% of the employed are working under a collective agreement (100% in the public sector, 73% in the private sector).<sup>29</sup> To this comes firm-specific pension arrangements, but not all employees are covered by an

<sup>27</sup>The full base amount requires residence in Denmark for at least 40 years since age 15. The amount is reduced proportionally for shorter residence periods.

<sup>28</sup>To strengthen incentives to work in old age, a 2023 reform made the base amount and pension supplement of public pensions independent of one's own labor income.

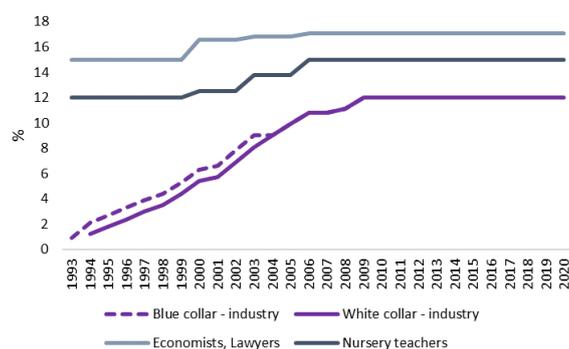
<sup>29</sup>Approximately 25% of individuals between the ages of 30 and 59 have pension contributions so low that they are expected

Figure A.1: Public pensions – basic amount and supplements



Notes: This figure shows a stylized illustration of the Danish public pension system for the year 2021. Only the direct pension supplements (supplement 1: *pensionstillæg* and supplement 2: *særlig pensionsydelse*) are included. Other supplements, such as housing supplements for the elderly, are disregarded in this figure. The figure is from Andersen (2022).

Figure A.2: Contribution rates determined by collective bargaining, selected groups



Notes: The figure displays contribution rates determined by collective bargaining for selected groups. The figure is from Andersen (2022).

occupational pension scheme. The collectively bargained pension schemes have developed over time, see Figure A.2. The key change happened in the late 1980s/early 1990s when such schemes were also widely introduced in the private segment of the labor market. The schemes are organized across occupational groups. Contribution rates have been steady since around 2010. The occupational pension schemes are fully funded and have gradually changed from being Defined Benefit (DB) schemes to being Defined Contribution (DC) schemes (more than 70% of contributions are to DC schemes).

Wage contracts and pension contribution rates are not recorded in the Danish register data. As explained in Section 4, we identify FCs in the data by constructing individual contribution rates (payments to occupational pensions divided by total earnings). It is important to note that not all wage elements are included in the base for which the contribution rate applies. The pension contributions as a percentage of the total wage are thus lower than the contribution rates reported in Figure A.2. The average pension contribution as a percentage of the total wage sum was about 10% in 2022. The effective contribution rate is increasing in income. The median contribution rate is increasing from 3.9% for a gross income of DKK 170.000 to 11.8% for a gross income of DKK 935.000. There is considerable dispersion within income groups, e.g., for the high-income group between 6.6% (P10) and 18.2% (P90), see ATP (2023).

In addition to mandatory payments into occupational pension accounts, there are voluntary pension savings (see below on tax rules) and other forms of savings and wealth accumulation.

### Tax rules

Many aspects of the pension system are regulated through the tax code, and the specific rules have been changed over time. For schemes where funds cannot be withdrawn prior to reaching the statutory to receive the maximal supplement to the public pension due to low pension savings (ATP, 2024).

pension age, there are favorable tax treatments. First, the return on pension savings is taxed more leniently than other forms of capital income. The tax on the rate of return is 15.3%, while positive capital income is taxed at 37-42%. Second, contributions to pension schemes are non-taxable and taxed when paid out. With an income tax system with progressive elements, it is implied that the tax value of the deduction of the contribution is higher than the tax applied to the received pension.

Furthermore, there is an upper bound on contributions to an installment pension where benefits are paid out over a period of 10 years or more. Additionally, there is an age-specific additional tax deduction on pension contributions made in a window of 15 years prior to reaching the statutory pension age. Contributions to the scheme *aldersopsparing* are not tax deductible, but benefit payments are non-taxable income, and they are not included in means-testing. There is an upper cap on the annual contribution to the scheme.

Early withdrawal of pension funds is possible in a window of three years prior to reaching the statutory pension age (before 2018, it was five years before the statutory pension age, and for pension accounts established before May 2007, it was at 60 years old).<sup>30</sup> Funds withdrawn earlier (except in special circumstances, such as life-threatening illness) are taxed by 60% (but it can in some cases be 40%).<sup>31</sup> However, premature pension withdrawals are not possible for all schemes.

### **Statutory pension age**

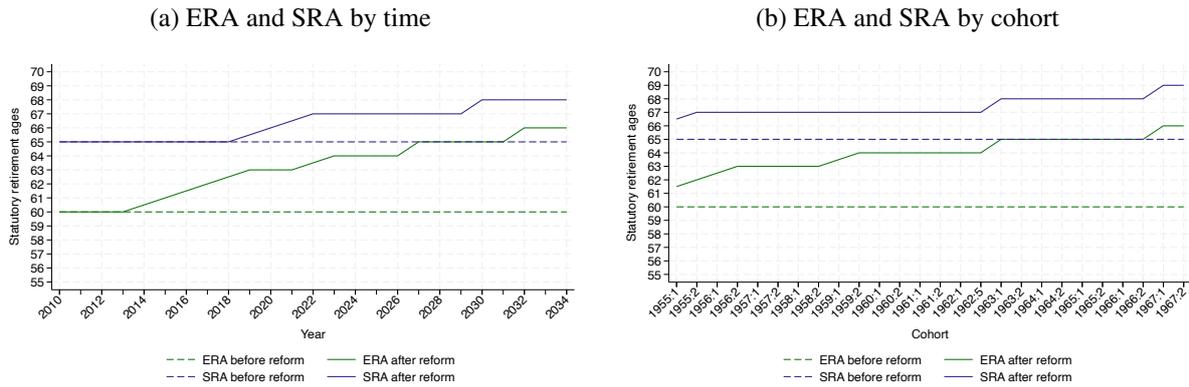
Statutory ages in the pension system are established by law and, thus, regulated at the political level. Two recent reforms, the 2006 Welfare Reform and the 2011 Retirement Reform, have increased the statutory retirement ages in steps from age 60 years to 64 years for early retirement (2023), for the public pension from 65 years to 67 years (2022), and also shortened the early retirement period from five years to three years, see also [Figure A.3](#) for an overview. Moreover, the pension age (and most other age thresholds, including the early retirement age) is now indexed to the development in life expectancy (at the age of 60) in order to target the expected pension period of 14.5 years (17.5 years including early retirement) in the long term (currently about 18.5/23.5 years). The Danish parliament decides every 5<sup>th</sup> year, with a 15-year lead, the statutory retirement age. Hence, in 2025, it was decided that the statutory retirement age in 2040 will be 70 years, and in 2030, it is up for approval that it is going to be 71 years in 2045. There is a speed limit such that the statutory retirement age can only be increased by a maximum of one year every 5<sup>th</sup> year.

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<sup>30</sup>See [https://info.skat.dk \(a\)](https://info.skat.dk (a)) for more information on Danish tax rules on pension withdrawals.

<sup>31</sup>See also [https://info.skat.dk \(b\)](https://info.skat.dk (b)) for Danish tax rules on premature pension withdrawals.

Figure A.3: ERA and SRA by Time and Cohort



Notes: Panel (a) displays the early retirement age (ERA) and statutory retirement age (SRA) before and after the 2006 Welfare Agreement and 2011 Retirement Reform for the time period 2010-2034. Panel (b) displays the ERA and SRA before and after for the cohorts in our sample, i.e., individuals born in 1955-1967.

### Early exit options

There are different options for retiring earlier than the statutory retirement age. A complex set of tax-financed schemes exists for individuals with reduced work capabilities. As a rule, permanent support in the form of *disability pensions* can only be granted to persons above the age of 40 if work capabilities are reduced to such an extent that self-support cannot be expected (not even in a so-called flex-job). A ‘senior pension’ (*seniorpension*) is available from the period six years prior to reaching the statutory retirement age, provided work capability is reduced (i.e., an individual must be unable to work 15 or more hours per week). A new scheme, ‘early pension’ (*tidlig pension*), is available for persons who at the age of 61 have worked at least 42 years in the labor market. Finally, voluntary early retirement pay (VERP, *efterløn*) is a possibility to retire in a window prior to the statutory pension age for persons who have contributed to the scheme for at least 30 years. The rules have been changed numerous times to make the scheme less generous, and as a consequence, the number of persons eligible for early retirement is decreasing.

## B Theoretical model

The following presents a simple theoretical setting admitting an analysis of mandatory savings requirements and their effects on retirement decisions. The model captures the essence of a significant part of the pension literature examining the extent to which mandated savings requirements crowd out voluntary savings, the importance of behavioral decision making, and the role of borrowing constraints. To

arrive at clear-cut analytical results, the following uses a standard two-period overlapping generations setting, allowing an analysis of retirement decisions by reinterpreting the length of periods<sup>32</sup>. Specifically, normalize the length of life as young to one, and let the length of the second period be  $L (\leq 1)$ <sup>33</sup>, see e.g. Bloom et al. (2007), Andersen (2008), Pestieau and Ponthiere (2012). The length of the second period ( $L$ ) can be interpreted as longevity. The individual then chooses at what age ( $R$ ) to retire in the second period ( $0 \leq R < L$ ). This approach offers a simple way to analyze pension savings and retirement decisions and the consequences of changes in longevity.

Let lifetime utility for a representative agent be

$$\Omega \equiv u(c^y) + \frac{1}{1+\delta} [Lv(c^o) - Rd(R, L)] \quad (4)$$

where the first term is the utility from consumption when young,  $c^y$  (disutility from working is suppressed since labor supply as young is exogenous), and  $\delta$  is the subjective time preference. The utility as old has two terms: utility from consumption when old, given as the product of longevity  $L$  and the flow utility  $v(c^o)$  from consuming  $c^o$  throughout "old age", and disutility from work given as the length of the working period (=retirement age)  $R$  times the flow disutility from work  $d(R, L)$ , depending on the retirement age and longevity (for specific properties, see below). The utility functions  $u(\cdot)$  and  $v(\cdot)$  fulfil all standard properties, and  $\delta$  is the subjective time preference. The marginal disutility of retirement at age  $R$  is

$$\eta(R, L) \equiv d(R, L) + Rd_R(R, L) = d(R, L)[1 + \varepsilon_R(R, L)]$$

where  $\varepsilon_R(R, L) \equiv \frac{d_R(R, L)R}{d(R, L)}$  is the elasticity of the disutility from work  $d(\cdot)$  wrt. the retirement age  $R$ . The second order condition to this problem requires that  $\eta_R(R, L) - v_{cc}(c^o)\frac{w}{L} < 0$ . It is assumed that the marginal disutility is increasing in the retirement age ( $\eta_R(R, L) > 0$ ) and declining in longevity ( $\eta_L(R, L) < 0$ ). The latter captures healthy ageing.

To introduce behavioral decision making in the most simple form, the following introduces myopia. Specifically, the preferences in (4) are the choice preferences determining the actions by the individual, while the true preferences by which to assess lifetime utility are

$$\Omega \equiv u(c^y) + \frac{1}{1+\delta^*} [Lv(c^o) - Rd(R, L)]$$

---

<sup>32</sup>Effectively, this assumes a continuous time setting within period two. The simplification arises by having no discounting "within" but only "between" periods. Hence, the consumption flow is constrained to be invariant (smoothed) within the two phases constituting the life cycle of the individual.

<sup>33</sup>To a first approximation, this can be taken to match observed mortality rates which are constant (and low) up to a certain age, from which they are increasing with age.

where  $\delta^* < \delta$ , implying that more weight is attached to the utility as old than implied by the choice preferences. A key implication is that the individually chosen savings level is lower than what is optimal given true preferences, and hence there is undersaving, motivating a mandated savings requirement. A large literature explores how various behavioral factors influence intertemporal decision making, and the central finding is the tendency to save insufficiently, and this is captured by this formulation, see discussion in the main text.

### Funded DC pension scheme

Consider a mandatory fully funded scheme with a contribution rate<sup>34</sup>  $\tau$ , implying that the budget constraints read

$$\begin{aligned} c^y &= w[1 - \tau] - s \\ c^o &= \frac{Rw + [1 + r][s + \tau w]}{L} \end{aligned}$$

where  $s$  is voluntary savings. For simplicity, it is assumed that voluntary and mandatory savings earn the same rate of return. The individual decision problem is solved "backwards", first considering the retirement decision as old given the savings decision made as young, and then considering the savings decision as young. The first order condition for the retirement decision as old reads

$$v_c(Rw + [1 + r][s + \tau w])w = \eta(R, L)$$

where it follows straightforwardly that the retirement age via a wealth effect is declining in savings made as young,

$$\frac{\partial R}{\partial s} = -\frac{v_{cc}(c^o)[1 + r]w}{v_{cc}(c^o)w^2 - \eta_R(R, L)} < 0$$

The standard first order condition for optimal voluntary savings as young reads

$$u_c(w[1 - \tau] - s) = \frac{1 + r}{1 + \delta} v_c\left(\frac{Rw + [1 + r][s + \tau w]}{L}\right)$$

Importantly this first order condition determines total savings given as  $s + \tau w$ . A change in mandatory savings leaves total savings unchanged ( $\frac{\partial(s + \tau w)}{\partial \tau} = 0$ ). The intuition is that the two forms of savings are perfect substitutes since they have the same rate of return. What matters to the individual is total savings, and hence the higher the mandated savings, the lower the voluntary savings,  $\frac{\partial s}{\partial \tau} = -w < 0$ . This

<sup>34</sup>Given the interpretation of the old-age period, contributions as old do not matter.

captures the standard crowding out result that mandated savings crowd out voluntary saving (here in a strong form due to the assumption that the two forms of savings are perfect substitutes to the individual). It is implied that the retirement age is unaffected by the mandatory pension savings requirement ( $\frac{\partial R}{\partial \tau} = 0$ ).

The crowding out of voluntary savings implies that voluntary savings become negative at sufficiently high mandatory savings requirements ( $\tau \geq \underline{\tau}$ ); that is, the mandated savings requirement is so high that the individual starts borrowing to avoid too low consumption as young (here it is assumed that borrowing is possible at the rate  $r$ ). Define the critical contribution rate  $\underline{\tau}$  as the contribution rate at which voluntary savings is exactly zero,

$$u_c(w[1 - \underline{\tau}]) = \frac{1+r}{1+\delta} v_c\left(\frac{Rw + [1+r]\underline{\tau}w}{L}\right)$$

For this contribution rate, the retirement age is

$$v_c(Rw + [1+r]\underline{\tau}w)w = \eta(R, L)$$

Next, assume – in line with the literature – that borrowing is not possible (qualitatively similar effects would arise if the borrowing rate were higher than the savings rate)<sup>35</sup> ( $s \geq 0$ ). With a binding borrowing constraint, an increase in the contribution rate has a one-to-one effect on savings, since there is no crowding out,  $\frac{\partial(s+\tau w)}{\partial \tau} = w$  for  $\tau > \underline{\tau}$ . The individual may be characterized as a passive saver in this situation. When the borrowing constraint is binding, the individual would like to increase consumption as young and decrease it as old – if borrowing was possible – since the marginal utility of consumption is higher as young than (weighted) as old,

$$u_c(w[1 - \tau]) > \frac{1+r}{1+\delta} v_c\left(\frac{Rw + [1+r]\tau w}{L}\right) \text{ for } \tau > \underline{\tau}$$

It follows straightforwardly that the optimal retirement age (for  $s=0$ ) is determined by

$$v_c\left(\frac{Rw + [1+r]\tau w}{L}\right)w = \eta(R, L) \text{ for } \tau > \underline{\tau}$$

For borrowing constrained individuals, the response to an increase in the contribution rate to the man-

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<sup>35</sup>Borrowing here is essentially using the pension as collateral, which is not possible in many countries.

dated funded scheme is to lower the retirement age,

$$\frac{\partial R}{\partial \tau} = \frac{v_{cc}(c^o) [1+r] \frac{[w]^2}{L}}{\eta_R(R, L) - v_{cc}(c^o) \frac{w}{L}} < 0 \text{ for } \tau > \underline{\tau}$$

The intuition is that a higher contribution rate decreases consumption as young and increases it as old. This is the opposite of what the borrowing-constrained individual wants. Lower marginal utility of consumption as old due to the higher pension makes the individual retire earlier. Hence, at a contribution rate so high that the borrowing constraint is binding ( $\tau > \underline{\tau}$ ), an increase in the contribution rate reduces the retirement age compared to the case where borrowing is feasible. Importantly, the borrowing constraint affects the young who are liquidity-constrained. As old, they are in the opposite position, finding that they have ended up saving too much. To see this clearly, consider the special case where  $u(c) = v(c)$  and  $r = \delta$ , in which case the borrowing constraint implies that  $c^y < c^o$ . Hence, consumption possibilities as old are larger than as young, and the individual responds by retiring earlier. Phrased differently, it is possible to retire earlier and still have the same consumption as old as when young (consumption does not fall when retiring).

Under true preferences, the optimal retirement age and savings are determined by (for  $s > 0$ )

$$v_c(R^*w + [1+r][s^* + \tau w])w = \eta(R^*, L) \quad (5)$$

$$u_c(w[1-\tau] - s^*) = \frac{1+r}{1+\delta^*} v_c\left(\frac{R^*w + [1+r][s^* + \tau w]}{L}\right) \quad (6)$$

Under true preferences, savings is higher ( $s^* > s$ ) and the retirement age lower ( $R^* < R$ ) than under the choice preferences. This can be proved by contradiction. Assume that  $s > s^*$ . Then it follows straightforwardly that  $R < R^*$  since  $\frac{\partial R}{\partial s} < 0$ . If  $s > s^*$ , it is implied that  $u_c(w[1-\tau] - s^*) < u_c(w[1-\tau] - s)$ , and  $R < R^*$  implies  $\eta(R, L) < \eta(R^*, L)$ , which in turn from (5) implies  $\frac{Rw + [1+r][s + \tau w]}{L} > \frac{R^*w + [1+r][s^* + \tau w]}{L}$ .

It thus follows that

$$u_c(w[1-\tau] + s) = \frac{1+r}{1+\delta} v_c\left(\frac{Rw + [1+r][s + \tau w]}{L}\right) < \frac{1+r}{1+\delta} v_c\left(\frac{R^*w + [1+r][s^* + \tau w]}{L}\right)$$

Using (6), it is implied that

$$u_c(w[1-\tau] + s^*) < u_c(w[1-\tau] - s) < \frac{1+r}{1+\delta} v_c\left(\frac{R^*w + [1+r][s^* + \tau w]}{L}\right) < \frac{1+r}{1+\delta^*} v_c\left(\frac{R^*w + [1+r][s^* + \tau w]}{L}\right)$$

and hence a contradiction. Hence,  $s^* > s$  and  $R^* < R$ . The intuition is that the individual saves too little

due to myopia, and hence pension wealth is lower, the marginal utility of consumption as old higher, and as a result a higher retirement age is chosen. Phrased differently, the low savings level implies that the individual ends up having to retire later ("I cannot afford to retire") compared to the situation under true preferences. Note that it is implied that old-age consumption under true preferences is higher than under choice preferences, (follows from  $\eta(R, L) > \eta(R^*, L)$ )

$$c^{o*} = \frac{R^*w + [1+r]s^*}{L} > \frac{Rw + [1+r]s}{L} = c^o$$

Hence, from a social perspective, myopic individuals tend to retire too early.

Summing up: A policy attempting to increase old-age consumption via mandatory pension savings requirements is (i) not affecting the retirement decision of active savers ( $s > 0$ ), (ii) but it is inducing earlier retirement for passive savers (binding borrowing constraint,  $s = 0$ ). The preceding has disregarded taxation to simplify the exposition. An income tax would, in the standard way, cause individuals' chosen retirement age (labor supply) to fall short of the socially optimal level. Including income taxation, the decline in the retirement age also has a direct budget effect by decreasing tax revenue.

## C Sample selection and descriptives

In Appendix C, we describe the sample selection process, outline the construction of our variables, and present descriptive statistics for the broad population sample, the analysis sample, and the external validity of the selected sample compared to the broad population.

### C.1 Sample selection

We show our sample selection process for the first stage analysis in Table C.1. We start with a sample of 720,000 individuals, containing all 55-year-olds born in 1959 to 1967. We keep individuals who were employed in a non-military occupation at age 55 and who were also employed at age 40. This reduces our sample by 30% to 529,000 individuals. We then exclude individuals who had more than one employer at either age 40 or 55, which reduces our sample by 196,000 individuals. We further reduce our sample by 77,000 persons by excluding individuals with self-employment income at age 40 or 55. We remove 2000 individuals with income from civil servant pension. We also exclude individuals with missing observations for control variables at age 55 (see Section 5 for a description of control variables), resulting in a sample of 230,000. By including firm fixed effects at age 55, we lose an additional 16,000 individuals. We hence get a final sample of 213,000 individuals for our first stage analysis.

Table C.1: Sample Selection

Sample	<i>N</i>
Total population	720,495
Employed age 55 (non-military occupation)	578,642
Employed age 40	528,589
Only 1 employer at ages 40 and 55	332,488
No self-employment income at ages 40 and 55	255,591
No civil servant pension	254,022
No missing variables	229,668
Selected sample (including firm fixed effects)	213,349

*Notes:* This table shows the sample selection going from the total population (55-year-olds born in 1959-1967) to our selected sample used for our first stage results, see Section 4.3 for further description of sample selection.

## C.2 Main outcome variables

To investigate how pension wealth affects labor market performance, we construct four outcome variables. **Earnings** are defined as the sum of annual labor earnings before taxation and include overtime, bonuses, and severance payments, etc. Earnings are winsorized at the 1<sup>st</sup> and 99<sup>th</sup> percentile. **Employment** is an indicator variable for employment. Individuals are classified based on their status in November each year. **Partial employment** is a subgroup of employment and is an indicator variable for when an individual is employed, but earnings are less than 20% of the average earnings that the specific individual had at age 50-54. **Self-supporting** is an indicator variable for individuals neither being in employment (or self-employed) nor receiving any public transfers. As outlined above, there are various (tax-financed) options for retirement before the statutory retirement age due to health problems or low work capability (see Section 3 and Appendix A). Therefore, health-related reasons are not the main reason for being self-supporting.

Then, we also study early retirement behavior. We define early retirement as an indicator variable for receiving voluntary early retirement pay (VERP, *efterloen*), flex allowance (*fleksydelse*), senior pension (*seniorpension*), or early pension (*tidlig pension*). Lastly, to shed light on the non-participation margin and potentially test our empirical specification against outcomes where no effects are expected (e.g. health outcomes), we also consider the following labor market outcomes: 1) Disability pension is an indicator variable for receiving (temporary, full or partial) disability pension, and 2) Other transfers is an indicator variable for receiving any remaining government transfers (excluding universal public pension), such as UI benefits, cash assistance, student grants, etc. For additional details, see Table C.2 in the Appendix.

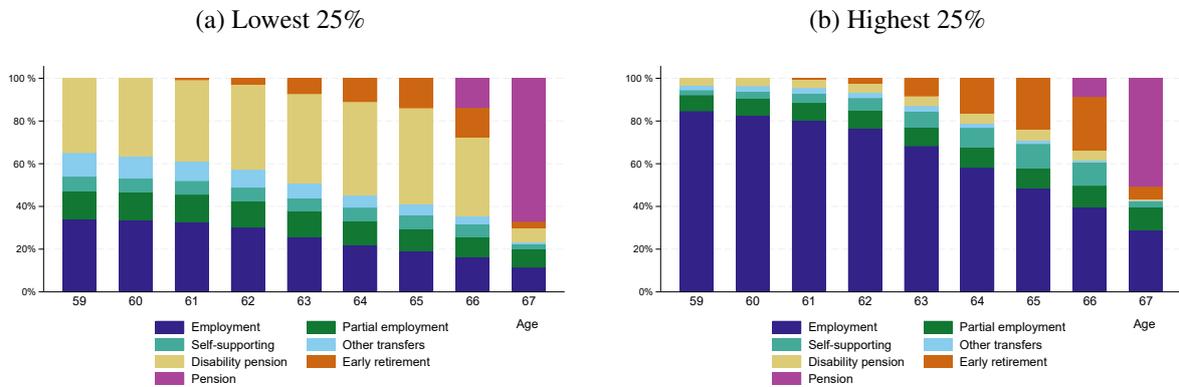
Table C.2: Outcome and Control Variables

Variable	Register name	Years available	Definition
<i>Outcome variables</i>			
Earnings (DKK)	LOEN_BELOEB_SMAL	2008-2022	
Employment (0/1)	JOB_P_SOCIO_KODE	2008-2022	110-138
Self-supporting (0/1)	JOB_P_SOCIO_KODE	2008-2022	300, 415, 513
Disability pension (0/1)	JOB_P_SOCIO_KODE	2008-2022	411, 321, 322
Other transfers (0/1)	JOB_P_SOCIO_KODE	2008-2022	200, 311-320, 511-612
Early retirement (0/1)	JOB_P_SOCIO_KODE	2008-2022	412, 413, 416, 417
Pension income (DKK)	QTILPENS + QANDPENS	1991-2022	
Pension income (0/1)	QTILPENS + QANDPENS	1991-2022	pension income > 0
Real assets (DKK)	BLB	2014-2020	FORMUEART: A
Financial assets (DKK)	BLB	2014-2020	FORMUEART: B
Mortgage debt (DKK)	BLB	2014-2020	FORMUEART: E
Other loans (DKK)	BLB	2014-2020	FORMUEART: F
<i>Control variables</i>			
Married (0/1)	CIVST	1986-2022	G
Children at home (0/1)	ANTBOERNH	1986-2022	ANTBOERNH > 0
Experience (years)	ERHVERV_AKK + ERHVERV_1979	1980-2022	(ERHVERV_AKK + ERHVERV_1979)/1000
Male (0/1)	KOEN	1986-2022	1
Payment VERP (0/1)	INDBEEFT	1999-2022	INDBEEFT > 0
Tenure (years)	AAR - ANSAAR	1980-2022	
Earnings (deciles)	LOEN_BELOEB_SMAL	2008-2022	
Other wealth (ventiles)	FORMREST_NY05	1997-2022	
Education (groups)	HFAUDD	1981-2022	AUDD2015_L1L5_K to create six education groups
Occupation (groups)	JOB_DISKO_KODE	2008-2022	DISCO-08 groups

Notes: This table details construction of key outcome and control variables used in the analysis.

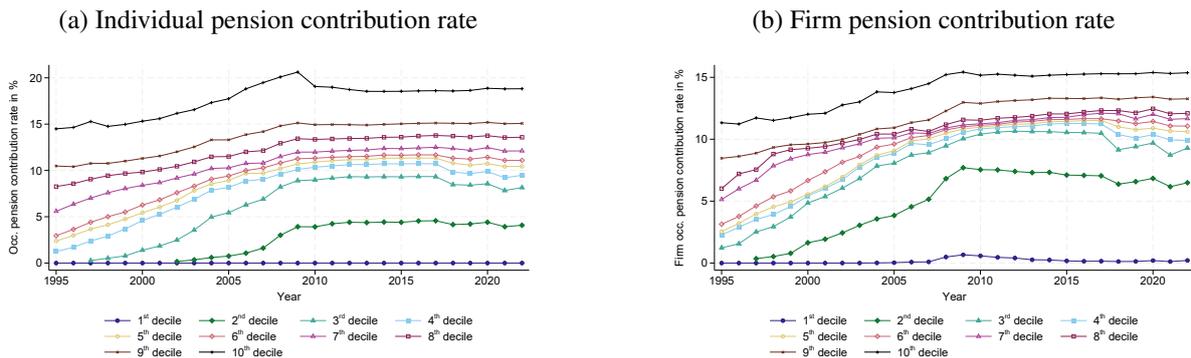
### C.3 Broad population descriptives

Figure C.1: Labor Supply by Pension Wealth



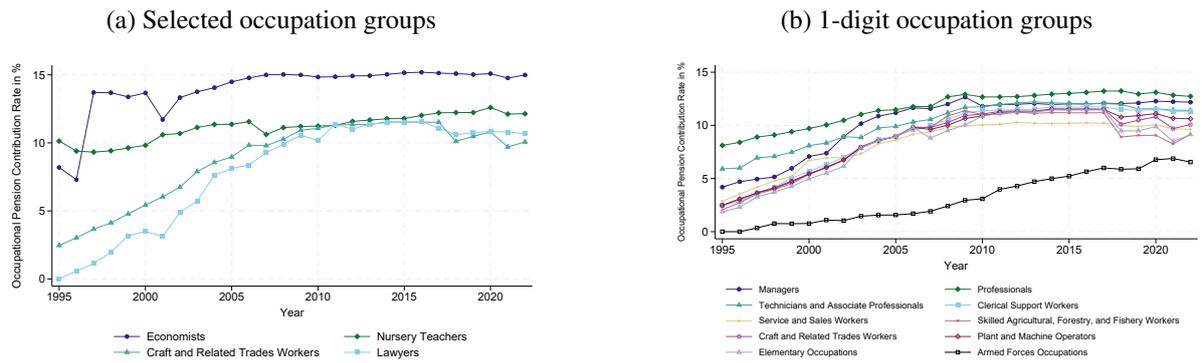
Notes: Displays labor supply by age and pension wealth at age 59 for the years 2014-2022. Panel (a) shows labor supply for age 59 to 67 for the 25% of individuals with lowest pension wealth by cohort, and panel (b) shows labor supply for age 59 to 67 for the 25% of individuals with the highest pension wealth by cohort. Civil servant recipients are excluded.

Figure C.2: Occupational Pension Contribution Rates over Time by Deciles



Notes: Panel (a) displays the average individual occupational pension contribution rate over time by deciles, and panel (b) displays the average firm occupational contribution rate over time weighted by individuals by deciles. The sample is individuals aged 25 to 55 with only one employer in a year for the years 1995-2022.

Figure C.3: Occupational Pension Contribution Rates over Time by Occupation Groups



Notes: Panel (a) displays the average individual occupational pension contribution rate over time for selected occupation groups, and panel (b) displays the average individual occupational pension contribution rate over time for 1-digit occupation groups. The sample is individuals aged 25 to 55 with only one employer in a year for the years 1995-2022.

#### C.4 Analysis sample descriptives

Table C.3: Descriptive Statistics for Analysis Sample

	Mean	SD
Pension wealth age 55	2,118,192.68	1,458,116.38
FC age 40	8.28	3.45
<i>Control variables measured at age 55:</i>		
Year	2018.19	2.55
Married	0.64	0.48
Children at home	0.32	0.47
Male	0.46	0.50
Lower secondary, primary, and unknown	0.15	0.36
Upper secondary	0.05	0.22
Vocational education	0.44	0.50
Short cycle tertiary	0.06	0.23
Bachelor	0.21	0.41
Master and doctoral	0.08	0.27
Experience (years)	31.28	6.82
Payment to VERP	0.40	0.49
Tenure (years)	9.01	8.26
Earnings	508,935.78	214,254.38
Other wealth	420,389.10	838,253.31
<i>Occupation</i>		
Managers	0.07	0.25
Professionals	0.27	0.45
Technicians and associate professionals	0.15	0.36
Clerical support workers	0.12	0.32
Services and sales workers	0.14	0.35
Skilled agricultural, forestry, and fishery	0.00	0.06
Craft and related trades workers	0.08	0.27
Plant and machine operators and assemblers	0.08	0.27
Elementary occupations	0.08	0.28
<i>N</i>	213,349	

*Notes:* This table reports mean and standard deviation for pension wealth at age 55, FC (firm specific pension contribution rate) age 40, and control variables measured at age 55 for the sample in the first stage regression (Equation 1), see Subsection 4.3 for description of sample selection. All monetary values are measured in DKK (2023 prices). Other wealth refers to net wealth excluding pension wealth.

Table C.4: External Validity

	Selected sample		Total population	
	Mean	SD	Mean	SD
Pension wealth (DKK)	2,118,192.68	1,458,116.38	1,740,242.40	1,932,488.13
Male	0.46	0.50	0.50	0.50
Experience (years)	31.28	6.82	24.61	11.66
Earnings (DKK)	508,935.78	214,254.38	341,632.12	297,211.84
Other wealth (DKK)	420,389.10	838,253.31	429,163.92	1,121,999.00
<i>N</i>	213,349		720,495	

*Notes:* This table reports mean and standard deviation for selected variables measured at age 55 for the full population of individuals born in 1959-1967 and for the selected sample used in the first stage regression (Equation 1), see Subsection 4.3 for description of sample selection. All monetary values are measured in DKK (2023 prices). Other wealth refers to net wealth excluding pension wealth.

## D Baseline results: Additional details

In Appendix D, we show additional details for our baseline results. First, we show our first stage results in Table D.1. Second, we show the estimated effects of FC age 40 on individual variables at ages 40 to 55, e.g., the private pension contribution rate, sickness benefits, and the monetary amount of pension contributions. Third, we investigate the variation driving our first stage and reduced form results. Then, we present tables with the estimates for our reduced form (Table D.4) and IV (Table D.5) analyses for our main labor market outcomes.

### D.1 First Stage

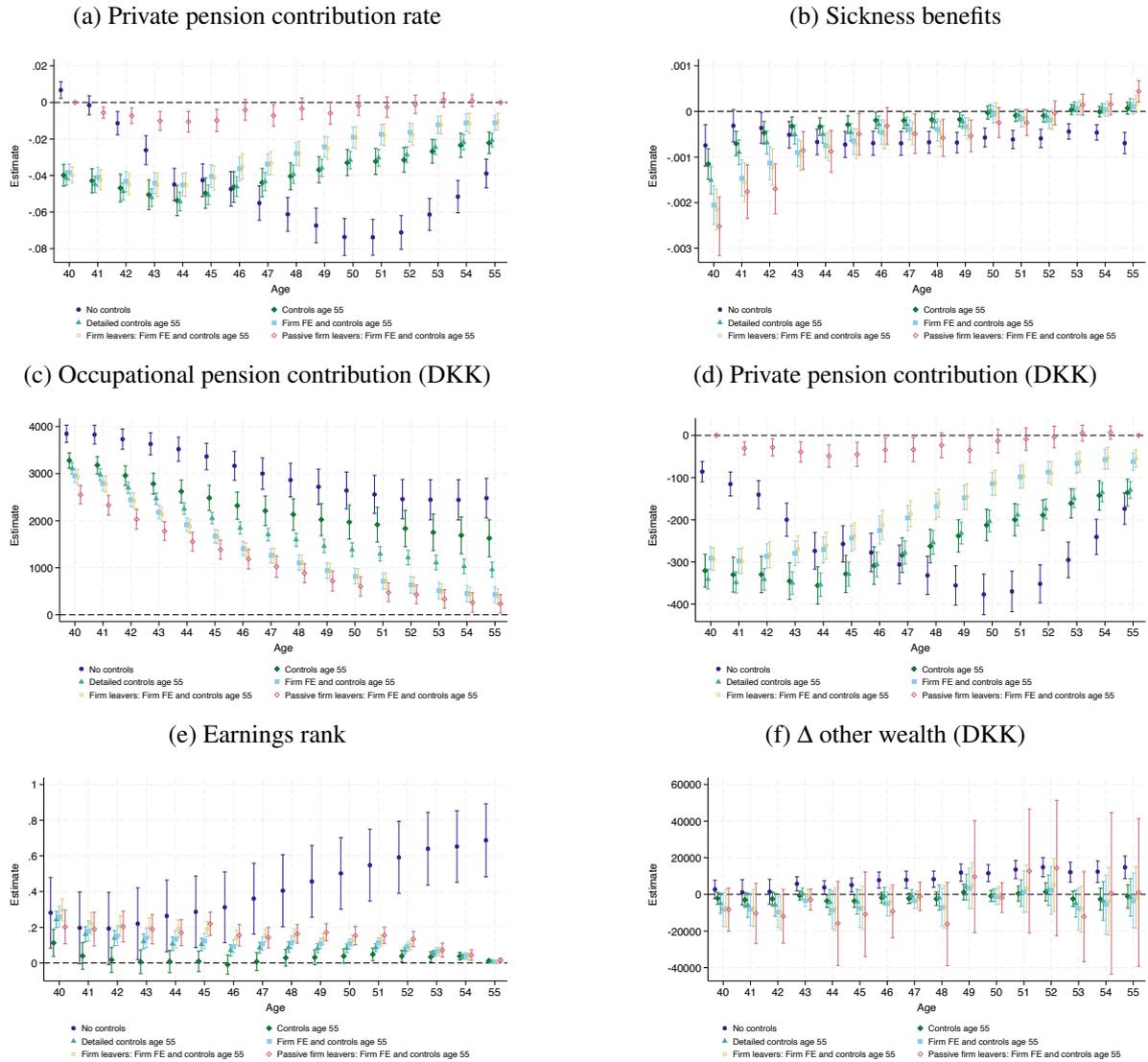
Table D.1: First Stage

	Pension wealth (1)	Pension wealth (2)	Pension wealth (3)
FC age 40	115,542.21*** (7139.09)	94,709.19*** (4804.29)	63,303.71*** (2766.87)
Controls age 55	No	Yes	Yes
Firm FE age 55	No	No	Yes
Observations	229,668	229,668	213,349
$R^2$	0.077	0.412	0.520
Mean	2,096,483.58	2,096,483.58	2,118,192.68
Pct. Change	5.51	4.52	2.99

*Notes:* This table reports the results from the first stage regression (Equation 1) where FC is the firm-specific occupational pension contribution rate at age 40. In columns (1)-(3), the outcome variable is pension wealth at age 55. Column (1) includes no control variables, column (2) includes controls at age 55, and column (3) includes controls and firm FE at age 55. Controls at age 55 include year FE, dummy for payment to VERP scheme, male dummy, education dummies, marriage dummy, children at home dummy, experience, experience squared, tenure, 1-digit occupation dummies, earnings (deciles), and net wealth excluding pension wealth (ventiles). We show a robustness check additionally varying the inclusion of control variables in Appendix F.1. All monetary values are in DKK (2023 prices). Standard errors are clustered at the firm level at age 55 and shown in parentheses. Significance levels are indicated as \*  $p < 0.05$ , \*\*  $p < 0.01$ , and \*\*\*  $p < 0.001$ .

### D.2 Estimated effect of FC age 40

Figure D.1: Estimated Effect of FC Age 40



*Notes:* This figure shows the estimated effect of the firm-specific pension contribution rate (FC) at age 40 on the following individual variables at ages 40 to 55: the individual private pension contribution rate in panel (a), a dummy for receiving sickness benefits in panel (b), individual occupational pension contribution (DKK) in panel (c), individual private pension contribution (DKK) in panel (d), earnings percentile rank by year in panel (e), and yearly change in net wealth (excluding pension wealth) in panel (f). Controls at age 55 are the following baseline controls: year FE, dummy for payment to the VERP scheme, male dummy, education dummies, marriage dummy, children at home dummy, experience, experience squared, tenure, 1-digit occupation dummies, earnings (deciles), and net wealth excluding pension wealth (ventiles). Detailed controls age 55 are our baseline controls age 55 and additionally include three firm characteristics measured at age 55: industry dummies at the 3-digit level, number of employees in the firm, and start year of firm. Firm FE is firm fixed effects at age 55. Firm leavers are defined as individuals who are not employed in the same firm at age 55 as they were at age 40. Passive savers are defined as individuals who did not contribute to a private pension scheme at ages 40 and 55. Standard errors are clustered at the firm level at age 55, and 95% confidence intervals are shown.

### D.3 Understanding our variation

In this section, we further explore our variation in the FC age 40. First, in [Table D.2](#), we decompose variance for the residualized FC in a between- and within-group for firms, industries, occupations, and earnings deciles. Second, in [Table D.3](#), we show the  $R^2$  of regressing wage, earnings, year-occupation, year-industry, or year-earnings decile groups, and lagged FC on FC age 40 as well as a residualized measure of the FC age 40 (using baseline control variables and firm fixed effects) to understand to what degree these variables can explain the variation in the FC age 40. Third, in [Figure D.2](#), we plot the relationship between FC age 40 and earnings age 63 as well as the residualized FC age 40 and residualized earnings age 63 to graphically investigate the relationship between these variables. Age 63 is chosen as this is the latest age available in our main IV set-up.

Table D.2: Decomposition of Variance

	Firms (1)	Industries (2)	Occupations (3)	Earnings Deciles (4)
<i>Variance</i>				
Between-Group	3.956	0.142	0.105	0.017
Within-Group	2.026	5.840	5.877	5.965
<i>Share of Variance</i>				
Between-Group	0.661	0.024	0.018	0.003
Within-Group	0.339	0.976	0.982	0.997

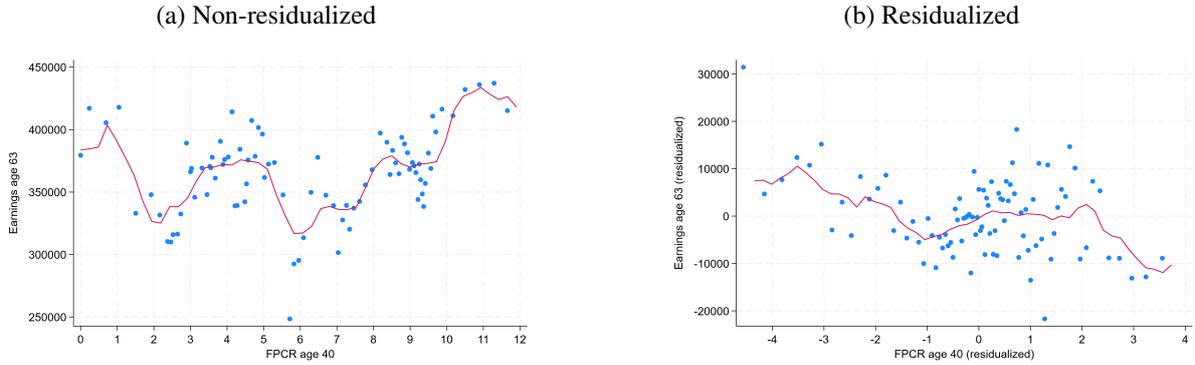
*Notes:* For the first stage sample, we show the between- and within-group variance for the residualized firm-specific pension contribution rate (FC) at age 40 for firms at age 40 in column (1), 1-digit industries at age 40 in column (2), 1-digit occupation groups at age 40 in column (3), and earnings deciles at age 40 in column (4). We obtain the residualized FC age 40 by regressing the FC age 40 on controls and firm FE age 55. Controls at age 55 include year FE, dummy for payment to VERP scheme, male dummy, education dummies, marriage dummy, children at home dummy, experience, experience squared, tenure, 1-digit occupation dummies, earnings (deciles), and net wealth excluding pension wealth (ventiles).

Table D.3:  $R^2$  for Residualized FC age 40 and FC age 40

	Residualized FC 40	FC age 40
Log Hourly Wage	0.000	0.004
Log Earnings	0.002	0.008
Year $\times$ Occupation	0.030	0.168
Year $\times$ Industry	0.041	0.213
Year $\times$ Earnings Deciles	0.006	0.108
Lagged FC	0.370	0.864

*Notes:* This table displays the  $R^2$  from regressing variables on the residualized FC age 40 in column (1) and FC age 40 in column (2) for the first stage sample. "Log Hourly Wage" is the logarithm to hourly wage at age 40, "Log Earnings" is logarithm to earnings age 40, "Year  $\times$  Occupation" is year age 40 by 1-digit occupation groups age 40, "Year  $\times$  Industry" is year age 40 by 1-digit industry groups age 40, "Year  $\times$  Earnings Deciles" is year at age 40 by earnings deciles age 40, and "Lagged FC" is the individual's firm specific pension contribution rate at age 39. We obtain the residualized FC age 40 by regressing the FC age 40 on the following measured at age 55: Firm FE, year FE, dummy for payment to VERP scheme, male dummy, education dummies, marriage dummy, children at home dummy, experience, experience squared, tenure, 1-digit occupation dummies, earnings (deciles), and net wealth excluding pension wealth (ventiles).

Figure D.2: Reduced Form Earnings age 63: Variation



*Notes:* For panel (a), we divide the firm-specific occupational pension contribution rate (FC) at age 40 into 100 equally sized bins and then plot the mean of FC and earnings age 63 within each bin as the blue dots. The red line is the local linear regressions of the FC and earnings age 63 using a rectangular kernel. In panel (b), we first regress the FC at age 40 on the explanatory variables (see Section 5) to obtain the residualized FC. We then repeat this for earnings at age 63. We divide the residualized FC into 100 equally sized bins and then plot the mean of residualized FC and residualized earnings age 63 within each bin as the blue dots. The red line is the local linear regressions of the FC residual and the earning residual using a rectangular kernel. For both (a) and (b), we exclude values below the 5<sup>th</sup> percentile and above the 95<sup>th</sup> percentile.

#### D.4 Tables: Reduced form and IV

Table D.4: Reduced Form Estimates for Labor Market Outcomes

	Age 56 (1)	Age 57 (2)	Age 58 (3)	Age 59 (4)	Age 60 (5)	Age 61 (6)	Age 62 (7)	Age 63 (8)	Age 64 (9)	Age 65 (10)	Age 66 (11)	Age 67 (12)
Panel A: Earnings (DKK)												
FC age 40	163.76 (86.91)	-47.26 (115.79)	-168.33 (143.12)	-74.87 (166.16)	-249.25 (191.57)	-470.18* (225.59)	-909.61*** (251.38)	-1872.09*** (329.44)	-2411.64*** (396.76)	-2624.03*** (494.55)	-3201.49*** (615.05)	-2703.69*** (761.79)
Observations	259,130	230,394	202,927	176,590	150,641	126,927	104,573	83,428	63,815	45,882	29,156	13,039
R <sup>2</sup>	0.821	0.748	0.695	0.645	0.597	0.542	0.490	0.445	0.412	0.382	0.348	0.321
Mean	494,464.14	483,464.72	474,219.08	465,099.57	454,098.36	440,197.28	417,348.84	367,724.70	291,232.48	230,223.84	176,432.62	111,652.98
Pct. Change	0.03	-0.01	-0.04	-0.02	-0.05	-0.11	-0.22	-0.51	-0.83	-1.14	-1.81	-2.42
Panel B: Employment												
FC age 40	-0.000 (0.000)	-0.000** (0.000)	-0.001** (0.000)	-0.000 (0.000)	-0.001** (0.000)	-0.001** (0.000)	-0.002*** (0.000)	-0.005*** (0.001)	-0.005*** (0.001)	-0.006*** (0.001)	-0.006*** (0.001)	-0.005** (0.002)
Observations	259,130	230,394	202,927	176,590	150,641	126,927	104,573	83,428	63,815	45,882	29,156	13,039
R <sup>2</sup>	0.122	0.126	0.129	0.131	0.130	0.135	0.163	0.201	0.238	0.248	0.252	0.242
Mean	0.973	0.959	0.948	0.937	0.922	0.894	0.841	0.702	0.557	0.444	0.352	0.239
Pct. Change	-0.006	-0.051	-0.072	-0.052	-0.101	-0.128	-0.249	-0.652	-0.951	-1.249	-1.575	-2.084
Panel C: Partial employment												
FC age 40	0.000* (0.000)	0.000* (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	-0.000 (0.000)	-0.000 (0.000)	0.000 (0.000)	0.000 (0.001)
Observations	259,130	230,394	202,927	176,590	150,641	126,927	104,573	83,428	63,815	45,882	29,156	13,039
R <sup>2</sup>	0.141	0.123	0.116	0.119	0.122	0.121	0.126	0.126	0.129	0.144	0.146	0.161
Mean	0.002	0.004	0.006	0.008	0.011	0.012	0.013	0.014	0.017	0.019	0.021	0.028
Pct. Change	3.875	3.352	2.495	1.920	0.485	1.967	1.385	1.744	-0.523	-0.178	1.900	0.582
Panel D: Self-supporting												
FC age 40	-0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	0.001*** (0.000)	0.001*** (0.000)	0.001*** (0.000)	0.003*** (0.000)	0.003*** (0.000)	0.004*** (0.001)	0.003*** (0.001)	0.000 (0.000)
Observations	259,130	230,394	202,927	176,590	150,641	126,927	104,573	83,428	63,815	45,882	29,156	13,039
R <sup>2</sup>	0.102	0.099	0.099	0.096	0.100	0.111	0.127	0.147	0.178	0.198	0.214	0.160
Mean	0.004	0.006	0.008	0.011	0.018	0.026	0.034	0.044	0.051	0.061	0.055	0.012
Pct. Change	-0.259	2.047	1.838	1.636	3.586	3.533	4.362	5.873	5.699	6.081	4.646	1.737

Notes: This table reports reduced form estimates (Equation 2) for ages 56 to 67. In panel A, the outcome variable is earnings (DKK), in panel B the outcome variable is a dummy for being employed, in panel C the outcome variable is a dummy for being partially employed, and in panel D the outcome variable is a dummy for being self-supporting. Controls age 55 include firm FE, year FE, dummy for payment to VERP scheme, male dummy, education dummies, marriage dummy, children at home dummy, experience, experience squared, tenure, 1-digit occupation dummies, earnings (deciles), and net wealth excluding pension wealth (ventiles). All monetary values are in DKK (2023 prices). Standard errors are clustered at the firm level at age 55 and shown in parentheses. Significance levels are indicated as \*  $p < 0.05$ , \*\*  $p < 0.01$ , and \*\*\*  $p < 0.001$ .

Table D.5: IV Estimates for Labor Market Outcomes

	Age 56 (1)	Age 57 (2)	Age 58 (3)	Age 59 (4)	Age 60 (5)	Age 61 (6)	Age 62 (7)	Age 63 (8)
<b>Panel A: Earnings (DKK)</b>								
Pension wealth (100K DKK)	316.53** (156.85)	9.32 (217.35)	-255.53 (259.99)	-272.80 (328.29)	-662.84 (406.80)	-1078.91* (559.50)	-2136.94*** (791.19)	-4998.57*** (1736.85)
Observations	185,417	157,130	130,087	1042,89	79,118	56,218	35,011	15,657
R <sup>2</sup>	0.731	0.636	0.573	0.517	0.462	0.401	0.343	0.245
Mean	507,207.19	497,251.42	487,339.57	476,906.95	464,042.65	447,989.30	429,164.63	396,254.20
Pct. Change	0.06	0.00	-0.05	-0.06	-0.14	-0.24	-0.50	-1.26
<b>Panel B: Employment</b>								
Pension wealth (100K DKK)	-0.000 (0.000)	-0.001*** (0.000)	-0.001*** (0.000)	-0.001 (0.001)	-0.002*** (0.001)	-0.002** (0.001)	-0.005*** (0.002)	-0.012*** (0.004)
Observations	185,417	157,130	130,087	1042,89	79,118	56,218	35,011	15,657
R <sup>2</sup>	0.024	0.025	0.029	0.034	0.032	0.040	0.035	-0.015
Mean	0.975	0.963	0.952	0.941	0.924	0.899	0.870	0.808
Pct. Change	-0.010	-0.111	-0.138	-0.075	-0.251	-0.230	-0.563	-1.478
<b>Panel C: Partial employment</b>								
Pension wealth (100K DKK)	0.000*** (0.000)	0.000** (0.000)	0.000 (0.000)	0.000 (0.000)	-0.000 (0.000)	0.000 (0.000)	0.001 (0.001)	0.001 (0.001)
Observations	185,417	157,130	130,087	1042,89	79,118	56,218	35,011	15,657
R <sup>2</sup>	0.035	0.023	0.017	0.010	0.008	0.010	0.008	0.013
Mean	0.003	0.005	0.007	0.009	0.011	0.012	0.013	0.014
Pct. Change	8.399	6.253	2.135	2.118	-1.701	2.351	6.195	5.173
<b>Panel D: Self-supporting</b>								
Pension wealth (100K DKK)	-0.000 (0.000)	0.000* (0.000)	0.000* (0.000)	0.000 (0.000)	0.001*** (0.000)	0.002*** (0.001)	0.003*** (0.001)	0.007*** (0.002)
Observations	185,417	157,130	130,087	1042,89	79,118	56,218	35,011	15,657
R <sup>2</sup>	0.005	0.006	0.008	0.011	0.012	0.017	0.019	-0.022
Mean	0.004	0.006	0.008	0.012	0.018	0.027	0.035	0.049
Pct. Change	-1.163	3.972	3.781	3.170	7.835	6.941	8.059	14.891

Notes: This table reports IV estimates (Equation 3) for ages 56 to 63. In panel A, the outcome variable is earnings (DKK), in panel B the outcome variable is a dummy for being employed, in panel C the outcome variable is a dummy for being partially employed, and in panel D the outcome variable is a dummy for being self-supporting. Controls age 55 include firm FE, year FE, dummy for payment to VERP scheme, male dummy, education dummies, marriage dummy, children at home dummy, experience, experience squared, tenure, 1-digit occupation dummies, earnings (deciles), and net wealth excluding pension wealth (ventiles). All monetary values are in DKK (2023 prices). Standard errors are clustered at the firm level at age 55 and shown in parentheses. Significance levels are indicated as \*  $p < 0.05$ , \*\*  $p < 0.01$ , and \*\*\*  $p < 0.001$ .

## E Additional results

In Appendix E, we show additional results. We begin by repeating our analysis with pension wealth at age 59. Second, we rerun our analysis using FC at age 35 with a twenty-year interval (instead of FC at age 40 with a fifteen-year interval). Third, we show the impact on non-public pension income and the probability of being self-supporting by whether an individual has non-public pension income. Then, we show results on early retirement, disposable income, and financial outcomes. We also investigate responses by liquidity constraints. Additionally, we show results on bridging behavior (transfers, disability pension). Finally, we show subgroup heterogeneity by gender, savings behavior, educational level, homeownership, and marital status.

### E.1 Pension wealth age 59

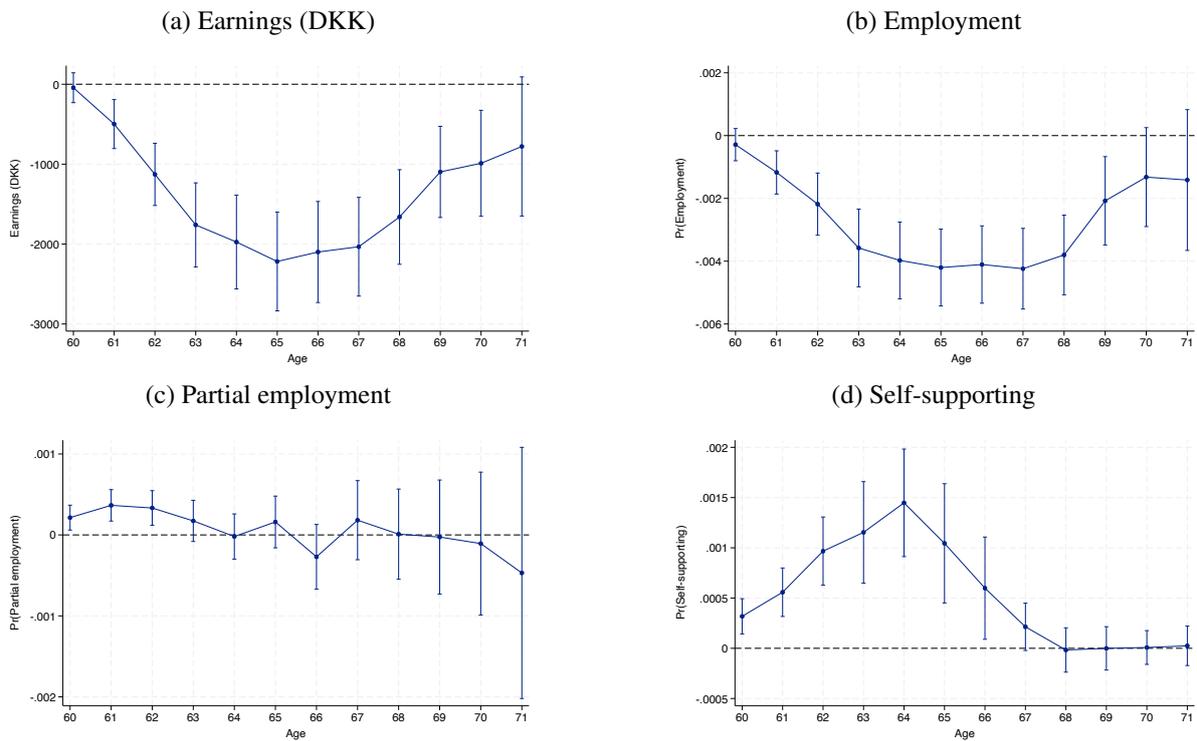
We repeat our first stage (Table E.1), reduced form (Figure E.1 and Table E.2), and IV analyses (Table E.3 and Figure E.2) using FC age 44 (instead of age 40) and pension wealth age 59 (instead of age 55).

Table E.1: First Stage: Age 59

	Pension wealth (1)	Pension wealth (2)	Pension wealth (3)
FC age 44	128,854.21*** (8432.02)	108,640.41*** (6235.86)	69,372.23*** (3817.10)
Controls age 59	No	Yes	Yes
Firm FE age 59	No	No	Yes
Observations	212,720	212,720	197,459
$R^2$	0.071	0.414	0.523
Mean	2,360,883.88	2,360,883.88	2,383,083.05
Pct. Change	5.46	4.60	2.91

*Notes:* This table reports the results from the first stage regression (Equation 1) where FC is the firm occupational pension contribution rate at age 44. In columns (1)-(3), the outcome variable is pension wealth at age 59. Column (1) includes no control variables, column (2) includes controls at age 59, and column (3) includes firm FE and controls at age 59. Controls age 59 include year FE, dummy for payment to VERP scheme, male dummy, education dummies, marriage dummy, children at home dummy, experience, experience squared, tenure, 1-digit occupation dummies, earnings (deciles), and net wealth excluding pension wealth (ventiles). All monetary values are in DKK (2023 prices). Standard errors are clustered at the firm level at age 59 and shown in parentheses. Significance levels are indicated as \*  $p < 0.05$ , \*\*  $p < 0.01$ , and \*\*\*  $p < 0.001$ .

Figure E.1: Reduced Form Estimates for Labor Market Outcomes: Age 59



*Notes:* This figure plots reduced form estimates (Equation 2) for FC age 44 for ages 60 to 71. In panel (a), the outcome variable is earnings (DKK), in panel (b) the outcome variable is a dummy for being employed, in panel (c) the outcome variable is a dummy for being partially employed, and in panel (d) the outcome variable is a dummy for being self-supporting. Controls measured at age 59 include firm FE, year FE, dummy for payment to VERP scheme, male dummy, education dummies, marriage dummy, children at home dummy, experience, experience squared, tenure, 1-digit occupation dummies, earnings (deciles), and net wealth excluding pension wealth (ventiles). All monetary values are in DKK (2023 prices). Standard errors are clustered at the firm level at age 59, and 95% confidence intervals are shown.

Table E.2: Reduced Form Estimates for Labor Market Outcomes

	Age 60 (1)	Age 61 (2)	Age 62 (3)	Age 63 (4)	Age 64 (5)	Age 65 (6)	Age 66 (7)	Age 67 (8)	Age 68 (9)	Age 69 (10)	Age 70 (11)	Age 71 (12)
Panel A: Earnings (DKK)												
FC age 44	-43.49 (95.28)	-498.32** (156.39)	-1128.07*** (198.70)	-1760.20*** (268.39)	-1974.39*** (299.17)	-2217.71*** (315.50)	-2099.35*** (322.65)	-2033.21*** (315.14)	-1661.31*** (302.06)	-1096.87*** (291.00)	-989.05** (338.51)	-778.50 (444.24)
Observations	226,607	201,799	177,629	154,620	132,650	111,633	92,004	73,019	55,601	40,050	25,060	11,386
R <sup>2</sup>	0.798	0.648	0.572	0.499	0.440	0.398	0.351	0.304	0.269	0.257	0.244	0.231
Mean	455,632.58	423,320.00	388,599.01	327,237.85	260,445.94	205,068.80	139,220.04	91,864.68	61,437.92	44,262.06	31,251.86	20,677.17
Pct. Change	-0.01	-0.12	-0.29	-0.54	-0.76	-1.08	-1.51	-2.21	-2.70	-2.48	-3.16	-3.76
Panel B: Employment												
FC age 44	-0.000 (0.000)	-0.001*** (0.000)	-0.002*** (0.001)	-0.004*** (0.001)	-0.004*** (0.001)	-0.004*** (0.001)	-0.004*** (0.001)	-0.004*** (0.001)	-0.004*** (0.001)	-0.002** (0.001)	-0.001 (0.001)	-0.001 (0.001)
Observations	226,607	201,799	177,629	154,620	132,650	111,633	92,004	73,019	55,601	40,050	25,060	11,386
R <sup>2</sup>	0.162	0.198	0.244	0.256	0.259	0.261	0.247	0.227	0.220	0.225	0.215	0.221
Mean	0.929	0.870	0.776	0.634	0.512	0.386	0.289	0.209	0.163	0.132	0.103	0.084
Pct. Change	-0.031	-0.135	-0.281	-0.565	-0.776	-1.089	-1.422	-2.026	-2.334	-1.579	-1.286	-1.674
Panel C: Partial employment												
FC age 44	0.000** (0.000)	0.000*** (0.000)	0.000** (0.000)	0.000 (0.000)	-0.000 (0.000)	0.000 (0.000)	-0.000 (0.000)	0.000 (0.000)	0.000 (0.000)	-0.000 (0.000)	-0.000 (0.000)	-0.000 (0.001)
Observations	226,607	201,799	177,629	154,620	132,650	111,633	92,004	73,019	55,601	40,050	25,060	11,386
R <sup>2</sup>	0.206	0.172	0.139	0.124	0.120	0.128	0.120	0.128	0.142	0.153	0.168	0.184
Mean	0.005	0.007	0.009	0.011	0.013	0.015	0.021	0.025	0.028	0.027	0.025	0.026
Pct. Change	3.948	4.886	3.811	1.611	-0.147	1.045	-1.262	0.736	0.034	-0.097	-0.420	-1.782
Panel D: Self-supporting												
FC age 44	0.000*** (0.000)	0.001*** (0.000)	0.001*** (0.000)	0.001*** (0.000)	0.001*** (0.000)	0.001*** (0.000)	0.001* (0.000)	0.000 (0.000)	-0.000 (0.000)	-0.000 (0.000)	0.000 (0.000)	0.000 (0.000)
Observations	226,607	201,799	177,629	154,620	132,650	111,633	92,004	73,019	55,601	40,050	25,060	11,386
R <sup>2</sup>	0.089	0.102	0.115	0.132	0.164	0.159	0.150	0.112	0.104	0.114	0.159	0.134
Mean	0.008	0.015	0.022	0.029	0.033	0.031	0.021	0.005	0.002	0.002	0.001	0.001
Pct. Change	3.825	3.676	4.462	3.969	4.405	3.338	2.802	4.307	-0.690	-0.035	0.568	3.100

Notes: This table reports reduced form estimates (Equation 2) for FC age 44 for ages 60 to 71. In panel A, the outcome variable is earnings (DKK), in panel B the outcome variable is a dummy for being employed, in panel C the outcome variable is a dummy for being partially employed, and in panel D the outcome variable is a dummy for being self-supporting. Controls age 59 include firm FE, year FE, dummy for payment to VERP scheme, male dummy, education dummies, marriage dummy, children at home dummy, experience, experience squared, tenure, 1-digit occupation dummies, earnings (deciles), and net wealth excluding pension wealth (ventiles). All monetary values are in DKK (2023 prices). Standard errors are clustered at the firm level at age 59 and shown in parentheses. Significance levels are indicated as \*  $p < 0.05$ , \*\*  $p < 0.01$ , and \*\*\*  $p < 0.001$ .

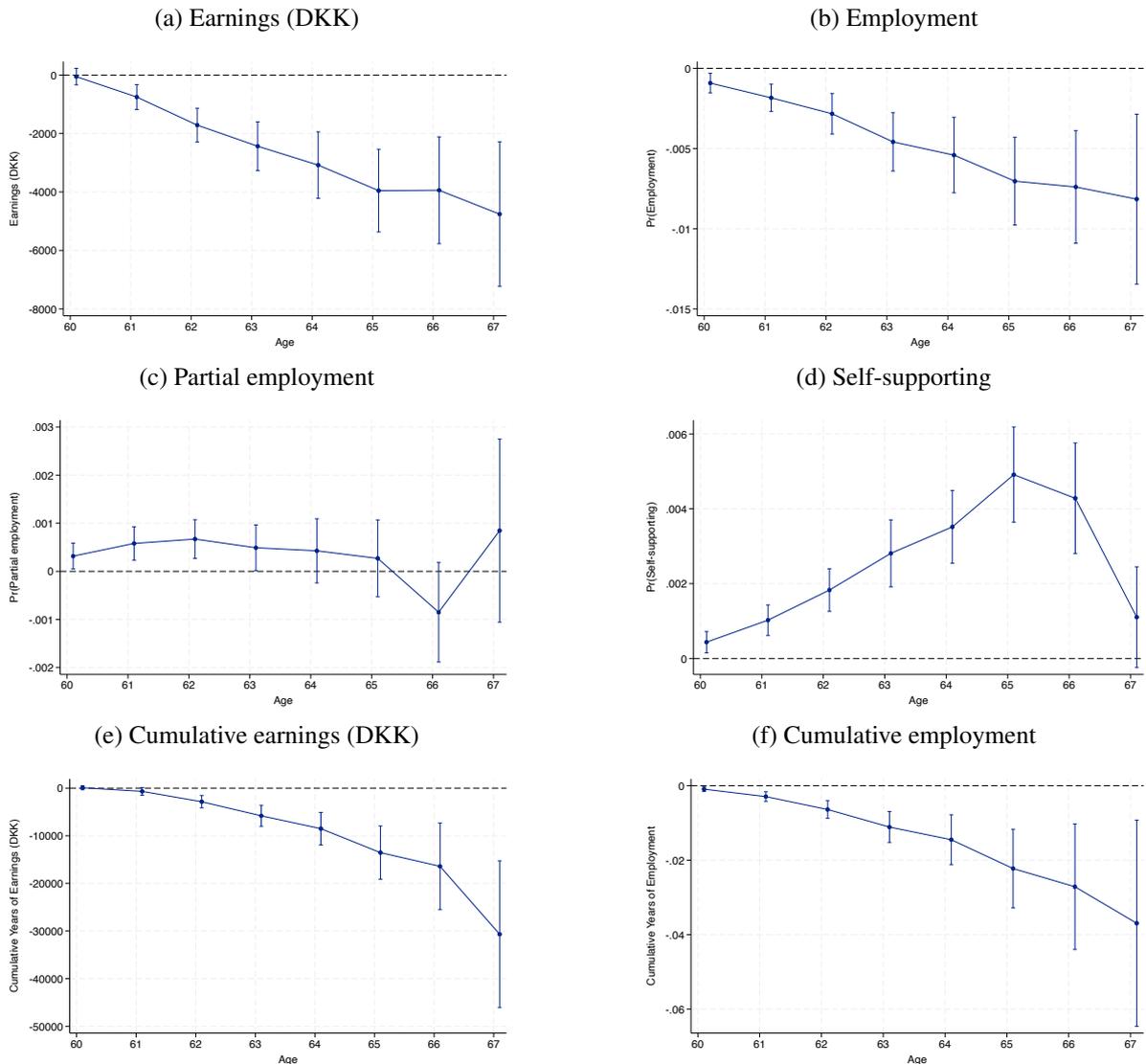
Table E.3: IV Estimates for Labor Market Outcomes: Pension Wealth Age 59

	Age 60 (1)	Age 61 (2)	Age 62 (3)	Age 63 (4)	Age 64 (5)	Age 65 (6)	Age 66 (7)	Age 67 (8)
Panel A: Earnings (DKK)								
Pension wealth (100K DKK)	-51.69 (144.40)	-750.71*** (217.30)	-1712.03*** (295.44)	-2433.98*** (424.20)	-3079.63*** (580.38)	-3953.58*** (722.45)	-3940.86*** (932.43)	-4756.95*** (1262.48)
Observations	160,894	136,592	112,950	90,587	69,304	49,253	30,832	13,649
R <sup>2</sup>	0.714	0.550	0.439	0.351	0.295	0.245	0.195	0.104
Mean	471,838.31	454,147.95	428,410.69	375,792.02	296,325.32	234,071.39	179,242.72	115,114.55
Pct. Change	-0.01	-0.17	-0.40	-0.65	-1.04	-1.69	-2.20	-4.13
Panel B: Employment								
Pension wealth (100K DKK)	-0.001*** (0.000)	-0.002*** (0.000)	-0.003*** (0.001)	-0.005*** (0.001)	-0.005*** (0.001)	-0.007*** (0.001)	-0.007*** (0.002)	-0.008*** (0.003)
Observations	160,894	136,592	112,950	90,587	69,304	49,253	30,832	13,649
R <sup>2</sup>	0.018	0.033	0.073	0.102	0.129	0.128	0.109	0.052
Mean	0.964	0.928	0.868	0.721	0.571	0.455	0.360	0.242
Pct. Change	-0.095	-0.198	-0.326	-0.636	-0.949	-1.547	-2.056	-3.366
Panel C: Partial employment								
Pension wealth (100K DKK)	0.000** (0.000)	0.001*** (0.000)	0.001*** (0.000)	0.000** (0.000)	0.000 (0.000)	0.000 (0.000)	-0.001 (0.001)	0.001 (0.001)
Observations	160,894	136,592	112,950	90,587	69,304	49,253	30,832	13,649
R <sup>2</sup>	0.106	0.065	0.041	0.023	0.014	0.009	-0.006	0.005
Mean	0.007	0.008	0.009	0.010	0.014	0.015	0.018	0.022
Pct. Change	4.870	7.190	7.196	4.727	3.130	1.798	-4.748	3.840
Panel D: Self-supporting								
Pension wealth (100K DKK)	0.000*** (0.000)	0.001*** (0.000)	0.002*** (0.000)	0.003*** (0.000)	0.004*** (0.000)	0.005*** (0.001)	0.004*** (0.001)	0.001 (0.001)
Observations	160,894	136,592	112,950	90,587	69,304	49,253	30,832	13,649
R <sup>2</sup>	0.011	0.021	0.032	0.047	0.076	0.097	0.097	0.018
Mean	0.009	0.017	0.026	0.036	0.043	0.053	0.049	0.011
Pct. Change	4.984	6.078	7.167	7.823	8.142	9.351	8.794	10.039

Notes: This table reports IV estimates (Equation 3) for pension wealth age 59 for ages 60 to 67. In panel A, the outcome variable is earnings (DKK), in panel B the outcome variable is a dummy for being employed, in panel C the outcome variable is a dummy for being partially employed, and in panel D the outcome variable is a dummy for being self-supporting. Controls measured age 59 include firm FE, year FE, dummy for payment to VERP scheme, male dummy, education dummies, marriage dummy, children at home dummy, experience, experience squared, tenure, 1 digit occupation dummies, earnings (deciles), and net wealth excluding pension wealth (ventiles). All monetary values are in DKK (2023 prices). Standard errors are clustered at the firm level at age 59 and shown in parentheses. Significance levels are indicated as \*  $p < 0.05$ , \*\*  $p < 0.01$ , and \*\*\*  $p < 0.001$ .

## E.2 Figures: IV age 59

Figure E.2: IV Estimates: Pension Wealth at Age 59



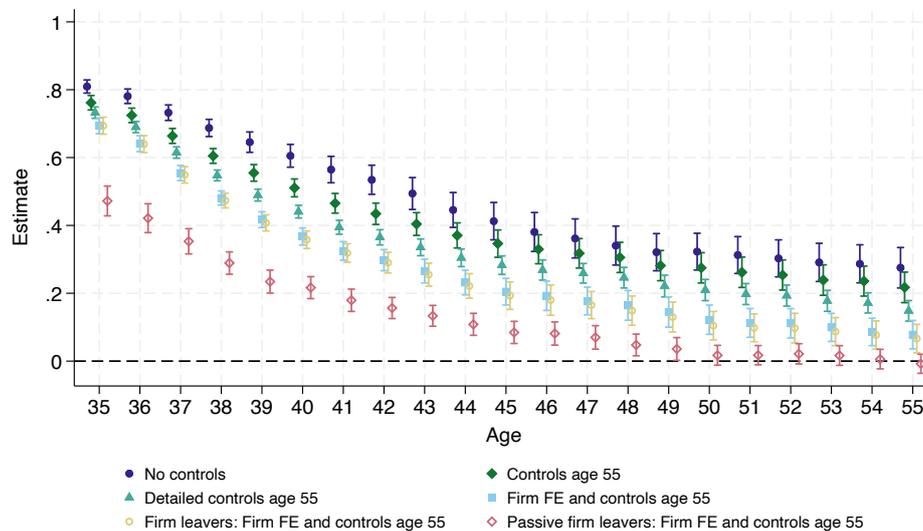
*Notes:* This figure plots IV estimates (Equation 3) for ages 60 to 67 for pension wealth measured at age 59. In panel (a), the outcome variable is earnings (DKK), in panel (b) the outcome variable is a dummy for being employed, in panel (c) the outcome variable is a dummy for being partially employed, in panel (d) the outcome variable is a dummy for being self-supporting, in panel (e) the outcome is cumulative earnings (DKK) since age 60, and in panel (f) the outcome is cumulative years of employment since age 60. Controls measured at age 59 include firm FE, year FE, dummy for payment to VERP scheme, male dummy, education dummies, marriage dummy, children at home dummy, experience, experience squared, tenure, 1-digit occupation dummies, earnings (deciles), and net wealth excluding pension wealth (ventiles). All monetary values are in DKK (2023 prices). Standard errors are clustered at the firm level at age 59, and 95% confidence intervals are shown.

## E.3 FC age 35

We show the estimated effect of the firm-specific pension contribution rate (FC) age 35 on the individual occupational pension contribution rates for ages 35 to 55 (Figure E.3). We repeat the first stage (Table E.4) and IV (Figure E.4) analyses using FC age 35 (twenty-year spacing). For these analyses, we

condition on employment and no self-employment income at ages 35 and 55.

Figure E.3: FC Age 35 and Individual Occupational Contribution Rates Ages 35 to 55



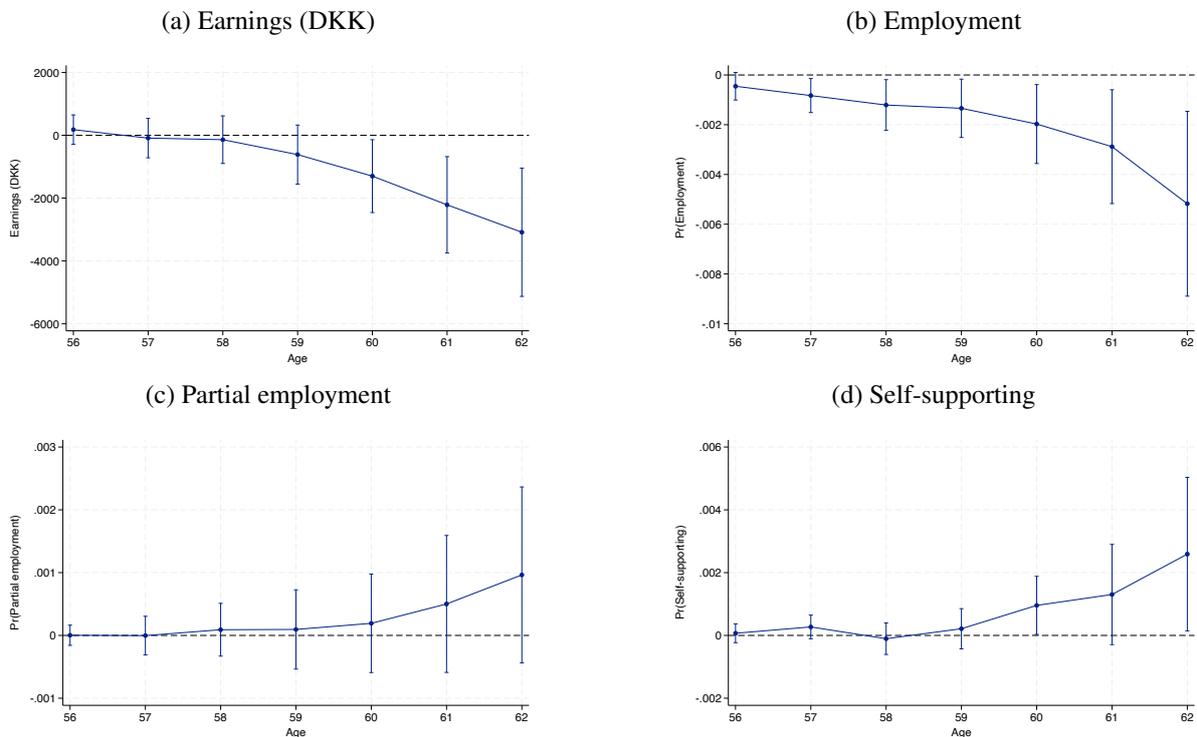
*Notes:* This figure shows the estimated effect of the firm-specific occupational pension contribution rate (FC) at age 35 on the individual occupational pension contribution rates at ages 35 to 55. Controls at age 55 are the following baseline controls: year FE, dummy for payment to the VERP scheme, male dummy, education dummies, marriage dummy, children at home dummy, experience, experience squared, tenure, 1-digit occupation dummies, earnings (deciles), and net wealth excluding pension wealth (ventiles). Detailed controls age 55 are our baseline controls age 55 and additionally include three firm characteristics measured at age 55: industry dummies at the 3-digit level, number of employees in the firm, and start year of firm. Firm FE is firm fixed effects at age 55. Firm leavers are defined as individuals who are not employed in the same firm at age 55 as they were at age 35. Passive savers are defined as individuals who did not contribute to a private pension scheme at age 35 and 55. Standard errors are clustered at the firm level at age 55, and 95% confidence intervals are shown.

Table E.4: First Stage: FC age 35

	Pension wealth (1)	Pension wealth (2)	Pension wealth (3)
FC age 35	116,688.67*** (10389.58)	112,399.99*** (6940.81)	73,922.86*** (4240.04)
Controls age 55	No	Yes	Yes
Firm FE age 55	No	No	Yes
Observations	79,623	79,623	71,122
$R^2$	0.063	0.402	0.524
Mean	2,664,092.61	2,664,092.61	2,704,539.35
Pct. Change	4.38	4.22	2.73

Notes: This table reports the results from the first stage regression (Equation 1) where FC is the firm-specific occupational pension contribution rate at age 35. In columns (1)-(3), the outcome variable is pension wealth at age 55. Column (1) includes no control variables, column (2) includes controls at age 55, and column (3) includes controls and firm FE at age 55. Controls at age 55 include year FE, dummy for payment to VERP scheme, male dummy, education dummies, marriage dummy, children at home dummy, experience, experience squared, tenure, 1-digit occupation dummies, earnings (deciles), and net wealth excluding pension wealth (ventiles). All monetary values are in DKK (2023 prices). Standard errors are clustered at the firm level at age 55 and shown in parentheses. Significance levels are indicated as \*  $p < 0.05$ , \*\*  $p < 0.01$ , and \*\*\*  $p < 0.001$ .

Figure E.4: IV Estimates: FC age 35

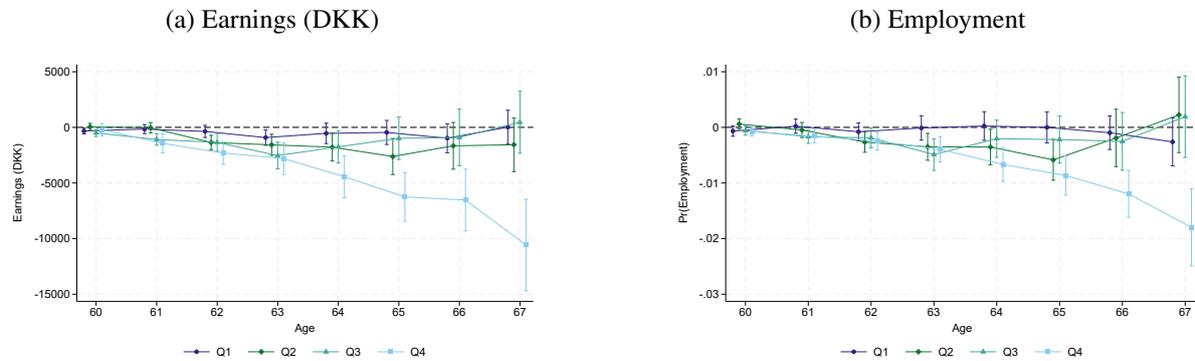


Notes: This figure plots IV estimates (Equation 3) for pension wealth age 55, instrumented by FC age 35. In panel (a), the outcome variable is earnings (DKK), in panel (b) the outcome variable is a dummy for being employed, in panel (c) the outcome variable is a dummy for being partially employed, and in panel (d) the outcome is a dummy for being self-supporting. Controls age 55 include firm FE, year FE, dummy for payment to VERP scheme, male dummy, education dummies, marriage dummy, children at home dummy, experience, experience squared, tenure, 1-digit occupation dummies, earnings (deciles), and net wealth excluding pension wealth (ventiles). All monetary values are in DKK (2023 prices). Standard errors are clustered at the firm level at age 55, and 95% confidence intervals are shown.

## E.4 Pension wealth heterogeneity

We study reduced form earnings and employment responses by quartiles of pension wealth measured age 59. As pension wealth is available from year 2014 and on, we are only able to study ages 60 to 67.

Figure E.5: Reduced Form Estimates by Pension Wealth

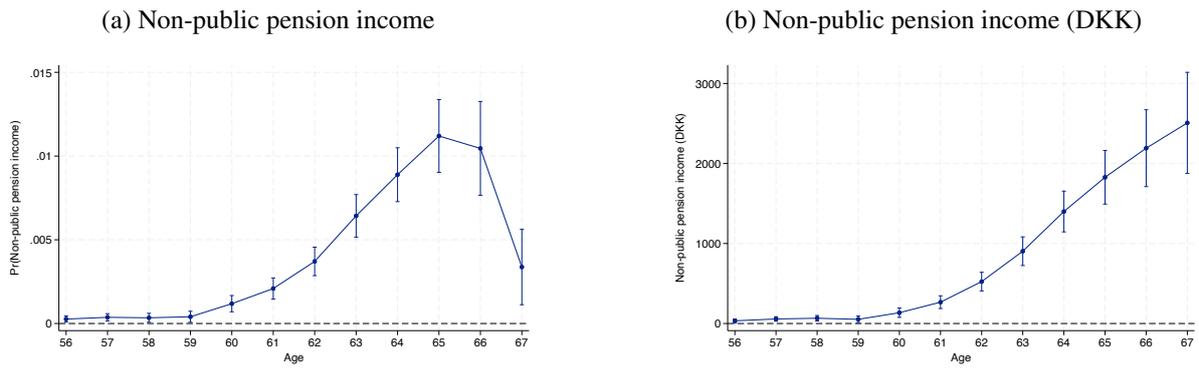


*Notes:* This figure plots reduced form estimates (FC age 44) (Equation 2) for ages 60 to 67 by pension wealth quartiles at age 59. In panel (a), the outcome variable is earnings (DKK), and in panel (b) the outcome variable is a dummy for being employed. Controls measured at age 59 include firm FE, year FE, dummy for payment to VERP scheme, male dummy, education dummies, marriage dummy, children at home dummy, experience, experience squared, tenure, 1-digit occupation dummies, earnings (deciles), and net wealth excluding pension wealth (ventiles). All monetary values are in DKK (2023 prices). Standard errors are clustered at the firm level at age 59, and 95% confidence intervals are shown.

## E.5 Non-public pension income

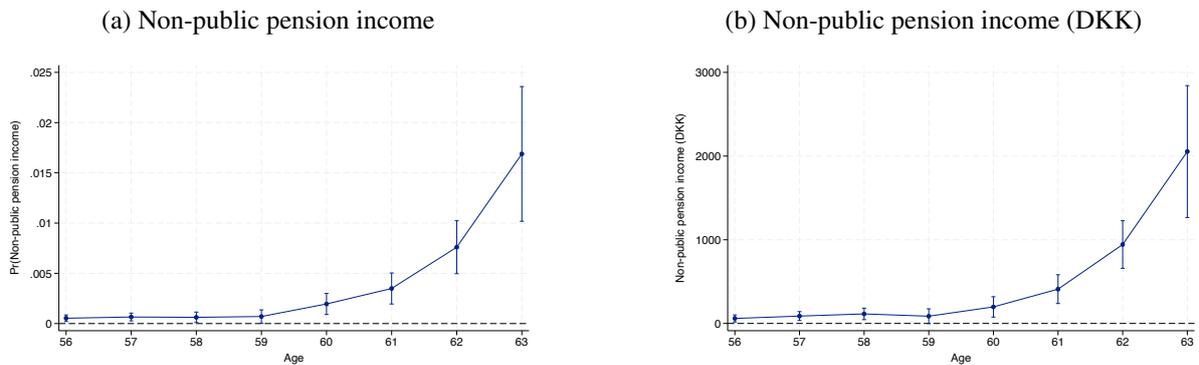
We study the effect of the FC age 40 on the probability of receiving non-public pension income and the monetary amount of non-public pension income in Figure E.6 (reduced form). Then, we study the effect of pension wealth age 55 on the probability of receiving non-public pension income and the monetary amount of non-public pension income in Figure E.7 (IV).

Figure E.6: Reduced Form Estimates: Pension Income



Notes: This figure plots reduced form estimates (Equation 2) for ages 56 to 67. In panel (a), the outcome variable is a dummy for receiving non-public pension income, and in panel (b) the outcome variable is non-public pension income (DKK). Controls measured age 55 include firm FE, year FE, dummy for payment to VERP scheme, male dummy, education dummies, marriage dummy, children at home dummy, experience, experience squared, tenure, 1-digit occupation dummies, earnings (deciles), and net wealth excluding pension wealth (ventiles). All monetary values are in DKK (2023 prices). Standard errors are clustered at the firm level at age 55, and 95% confidence intervals are shown.

Figure E.7: OLS and IV Estimates: Pension Income

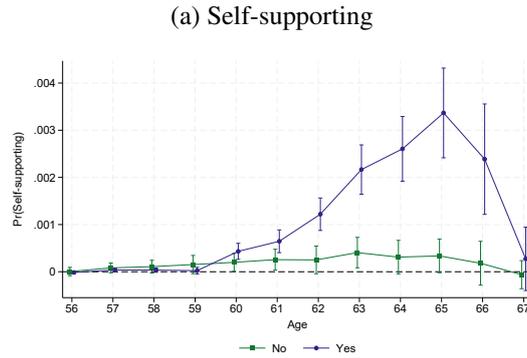


Notes: This figure plots OLS and IV estimates (Equation 3) for ages 56 to 63. In panel (a), the outcome variable is a dummy for receiving non-public pension income, and in panel (b) the outcome variable is non-public pension income (DKK). Controls measured age 55 include firm FE, year FE, dummy for payment to VERP scheme, male dummy, education dummies, marriage dummy, children at home dummy, experience, experience squared, tenure, 1-digit occupation dummies, earnings (deciles), and net wealth excluding pension wealth (ventiles). All monetary values are in DKK (2023 prices). Standard errors are clustered at the firm level at age 55, and 95% confidence intervals are shown.

## E.6 Self-supporting and non-public pension income

We then investigate the effect of FC on the probability of being self-supporting by whether an individual has non-public pension income or not.

Figure E.8: Reduced Form Estimates for self-supporting by Non-Public Pension Income

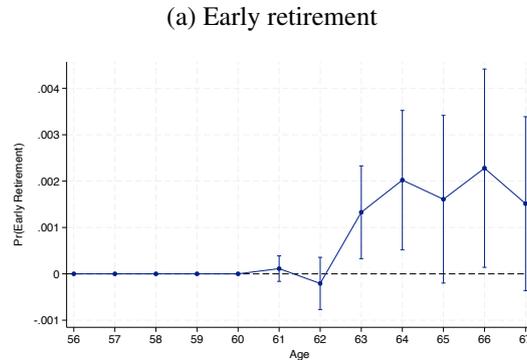


*Notes:* This figure plots reduced form estimates (Equation 2) for ages 56 to 67 by whether an individual has positive non-public pension income (yes) or not (no). The outcome variable is the probability of being self-supporting. Controls age 55 include firm FE, year FE, dummy for payment to VERP scheme, male dummy, education dummies, marriage dummy, children at home dummy, experience, experience squared, tenure, 1-digit occupation dummies, earnings (deciles), and net wealth excluding pension wealth (ventiles). Standard errors are clustered at the firm level at age 55, and 95% confidence intervals are shown.

## E.7 Early retirement

We study the effect of the FC on the likelihood of early retirement.

Figure E.9: Reduced Form Estimates: Early retirement

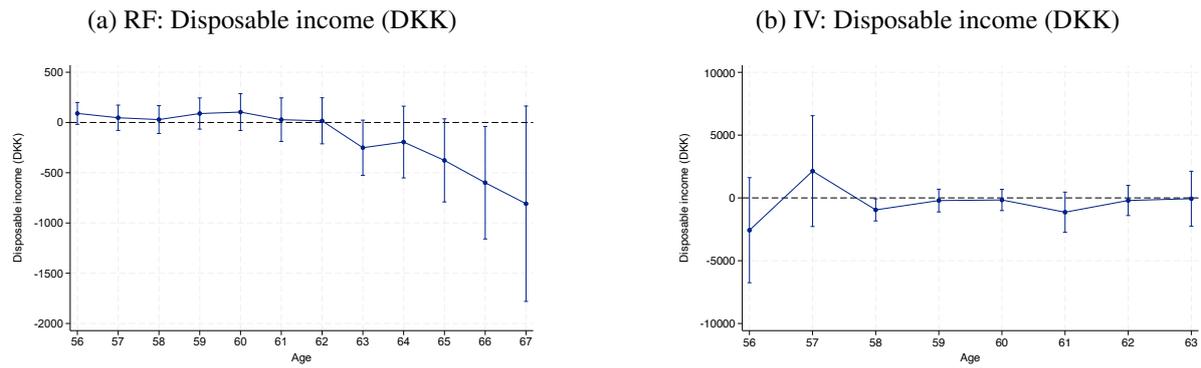


*Notes:* This figure plots reduced form estimates (Equation 2) for ages 56 to 67. The outcome variable is a dummy for early retirement. Controls age 55 include firm FE, year FE, dummy for payment to VERP scheme, male dummy, education dummies, marriage dummy, children at home dummy, experience, experience squared, tenure, 1-digit occupation dummies, earnings (deciles), and net wealth excluding pension wealth (ventiles). All monetary values are in DKK (2023 prices). Standard errors are clustered at the firm level at age 55, and 95% confidence intervals are shown.

## E.8 Disposable income

We study the effect of the FC and pension wealth on disposable income (DKK) in Figure E.10. Disposable income (in DKK) is defined as earnings, business income, transfers, etc., after taxes and interest expenses, plus the imputed rental value of an owner-occupied home.

Figure E.10: Reduced Form and IV Estimates: Disposable income

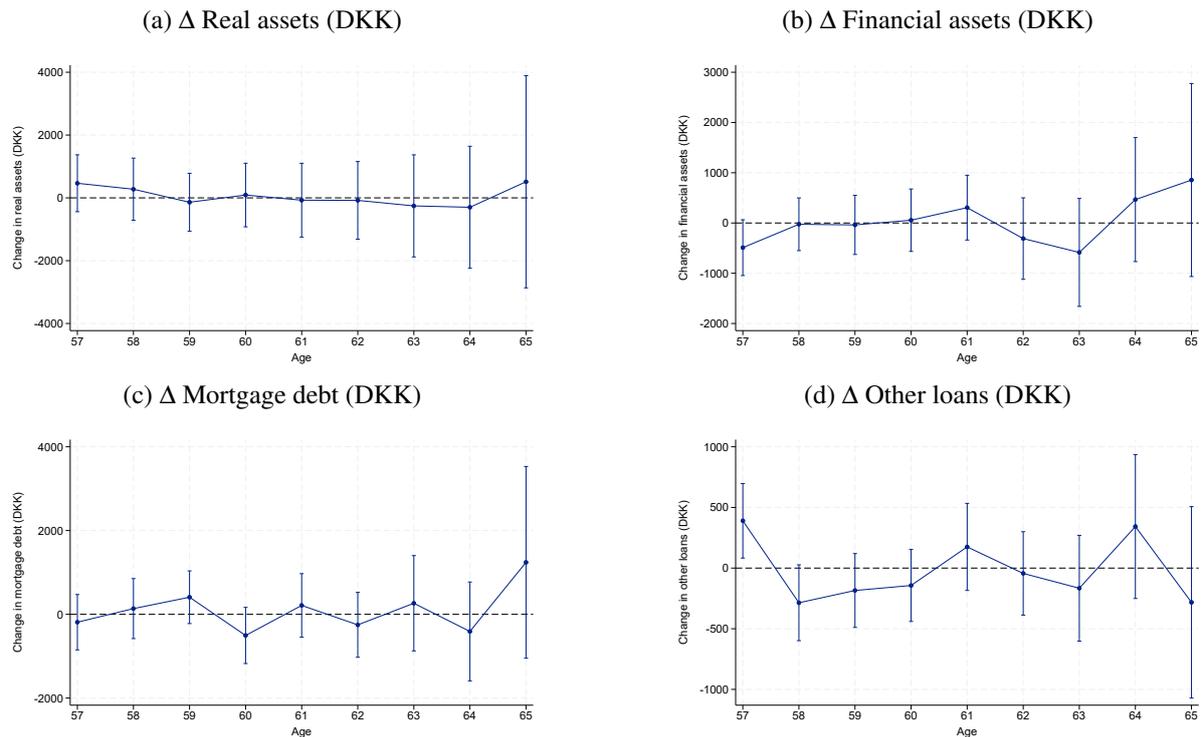


*Notes:* This figure plots reduced form estimates (Equation 2) for ages 56 to 67 in panel (a) and OLS and IV estimates (Equation 3) for ages 56 to 63 in panel (b). The outcome variable is disposable income (in DKK). Controls measured age 55 include firm FE, year FE, dummy for payment to VERP scheme, male dummy, education dummies, marriage dummy, children at home dummy, experience, experience squared, tenure, 1-digit occupation dummies, earnings (deciles), and net wealth excluding pension wealth (ventiles). All monetary values are in DKK (2023 prices). Standard errors are clustered at the firm level at age 55. 95% confidence intervals are shown.

## E.9 Financial outcomes

We study the effect of the FC age 40 on financial outcomes in Figure E.11. Note that the data base FORMGELD (which provides us with detailed data on types of wealth) is only available for the years 2014-2020, hence, we can only study financial outcomes up until age 65.

Figure E.11: Reduced Form Estimates for Financial Outcomes

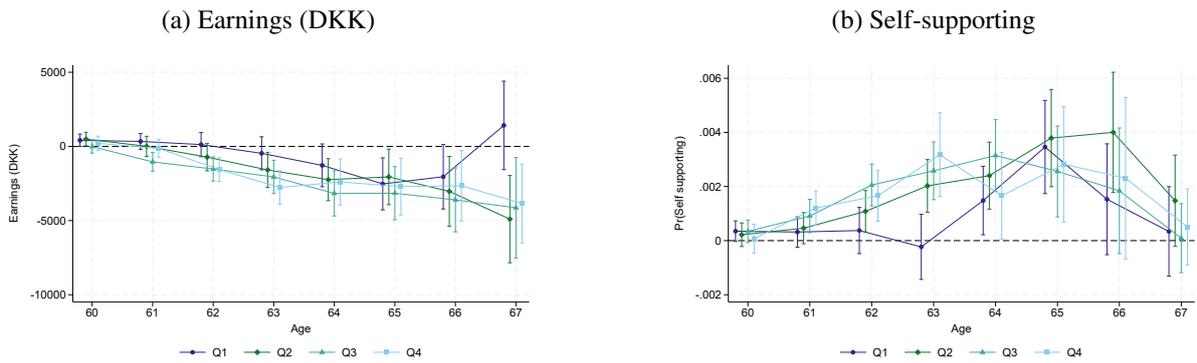


*Notes:* This figure plots reduced form estimates (Equation 2) for ages 57 to 65. In panel (a), the outcome variable is the change in real assets (DKK) from  $t - 1$  to  $t$ , in panel (b) the outcome is change in financial assets (DKK), in panel (c) the outcome is change in mortgage debt (DKK), and in panel (d) the outcome is change in other loans (DKK). Controls age 55 include firm FE, year FE, dummy for payment to VERP scheme, male dummy, education dummies, marriage dummy, children at home dummy, experience, experience squared, tenure, 1-digit occupation dummies, earnings (deciles), and net wealth excluding pension wealth (ventiles). Standard errors are clustered at the firm level at age 55, and 95% confidence intervals are shown.

## E.10 Liquidity constraints

We study the effect of the FC on earnings and the probability of being self-supporting by how liquidity constrained an individual is in Figure E.12. We define a measure of liquidity constraints by dividing bank deposits by debt. We use bank deposits over debt to try to have a measure which takes account of "net liquid wealth", i.e., accounting for potential liabilities which require liquidity (mortgage payments). The idea is that the lower this ratio is for a given level of bank deposits, the less likely it is that individuals really have excess liquidity as they face large payments maintaining, e.g., mortgages. As mentioned previously, FORMGELD is only available from 2014-2020, hence we use FC age 44 and pension wealth age 59 to be able to study responses from ages 60 to 67.

Figure E.12: Reduced Form Estimates by Liquidity Constraints

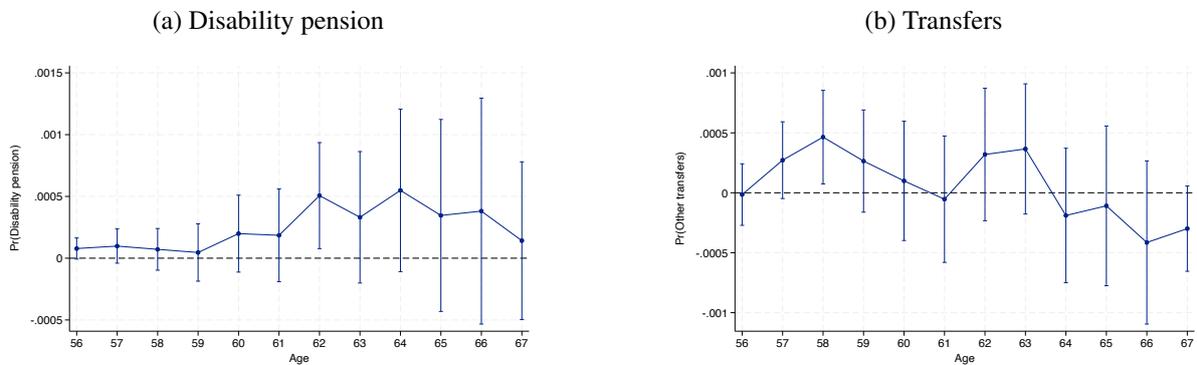


Notes: This figure plots reduced form estimates (FC age 44) (Equation 2) for ages 60 to 67 by quartiles of total bank deposits divided by total debt. In panel (a), the outcome variable is earnings (DKK), and in panel (b) the outcome variable is a dummy for being self-supporting. Controls measured at age 59 include firm FE, year FE, dummy for payment to VERP scheme, male dummy, education dummies, marriage dummy, children at home dummy, experience, experience squared, tenure, 1-digit occupation dummies, earnings (deciles), and net wealth excluding pension wealth (ventiles). All monetary values are in DKK (2023 prices). Standard errors are clustered at the firm level at age 59, and 95% confidence intervals are shown.

## E.11 Bridging

We study bridging behavior in Figure E.13 by looking at the probability of being on disability pension and receiving transfers.

Figure E.13: Reduced Form Estimates: Bridging

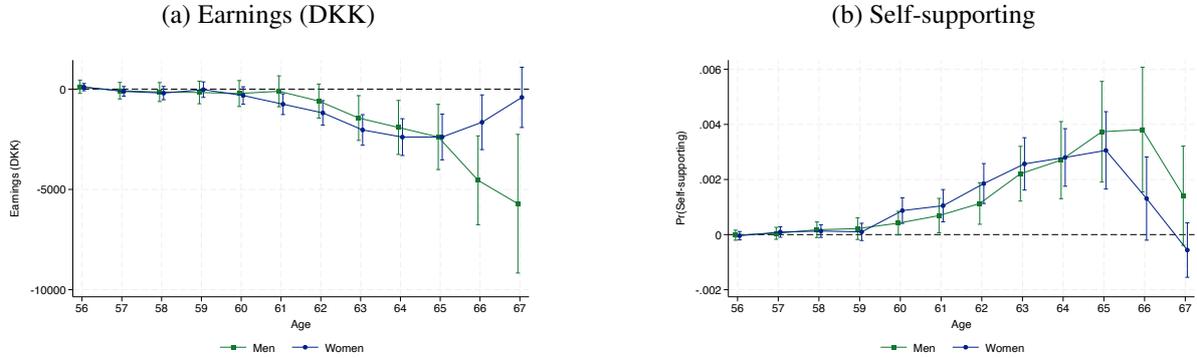


Notes: This figure plots reduced form estimates (Equation 2) for ages 56 to 67. In panel (a), the outcome variable is dummy for (partial) disability pension, and in panel (b) the outcome variable is a dummy for receiving transfers. Controls age 55 include firm FE, year FE, dummy for payment to VERP scheme, male dummy, education dummies, marriage dummy, children at home dummy, experience, experience squared, tenure, 1-digit occupation dummies, earnings (deciles), and net wealth excluding pension wealth (ventiles). All monetary values are in DKK (2023 prices). Standard errors are clustered at the firm level at age 55, and 95% confidence intervals are shown.

## E.12 Subgroup heterogeneity

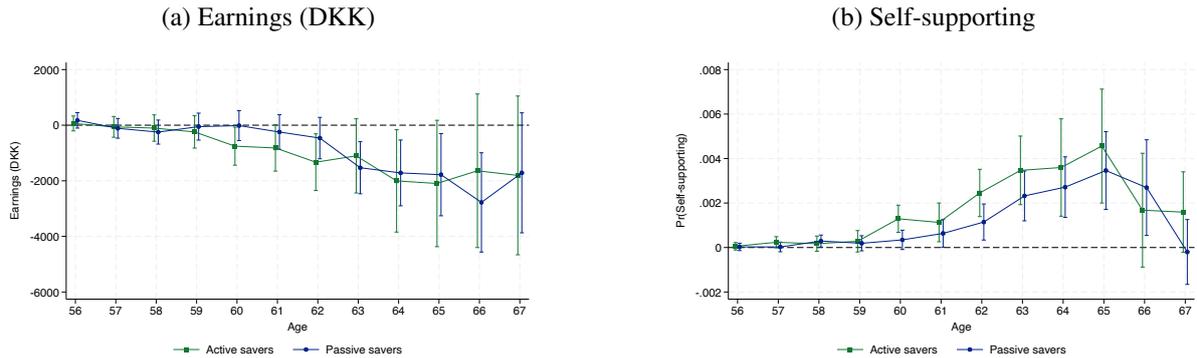
We examine subgroup differences in the impact of FC age 40 on earnings (DKK) and the probability of being self-supporting. We split the sample by gender (Figure E.14), saver type (Figure E.15), home-ownership (Figure E.16), education (Figure E.17), and marital status (Figure E.18).

Figure E.14: Reduced Form Estimates by Gender



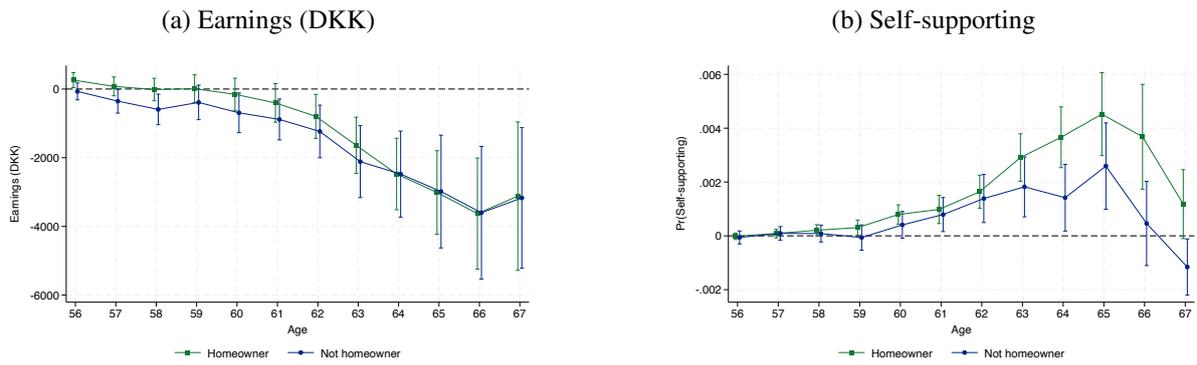
Notes: This figure plots reduced form estimates (Equation 2) for ages 56 to 67 for men and women. In panel (a), the outcome variable is earnings (DKK), and in panel (b) the outcome variable is a dummy for being self-supporting. Controls age 55 include firm FE, year FE, dummy for payment to VERP scheme, male dummy, education dummies, marriage dummy, children at home dummy, experience, experience squared, tenure, 1-digit occupation dummies, earnings (deciles), and net wealth excluding pension wealth (ventiles). All monetary values are in DKK (2023 prices). Standard errors are clustered at the firm level at age 55, and 95% confidence intervals are shown.

Figure E.15: Reduced Form Estimates by Savings Behavior



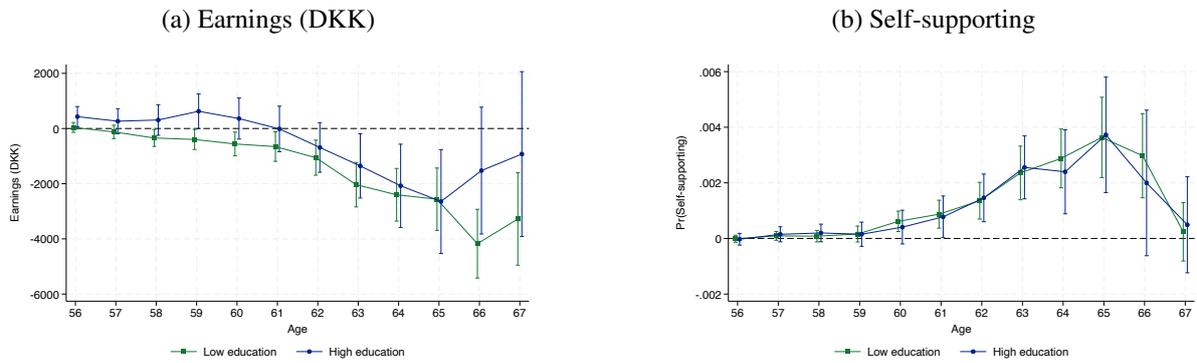
Notes: This figure plots reduced form estimates (Equation 2) for ages 56 to 67 for passive and active savers. Passive savers are defined as individuals who did not contribute to a private pension scheme at ages 40 and 55. In panel (a), the outcome variable is earnings (DKK), and in panel (b) the outcome variable is a dummy for being self-supporting. Controls age 55 include firm FE, year FE, dummy for payment to VERP scheme, male dummy, education dummies, marriage dummy, children at home dummy, experience, experience squared, tenure, 1-digit occupation dummies, earnings (deciles), and net wealth excluding pension wealth (ventiles). All monetary values are in DKK (2023 prices). Standard errors are clustered at the firm level at age 55, and 95% confidence intervals are shown.

Figure E.16: Reduced Form Estimates by Homeownership



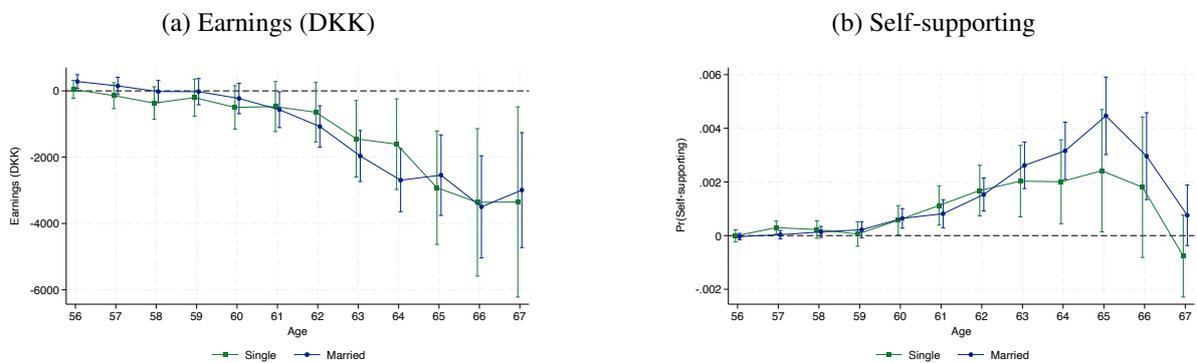
Notes: This figure plots reduced form estimates (Equation 2) for ages 56 to 67 by homeownership at age 55. In panel (a), the outcome variable is earnings (DKK), and in panel (b) the outcome variable is a dummy for being self-supporting. Controls age 55 include firm FE, year FE, dummy for payment to VERP scheme, male dummy, education dummies, marriage dummy, children at home dummy, experience, experience squared, tenure, 1-digit occupation dummies, earnings (deciles), and net wealth excluding pension wealth (ventiles). All monetary values are in DKK (2023 prices). Standard errors are clustered at the firm level at age 55, and 95% confidence intervals are shown.

Figure E.17: Reduced Form Estimates by Education



Notes: This figure plots reduced form estimates (Equation 2) for ages 56 to 67 by education. High education is defined as college or above. In panel (a), the outcome variable is earnings (DKK), and in panel (b) the outcome variable is a dummy for being self-supporting. Controls age 55 include firm FE, year FE, dummy for payment to VERP scheme, male dummy, education dummies, marriage dummy, children at home dummy, experience, experience squared, tenure, 1-digit occupation dummies, earnings (deciles), and net wealth excluding pension wealth (ventiles). All monetary values are in DKK (2023 prices). Standard errors are clustered at the firm level at age 55, and 95% confidence intervals are shown.

Figure E.18: Reduced Form Estimates by Marital Status



Notes: This figure plots reduced form estimates (Equation 2) for ages 56 to 67 by marital status at age 55. In panel (a), the outcome variable is earnings (DKK), and in panel (b) the outcome variable is a dummy for being self-supporting. Controls age 55 include firm FE, year FE, dummy for payment to VERP scheme, male dummy, education dummies, marriage dummy, children at home dummy, experience, experience squared, tenure, 1-digit occupation dummies, earnings (deciles), and net wealth excluding pension wealth (ventiles). All monetary values are in DKK (2023 prices). Standard errors are clustered at the firm level at age 55, and 95% confidence intervals are shown.

## F Robustness checks

In Appendix F, we conduct a variety of robustness checks that can be grouped into four subsections: Role of controls and sample selection (F.1), distance to retirement and FC definition (F.2), functional form and matching (F.3), and clustering (F.4).

### F.1 Role of controls and sample selection

In Section F.1, we start by showing that our results are robust to changing the set of control variables and to varying the sample selection.

#### F.1.1 Varying controls

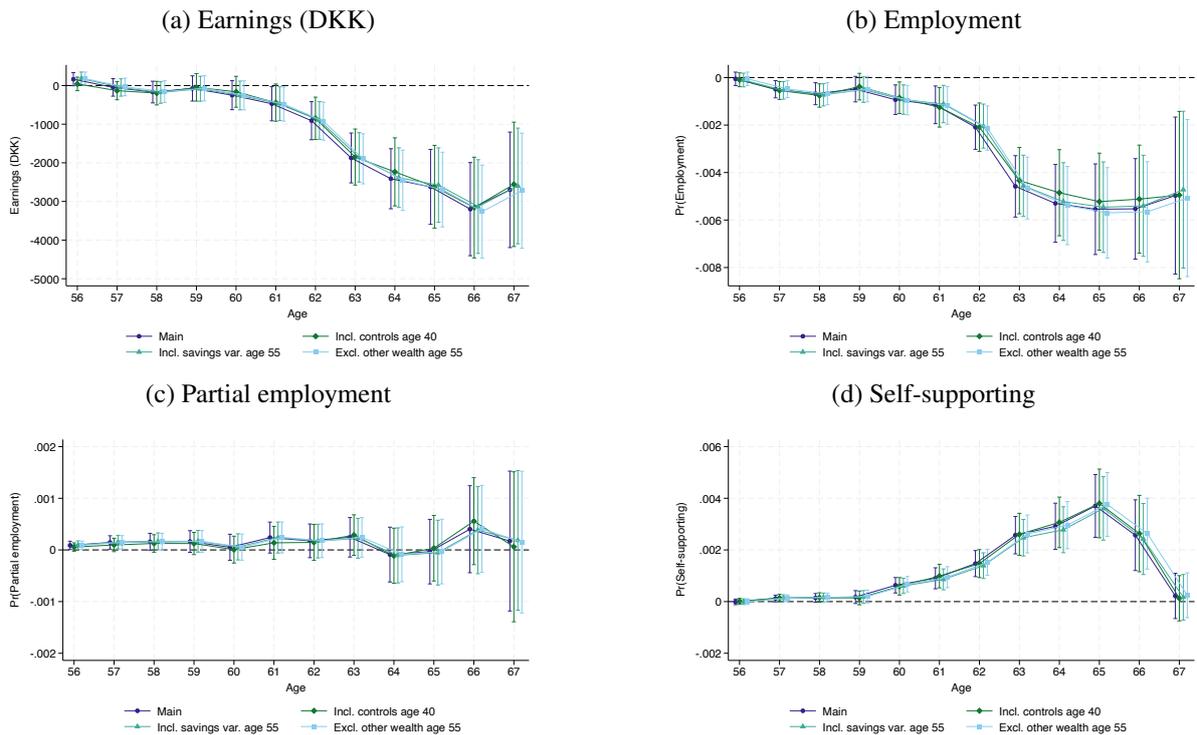
We show our results are robust to the inclusion of control variables at age 40 and individual savings behavior at age 55 or, alternatively, excluding wealth controls at age 55 for the first stage analysis (Table F.1), reduced form analysis (Figure F.1), and IV analysis (Figure F.2).

Table F.1: First Stage: Varying Controls

	Pension wealth (1)	Pension wealth (2)	Pension wealth (3)	Pension wealth (4)
FC age 40	63,303.71*** (2766.87)	62,101.23*** (2952.89)	59,185.60*** (2224.94)	65,286.77*** (2827.59)
Controls age 55	Yes	Yes	Yes	Yes
Firm FE age 55	Yes	Yes	Yes	Yes
Other wealth age 55	Yes	Yes	Yes	No
Controls age 40	No	Yes	No	No
Pension savings age 55	No	No	Yes	No
Observations	213,349	203,847	213,349	213,349
$R^2$	0.520	0.545	0.549	0.496
Mean	2,118,192.68	2,137,672.39	2,118,192.68	2,118,192.68
Pct. Change	2.99	2.91	2.79	3.08

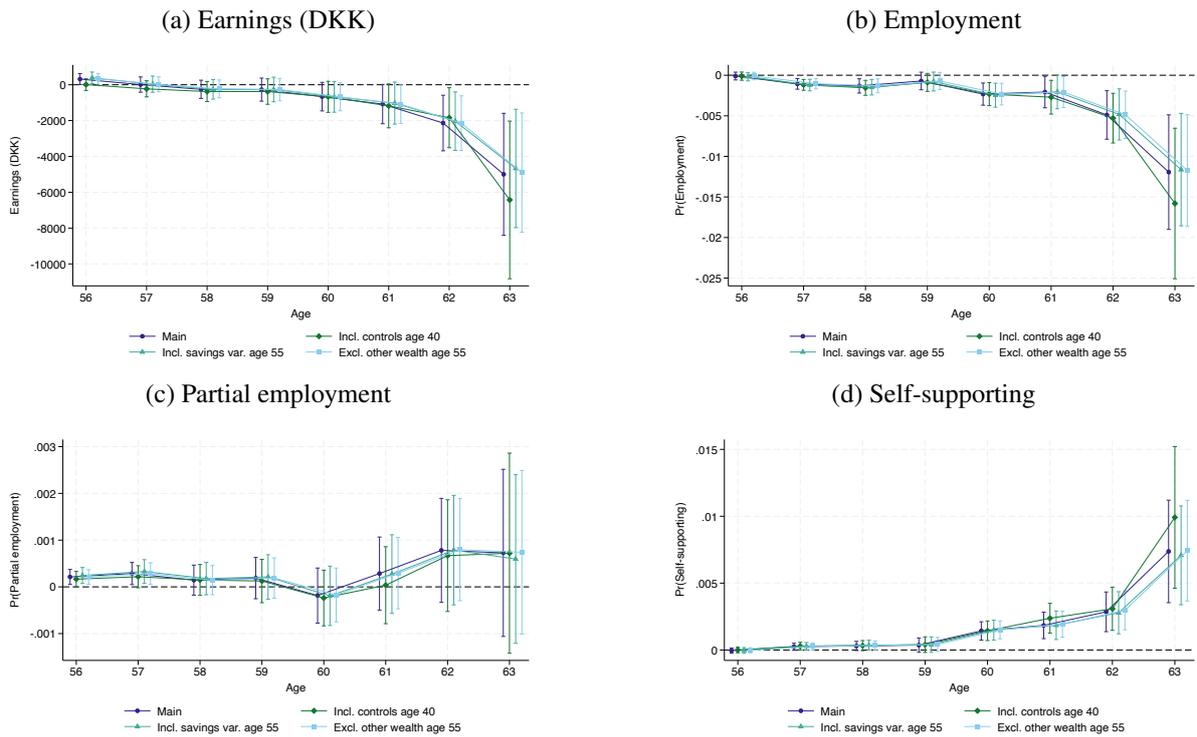
*Notes:* This table reports the results from the first stage regression (Equation 1) where FC is the firm occupational pension contribution rate at age 40. In columns (1)-(4), the outcome variable is pension wealth at age 55. Column (1) is our main specification. In column (2), we additionally include age 40 controls to our main specification. In column (3), we add controls for the individual private and occupational contribution rates at age 55 to our main specification. In column (4), we exclude net wealth excluding pension wealth (ventiles) age 55. Controls at age 55 include year FE, dummy for payment to VERP scheme, male dummy, education dummies, marriage dummy, children at home dummy, experience, experience squared, tenure, 1-digit occupation dummies, earnings (deciles), and net wealth excluding pension wealth (ventiles). Controls age 40 include marriage dummy, children at home dummy, experience, experience squared, tenure, 1-digit occupation dummies, 1-digit industry dummies, earnings (deciles), and net wealth excluding pension wealth (ventiles). All monetary values are in DKK (2023 prices). Standard errors are clustered at the firm level at age 55 and shown in parentheses. Significance levels are indicated as \*  $p < 0.05$ , \*\*  $p < 0.01$ , and \*\*\*  $p < 0.001$ .

Figure F.1: Reduced Form Estimates: Varying Controls



*Notes:* This figure plots reduced form estimates (Equation 2) for ages 56 to 67, varying controls included. In panel (a), the outcome variable is earnings (DKK), in panel (b) the outcome variable is a dummy for being employed, in panel (c) the outcome variable is a dummy for being partially employed, and in panel (d) the outcome variable is a dummy for being self-supporting. In the main specification, controls measured at age 55 include year FE, dummy for payment to VERP scheme, male dummy, education dummies, marriage dummy, children at home dummy, experience, experience squared, tenure, 1-digit occupation dummies, earnings (deciles), and net wealth excluding pension wealth (ventiles). Controls age 40 include marriage dummy, children at home dummy, experience, experience squared, tenure, 1-digit occupation dummies, 1-digit industry dummies, earnings (deciles), and net wealth excluding pension wealth (ventiles). Savings variables age 55 include individual occupational and private pension contribution rate. All monetary values are in DKK (2023 prices). Standard errors are clustered at the firm level at age 55, and 95% confidence intervals are shown.

Figure F.2: IV Estimates: Varying Controls



*Notes:* This figure plots IV estimates (Equation 3) for ages 56 to 63 varying controls included. In panel (a), the outcome variable is earnings (DKK), in panel (b) the outcome variable is a dummy for being employed, in panel (c) the outcome variable is a dummy for being partially employed, and in panel (d) the outcome variable is a dummy for being self-supporting. In the main specification, controls measured at age 55 include year FE, dummy for payment to VERP scheme, male dummy, education dummies, marriage dummy, children at home dummy, experience, experience squared, tenure, 1-digit occupation dummies, earnings (deciles), and net wealth excluding pension wealth (ventiles). Controls age 40 include marriage dummy, children at home dummy, experience, experience squared, tenure, 1-digit occupation dummies, 1-digit industry dummies, earnings (deciles), and net wealth excluding pension wealth (ventiles). Savings variables age 55 include individual occupational and private pension contribution rate. All monetary values are in DKK (2023 prices). All monetary values are in DKK (2023 prices). Standard errors are clustered at the firm level at age 55, and 95% confidence intervals are shown.

## F.1.2 Firm leavers

We repeat the analysis for firm leavers. We define firm leavers as individuals who are not employed at the firm at age 55 they were at age 40. We show first stage (Table F.2), reduced form (Figure F.3), and IV (Figure F.4) results.

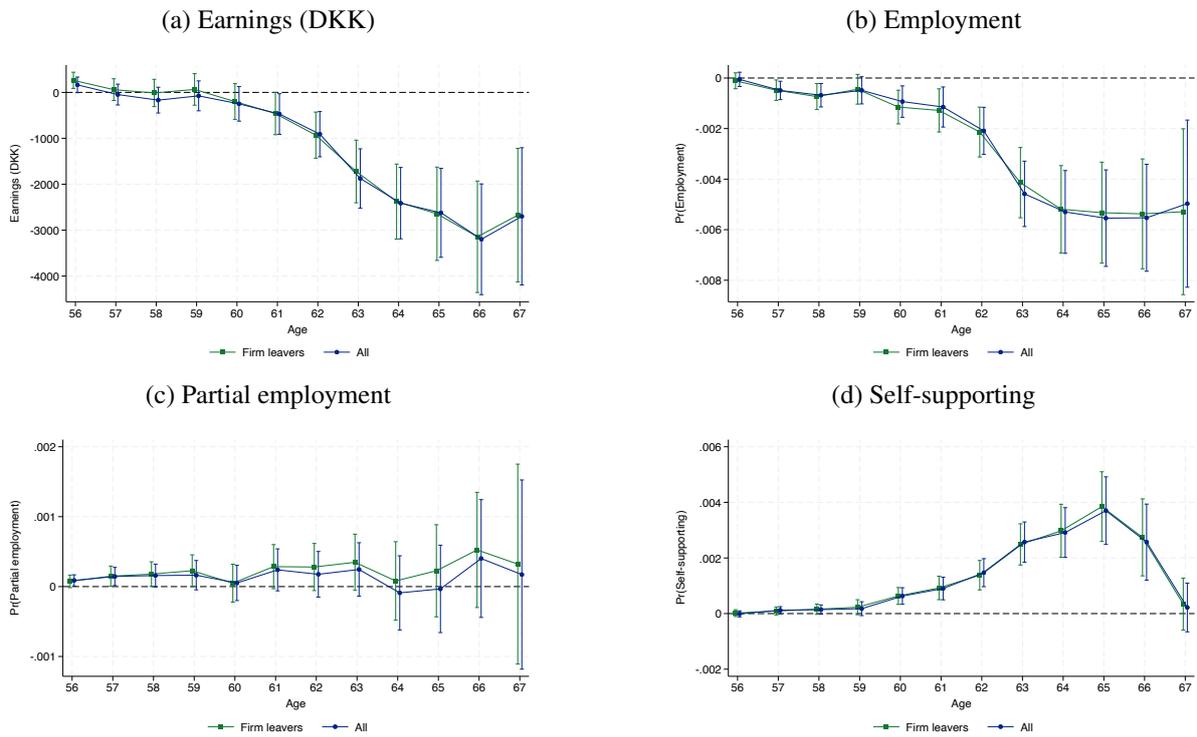
For the first stage, a 1 percentage point increase in the FC at age 40 increases pension wealth at age 55 by 3.0%, a similar estimate as for our main specification. Firm leavers account for approximately three-fourths of our full sample

Table F.2: First Stage: Firm Leavers

	Pension wealth (1)	Pension wealth (2)	Pension wealth (3)
FC age 40	108,111.49*** (6097.69)	84,580.19*** (4700.18)	61,425.97*** (2270.24)
Controls age 55	No	Yes	Yes
Firm FE age 55	No	No	Yes
Observations	173,631	173,631	158,599
$R^2$	0.073	0.422	0.530
Mean	2,020,971.99	2,020,971.99	2,044,270.15
Pct. Change	5.35	4.19	3.00

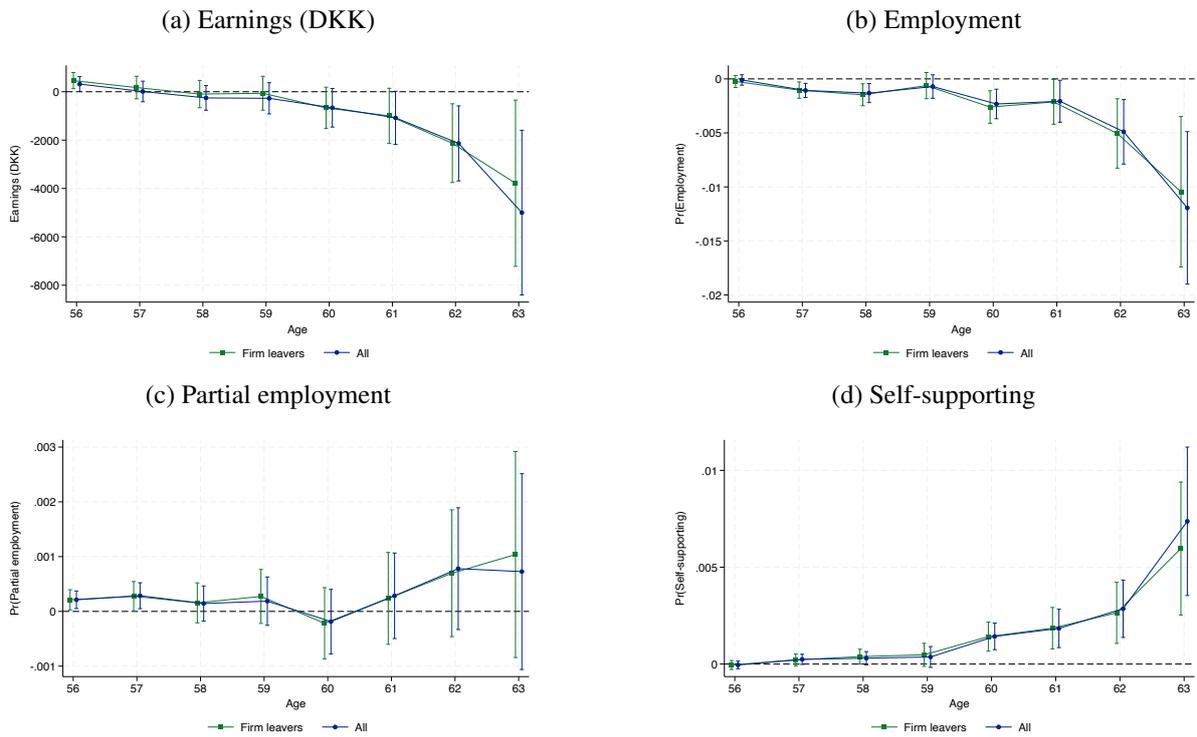
*Notes:* This table reports the results from the first stage regression (Equation 1) where FC is the firm occupational pension contribution rate at age 40 for individuals who are not at the same firm at age 55 as at age 40 ("firm leavers"). In columns (1)-(3), the outcome variable is pension wealth at age 55. Column (1) includes no control variables, column (2) includes controls at age 55, and column (3) includes controls and firm fixed effects at age 55. Controls at age 55 include year fixed effects, dummy for payment to VERP scheme, male dummy, education dummies, marriage dummy, children at home dummy, experience, experience squared, tenure, 1-digit occupation dummies, earnings (deciles), and net wealth excluding pension wealth (ventiles). All monetary values are in DKK (2023 prices). Standard errors are clustered at the firm level at age 55 and shown in parentheses. Significance levels are indicated as \*  $p < 0.05$ , \*\*  $p < 0.01$ , and \*\*\*  $p < 0.001$ .

Figure F.3: Reduced Form: Firm Leavers



*Notes:* This figure plots reduced form estimates (Equation 2) for ages 56 to 67 for the full sample and for firm leavers (individuals who are not employed at the same firm at age 55 as at age 40). In panel (a), the outcome variable is earnings (DKK), in panel (b) the outcome variable is a dummy for being employed, in panel (c) the outcome variable is a dummy for being partially employed, and in panel (d) the outcome variable is a dummy for being self-supporting. Controls measured at age 55 include firm FE, year FE, dummy for payment to VERP scheme, male dummy, education dummies, marriage dummy, children at home dummy, experience, experience squared, tenure, 1-digit occupation dummies, earnings (deciles), and net wealth excluding pension wealth (ventiles). All monetary values are in DKK (2023 prices). Standard errors are clustered at the firm level at age 55, and 95% confidence intervals are shown.

Figure F.4: IV Estimates: Firm Leavers

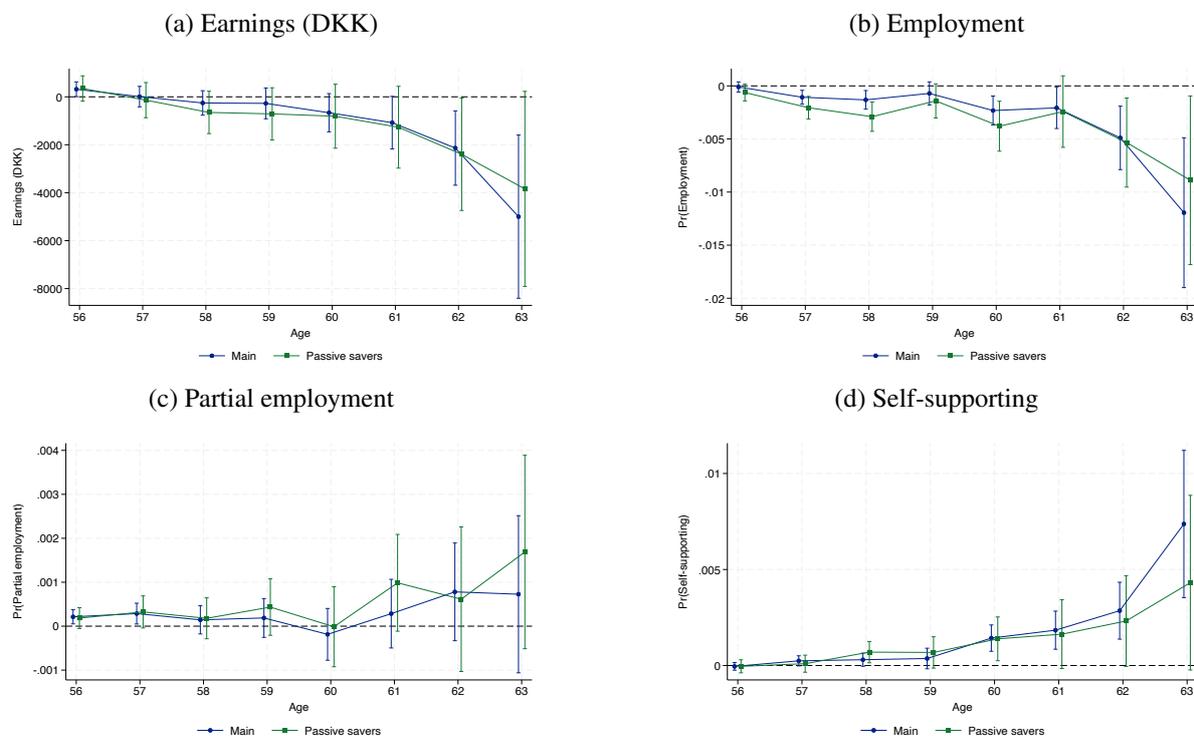


*Notes:* This figure plots IV estimates (Equation 3) for ages 56 to 63 for for the full sample and for firm leavers (individuals who do not work at the same firm at age 40 and age 55). In panel (a), the outcome variable is earnings (DKK), in panel (b) the outcome variable is a dummy for being employed, in panel (c) the outcome variable is a dummy for being partially employed, and in panel (d) the outcome variable is a dummy for being self-supporting. Controls measured age 55 include firm FE, year FE, dummy for payment to VERP scheme, male dummy, education dummies, marriage dummy, children at home dummy, experience, experience squared, tenure, 1-digit occupation dummies, earnings (deciles), and net wealth excluding pension wealth (ventiles). All monetary values are in DKK (2023 prices). Standard errors are clustered at the firm level at age 55, and 95% confidence intervals are shown.

### F.1.3 Passive savers

We repeat the analysis for passive savers. Passive savers are defined as individuals who at ages 40 and 55 did not contribute to a private pension scheme. We show IV results in [Figure F.5](#).

Figure F.5: IV Estimates: Passive Savers



*Notes:* This figure plots IV estimates ([Equation 3](#)) for ages 56 to 63 for the full sample and for passive savers. Passive savers are defined as individuals who did not contribute to a private pension scheme at ages 40 and 55. In panel (a), the outcome variable is earnings (DKK), in panel (b) the outcome variable is a dummy for being employed, in panel (c) the outcome variable is a dummy for being partially employed, and in panel (d) the outcome variable is a dummy for being self-supporting. Controls measured age 55 include firm FE, year FE, dummy for payment to VERP scheme, male dummy, education dummies, marriage dummy, children at home dummy, experience, experience squared, tenure, 1-digit occupation dummies, earnings (deciles), and net wealth excluding pension wealth (ventiles). All monetary values are in DKK (2023 prices). Standard errors are clustered at the firm level at age 55, and 95% confidence intervals are shown.

## F.2 Distance to retirement and FC definition

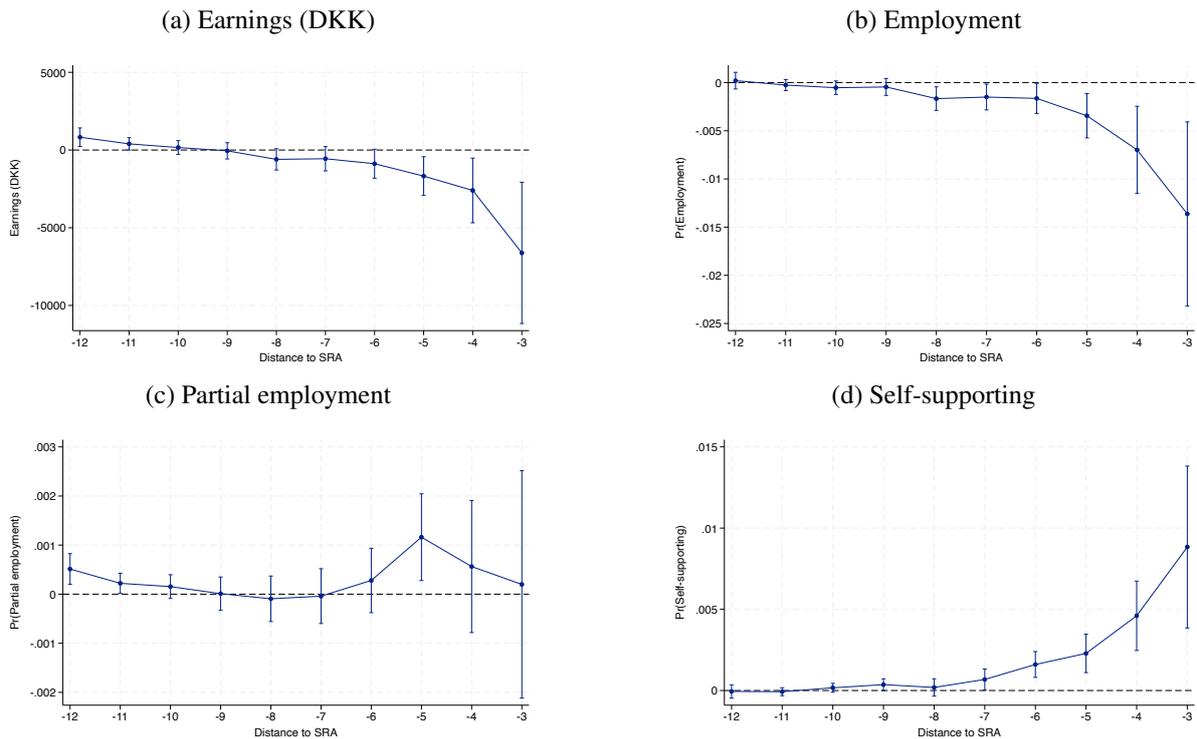
In [Section F.2](#), first, we repeat our analysis using distance to the statutory retirement age instead of age, and second, we vary the FC definition.

### F.2.1 Distance to retirement

Given the Welfare Agreement from 2006 and the Retirement Reform in 2011 (see [Appendix A](#) for more details), the statutory retirement age is increasing in Denmark. Hence, for different cohorts, the age at which public pension benefits can be claimed differs. We start by showing labor market attachment



Figure F.8: IV Estimates: Distance to SRA



*Notes:* This figure plots OLS and IV estimates (Equation 3) by distance to the statutory retirement age (SRA). In panel (a), the outcome variable is earnings (DKK), in panel (b) the outcome variable is a dummy for being employed, in panel (c) the outcome variable is a dummy for being partially employed, and in panel (d) the outcome variable is a dummy for being self-supporting. Controls measured age 55 include firm FE, year FE, dummy for payment to VERP scheme, male dummy, education dummies, marriage dummy, children at home dummy, experience, experience squared, tenure, 1-digit occupation dummies, earnings (deciles), and net wealth excluding pension wealth (ventiles). All monetary values are in DKK (2023 prices). Standard errors are clustered at the firm level at age 55, and 95% confidence intervals are shown.

## F.2.2 Definition of FC

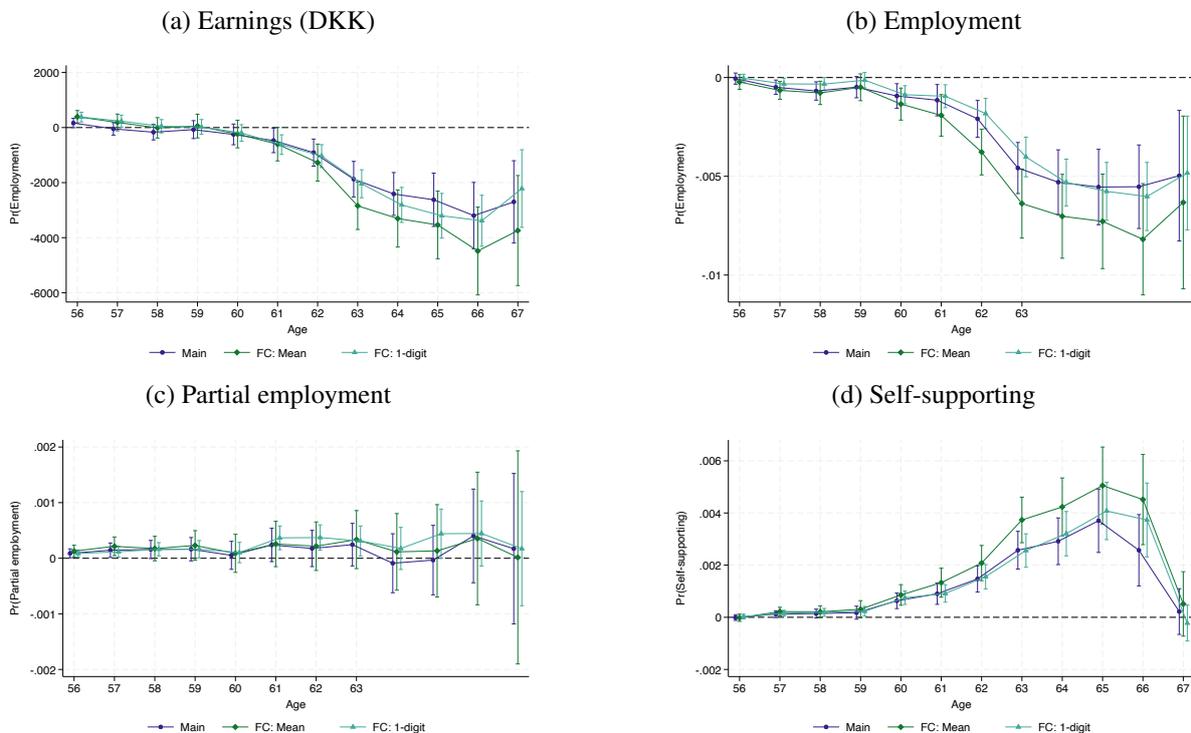
In Section F.2.2, we vary the definition of the firm-specific pension contribution rate (FC). In our main specification, we define the FC as the median of the occupational pension contribution rate for all employees with only that firm as employer in a given year. We show results for two other definitions of the FC: 1) We define the FC as the mean of the occupational pension contribution rate for all employees with only that firm as employer in that year, and 2) we define the FC by each 1-digit occupation level in the firm, meaning that we take the median of the occupational pension contribution rate for all employees within a 1-digit occupation category for a specific firm where the employee is employed in the given year. We show first stage (Table F.3), reduced form (Figure F.9), and IV (Figure F.10) results using these other definitions of the FC.

Table F.3: First Stage: FC definitions

	Pension wealth (1)	Pension wealth (2)
FC (mean) age 40	81,272.98*** (3155.29)	
FC (1-digit) age 40		67,485.20*** (3117.97)
Controls age 55	Yes	Yes
Firm FE age 55	Yes	Yes
Observations	213,349	213,349
$R^2$	0.521	0.528
Mean	2,118,192.68	2,118,192.68
Pct. Change	3.84	3.19

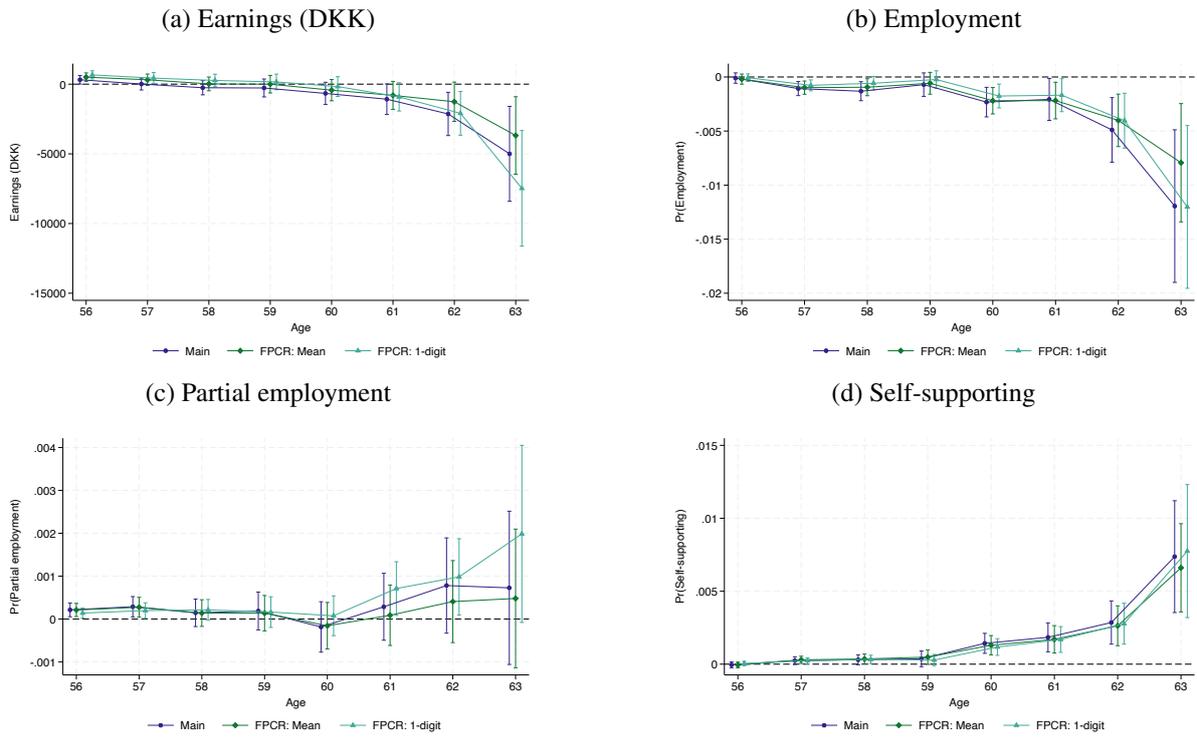
Notes: This table reports the results from the first stage regression (Equation 1) using FC (mean) in column (1) and FC (1-digit) in column (2), both measured at age 40. In columns (1)-(2), the outcome variable is pension wealth, and controls and firm FE at age 55 are included. Controls at age 55 include year FE, dummy for payment to VERP scheme, male dummy, education dummies, marriage dummy, children at home dummy, experience, experience squared, tenure, 1-digit occupation dummies, earnings (deciles), and net wealth excluding pension wealth (ventiles). All monetary values are in DKK (2023 prices). Standard errors are clustered at the firm level at age 55 and shown in parentheses. Significance levels are indicated as \*  $p < 0.05$ , \*\*  $p < 0.01$ , and \*\*\*  $p < 0.001$ .

Figure F.9: Reduced Form Estimates: FC definition



Notes: This figure plots reduced form estimates (Equation 2) for ages 56 to 67 for FC (main specification), FC (mean), and FC (1-digit). In panel (a), the outcome variable is earnings (DKK), in panel (b) the outcome variable is a dummy for being employed, in panel (c) the outcome variable is a dummy for being partially employed, and in panel (d) the outcome variable is a dummy for being self-supporting. Controls age 55 include firm FE, year FE, dummy for payment to VERP scheme, male dummy, education dummies, marriage dummy, children at home dummy, experience, experience squared, tenure, 1-digit occupation dummies, earnings (deciles), and net wealth excluding pension wealth (ventiles). All monetary values are in DKK (2023 prices). Standard errors are clustered at the firm level at age 55, and 95% confidence intervals are shown.

Figure F.10: IV Estimates: FC definition



*Notes:* This figure plots IV estimates (Equation 3) for ages 56 to 63, instrumenting pension wealth at age 55 by FC (main specification), FC (mean), and FC (1-digit). In panel (a), the outcome variable is earnings (DKK), in panel (b) the outcome variable is a dummy for being employed, in panel (c) the outcome variable is a dummy for being partially employed, and in panel (d) the outcome variable is a dummy for being self-supporting. Controls age 55 include firm FE, year FE, dummy for payment to VERP scheme, male dummy, education dummies, marriage dummy, children at home dummy, experience, experience squared, tenure, 1-digit occupation dummies, earnings (deciles), and net wealth excluding pension wealth (ventiles). Standard errors are clustered at the firm level at age 55, and 95% confidence intervals are shown.

### F.3 Functional form and matching

In Section F.3, we start by showing our results using different functional forms, and we then show our first stage analysis using matching.

#### F.3.1 Functional form specifications

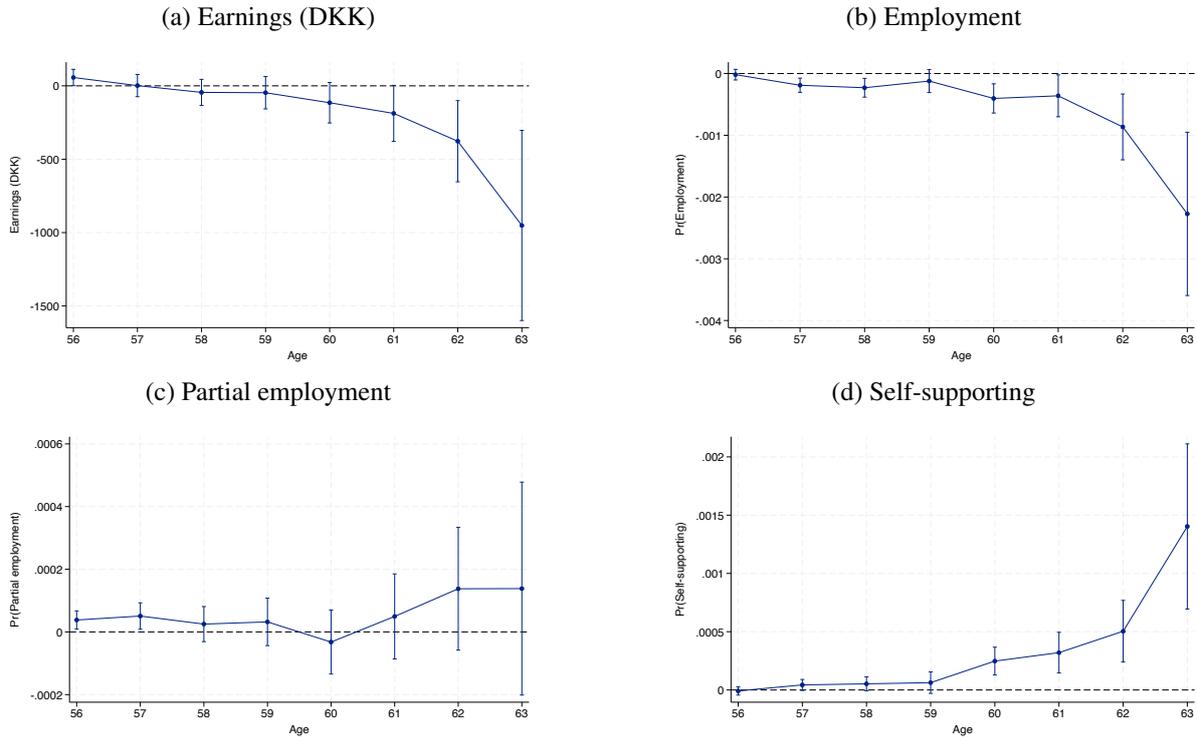
Instead of using pension wealth age 55, we use the logarithm of pension wealth age 55 as our outcome variable in the first stage analysis (Table F.4) and as our variable of interest in the IV analysis (Figure F.11). We then show reduced form and IV estimates using logarithm of earnings as outcome variable in Figure F.12.

Table F.4: First Stage: Log Pension Wealth

	Log pension wealth (1)	Log pension wealth (2)	Log pension wealth (3)
FC age 40	0.062*** (0.003)	0.053*** (0.003)	0.037*** (0.002)
Controls age 55	No	Yes	Yes
Firm FE age 55	No	No	Yes
Observations	229,668	229,668	213,349
$R^2$	0.131	0.492	0.574

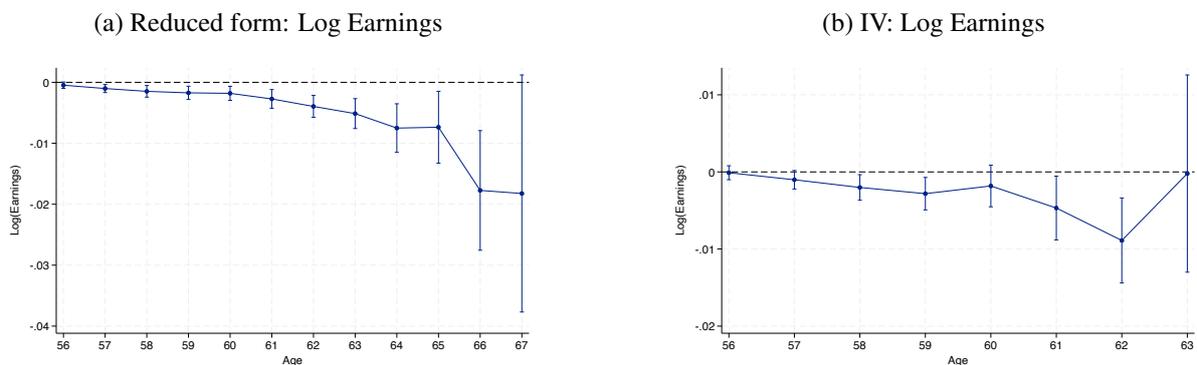
*Notes:* This table reports the results from the first stage regression (Equation 1) where FC is the firm-specific occupational pension contribution rate at age 40. In columns (1)-(3), the outcome variable is the logarithm of pension wealth at age 55. Column (1) includes no control variables, column (2) includes controls at age 55, and column (3) includes controls and firm FE at age 55. Controls at age 55 include year FE, dummy for payment to VERP scheme, male dummy, education dummies, marriage dummy, children at home dummy, experience, experience squared, tenure, 1-digit occupation dummies, earnings (deciles), and net wealth excluding pension wealth (ventiles). All monetary values are in DKK (2023 prices). Standard errors are clustered at the firm level at age 55 and shown in parentheses. Significance levels are indicated as \*  $p < 0.05$ , \*\*  $p < 0.01$ , and \*\*\*  $p < 0.001$ .

Figure F.11: IV Estimates: Log Pension Wealth



Notes: This figure plots IV estimates (Equation 3) for ages 56 to 63 for the logarithm of pension wealth age 55. Estimates are divided by 100 due to the level-log model specification. In panel (a), the outcome variable is earnings (DKK), in panel (b) the outcome variable is a dummy for being employed, in panel (c) the outcome variable is a dummy for being partially employed, and in panel (d) the outcome variable is a dummy for being self-supporting. Controls measured age 55 include firm FE, year FE, dummy for payment to VERP scheme, male dummy, education dummies, marriage dummy, children at home dummy, experience, experience squared, tenure, 1-digit occupation dummies, earnings (deciles), and net wealth excluding pension wealth (ventiles). All monetary values are in DKK (2023 prices). Standard errors are clustered at the firm level at age 55, and 95% confidence intervals are shown.

Figure F.12: RF and IV Estimates: Log Earnings

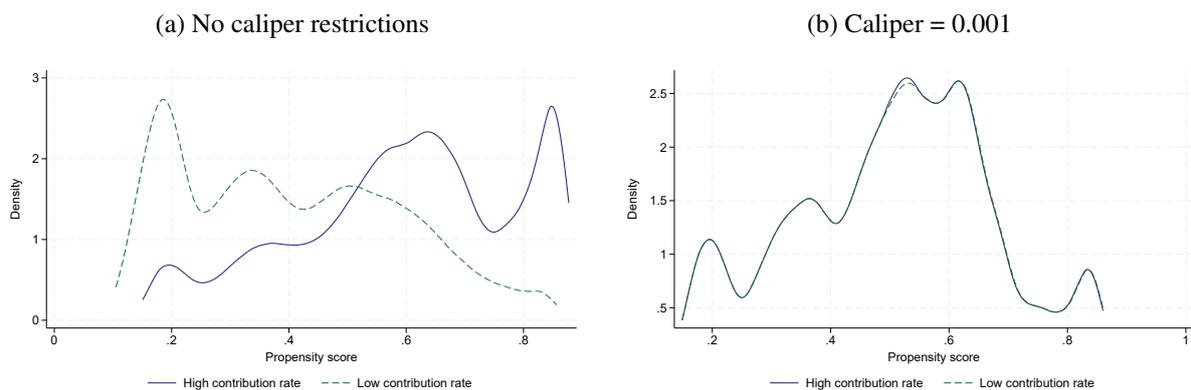


Notes: In panel (a), reduced form estimates (Equation 2) for ages 56 to 67 are shown for the outcome variable, logarithm of earnings. In panel (b), IV estimates (Equation 3) for ages 56 to 63 are shown for the outcome variable, logarithm of earnings. Controls measured age 55 include firm FE, year FE, dummy for payment to VERP scheme, male dummy, education dummies, marriage dummy, children at home dummy, experience, experience squared, tenure, 1-digit occupation dummies, earnings (deciles), and net wealth excluding pension wealth (ventiles). All monetary values are in DKK (2023 prices). Standard errors are clustered at the firm level at age 55. 95% confidence intervals are shown.

### F.3.2 Matching

For our first stage analysis, we investigate whether the use of matching changes the results. We define a treatment variable for having a high FC at age 40 (median or above FC age 40 by cohort). For covariates, we include firm FE, year FE, dummy for payment to VERP scheme, male dummy, education dummies, marriage dummy, children at home dummy, experience, experience squared, tenure, 1-digit occupation dummies, earnings (deciles), and net wealth excluding pension wealth (ventiles), all measured at age 55. We then use 1:1 Nearest Neighbor Propensity Score Matching (PSM) with no replacement to find a "control" individual for each "treated" individual. We estimate two versions: First, without caliper restrictions, and second, with caliper restriction equal to 0.001. By setting a caliper restriction, we impose a maximum allowable difference between propensity scores for matched pairs. We show propensity scores in Figure F.13 and the first stage results using matching in Table F.5 with and without caliper restrictions.

Figure F.13: Propensity Score Matching



*Notes:* Displays propensity scores for individuals with a high ("treated" individuals) and low ("control" individuals) firm pension contribution rate. In panel (a), there is no restriction on caliper, and in panel (b) caliper is set equal to 0.001. The 1<sup>st</sup> and 99<sup>th</sup> percentile of propensity scores are excluded from the graph.

Table F.5: First Stage: Matching

	Pension wealth (1)	Pension wealth (2)	Pension wealth (3)	Pension wealth (4)
FC age 40	114,823.18*** (7113.10)	63,275.15*** (2767.71)	111,955.25*** (7225.09)	61,285.31*** (3210.95)
Controls age 55	No	Yes	No	Yes
Firm FE age 55	No	Yes	No	Yes
Matching	Yes	Yes	Yes	Yes
Caliper restriction	No	No	Yes	Yes
Observations	226,888	210,678	147,233	133,193
$R^2$	0.076	0.520	0.071	0.524
Mean	2,086,992.20	2,108,913.80	2,118,037.36	2,148,161.46
Pct. Change	5.50	3.00	5.29	2.85

*Notes:* This table reports the results from the first stage regression (Equation 1) where FC is the firm-specific occupational pension contribution rate at age 40. In columns (1)-(4), the outcome variable is pension wealth at age 55. Columns (1)-(2) have no caliper restrictions, and columns (3)-(4) have caliper = 0.001. Column (1) and (3) include no control variables, and column (2) and column (4) include controls and firm FE at age 55. Controls at age 55 include year FE, dummy for payment to VERP scheme, male dummy, education dummies, marriage dummy, children at home dummy, experience, experience squared, tenure, 1-digit occupation dummies, earnings (deciles), and net wealth excluding pension wealth (ventiles). All monetary values are in DKK (2023 prices). Standard errors are clustered at the firm level at age 55 and shown in parentheses. Significance levels are indicated as \*  $p < 0.05$ , \*\*  $p < 0.01$ , and \*\*\*  $p < 0.001$ .

#### F.4 Clustering

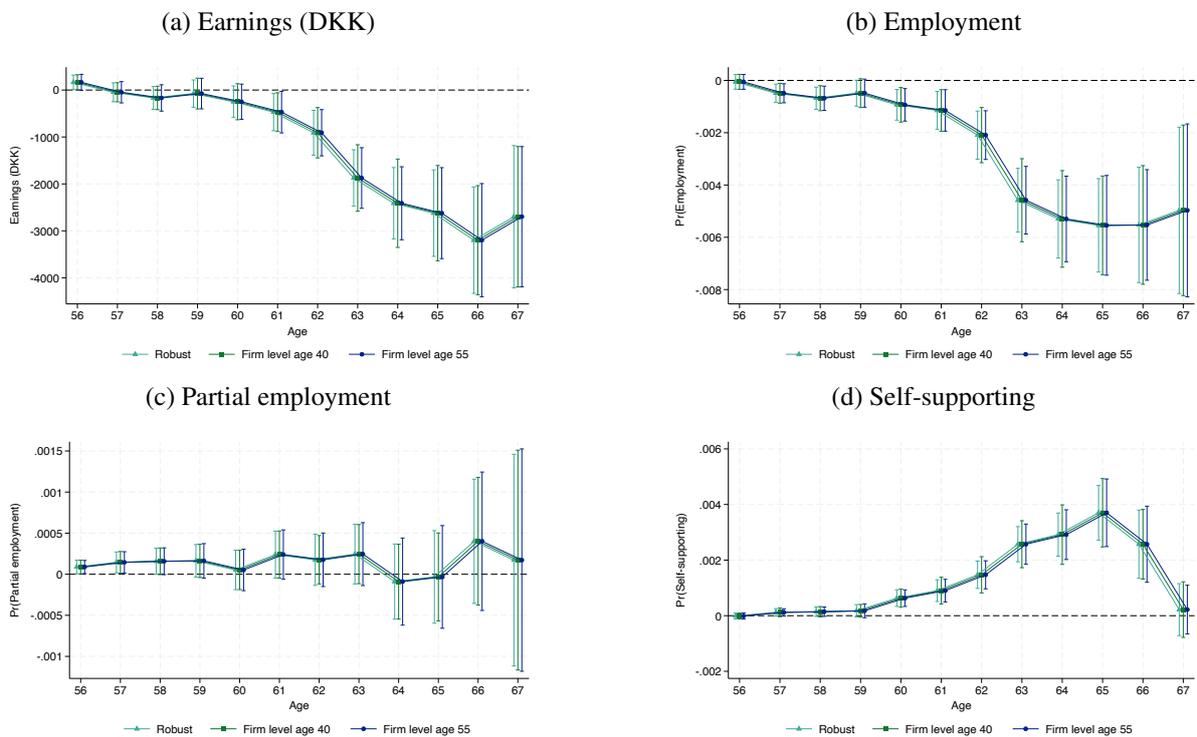
In Section F.4, we investigate whether the choice of standard errors affects the significance of our results. We show our results using standard errors clustered at the firm level at age 55 (main specification), standard errors clustered at the firm level at age 40, and robust standard errors for our first stage analysis (Table F.6), reduced form analysis (Figure F.14), and IV analysis (Figure F.15).

Table F.6: First Stage: Clustering

	Pension wealth (1)	Pension wealth (2)	Pension wealth (3)
FC age 40	63,303.71*** (2766.87)	63,303.71*** (2583.34)	63,303.71*** (1009.03)
Controls age 55	Yes	Yes	Yes
Firm FE age 55	Yes	Yes	Yes
Standard error	Clustered firm-level age 55	Clustered firm-level age 40	Robust
Observations	213,349	213,349	213,349
$R^2$	0.520	0.520	0.520
Mean	2,118,192.68	2,118,192.68	2,118,192.68
Pct. Change	2.99	2.99	2.99
Clusters	15,622	32,843	.

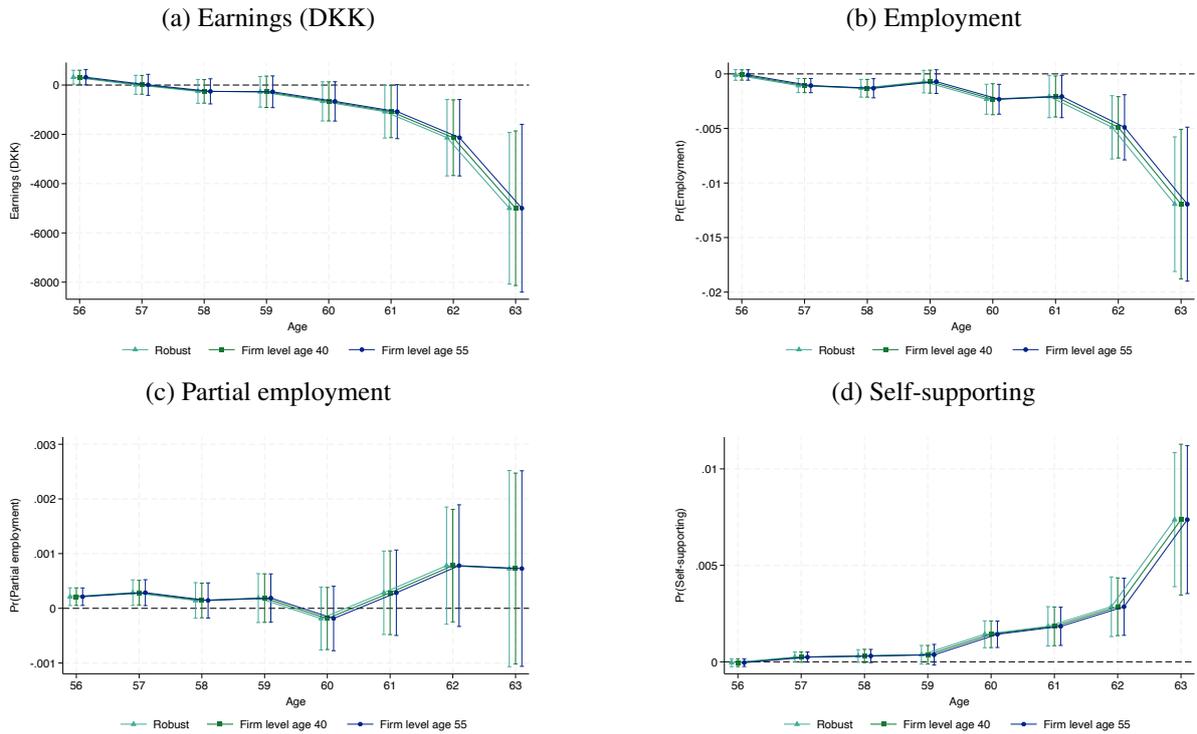
Notes: This table reports the results from the first stage regression (Equation 1) where FC is the firm-specific occupational pension contribution rate at age 40. In columns (1)-(3), the outcome variable is pension wealth at age 55. Column (1) uses standard errors clustered at the firm level at age 55, column (2) uses standard errors clustered at the firm level at age 40, and column (3) uses robust standard errors. Controls measured age 55 include firm FE, year FE, dummy for payment to VERP scheme, male dummy, education dummies, marriage dummy, children at home dummy, experience, experience squared, tenure, 1-digit occupation dummies, earnings (deciles), and net wealth excluding pension wealth (ventiles). All monetary values are in DKK (2023 prices). Standard errors are shown in parentheses. Significance levels are indicated as \*  $p < 0.05$ , \*\*  $p < 0.01$ , and \*\*\*  $p < 0.001$ .

Figure F.14: Reduced Form Estimates: Clustering



Notes: This figure plots reduced form estimates (Equation 2) for ages 56 to 67 using standard errors clustered at the firm level at age 55, standard errors clustered at the firm level at age 40, or robust standard errors. In panel (a), the outcome variable is earnings (DKK), in panel (b) the outcome variable is a dummy for being employed, in panel (c) the outcome variable is a dummy for being partially employed, and in panel (d) the outcome variable is a dummy for being self-supporting. Controls measured at age 55 include firm FE, year FE, dummy for payment to VERP scheme, male dummy, education dummies, marriage dummy, children at home dummy, experience, experience squared, tenure, 1-digit occupation dummies, earnings (deciles), and net wealth excluding pension wealth (ventiles). All monetary values are in DKK (2023 prices). 95% confidence intervals are shown.

Figure F.15: IV Estimates: Clustering



*Notes:* This figure plots IV estimates (Equation 3) for ages 56 to 63 using standard errors clustered at the firm level at age 55, standard errors clustered at the firm level at age 40, or robust standard errors. In panel (a), the outcome variable is earnings (DKK), in panel (b) the outcome variable is a dummy for being employed, in panel (c) the outcome variable is a dummy for being partially employed, and in panel (d) the outcome variable is a dummy for being self-supporting. Controls measured at age 55 include firm FE, year FE, dummy for payment to VERP scheme, male dummy, education dummies, marriage dummy, children at home dummy, experience, experience squared, tenure, 1-digit occupation dummies, earnings (deciles), and net wealth excluding pension wealth (ventiles). All monetary values are in DKK (2023 prices). 95% confidence intervals are shown.