# The Role of Pension Systems in Retirement across Development*

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**Abstract**

We study how pension systems shape late-life labor supply using census microdata from 78 countries. By age 75, 54% of men remain employed in low-income countries versus 8% in high-income ones, with larger gaps among less-educated workers and similar patterns for women. Exploiting variation in pension eligibility ages and coverage rates, we find that a 10-percentage-point increase in coverage reduces post-retirement employment by 2.1 percentage points. Coverage differences explain 31% of the male and 65% of the female late-life employment gap between high- and low-income countries, as limited pension access prevents less-educated workers from retiring.

**Keywords:** Late-life employment, old-age pension systems, statutory retirement age, early retirement age, effective old-age pension coverage, development.

**JEL Codes:** D14, J14, H55, J26, J32

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# 1 Introduction

In most countries, the employment-to-population ratio peaks between the ages of 40 and 50, with approximately 85% of men and 59% of women actively employed. After age 45, participation begins to decline, gradually in some cases, abruptly in others, falling to 52% for men and 28% for women by age 65, and to 34% and 16%, respectively, by age 75. Yet these averages obscure a striking divergence across income levels. In high-income countries, the employment rate of men falls by roughly 74 percentage points between ages 40 and 75; in low-income countries, the corresponding decline is only 33 percentage points. By age 75, fewer than 8% of men remain employed in countries such as France, Spain, and Italy, while more than 54% continue to work in countries such as Mozambique, Kenya, and Uganda. Patterns for women follow the same income gradient.

The process of labor market withdrawal carries critical financial, economic, and social implications for countries worldwide. As populations age, the fiscal burden of supporting retirement—particularly through pensions and healthcare—intensifies. These challenges are especially acute in more developed and aged societies (Nerlich and Schroth, 2018; Amaglobeli et al., 2019; Kim and Dougherty, 2020; Gruber and McGarry, 2023). However, it is already emerging as an issue in many low- and middle-income countries (LMICs) (Giles et al., 2025). Employment among older people also plays a crucial role in determining the capacity of countries to maintain overall employment levels amid demographic shifts. Early withdrawal from the labor force may lead to significant underutilization of resources and underinvestment in human capital, particularly when it begins at relatively younger ages (Gruber and Wise, 1999; Conde-Ruiz and Galasso, 2004). In addition, a growing body of literature examines the implications of labor market withdrawals on physical and mental health in aging populations. While some studies report positive health effects associated with retirement (Latif, 2011; Zhu, 2016; Vo and Phu-Duyen, 2023; Clark and Zhu, 2024), others highlight negative outcomes (Behncke, 2012; Heller-Sahlgren, 2017; Feng et al., 2020).

A large literature documents that employment ratios decline with age (Coile and Gruber, 2007; Rogerson and Wallenius, 2009; OECD, 2025; Kim and Dougherty, 2020). Multiple factors may drive this withdrawal (see Blundell et al. (2016), for a review), including deteriorating health as individuals age (Benjamin et al., 2003; Mete and Schultz, 2007), age-related declines in wages that reduce the returns to work, and pension system rules that embed strong incentives and behavioral cues for exit around minimum retirement ages (French, 2005; De Carvalho Filho, 2008; Staubli and Zweimüller, 2013; Manoli and Weber, 2016; Seibold, 2021; Nakazawa, 2022; Dolls and Krolage, 2023; Garcia-Miralles and Leganza, 2024).

This paper studies the role of pension systems in shaping employment patterns in old age across countries. Using census data from 78 countries during the 2000–2019 period, we exploit within-country variation in gender-specific pension eligibility ages and cross-country variation in pension coverage to estimate the effect of old-age pension systems on employment-to-population ratios at older ages across the development process. We make three contributions to the literature.

First, we document key stylized facts on employment at older ages across countries at different stages of development. While extensive literature has primarily examined late-life employment within individual countries or small sets of high-income economies (Gruber and Wise, 1999; Rupert and Zanella, 2015; Blundell et al., 2016), evidence on cross-country differences has only recently begun to emerge (Gethin and Saez, 2025). Addressing this gap is increasingly important: by 2050, one in five people worldwide will be over age 60, and nearly 80% of them will live in LMICs, placing these economies at the center of global population aging (World Health Organization, 2024).

We show that, while male employment-to-population ratios at age 40 exhibit little variation across countries at different income levels, a pronounced income gradient emerges by age 75. A 10% increase in income per capita is associated with a 1.6-percentage-point greater decline in male employment between ages 40 and 75. Furthermore, we find that the primary source of cross-country variation in employment-to-population ratios lies in the divergent labor supply behavior of workers with lower levels of education. Among men at age 75, the employment gap between low- and high-income countries is 48 percentage points for non-university graduates, compared with a 20-percentage-point gap among university graduates. For women, cross-country variation is greater during midlife, but the overall pattern of labor market exit follows the same income gradient observed among men.

Our second contribution relates to the literature on how the design and functioning of pension systems affect late-life employment. Our analysis exploits within-country variation in gender-specific pension eligibility ages, as well as cross-country variation in pension coverage rates. In our sample, minimum retirement ages range from 45 to 70, and pension coverage spans a continuum from near zero in some low-income countries to universality in high-income countries. To identify the effect of pension systems, we compare reductions in employment-to-population ratios after the country-gender-specific minimum retirement age between high- and low-coverage countries, while controlling for potential confounders related to levels of development. We find that a 10-percentage-point increase in effective pension coverage leads to a 2.1-percentage-point decline in the employment-to-population ratio five years or more after the country-gender-specific minimum retirement age. Consequently, countries with full coverage experience a 21-percentage-point fall in employment after the established retirement age, relative to a no-pension counterfactual.

Our cross-country estimates are comparable in magnitude to evidence from individual-country reforms. Increases in retirement ages—which effectively shift cohorts from full to zero coverage—have been shown to raise employment among older workers by 6.3 percentage points in the United Kingdom (Cribb et al., 2016), 7–8 percentage points in Japan (Nakazawa, 2022), 9.8–11 percentage points in Austria (Staubli and Zweimüller, 2013) and up to 19 percentage points in Australia (Atalay and Barrett, 2015) and Finland (Nivalainen and Ilmakunnas, 2025). Similarly, Fetter and Lockwood (2018) find that the introduction of Old Age Assistance in the United States reduced labor force participation among men aged 65–74 by 8.5 percentage points. Our study also contributes to a complementary literature that exploits cross-country variation in social-security parameters—such as early retirement ages, replacement rates, and disability-insurance rules—to explain international differences in older-worker employment (Erosa et al., 2012; Coile et al., 2025). Unlike earlier analyses, which focus primarily on advanced economies, our study spans the full income spectrum and shows that variation in effective old-age pension coverage accounts for 31% (14.5 percentage points) of the male and 65% (18.4 percentage points) of the female employment-to-population gap at age 75 between high- and low-income countries.

Our findings are closely related to Gethin and Saez (2025), who document a sharp decline in hours worked by older adults with economic development, largely attributed to differences in pension coverage. We advance this literature by showing that these declines are tightly concentrated around retirement ages, providing more direct evidence linking cross-country differences in labor supply at older ages to pension design.

Our third contribution builds on two core findings of this paper—the large, causal impact of pension entitlements on late-life employment and the persistently low pension coverage in middle- and low-income countries—to show how variations in pension coverage reshape older-worker employment across education groups. In high-income economies, where coverage is effectively universal, the employment rate of university graduates exceeds that of non-graduates by an average of 20% at age 40, yet by age 75, it is more than twice as high. This widening gap reflects faster labor-market exits among less-educated workers once old-age pension benefits become available. This is not surprising. Less-educated workers are more likely to hold physically demanding jobs and face adverse working conditions (Dieker et al., 2019); experience poorer health outcomes (van der Put et al., 2020); receive higher pension benefits relative to wages, due to the design of pension systems (Tamborini and Kim, 2017; Clavet et al., 2022); and have greater access to early-retirement or disability insurance programs (Bound et al., 2014; Binder and Bound, 2019; Schuring et al., 2019; Qvist, 2021; Thern et al., 2022). In contrast, in lower-middle and low-income settings, this employment gradient reverses—university graduates are less likely to remain employed later in life than their non-university graduate peers by around 20%.

Exploiting the same variation in pension design and coverage, we find that differences in old-age pension coverage account for a 0.8-point higher employment ratio of university graduates relative to non-university graduates among men at age 75. This magnitude represents roughly 46% of the observed gap in the relative employment between high- and low-income countries for men at that age. In other words, in countries with underdeveloped pension systems, it is the less-educated population—who must continue working in the absence of adequate benefits—that drives a large share of the late-life employment disparities observed between high- and low-income economies.

The remainder of the paper is organized as follows. Section 2 describes the data and provides an overview of old-age pension systems across countries. Section 3 presents the main stylized facts on retirement patterns across levels of development. Section 4 outlines the empirical strategy and discusses the main results. Section 5 concludes.

## 2 Institutional settings and data

***Employment and contextual data***

The central object of analysis is the late-life age profile of employment-to-population ratios. We construct these profiles using IPUMS-International census microdata (Ruggles et al., 2025). The sample includes all countries with at least one census conducted between 2000 and 2019; when multiple censuses are available for a country, we use the most recent. We restrict the sample to individuals aged 40 to 75 and exclude records with missing information on age, sex, or employment status. From the resulting dataset, we calculate employment-to-population ratios by age, sex, and education level. Our education comparisons rely on two thresholds: (i) university versus non-university attainment, and (ii) completion versus non-completion of high school.

We obtain GDP per capita at purchasing-power parity from the IMF's World Economic Outlook. For descriptive comparisons, we adopt the World Bank four-tier income-group classification: low, lower-middle, upper-middle, and high income. Country-level demographic data are sourced from the United Nations (UN) Population Division. GDP and demographic variables are measured in the same year as the employment outcome.

***Old-age pension systems***

Most nations operate at least one old-age public pension program that covers either the entire workforce or relatively large specific segments (e.g., public-sector, private-sector, or other salaried employees), and many maintain multiple schemes tailored to distinct populations. The ILO (2024) documents 178 major old-age public pension programs for which data exist. Most programs are contributory in nature, entitling individuals to retirement benefits provided they have made contributions or payments throughout their working lives. However, an increasing number of countries have introduced or expanded their systems to allow for non-contributory old-age pensions. These are age-based transfers designed to provide a retirement income irrespective of prior contributions. To date, 127 countries have implemented non-contributory old-age pensions (ILO, 2024).

Characterizing and comparing old-age pension programs is inherently challenging, as they vary across multiple dimensions: the rules governing benefit entitlements (e.g., defined benefit versus defined contribution), the underlying financing arrangements (e.g., pay-as-you-go versus fully funded), the level of benefit generosity, and the methods of indexation and adjustment, among others. In this paper, we examine the impact of national old-age pension systems on late-life labor supply by leveraging two key sources of variation: within-country differences in gender-specific pension eligibility ages and cross-country differences in pension coverage rates.

***Retirement ages***

A key parameter of old-age pension programs is the age at which individuals first become eligible to claim benefits. Eligibility is typically anchored to a minimum retirement age, defined in chronological years. In contributory systems, the statutory retirement age specifies when beneficiaries qualify for full benefits, while the early retirement age allows earlier claims with actuarially reduced payouts. When early retirement is available (44% of our sample), eligibility is typically 3–5 years before the statutory threshold. Throughout the paper, we define the earliest retirement age as the minimum age at which individuals can begin receiving benefits—corresponding to the early retirement age when available, or otherwise to the statutory retirement age. Prior research has shown that the earliest possible retirement age is a key reference point that triggers labor market exits[1].

We draw on data for statutory and early pensionable ages, disaggregated by sex, from two main sources. Our primary source is the Social Security Programs Throughout the World (SSPTW) series, a biennial publication of the U.S. Social Security Administration (SSA). When data for a specific year are unavailable in SSPTW, we supplement these with country profile information from the International Social Security Association (ISSA).

Minimum retirement ages vary widely across countries and programs, reflecting demographic conditions, occupational structures, and broader economic factors. On average, statutory and early retirement ages are about five years lower in low-income countries compared to high-income countries. This pattern is consistent with demographic differences: life expectancy at age 60 is roughly nine years shorter for women and seven years shorter for men in low-income countries, and their populations are considerably younger overall. In high-income countries, individuals aged 65 and older account for 17% of women and 13% of men—roughly four times the corresponding shares in low-income settings—with middle-income countries falling in between.

In a subset of countries, retirement ages also differ by gender (35% in our sample)—typically with women eligible to retire between one and five years earlier than men. In old-age non-contributory (social) pension systems, age also serves as a key eligibility criterion—alongside residency or citizenship requirements—most commonly aligning benefit commencement with the statutory or early retirement age of the contributory system, although in some systems this may differ. In our dataset, most minimum retirement ages fall between 55 and 65, with roughly 90% of cases within this range. However, there are notable outliers, with eligibility ages as low as 45 and as high as 70.

***Pension coverage***

We measure effective pension coverage as the share of individuals above the statutory retirement age who are entitled to benefits, using data from the ILO's Sustainable Development Goals Labor Market Indicators (ILOSDG). The ILOSDG compiles administrative statistics self-reported by national ministries, encompassing both contributory and non-contributory schemes. Importantly, this measure does not capture the share of individuals currently receiving a pension. Rather, it reflects governments' estimates—reported to the ILO through the Social Security Inquiry (SSI)—of the proportion of people above retirement age who are legally entitled to benefits, making it a reliable indicator of the overall reach of the pension system.

Effective pension coverage varies widely across countries, reflecting differences in institutional design and labor market structure. In some systems, benefits accrue primarily to salaried

[1] Results using the statutory retirement age are presented in Table A9 of the Supplemental Appendix.

workers, while the self-employed and those in non-standard employment are often excluded from mandatory contributions. High levels of informality in low- and middle-income countries further constrain participation, even under compulsory schemes. The International Labour Organization (ILO) reports contributory coverage—the share of the labor force actively contributing to a pension scheme—as a complementary measure. On average, only 15% of workers in low-income countries contribute, compared with 89% in high-income countries, with middle-income countries falling in between. However, the relationship between contributors and total population coverage is imperfect. Non-contributory pensions can substantially expand coverage even where contributory participation remains low. As a result, some countries have achieved near-universal coverage, while others protect only a small fraction of the elderly. In our sample, overall coverage ranges from 0.7% to 100%.

Our final dataset consists of 28,080 age-, gender-, and education-specific employment ratio profile cells, as well as country- and gender-specific minimum retirement ages, pension coverage, and GDP per capita, covering 78 countries and representing a broad mix of developed and developing economies. Table A1 of the Supplemental Appendix reports the corresponding descriptive statistics.

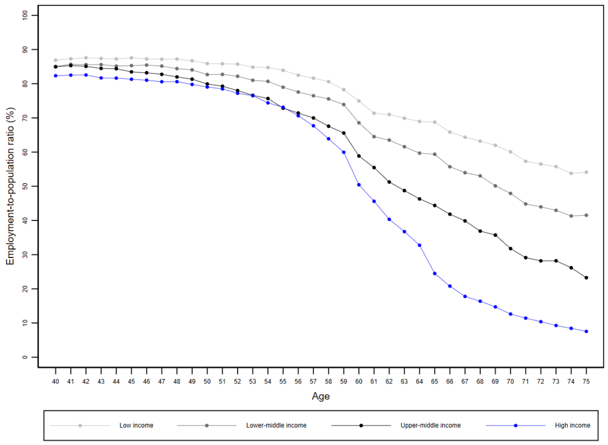
# 3 Stylized facts on retirement across development

## 3.1 Cross-country variation in employment age profiles near retirement

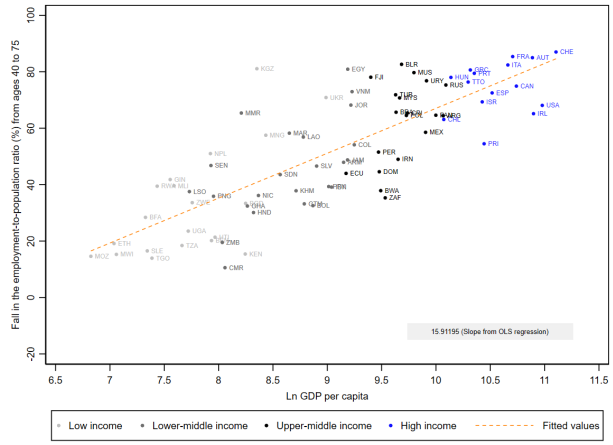
It is well known that labor supply declines with age. In our sample of 78 countries, the average male employment rate drops from 85.0% at age 40 to 64.4% at age 60, and further to 34.0% by age 75. While this trend holds across all countries, the patterns and magnitudes of decline vary significantly by income level. This drop follows a distinct income gradient: the wealthier the country, the steeper the drop in male labor supply.

Figure 1: Employment-to-population ratio (%) by sex and country income group

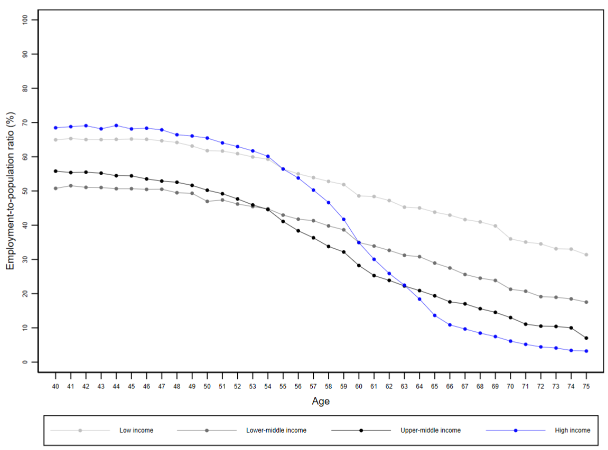
Panel A: Employment age profiles by country income group (Men)



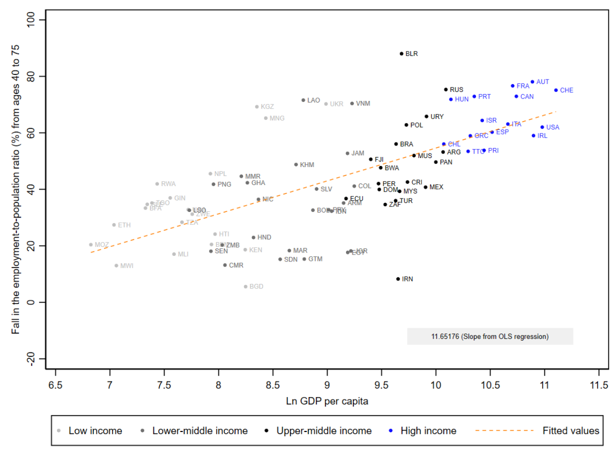

Panel B: Employment decline (ages 40–75) vs. ln GDP per capita (Men)




Panel C: Employment age profiles by country income group (Women)




Panel D: Employment decline (ages 40–75) vs. ln GDP per capita (Women)




**Note**: Panels B and D plot the relationship between the natural logarithm of GDP per capita and the total decline in employment between ages 40 and 75. Employment data at age 75 were unavailable for three countries—Jordan (2004), Russia (2010), and South Africa (2011); in these cases, values from the nearest available age were used. Across all four panels, employment is proxied by the employment-to-population ratio, derived from census microdata covering 78 countries and sourced from IPUMS International.

Panel A of Figure 1 shows that the male employment-to-population ratio varies little across income groups between ages 40 and 45, but differences widen sharply with age. In high-income countries, the average male employment rate declines to 50.5% by age 60, compared with 75.0% in low-income countries. This divergence continues at older ages: by age 75, male employment falls to 7.6% in high-income countries but remains as high as 54.1% in low-income countries. Panel B further illustrates that the decline in male employment between ages 40 and 75 is strongly correlated with income levels—a 10% increase in GDP per capita is associated with a 1.6-percentage-point larger drop in the employment-to-population ratio.

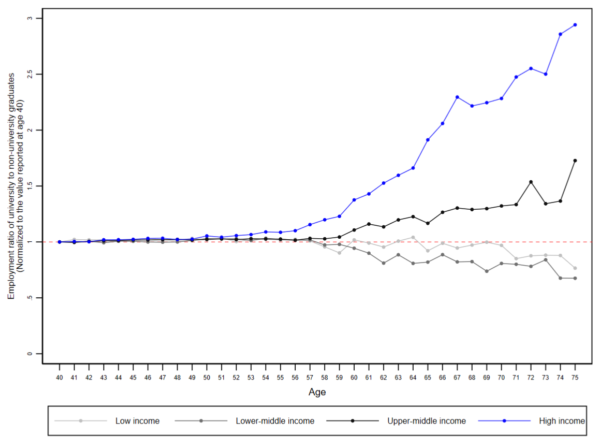
Female employment age profiles follow similar trends but show more variation in midlife employment (see Panel C). At age 45, the female employment-to-population ratio is higher in high-income (68.2%) and low-income (65.2%) countries compared to upper-middle-income (54.4%) and lower-middle-income (50.7%) countries. However, by age 64, this pattern reverses: as with male employment, the higher the income level, the lower the employment-to-population ratio. This shift reflects the same income gradient, with steeper declines in female employment in wealthier countries. By age 64, the female labor supply in high-income countries drops to approximately 18.4%, compared to an average of 45.0% in low-income countries. By age 75, the gap becomes even more pronounced: female employment falls to approximately 3.2% in high-income countries, while averaging 31.4% in low-income countries. As with men, the total decline in female employment from ages 40 to 75 is strongly correlated with income: a 10% increase in GDP per capita is associated with a 1.2-percentage-point larger decline in the total female employment-to-population ratio (see Panel D).

The divergence in late-life employment between high- and low-income countries is most intense for workers with low levels of education. Among university graduates, age-employment profiles are relatively similar across development with only significant divergence in high-income countries after the age of 65. At age 40, men's employment-to-population ratios stand at 90.9% in high-income countries versus 89.0% in low-income countries; by age 75, they decline to 15.0% and 32.0%, respectively—a gap of 17 percentage points. In contrast, non-university graduates exhibit far steeper exits in high-income countries: by age 75, male employment rates for non-university graduates are only 6.7% in high-income countries but 54.0% in low-income countries, a 48-percentage-point difference. A parallel pattern emerges for women. University-educated women display nearly identical age-employment trajectories across income groups, with less than a 10-percentage-point gap by age 75. Among women without a university degree, mid-career employment rates are comparable across high- and low-income countries (and slightly lower in middle-income countries), but post-retirement declines are much steeper in high-income settings. Results are similar when using secondary graduates versus non-secondary graduates.

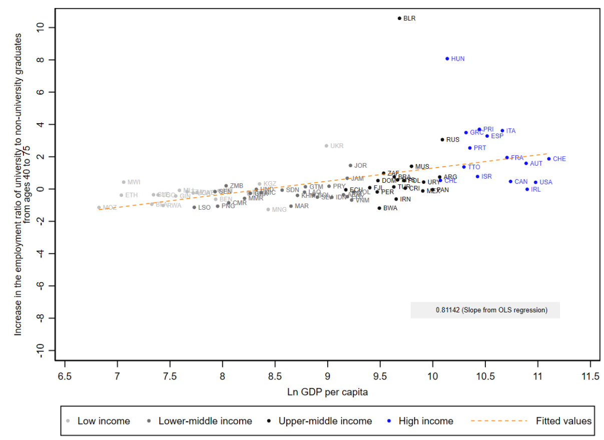
These divergent age profiles by educational attainment generate distinct age gradients in the relative employment ratio (university versus non-university graduates) (see Figure 2, Panels A and C). In high-income countries, the ratio of employment probabilities rises sharply with age. When normalized to 1 at age 40, this ratio increases to about 3.0 by age 75, reflecting the more rapid exit of less-educated workers. By contrast, in low- and lower-middle-income countries, the relative employment ratio remains flat or even declines, as non-university graduates continue to participate in the labor force at older ages, with upper-middle-income countries occupying an intermediate position. Panels B and D of Figure 2 plot the evolution of the relative employment ratio between university and non-university graduates against GDP per capita, revealing a clear and strong positive association for both men and women. Figure A5 of the Supplemental Appendix replicates this analysis for secondary education graduates.

Figure 2: Employment ratio of university to non-university graduates by sex and country income group

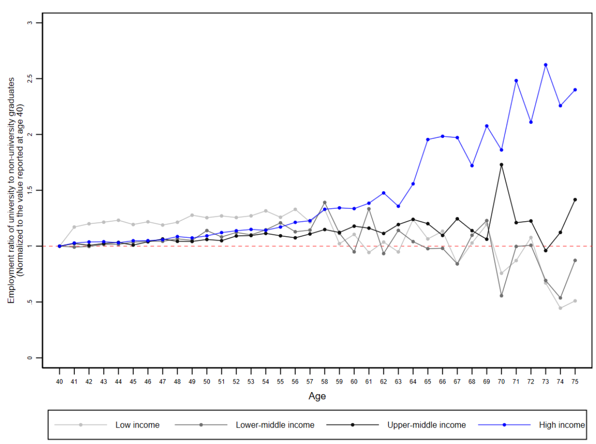
Panel A: Employment ratio of university to non-university graduates by country income group (Men)



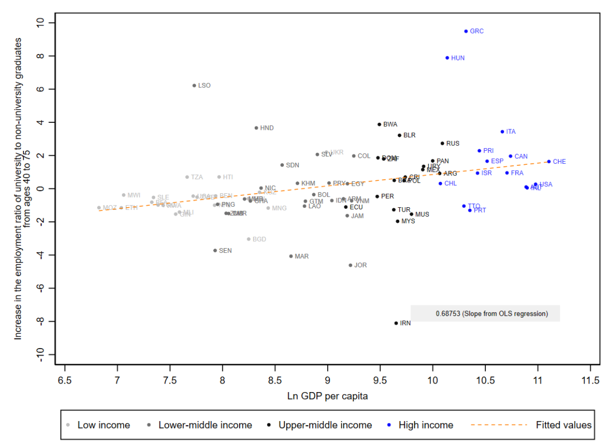

Panel B: Increase in the employment ratio of university to non-university graduates (ages 40–75) vs. ln GDP per capita (Men)




Panel C: Employment ratio of university to non-university graduates by country income group (Women)




Panel D: Increase in the employment ratio of university to non-university graduates (ages 40–75) vs. ln GDP per capita (Women)




**Note**: Panels B and D plot the relationship between the natural logarithm of GDP per capita and the total increase in the employment ratio of university to non-university graduates between ages 40 and 75. Employment data at age 75 were unavailable for three countries—Jordan (2004), Russia (2010), and South Africa (2011); in these cases, values from the nearest available age were used. Across all four panels, employment is proxied by the employment-to-population ratio, derived from census microdata covering 78 countries and sourced from IPUMS International. In Panels A and C, the y-axis variable is normalized to 1 at age 40 by dividing each series by its value at that age.

Hence, a key stylized fact emerging from the analysis is that, irrespective of sex, employment declines more rapidly with age in higher-income countries along the development process. However, the pace of labor force withdrawal varies markedly by educational attainment: in richer countries, less-educated workers exit the labor market earlier than their more-educated peers, whereas in poorer countries the pattern is reversed.

# 4 Empirical approach and main results

To understand how pension systems shape these patterns, we exploit two key sources of variation. The first is the gender-specific pension eligibility ages, which mark the point at which individuals become entitled to draw pension benefits. The second source of variation is the cross-country heterogeneity in effective old-age pension coverage.

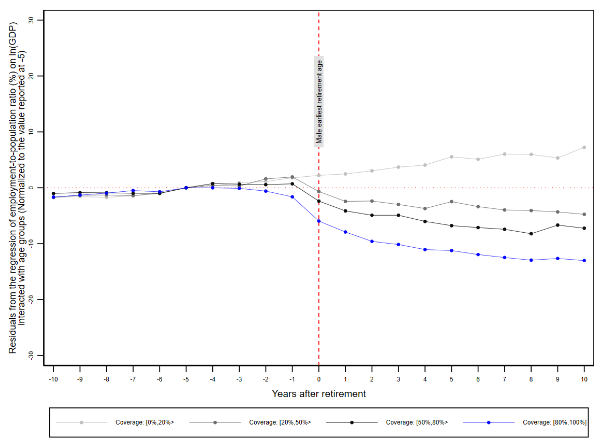
## 4.1 Exit from the labor market and pension systems

Before presenting the estimation model, we first illustrate how late-life employment varies with minimum retirement ages and pension coverage across countries. First, we estimate a pooled regression of the employment-to-population ratio on the interaction between the natural logarithm of GDP per capita and age-group indicators. The residuals from this regression capture cross-country variation in employment not explained by income differences, allowing us to relate these deviations to institutional factors such as retirement ages and pension coverage. Panels A and B of Figure 3 plot these residuals relative to the country-specific earliest retirement age for men and women, respectively, grouped by pension coverage levels.

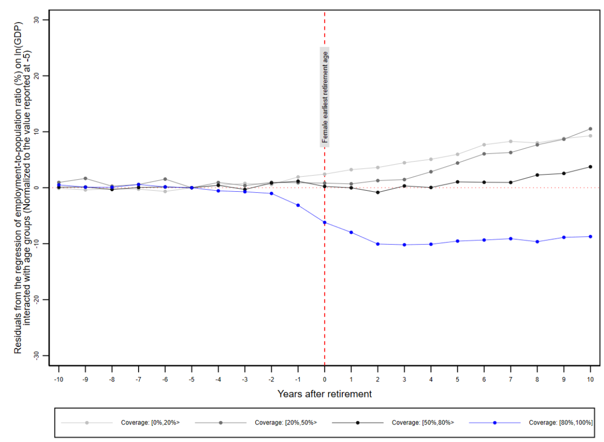
Figure 3 reveals distinct patterns of labor market withdrawal across pension coverage levels and between men and women. Before the earliest retirement age, employment residuals remain relatively stable across all coverage groups, indicating broadly parallel pre-trends. However, in countries with high pension coverage (above 80%), employment begins to decline gradually about three years before the minimum eligibility threshold, suggesting that factors associated with coverage may influence employment decisions even prior to retirement. At the earliest retirement age, employment falls sharply in high-coverage systems. Among men, countries with moderate coverage (20%–80%) also experience a decline, though considerably smaller, while among women, the discrete post-retirement drop observed for men is largely absent. Taken together, these patterns indicate that pension coverage plays a central role in determining both the timing and magnitude of labor market withdrawal.

Figure 3: Withdrawal from the labor market by sex and effective coverage

Panel A: Age profiles of employment residuals relative to the country-specific earliest retirement age by effective coverage (Men)




Panel B: Age profiles of employment residuals relative to the country-specific earliest retirement age by effective coverage (Women)




**Note**: In both panels, the outcome variable is the residual from a pooled regression of the employment-to-population ratio on the interaction between the natural logarithm of GDP per capita and age-group indicators. Employment is proxied by the employment-to-population ratio, derived from census microdata covering 78 countries and sourced from IPUMS International. The y-axis is normalized to zero five years before the earliest retirement age by subtracting the series value at that point.

## 4.2 Estimation model

We formally quantify the impact of pension systems on late-life employment by estimating the following event-study specification:

$$y_{s,a,c} = \alpha_0 + \sum_{k=-u}^{u} \beta_k \cdot \mathbb{1}(k_{a,c} = k) + \sum_{k=-u}^{u} \gamma_k \cdot \mathbb{1}(k_{a,c} = k) \times \text{Coverage}_c + X'_{a,s,c}\phi + \varepsilon_{s,a,c} \tag{1}$$

Where $y_{s,a,c}$ denotes the employment-to-population ratio for individuals of sex $s$, age $a$, and country $c$. The variable $k_{a,c}$ indexes years relative to the retirement eligibility threshold in country $c$, and $Coverage_c$ represents the overall effective old-age pension coverage in country $c$. The vector $X_{a,s,c}$ includes additional covariates, and $\varepsilon_{s,a,c}$ is an error term clustered at the country level. The coefficients $\beta_k$ trace out the average age-employment profile around the eligibility threshold. The interaction coefficients $\gamma_k$ capture how effective old-age pension coverage modifies this age-employment relationship. For the main specification, we set $u = 5$ and estimate effects for five years before and after the reference retirement age. In Tables A7 and A8 of the Supplemental Appendix, we extend the analysis window to $u = 10$ as a robustness check. We also normalize the coefficients by setting $\beta_{-5} = 0$, treating five or more years before retirement eligibility as the excluded category[2]. Similarly, we set $\beta_k = \beta_{-5}$ for all $k \leq -5$ and $\beta_k = \beta_{+5}$ for all $k \geq 5$.

[2]According to Miller (2023), event study models are commonly normalized by selecting a single pre-treatment period as the reference category. Rather than mechanically using the period immediately preceding the event, however, best practice is to assess the underlying dynamics and identify a credible pre-event window. In our setting, Figure 3 shows that

The control vector $X_{a,s,c}$ includes a set of economic and demographic covariates. Specifically, it incorporates age fixed effects. To account for factors potentially correlated with pension coverage and influencing employment trends, we interact age with the natural logarithm of GDP per capita in country c. This specification allows for heterogeneous employment age profiles across different stages of economic development. Such flexibility is essential, as the expansion of social protection programs—such as unemployment or disability insurance—may also vary with income (and hence coverage) and independently affect labor-market outcomes before pension eligibility age (as suggested by Figure 3).

We estimate equation (1) both for the pooled sample (men and women combined) and separately by gender. Given the absence of gender-disaggregated data on effective pension coverage for several countries in the sample, we employ overall coverage rates. We further extend the specification to examine heterogeneity by educational attainment, estimating the impact of effective old-age pension coverage on the employment-to-population ratio across groups defined by schooling: university versus non-university graduates, and secondary versus non-secondary graduates.

To interpret the estimated coefficients as capturing the causal effect of old-age pension systems on late-life labor supply, several key assumptions must hold. First, conditional on age, sex, country fixed effects, and GDP per capita, we assume that labor force exit would evolve similarly across countries in the absence of cross-country differences in pension system design. This requires that no unobserved factors simultaneously influence both pension system parameters (e.g., minimum retirement age) and the age profile of employment within the event window. Second, the interaction coefficients with pension coverage rely on the assumption that coverage serves as a valid proxy for the salience and accessibility of pension benefits. In particular, coverage should reflect meaningful access to retirement income rather than merely capturing broader labor market formality or institutional quality that might independently affect employment withdrawals. Finally, we examine employment pre-trends by estimating event-time coefficients before pension eligibility. The absence of systematic differences in these pre-trends supports a causal interpretation of the observed employment declines around retirement thresholds.

### 4.3 Empirical results

Table 1 reports the main results. We estimate equation (1) jointly and separately for men and women, using the earliest retirement age. In all specifications, countries with greater pension coverage show larger reductions in employment-to-population ratios after the country-specific minimum eligibility age. We find that pension coverage has a strong influence on late-life employment after the earliest retirement age. Columns 1–3 show a statistically significant effect of

in countries with high pension coverage (above 80%), employment rates begin to decline gradually approximately three years before the eligibility threshold. This pattern suggests that factors associated with social insurance coverage—such as access to health insurance, disability insurance, or unemployment insurance—may influence labor supply decisions even before formal retirement eligibility. Accordingly, we define the omitted category as five or more years before the eligibility threshold. This approach is consistent with existing empirical work; for example, Jacobson et al. (1993) use "five or more years prior to the layoff" as the reference period in their event study analysis.

pension coverage on late-life labor market exit.

In the pooled sample, a 10-percentage-point increase in effective pension coverage is associated with a 0.99-percentage-point reduction in employment in the year in which individuals reach the minimum retirement age. This effect intensifies in subsequent years: five or more years after the earliest eligibility age, the estimated decline in employment more than doubles. We find no statistically significant relationship between effective pension coverage and employment in the years preceding eligibility, although the estimates exhibit a non-significant but negative coefficient in the years before eligibility, suggesting the possibility of anticipatory responses.

Table 1: The impact of effective old-age pension coverage on late-life employment after the gender-specific earliest retirement age

| | (1) | (2) | (3) |
|---|---|---|---|
| | **Outcome 1: Employment-to-population ratio** | | |
| Variables | All | Women | Men |
| (Earliest retirement age -4) * coverage | 0.041 | -1.870 | -0.432 |
| | (1.770) | (2.045) | (2.104) |
| (Earliest retirement age -3) * coverage | -0.801 | -2.759 | -1.147 |
| | (2.010) | (2.391) | (2.258) |
| (Earliest retirement age -2) * coverage | -1.569 | -3.620 | -2.105 |
| | (2.467) | (2.828) | (2.769) |
| (Earliest retirement age -1) * coverage | -4.486 | -7.620** | -3.940 |
| | (2.916) | (3.469) | (3.177) |
| (Earliest retirement age) * coverage | -9.912** | -13.025*** | -9.546** |
| | (3.763) | (4.067) | (4.293) |
| (Earliest retirement age +1) * coverage | -13.154*** | -16.450*** | -12.935** |
| | (4.424) | (4.724) | (5.115) |
| (Earliest retirement age +2) * coverage | -16.517*** | -20.557*** | -15.578*** |
| | (5.077) | (5.370) | (5.785) |
| (Earliest retirement age +3) * coverage | -17.955*** | -22.729*** | -16.643*** |
| | (5.188) | (5.541) | (5.870) |
| (Earliest retirement age +4) * coverage | -19.120*** | -23.454*** | -18.329*** |
| | (5.397) | (5.738) | (6.262) |
| (Earliest retirement age +5) * coverage | -21.519*** | -27.643*** | -21.666*** |
| | (5.888) | (6.226) | (6.968) |
| Constant | 59.095*** | 59.064*** | 85.062*** |
| | (1.446) | (0.830) | (0.649) |
| Observations | 5,586 | 2,793 | 2,793 |
| R-squared | 0.869 | 0.934 | 0.939 |
| FE by Country | Yes | Yes | Yes |
| Mean of dependent variable | 53.49 | 41.07 | 65.92 |
| Standard deviation of dependent variable | 27.78 | 24.74 | 24.95 |

**Notes:** Robust standard errors are clustered at the country level and reported in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Overall, our estimates imply that a 10-percentage-point rise in effective pension coverage leads to a 2.1-percentage-point reduction in employment five years or more after the gender-specific minimum retirement threshold—corresponding to a 21-percentage-point decline under full coverage. A similar regression using the statutory retirement age (see Table A9 of the Supplemental Appendix) reveals notable pre-trends, consistent with the interpretation that the earliest retirement age is the relevant threshold at which individuals begin claiming benefits.

When estimating equation (1) separately for men and women, the effects are similar, although women exhibit a more pronounced—and statistically-significant—coefficient in the year before the earliest retirement age. Among women, a 10-percentage-point increase in effective pension coverage is associated with a 1.30-percentage-point reduction in the employment-to-population ratio at the retirement threshold. In subsequent years, the magnitude of the effect increases further, reaching a decline of 2.76 percentage points five or more years after the earliest retirement age. For men, the same 10-percentage-point increase in coverage leads to a 0.95-percentage-point drop at the relevant threshold, growing to 2.17 percentage points five or more years after the minimum retirement age.

To place these estimates in context, consider that the average difference in pension coverage between high- and low-income countries is approximately 67 percentage points. Applying our estimated effects, this coverage gap accounts for a 14.5-percentage-point difference in the employment-to-population ratio among men and an 18.4-percentage-point difference among women at age 75. These figures represent approximately 31% and 65% of the observed employment-to-population gap between high- and low-income countries for men and women at age 75, respectively. These results suggest that cross-country differences in pension systems' reach may explain a meaningful share of the variation in late-life employment patterns across income levels.

**Results by level of educational attainment**

We next examine how effective pension coverage reshapes late-life labor supply by educational attainment. Although our primary data do not provide coverage rates disaggregated by education, prior studies document a pronounced educational gradient in pension participation, with higher enrollment among the more educated (Ginn and Arber, 2002; Baum et al., 2013; Bosch et al., 2013; Tamborini and Kim, 2017; Chen et al., 2020; Chen et al., 2022). To capture how this gradient affects late-life employment, we re-estimate equation (1) using as outcomes the relative employment-to-population ratios of more- versus less-educated workers. Specifically, we construct two measures: (i) the employment ratio of university graduates relative to non-university graduates, and (ii) the employment ratio of secondary school graduates relative to those without secondary education.

Table 2 presents estimates for the pooled sample and separately by gender. The results show that higher pension coverage is associated with an increase in the relative employment of more educated workers, consistent with stronger pension-induced labor-force exit among the less educated. In the pooled sample, this pattern is particularly pronounced—and statistically significant—for the comparison between secondary- and non-secondary-educated workers. In contrast, we do not find statistically significant effects for the university- versus non-university-educated comparison.

Table 2: The impact of effective old-age pension coverage on late-life employment after the gender-specific earliest retirement age

| | (1) | (2) | (3) | (4) | (5) | (6) |
|---|---|---|---|---|---|---|
| | **Outcome 2: Employment ratio of university to non-university graduates** | | | **Outcome 3: Employment ratio of secondary to non-secondary graduates** | | |
| Variables | All | Women | Men | All | Women | Men |
| (Earliest retirement age -4) * coverage | -0.023 | 0.032 | 0.075 | 0.109 | 0.279 | 0.078 |
| | (0.181) | (0.320) | (0.077) | (0.103) | (0.187) | (0.057) |
| (Earliest retirement age -3) * coverage | -0.053 | -0.100 | 0.137 | 0.142 | 0.307 | 0.106* |
| | (0.180) | (0.290) | (0.092) | (0.136) | (0.242) | (0.060) |
| (Earliest retirement age -2) * coverage | -0.022 | 0.077 | 0.079 | 0.183 | 0.434* | 0.097 |
| | (0.242) | (0.399) | (0.105) | (0.144) | (0.258) | (0.072) |
| (Earliest retirement age -1) * coverage | 0.047 | 0.144 | 0.144 | 0.185 | 0.468* | 0.070 |
| | (0.287) | (0.496) | (0.123) | (0.141) | (0.254) | (0.080) |
| (Earliest retirement age) * coverage | 0.157 | 0.150 | 0.397** | 0.364** | 0.593** | 0.290** |
| | (0.299) | (0.472) | (0.171) | (0.180) | (0.286) | (0.131) |
| (Earliest retirement age +1) * coverage | 0.309 | 0.380 | 0.476** | 0.460** | 0.777** | 0.312* |
| | (0.306) | (0.457) | (0.214) | (0.206) | (0.315) | (0.162) |
| (Earliest retirement age +2) * coverage | 0.508 | 0.740 | 0.519* | 0.560** | 0.785** | 0.510** |
| | (0.330) | (0.451) | (0.264) | (0.231) | (0.332) | (0.213) |
| (Earliest retirement age +3) * coverage | 0.470 | 0.569 | 0.639** | 0.658*** | 0.917*** | 0.589*** |
| | (0.333) | (0.453) | (0.282) | (0.235) | (0.334) | (0.223) |
| (Earliest retirement age +4) * coverage | 0.686 | 0.772 | 0.907*** | 0.710** | 0.967** | 0.645*** |
| | (0.417) | (0.627) | (0.295) | (0.282) | (0.406) | (0.243) |
| (Earliest retirement age +5) * coverage | 0.808 | 0.780 | 1.145*** | 0.949*** | 1.162*** | 0.953*** |
| | (0.518) | (0.682) | (0.413) | (0.335) | (0.401) | (0.322) |
| Constant | 1.723*** | 1.721*** | 1.089*** | 1.684*** | 1.680*** | 1.108*** |
| | (0.138) | (0.229) | (0.036) | (0.087) | (0.112) | (0.030) |
| Observations | 5,585 | 2,792 | 2,793 | 5,584 | 2,791 | 2,793 |
| R-squared | 0.113 | 0.175 | 0.555 | 0.336 | 0.511 | 0.590 |
| FE by Country | Yes | Yes | Yes | Yes | Yes | Yes |
| Mean of dependent variable | 1.63 | 2.04 | 1.22 | 1.46 | 1.78 | 1.15 |
| Standard deviation of dependent variable | 4.13 | 5.77 | 0.74 | 1.48 | 1.96 | 0.61 |

**Notes:** Robust standard errors are clustered at the country level and reported in parentheses.
*** $p<0.01$, ** $p<0.05$, * $p<0.1$.

A likely explanation is that university graduates represent a relatively small share of the population in many low-income countries—particularly among women—leading to greater sampling variability and less precise estimates for that subgroup. Nevertheless, we find that among men, at the earliest retirement threshold, a 10-percentage-point increase in effective pension coverage is associated with a 0.03-percentage-point increase in the employment ratio of university graduates relative to non-university graduates. Five or more years after the minimum eligibility age, the magnitude of this effect increases further, reaching a 0.10-percentage-point increase in relative employment for a 10-percentage-point rise in effective pension coverage.

For the secondary-education comparison, a 10-percentage-point increase in effective coverage is associated with a 0.04-point increase in the relative employment ratio of secondary graduates relative to non-secondary graduates at the earliest retirement age, and a 0.09-point increase five or more years after eligibility. We find no evidence of pre-trends, reinforcing that the divergence between groups emerges only once pension benefits become available and lending support to our identification strategy. Although the gender-disaggregated estimates display some pre-trend noise due to smaller sample sizes, their patterns are directionally consistent with the pooled results.

To contextualize these estimates, consider that the average difference in pension coverage between high- and low-income countries is approximately 67 percentage points. Applying our estimated effects, this coverage gap accounts for a 0.8-point higher employment ratio of university graduates relative to non-university graduates among men at age 75. This magnitude represents roughly 46% of the observed gap in relative employment between high- and low-income countries for men at that age. For the secondary-education comparison, the same coverage difference leads to a 0.6-point higher employment ratio of secondary graduates relative to non-secondary graduates at age 75. This magnitude accounts for about 50% of the observed gap in relative employment between high- and low-income countries at the same age. Taken together, these results indicate that limited pension coverage prevents many less-educated workers from retiring, thereby contributing to global disparities in late-life employment across development levels.

## 5 Conclusions

This paper examines the impact of pension systems on late-life employment using harmonized census microdata from 78 countries between 2000 and 2019. Exploiting within-country variation in gender-specific pension eligibility ages and cross-country variation in pension coverage, and disaggregating data by age, sex, and educational attainment, we assess the role of old-age pension systems in shaping employment at older ages.

Our findings complement the existing literature in several dimensions. First, the effect of pension systems on employment is highly context dependent. For instance, in settings with universal coverage, a one-year increase in the earliest retirement age raises employment at the relevant ages by roughly 10 percentage points. By contrast, in middle- and low-income countries—where coverage remains limited, the employment effects of such reforms are likely to be far more muted.

Second, our results situate cross-national patterns within a growing literature documenting the labor-supply consequences of social pension expansion in developing economies. De Carvalho Filho (2008) finds that Brazil's rural pension scheme lowered men's retirement age; Galiani et al. (2016) show that Mexico's Adultos Mayores program reduced paid work, with some reallocation toward family businesses; Huang and Zhang (2021) document declines in farm labor among elderly beneficiaries in China; and Bosch and Guajardo (2012) report labor supply reductions in Argentina following a pension "moratoria". Consistent with this evidence, we estimate that a 10-percentage-point increase in coverage is associated with a 2.1-percentage-point decline in employment.

These patterns suggest that as coverage expands in low- and middle-income countries, late-life employment will decline, particularly among less-educated workers newly gaining access to benefits. While this shift need not be viewed negatively—employment rates among older individuals in low-income settings remain high by international standards—it raises pressing policy trade-offs. As demographic aging accelerates, balancing expanded coverage with incentives to remain in the labor force will become increasingly salient in LMICs.

A key limitation of our analysis, and something that future research should address, is that we do not account for cross-country heterogeneity in pension design features—such as the ability to combine work and pensions, implicit tax rates on continued work, actuarial adjustments, and penalties for early retirement—which are known to shape labor market behavior around retirement. Cross-nationally comparable data on these parameters remain scarce, precluding their inclusion in our empirical analysis.

Despite this limitation, our findings underscore the central role of pension systems in shaping both the level and composition of employment at older ages. They also highlight important equity considerations: in low-income countries, continued work—particularly among relatively low-educated workers—may reflect a lack of pension access rather than individual choice.

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