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Abstract

This paper examines the application of the gap concept to determine pension wealth differentials across different retirement arrangements and over a range of retirement ages. The gap concept allows for comparisons of equality outcomes without having to rely on the optimal savings paradigm. The micro simulation analysis draws a clear picture of inequalities generated by a pension system as opposed to other sources of inequality within the generation in retirement.

JEL Classification: D31, D63, J26.

Keywords: Personal Income, Wealth, and Their Distributions; Equity, Justice, Inequality, and Other Normative Criteria and Measurement; Retirement and Retirement Policies.

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1 Introduction

The delivery of sufficient income in retirement is an important feature on the policy agenda of pension reform. Due to increasingly aging societies, pay-as-you-go pensions have become difficult to sustain at current levels. Additional sources of income in retirement based on firm pensions or individual retirement savings plans are growing in importance to deliver income for retirees. Different arrangements raise concerns about inequality among retirees. How can we best capture the equality outcomes of a pension system? This paper suggests to use the concept of income gaps in the attempt to measure inequalities across different retirement arrangements.

In order to illustrate our methodology, we use the setup of pension arrangements in Ireland. Unlike in other economies, there is no centrally integrated pension system. This paper addresses the extent and dynamics of gaps in pension wealth across disintegrated arrangements of income sources. The overall aim of the research is to contrast the pension payoffs of otherwise equally salaried workers across different patterns of retirement income. A simulation of net present values of pension wealth is undertaken, followed by an analysis of gaps in pension wealth across retirement arrangements, and separate by gender, position in the income distribution and the age of retirement. Our findings suggest that considerable inequities exist in Ireland and that the standard of living in retirement largely depends on the patterns of pension coverage.

The conceptual contribution of this paper is to emphasize the role of the gap concept in the attempt to measure income inequality of retirees across different pension arrangements. Rather than looking at consumption smoothing over the life cycle and the adequacy of this resource allocation for retirement, we look at outcomes only and assess them in terms of equality. The gap concept is usually deployed to measure differentials between unequal positions in the earnings distribution. Here, we measure differentials at equal positions in the earnings distribution, but with unequal consequences for post-retirement income. These consequences are induced by the type of pension arrangement people are covered.

2 Literature on income adequacy and inequality in retirement

Common principles of pension system design include income adequacy, financial sustainability, balanced intergenerational redistribution, and minimizing the distortions pensions potentially have on the labor market (Barr and Diamond, 2009). This study attempts to approach adequacy from a different angle. Usually, adequacy of retirement income addresses the question how well a pension system performs in smoothing consumption over the life-cycle. Different measures like the earnings to benefit ratio and pension wealth are commonly used to assess the adequacy of retirement savings. Overall, adequacy deals with allocative efficiency over time, yet, it is conceptually not a measurement of inequality. Here, we propose to use pension wealth to address the equality issues of a pension system. We calculate pension wealth for representative agents across a population in order to derive gaps in pension wealth among equally salaried agents.

On the side of allocative efficiency, some behavioral factors have been identified that prevent people on similar earnings patterns and magnitudes to have similar amounts of pensions in retirement. In order to measure income adequacy in retirement, the concept of optimal savings over the life cycle has been deployed in agent based simulations. It grounds on the Life Cycle Hypothesis (Friedman, 1957) which implies rational agents to save for retirement in a way that smoothes their marginal utility of consumption over the life cycle. However, empirical evidence, for instance Battistin et al. (2009) among others, have shown that actual behavior often collides with the predictions of the life cycle model. This retirement consumption puzzle remains largely unresolved to date, but newer approaches try to remedy an unfinished research agenda. Several issues have been identified in the attempt to explain why agents are not able or willing to save adequately for retirement. Under the research heading of bounded rationality (Simon, 1998; Mullainathan and Thaler, 2000), lack of self-control (Thaler and Shefrin, 1981), myopia (Benartzi and Thaler, 1995), herding behavior (Duflo and Saez, 2004) and choice overload (Sethi-Iyengar et al., 2004), some important reasons have been identified to stand in the way of saving optimally for retirement. However, rather than considering the behavioral factors of non-optimal savings for retirement, this paper compares the

institutional arrangements that lead to differentials in pension wealth. It simply tries to identify the degree of inequality in the outcomes of pension delivery.

We show that the institutional setup of the Irish system results in rather diverging amounts. To this end, we deploy the gap concept commonly used in labor economics research in the attempt to measure the extent of inequality along the earnings distribution or between subgroups of a population (Blau and Kahn, 1994). With respect to pensions, gaps have been studied for instance in Antolin and Whitehouse (2009) to answer the question how much it takes to fill a certain earnings replacement threshold by pension income. Other studies have examined the gender gap in pension wealth (Johnson et al., 1999). The novelty of our approach is to determine gaps in pension wealth between equally salaried agents who only differ by their institutional sources of retirement income. Therefore, we do not have to consider the complications of optimal savings over the life cycle. We focus on the question whether pension entitlements are equitable. The Irish pension system with its particular setup of pension delivery exemplifies these gaps in a rather graphical way. Finally, this approach adds important and often omitted information for assessing a pension system, such as the dynamics of the inequalities and differentials in coverage by various pillars of retirement income.

3 The institutional framework

The following discusses common patterns of retirement income institutions and pension formulae prevalent in Ireland and the share of the workforce covered by different arrangements. These arrangements will form the basis for the simulations of pension wealth gaps later in the discussion.

3.1 Empirical evidence on pension plan coverage in Ireland

Income provision for retirees mainly arises from three pillars. There is a universal coverage by State Pensions, while occupational and private pensions are in general not mandatory. Employees is the public sector have an own occupational pension system. Table 1 shows

the share of workforce covered under different pillars of retirement income.

[Insert Table 1 about here]

The most common case of coverage is public retirement income only (SP) with a share of 46 percent of the workforce. 54 percent of workforce have another pillar of pension income. 37 percent are covered by both public and occupational pensions (SP + OP), 13 percent by a public and a private pension (SP + IP) and only 4 percent have three pillars of retirement income (SP + OP + IP). Considerable gender differentials exist; for example, women have less frequent access to a second pillar. Therefore, two main patterns of pension provision accounting for 83 percent of the workforce dominate the Irish landscape of income delivery in retirement:

1. State Pension (SP): 46 percent of workforce

2. State Pension and occupational pension (SP + OP): 37 percent of workforce

Differences in coverage across industries are persisting. While in public administration 86 percent are covered by an occupational pension, this share is only 9 percent in the hotels and restaurants industry. Mandatory enrolment into an occupational pension only exists in the public sector. Therefore, the simulation of pension wealth gaps grounds on three country typical sources of income in retirement: a State Pension only, a civil servant pension and a private sector occupational pension combined with a State Pension. Pension formulae and eligibility requirements may be summarized by type of pension provider.

3.2 Government as pension provider

At the age of 65, Irish workers are entitled to the State Pension (transition) which from age 66 onwards is referred to as State Pension (contributory). Benefits amount to €230 per week flat-rate for a person with no adult dependent. Supplements for adult and child dependents are available to top up the State Pension.

Ireland has no more program for early retirement. However, in the absence of occupational or private pensions, one might use a welfare program as a quasi-retirement

income source. By the nature of these programs, access requires certain conditions to hold. Moffitt and Nicholson (1982) among many others give evidence on welfare programs potentially being utilized for a longer or permanent withdrawal from the labor force.

Unemployment or disability makes older workers eligible for the Jobseeker's Benefit, the Jobseeker's Allowance, the Invalidity Pension or the Disability Allowance. There is little variation in the benefit levels of these programs which come close to the benefit level of the State Pension. Therefore, the flat-rate payments are nearly identical across all of the above pension and welfare schemes.

3.3 Occupational pensions for civil servants

In this section, we discuss the standard occupational pension scheme for the public sector. Civil servants appointed before 6 April 1995 are members of the Superannuation Scheme for Established Civil Servants (Republic of Ireland, 2006). Pensions may be claimed on the grounds of retirement on age, ill-health or redundancy reasons. The pension formula may be expressed as follows:

1. from age 60 onwards, the pension entitlement is $\frac{1}{80}$ of final salary per year of pensionable service subject to a maximum 40 years, and

2. a tax-free lump sum of $\frac{3}{80}$ of final salary per year of pensionable service, subject to a maximum of $\frac{3}{2}$ of final salary.

3. Early retirement is possible from age 50 to 59, according to the "Cost Neutral Incentivized Early Retirement Scheme" (Republic of Ireland, 2009a). For each year of early retirement, roughly 5 percentage points are deducted from the preserved age 60 pension and lump sum.

This scheme has been reformed in order to integrate civil servants' pensions with the State Pension. However, this study uses the "old" scheme because most employees currently in or close to retirement are covered under its provisions.

3.4 Occupational pensions for private sector workers

The considerable amount of pension schemes characterizes occupational pension provision in the private sector. The majority of scheme participants are covered by defined benefit (DB) schemes. DB schemes still prevail in provision, since the ratio of DB to DC plan members is approximately 2 to 1 across all sectors (Republic of Ireland, 2009b). It is not feasible to identify a unique pension formula. Moreover, the documentation on specific plans is scarce and rarely open source. Yet, there are features common across most private sector schemes (OECD, 2014; ISSA/IOPS/OECD, 2008). First, documentary evidence suggests that the standard assessment base for benefit calculation is final salaries. Second, occupational pensions are mostly "integrated" with the State Pension. Third, replacement rates usually accrue according to a common algorithm. Thus - using a typical real world scheme like Diageo (2014) - a private sector pension formula is likely to include the following features:

1. from age 60 onwards, a person is entitled to a pension of $\frac{1}{60}$ of pensionable salary per year of service subject to a maximum of $\frac{2}{3}$ of pensionable salary;

2. until the State Pension becomes available at age 65, a temporary pension amounting to $\frac{1}{40}$ of the State Pension per year of service;

3. pensionable salary is defined as final salary at the age of retirement minus 1.5 times the amount of the State Pension ("integration").

4. From age 50 to 59, a person may retire early with a deduction of approximately 4 percentage points per year of early retirement, determined by the scheme actuary.

The next section discusses the methodology used to calculate pension wealth gaps.

4 The determination of pension wealth gaps

4.1 The role of pension wealth in lifetime income and pension wealth gaps

Retirement wealth makes up a considerable amount of lifetime income. Considering a lifetime budget constraint, for instance the version proposed by Samwick (1998), an agent faces an income stream

$$A_t + \int_t^R e^{-r(s-t)} Y_s \; ds + \int_R^T e^{-r(s-t)} B_s(R) \; ds = \int_t^T e^{-r(s-t)} C_s \; ds \tag{1}$$

Agents t years of age plan to retire at age $s = R$. They expect to survive until age T, receive earnings from work before R, pensions and other non-labor income after R. Y_s is expected real net income at age s. $B_s(R)$ is the amount of net pension benefits and other retirement income which is a function of retirement age R. C_s is consumption at age s. Parameter r the discount rate, A_t is net wealth at age $s = t$. The third term on the left hand side of (1) represents pension wealth.

In order to compute retirement wealth, we recast this income flow coming from retirement arrangements into discrete time. Therefore, pension wealth at all feasible ages of retirement starting at age 55 is:

$$PW = \sum_R^T B_s(R, \theta) p(t|t-1) \rho^{t-R} \tag{2}$$

$B_s(R, \theta)$ are expected net payments from different retirement income sources; θ is a vector parameters other than retirement age influencing the level of payments, such as contribution years, pensionable salary, etc. To account for contingencies about the length of life, p is the conditional probability of survival until age t. A discount factor of $\rho = \frac{1}{1+r}$ is assumed to generate net present values of pension wealth.

In order to determine inequalities in pension wealth, pension wealth gaps are defined as follows:

$$Gap(\bar{Y}, R) = \frac{PW_{Sn=i} - PW_{Sn=j}}{PW_{Sn=i}}, \tag{3}$$

where Sn is retirement arrangement n with $n \in [1, 2, 3]$ and $i \neq j$. Gaps are simulated for representative agents on equal pre-retirement earnings $\bar{Y}$, and for different retirement ages R.

The following discussion outlines the country specific institutions and parameters used in simulating age profiles for equations (2) and (3).

4.2 Simulation parameters and scenarios

The following method has been developed by Raab and Gannon (2014) and aims to cover pension entitlements representative for the Irish population. It is used in order to simulate age profiles of pension wealth and pension wealth gaps following equations (2) and (3). The pension formulae in section 3 are deployed for the scenarios outlined below. The simulations span over the ages 55 to 67 as the most common ages to retire. All values are real net present values of pension wealth discounted to planning age 55 and assuming a real discount rate of 3 percent. Conditional survival probabilities originate from Irish life tables (CSO, 2009b). It is furthermore assumed that benefits in the years following the retirement year grow at a real rate of zero. All values represent net of tax magnitudes and follow income and payroll tax rates of 2009.

Age profiles distinguish between three country typical routes into retirement S1, S2, and S3, with pre-retirement earnings to be equal across scenarios. Within the scenarios, three levels of pre-retirement earnings are simulated, separate by gender (CSO, 2009a). Different positions in the earnings distribution are expressed in terms of 50, 100, and 150 percent of age and gender specific average industrial wages. Therefore, the simulations span over 18 representative cases. The three country typical patterns of retirement income are summarized as follows:

S1: Social Welfare and State Pension: This scenario comprises 46 percent of the workforce. Prior to retirement on a State Pension, a person might claim Social Welfare benefits between the ages of 55 to 64. Then, benefit levels amount to €10,909.60. Replacement rates and incentive measures for this retirement window are reported under the disclaimer that certain conditions, for instance unem-

ployment or disability, need to apply. From age 65 onwards, Welfare benefits are substituted by a State Pension. Then, benefit levels increase to €11,975.60.

S2: Public sector occupational pension: This arrangement covers civil servants. A person considers future payoffs from occupational pensions according to the public sector occupational pension scheme. For calculating benefit amounts, it is furthermore assumed that agents have accumulated 30 years of service at age 55, which implies 40 years of service at age 65.

S3: Private sector "integrated" occupational pension and State Pension: This arrangement includes employees enroled into a typical private sector scheme. The pension formula of the "integrated" DB scheme is used to calculate benefit entitlements here. Other simulation assumptions effectively follow S2. Notably, the major difference compared to S2 is the integration of the State Pension into the occupational pension scheme.

5 Results

Turing to the discussion of the simulation results, we will first discuss some general findings, and then analyze the simulations in detail. The results are reported in Figures 1 to 3. One important finding is that the degree of inequality of retirees divided into different retirement institutions is substantial. For instance, the gap in pension wealth between State pension recipients (S1) and civil servants (S2) at retirement age 65 is considerable for average and high earnings. In general, gaps are highest between S3 and S1 agents. Gaps between S2 and S1 are mainly lower; S3-S2 gaps are generally lowest except for small pre-retirement earnings. Comparing gaps across gender results in consistently lower numbers for females in the S3-S1 gaps and the S2-S1 gaps. Therefore, private sector occupational pensioners receive by far the best retirement package in terms of pension wealth, and the retirement arrangement induced inequality is lower for females than for males. Dynamically, our findings suggest that the extent of inequality mostly increases the later retirement is postponed.

Results for agents on average industrial wage pre-retirement earnings are summarized in Figure 1. Pension wealth over all possible retirement ages differs substantially across scenarios, being naturally higher for agents with occupational pension coverage. Dynamically, pension wealth declines in the age of retirement for both, males and females. Despite the flat-rate character of pension benefits and welfare payments in S1, females' pension wealth is slightly higher than males'; the reason for this pattern are ceteris paribus higher survival probabilities of women. It should also be noted that pension wealth levels for S1 are equal across all positions in the pre-retirement earnings distribution. In terms of gaps, the inequalities are lowest between S3 and S2 for males and between S2 and S1 for females. The S3-S1 gaps are highest relative to other gaps and increase in the age of retirement. Males covered under S3 receive approximately 110 to 160 percent (females 55 to 65 percent) more pension wealth than S1-agents.

[Insert Figure 1 about here]

At low pre-retirement earnings (Figure 2), pension wealth is highest for S3. For S2, the levels fall below those of S1. S3 agents are mostly better off compared to S1 and S2, accounting for gaps between roughly 20 to 45 percent (males) and 5 to 60 percent (females). Unlike for average pre-retirement earnings, S1 agents are consistently better off than S2 agents due to negative S2-S1 gaps throughout.

[Insert Figure 2 about here]

For high pre-retirement earnings (Figure 3), the patterns largely follow the average earnings continuum. Rankings of pension wealth levels and gaps are preserved, and pension wealth levels are higher in case of S2 and S3 compared to S1. Only for females retiring between the ages of 55 and 59, S1 agents are better off than agents of S2.

[Insert Figure 3 about here]

Overall, people earning exactly the same during their pre-retirement working life experience considerable differences in their standard of living in retirement. This difference largely depends on being covered by a firm pension, or not. Naturally, supplementary pensions result in higher pension wealth; however, in case of the Irish setup, the extent of the pension wealth gaps creates non-standard inequalities of the increasingly large

population group of retirees.

6 Conclusions

The findings of this paper are twofold. First, this paper conducts this type of exercise for the Irish case for the first time and in a comprehensive way. Large inequalities have been identified which provides valuable information for the discussion of pension reform in the country and beyond. Furthermore, the unique setup of the Irish pension system reveals in terms of general policy lessons that in a system with a basic flat rate pension organized by government, large inequalities may arise unless a second pillar of income in retirement is universally implemented.

Second, the application of the gap concept to different retirement arrangements is shown. Within a dynamic micro simulation framework, the trajectories of these gaps over a corridor of retirement ages reveal the evolution over time. Our approach has two major benefits compared to the optimal life cycle savings paradigm: it is purely concerned about equity without having to explain optimal or non-optimal savings behavior. Furthermore, it measures pension wealth outcomes of representative agents who were in the same position of the earnings distribution during their working lives allowing to isolate the effect of coverage by different pension plans. Overall, a clear picture of inequalities generated by a pension system itself can be distinguished from other sources of inequalities among retirees.

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Appendix of Tables and Figures

Table 1. Pension coverage of workforce in 2008 (in percent aged 20 to 69)

	SP	SP + OP	SP + IP	SP + OP + IP
Total workforce	46	37	13	4
Men	44	34	18	4
Women	49	40	7	4
Public administration	7	86	n/a	6
Hotels and restaurants	77	9	14	n/a

Source: CSO (2008); n/a numbers not reported.
Notes: SP=State Pension only; SP+OP=State+occupational pension; SP+IP=State+individual pension; SP+OP+IP=State+occupational+individual pension.

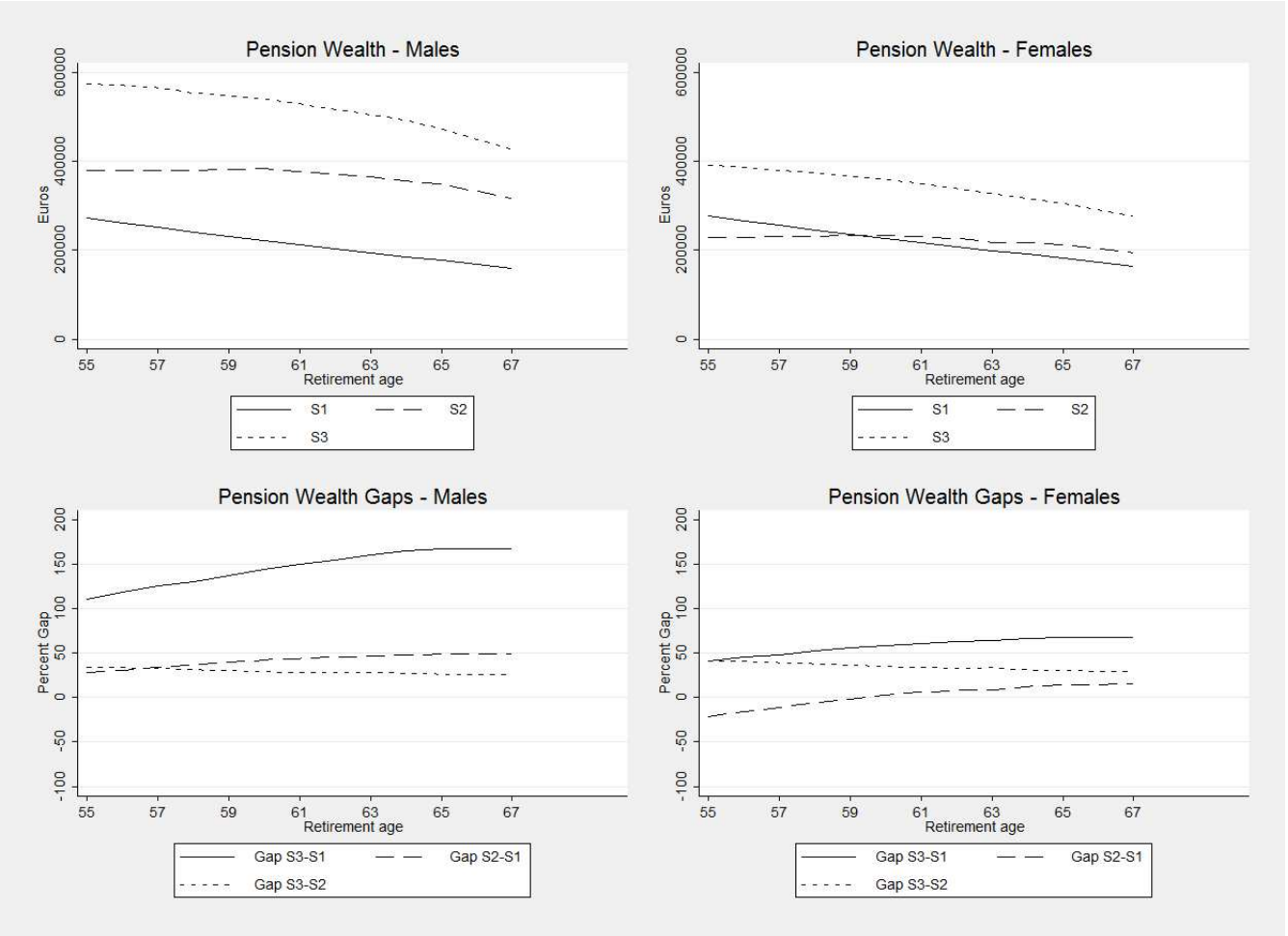

Figure 1: Pension wealth gaps, AIW
Source: Author's own calculations

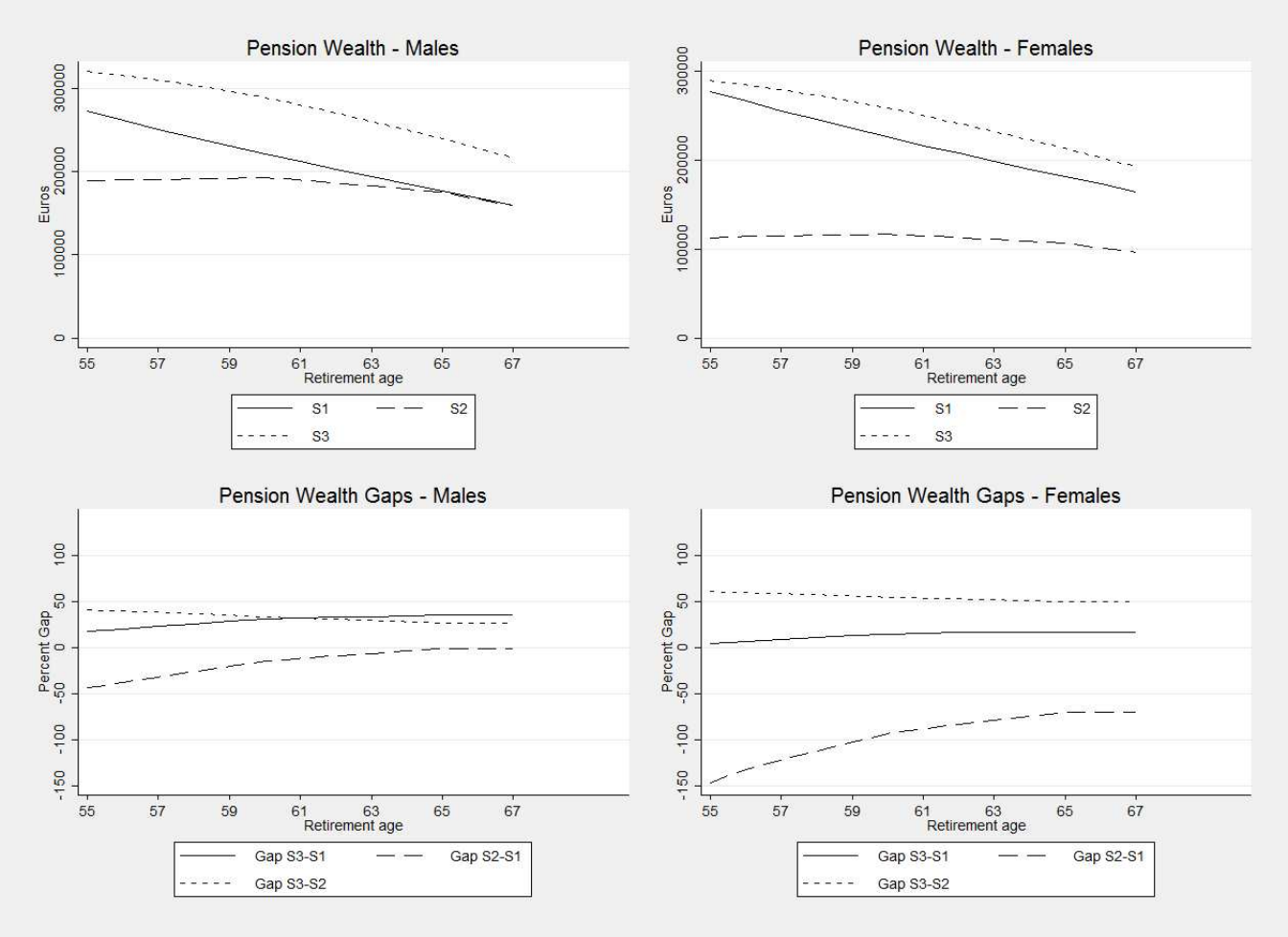

Figure 2: Pension wealth gaps, 50 percent of AIW
Source: Author's own calculations

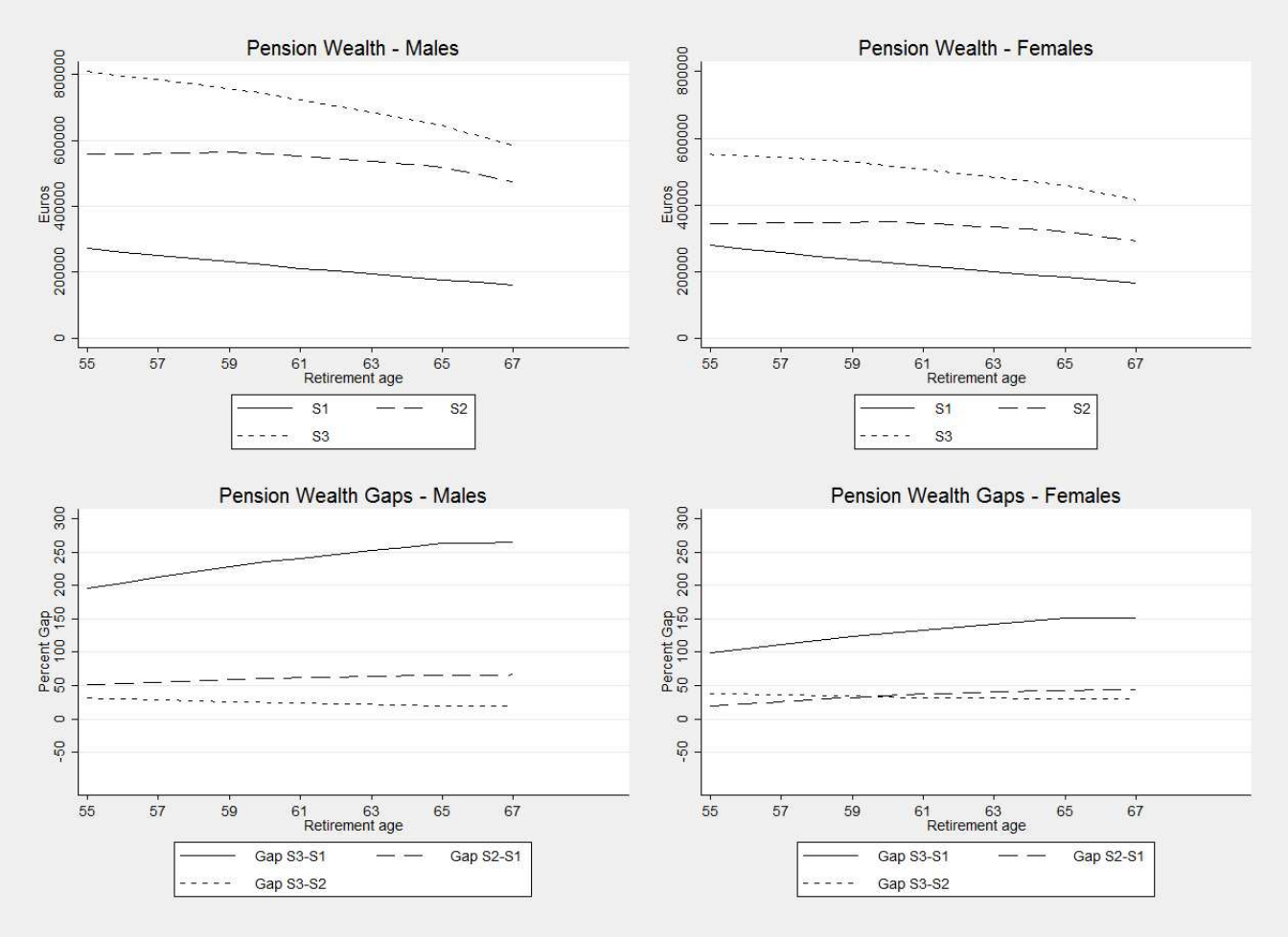

Figure 3: Pension wealth gaps, 150 percent of AIW
Source: Author's own calculations