Determinants of Pension Coverage and Retirement Income Replacement Rates – Evidence from TILDA

SANNA NIVAKOSKI*
Trinity College Dublin

Abstract: In Ireland, the absence of statutory earnings-related pensions in the private sector leads to large variations in pension coverage and adequacy. This paper uses recent data from *The Irish Longitudinal Study on Ageing* (TILDA) to evaluate how the pension system has performed for the current retiree cohort. The levels and compositions of retirees' incomes, supplementary pension coverage and retirement income replacement rates are examined and compared against Irish government targets. The determinants of supplementary pension coverage and retirement income replacement rates are also examined in a multivariate framework. Flat-rated State welfare pensions imply a high degree of progressivity in the Irish pension system: retirement income replacement rates are inversely related to pre-retirement earnings, particularly for former private sector employees. Supplementary pensions add an earnings-related component which insulates post-retirement incomes of middle-and high-earners to some degree.

I INTRODUCTION

This paper assesses the income levels, income sources, supplementary pension coverage and retirement income replacement rates of the current cohort of Irish retirees. Supplementary pensions consist of private and occupational pensions which replace labour income in retirement. In Ireland, the State provides social welfare pensions which comprise the contributory and the non-contributory pensions. Entitlements to the former are built up

over the working career of an individual through the accumulation of Pay Related Social Insurance (PRSI) credits. The latter is means-tested. The State welfare pensions guarantee a basic retirement income and are not linked to earnings, unlike in many other Western countries. The economic well-being of the retirees is assessed in the light of Irish government targets for supplementary pension coverage and retirement income adequacy. The findings provide tools for policy analysis by identifying groups for which pension coverage and earnings replacement are likely to be problematic.

This research is motivated by global concerns about the funding of pension systems in the future, stemming from the ageing of populations.[1] Although the Irish population is relatively young,[2] the Irish government has acknowledged the challenges facing future pension provision. The National Pensions Framework (Department of Social and Family Affairs, 2010) projects an increase in public pension (State welfare pensions and public service occupational pensions) spending in Ireland from approximately 5.5 per cent of GDP in 2008 to almost 15 per cent of GDP in 2050. The Framework highlights the need for increased supplementary pension coverage and higher contribution rates among those covered.

In the National Pensions Policy Initiative (1998), the Irish Pensions Board – the national pensions industry regulator – set a target supplementary pension coverage rate of 70 per cent for the total workforce over the age of 30. This analysis reveals a supplementary pension coverage rate of 49.8 per cent among current Irish retirees. A target of 50 per cent of gross pre-retirement income was also set for retirement income replacement rates, subject to a minimum of 34 per cent of average industrial earnings (The Pensions Board, 1998). These targets were restated in the Green Paper on Pensions (Department of Social and Family Affairs, 2007) with a suggestion that the targets could only be met through the introduction of mandatory supplementary pensions,[3] a policy that was also recommended in the OECD Review of the Irish Pension System (OECD, 2013).

---

[1] The old-age support ratio is the ratio of working age population – people between the ages of 20 and 64 – to population aged 65 and over. In Ireland, the old-age support ratio is projected to decrease from 5.4 to 1 in 2010 to 2.3 to 1 in 2050, whereas the ratio is expected to decrease from 3.5 to 1.8 over the same time period in the European Union overall (Eurostat, 2012).

[2] Department of Social and Family Affairs (2002) report on future pension provision states that although Ireland's population will age later than most other European countries due to a relatively recent decline in fertility and net emigration before the 1990s, growing pension costs are a concern.

[3] A plan to introduce a "soft-mandatory" supplementary pension to all employees was put in place in the National Pensions Framework (Department of Social and Family Affairs, 2010). It suggests that employees would automatically be enrolled into a pension scheme unless already a member of their employer's scheme with higher contribution levels. The employee may opt out of the scheme if they wished. The introduction of these schemes, however, has been postponed.

The analysis in this paper is carried out using recently collected data from *The Irish Longitudinal Study on Ageing* (TILDA), which samples the population aged 50 and above living in Ireland, and their spouses. This paper makes a contribution to the retirement saving literature by examining a nationally representative sample of the retired Irish population, the majority for whom supplementary pension saving has not been statutory. This is a unique feature of the TILDA dataset – Ireland is the only OECD country (along with New Zealand) with no statutory earnings-related pension provision in the private sector (see Appendix A for a description of the Irish pension system). Much of the responsibility for retirement saving provisions therefore lies with the individual, leading to large variations in pension levels and retirement income replacement rates. In the Irish context, this paper updates pensioners' income analysis using a large, nationally representative new data source that purposely samples the older population. In addition, the calculation of individuals' retirement income replacement rates has not previously been carried out at the individual level using observed data (rather than aggregate data on representative agents) in Ireland.

The paper first focuses on retirees' income levels and compositions, which are examined across the income distribution and different educational, occupational and work history categories. The examination highlights the importance of supplementary pensions. This is due to the structure of the Irish pension system: the State welfare pensions are flat-rated and not related to earnings and, therefore, only provide a minimum income guarantee for retirees. As supplementary pensions contribute most to the variance of retirement incomes, it is of interest to investigate which factors determine supplementary pension coverage. The second part of the analysis estimates multivariate models of the covariates of the probability that an individual in the private sector (with no statutory supplementary pension) receives income from one. Understanding the factors associated with supplementary pension coverage is important from a policy perspective because it facilitates the evaluation of the effectiveness and limitations of the current pension system and any planned reforms.

Combining data on the current retirement incomes with past labour incomes allows for the calculation of retirement income replacement rates. The retirement income replacement rate is calculated as a ratio of current income to inflation-adjusted pre-retirement labour income. The structure of the State welfare pensions means that replacement rates which incorporate all retirement income are high for individuals with low previous earnings. There is a U-shaped relationship between the retirement income replacement rate and education. Individuals with primary level education (or no formal education) have higher replacement rates than those with secondary level

education. Conversely, the replacement rate increases with earnings when only supplementary pensions are taken into account in calculating the rate. OLS regression analysis suggests that, *ceteris paribus*, supplementary pensions replace a greater share of earnings for individuals with higher education, who have worked in larger firms, in white-collar occupations or in the public sector.

The remainder of this paper is structured as follows: Section II summarises the relevant international and Irish literature. Section III presents the data and descriptive statistics, followed by Section IV which discusses supplementary pension coverage and presents the findings of probit models of supplementary pension receipt. Section V presents the results of the retirement income replacement rate analysis. The final Section discusses the findings and offers concluding remarks.

II EXISTING RESEARCH

According to Math (2004), the general trend in European pension reform has been to limit future expenditure on pay-as-you-go state pension schemes by promoting privately provided funded schemes and other forms of long-term saving.[4] Similar reforms have also taken place or are under review in Ireland (Department of Social and Family Affairs, 2010). The trends towards more individual responsibility about the choice to save, how much to save and how to invest those savings has led to a growing strand of literature exploring the ability of individuals to make retirement saving decisions and individuals' characteristics which determine saving behaviours. One of the theories explaining pension scheme participation – the segmented labour market theory – predicts that, for certain groups within the workforce, participation in a pension scheme is not determined by choice but rather by constraints experienced by them. Therefore, pension coverage is assumed to be determined by variables such as industry, work history, unionisation, the size of the employer firm and whether the work is full-or part-time (Ghilarducci, 1992). Pensions act as a mechanism for employee retention, which can be in the interest of both the employee and the employer. The employee is more committed to a long career with the employer, especially in the case of a

---

[4] Other changes that have taken place in many European countries include the reduction of rates of pay of state provided pensions, the increase of taxes and other charges levied on pensions, moves from defined benefit to defined contribution systems, the raising of retirement ages, changing the calculation rules for pension entitlements, and changes in the indexation of pension payments (Math, 2004).

defined benefit pension scheme where pension payments are usually linked to final year or end-of-career salary. Attracting employees by means of pension entitlements as a type of wage component can lengthen tenures and, therefore, decrease training costs as well as other costs associated with staff turnover. Another factor that may affect pension coverage is the size of the employer. As economies of scale also apply to pension provision, larger firms have lower costs of providing pension benefits per employee (Dummann, 2008).

When it comes to examining the determinants of income receipt from a supplementary pension, similar research has been carried out by Yabiku (2000) using data from the Health and Retirement Study. He examines how family history variables affect the probability of private pension receipt and how these effects vary between men and women. Yabiku finds that being married has a positive effect on pension coverage for men but the effect is the opposite for women. The effect has been theorised to be the consequence of specialisation of labour within the family – the traditional Family Model of Labour Supply (Honig, 1996) predicts that the husband is the main provider of labour income and the wife specialises in care-giving and other non-market labour. Also, womens' non-continuous labour market participation translates to higher rates of part-time short-tenured employment, and the concentration of working in industries such as services. Yabiku (2000) also finds that private pension coverage is positively correlated with early retirement (defined as retired before the age of 65). He suggests that having inadequate retirement resources forces people to stay in work for longer, whereas generous pension arrangements reduce labour market participation of older workers.

Other existing work closely comparable to this research, examining the factors affecting the probability that an individual or a household makes contributions to a pension scheme, are works by Holzmann *et al.* (2000) in Chile and Argentina, Guariglia and Markose (2000) in the UK, by Bassett *et al.* (1998) in the US, Dominguez-Barrero and Lopez-Laborda (2007) in Spain and Dummann (2008) in Germany. However, these studies focus on pension plan participation of current employees rather than retirees. Holzmann *et al.* (2000) and Barrientos (1998) use data from Chile and Argentina to estimate probit regressions to assess the determinants of the probability of individuals contributing to a pension scheme. They find that individuals with low incomes or low education levels and those who are self-employed are less likely to contribute to pension plans, as are women (especially married). Barrientos (1998), using Chilean cross-sectional data finds that age, employment history characteristics, firm size, occupational indicators, income levels and geographical location are all significant in determining the probability of an individual participating in a pension plan. Being married or co-habiting are found to be positively associated with pension scheme membership when it

comes to men, but the opposite is found for women. The probability of contributing to a pension plan increases with the number or hours worked per week and with higher income, and is lower for those either self-employed or employed under a temporary contract. Similar results are found also by the other authors using data from the UK, the US, Spain and Germany, with the addition of Bassett *et al.* (1998) reporting higher private pension scheme participation with higher employer contributions, Dominguez-Barrero and Lopez-Laborda (2007) finding significant effects of occupational categories, and Dummann (2008) reporting significant effects of firm size.

The existing Irish analyses have been mainly descriptive, reporting figures of poverty rates, deprivation rates and the relative importance of different income sources (Layte *et al.*, 1999; Connell and Stewart, 2004; Baroni and O'Donoghue, 2009; Central Statistics Office, 2011). In these studies, the inadequacy of retirement saving is reported especially in the cases of women, young people and those with part-time or non-continuous work histories. Hughes and Nolan (1999) carry out an analysis of pension entitlement in Ireland using data from the Living in Ireland Survey of 1994. According to their findings, certain groups of workers in Ireland have life-long consequences arising from their type of occupation – in terms of not acquiring a supplementary pension while working and not having the time or the resources to make alternative arrangements. These workers depend solely on the State for their retirement incomes. In the Irish literature, analysis of pension incomes and the determinants of pension coverage has been restricted due to lack of data on wealth, income levels and income sources (Connell and Stewart, 2004). Therefore, existing work has focused mainly on the financial situation of the elderly population as a whole, and the analysis has been descriptive for the most part. Incomes of Irish retirees have previously been examined by Blackwell (1984) and Connell and Stewart (2004), and therefore an updated analysis with recent data is welcome.

When it comes to examining the adequacy of retirement incomes, some analyses have been carried out on retirement income replacement rates. Internationally, investigations into the adequacy of North American (mostly US but also Canadian) retirement saving reach different conclusions depending on the definitions of adequacy used.[5] In Irish literature, the analysis of retirement income adequacy has relied mainly on the calculation of hypothetical replacement rates of representative workers or households, using average national data on earnings, work histories and State welfare pension

---

[5] See, for example, Moore and Mitchell (1997), Engen *et al.* (1999), Wolff (2002) and Scholz *et al.* (2006).

rates of payment. This paper makes an important contribution to the Irish literature by calculating retirement income replacement rates using individual-level data, therefore allowing for analysis of realised replacement rates, their distribution, and their heterogeneity across different socio-economic groups.

III DATA

This paper uses data from the first and second waves of *The Irish Longitudinal Study on Ageing* (TILDA). The TILDA dataset provides information on the health, lifestyles and socio-economic characteristics of a nationally representative,[6] stratified and clustered sample of Irish people aged 50 and over and their spouses. The first wave of data collection took place between 2009 and 2011, and the first wave contains information on 8,504 individuals, living in 6,279 households. Each participant underwent a face-to-face computer-assisted personal interview in their home, was given a self-completion questionnaire and was invited to a health assessment. The overall response rate of the first wave was 62 per cent. The second wave of the data was collected mainly in 2012 and has an overall response rate of 89 per cent (adjusted for deaths and non-eligibility). Crucially for this work, the dataset contains detailed information about the individuals' sources of income (including asset income), work histories, job tenures and salaries from pre-retirement employment.

The sample used in this analysis is restricted to individuals who are more than 65 years old (the State welfare pension entitlement age), who state that they are retired, and who have a relatively substantial working history (more than 10 years for women, more than 15 years for men). The focus is on individuals with a substantial working history because they have had the opportunity to accumulate supplementary pensions through work. Individuals looking after the home, permanently sick or disabled, and those who have never worked are not included in the analyses. The final sample is made up of 1,864 individuals.[7] The analysis is carried out at the individual rather than

---

[6] In order to make the TILDA sample nationally representative, weights reflecting each individual's probability of participation in the survey were estimated by comparing the numbers of individuals in the sample with a given combination of characteristics with the same number in the Irish population. The weights were estimated using the Irish *Quarterly National Household Survey*. The characteristics compared were age, sex and educational attainment, with education being the key determinant (Barrett *et al.*, 2011).

[7] Individuals who did not report their age or for whom there was no financial respondent in the household were also excluded from the final analysis.

the household level because the focus is on the way in which the Irish pension system provides retirement income for individuals with different socio-economic backgrounds and labour market histories.

Tables 1 and 2 present summary statistics of the main variables. Of the individuals in the sample 64.6 per cent are male and 35.4 per cent female. This reflects the higher labour market participation rates among (especially older) men in Ireland. The mean age for both men and women in the sample is 73.8 years. Nearly 60 per cent of the men have only primary level education, and one in eight has obtained a third level qualification. The women are better educated than the men, and are also more likely to have worked in the public sector prior to retirement. The men in the sample have had long working careers – the average total years worked is 47.1 years, bearing in mind that the sample is restricted to men with a minimum of 15 years worked. As expected, women have shorted working careers on average, with mean years worked at 35.0 years.

The percentages of Irish retirees receiving income from the two types of State welfare pensions, occupational pensions, private pensions, social welfare and assets[8] are presented in Table 3, with the figures reported by retirement income quartiles, separately for men and women. Of men 82.1 per cent and of women 73.5 per cent receive income from a State welfare pension (contributory, non-contributory or transition),[9] with men having a higher coverage rate for the contributory State welfare pension, whereas a slightly higher percentage of women receive the means-tested non-contributory State welfare pension. Overall, 49.8 per cent of all individuals receive income from supplementary pensions. 49.3 per cent of men and 38.1 per cent of women have occupational pensions, whereas the coverage rate for private pensions is much lower for both men and women, at 6.4 and 4.5 per cent, respectively.

Table 4 reports the percentage share of total retirement income that individuals report receiving from different sources.[10] The figures are reported by total retirement income quartiles, separately for men and women. For both men and women, the largest share of total income on average comes from contributory State welfare pensions. It is clear that for those with lower incomes, State welfare pensions play an important role. For those with higher incomes, supplementary (mainly occupational) pensions are more important due to the flat-rate nature of the State welfare pensions.

---

[8] Asset income comprises of interest from savings, interest from financial assets and rental income from property. See Appendix B for details.

[9] See Appendix A for a short description of the Irish pension system.

[10] The total mean weekly incomes are €389.8 and €287.0 for men and women, respectively.

Table 1: *Socio-economic Variables*

	Male %	Female %	Total %
	Gender		
Age			
65-69	30.5	31.7	30.9
70-74	28.8	26.1	27.8
75-79	21.1	24.1	22.1
80+	19.6	18.2	19.1
Children			
0	18.9	23.8	20.6
1-2	22.8	24.7	23.4
3-4	36.1	33.2	35.1
5+	22.3	18.3	20.9
Married/widow			
No	16.0	19.7	17.3
Yes	84.0	80.3	82.7
Divorced			
No	96.1	95.7	96.0
Yes	3.9	4.3	4.0
Single (never married)			
No	87.9	84.6	86.8
Yes	12.1	15.4	13.2
Education			
Primary/none	58.2	45.6	53.8
Secondary	29.4	35.7	31.6
Third/higher	12.4	18.7	14.6
Poor as child			
No	69.5	77.8	72.4
Yes	30.5	22.2	27.6
Homeowner			
No	10.3	13.5	11.4
Yes	89.7	86.5	88.6
Health			
Poor/Fair	30.6	32.7	31.4
Good	36.2	34.1	35.5
Very good/Excellent	33.1	33.1	33.1
Location			
Dublin	23.8	31.9	26.7
Another town/city	30.7	32.3	31.2
Rural	45.5	35.8	42.1
Sample size	1,204	660	1,864

Table 2: *Work History Variables*

| | Gender | | |
| | Male | Female | Total |
	%	%	%
Firm size			
1-5	32.1	28.5	30.8
6-15	13.4	17.1	14.7
16-24	7.9	9.5	8.5
25-199	24.6	24.9	24.7
200-499	9.6	8.9	9.4
500+	12.3	11.2	11.9
Occupation			
Professional	4.9	1.6	3.7
Managerial	18.8	27.8	22.0
Non-manual	10.4	23.8	15.1
Skilled manual	23.0	11.9	19.1
Semi-skilled	18.3	16.4	17.6
Unknown/unskilled	12.6	15.9	13.8
Farmer	11.9	2.6	8.6
Sector of employment			
Private	74.1	64.4	70.7
Public	25.9	35.6	29.3
Years worked			
11-20	0.3	17.7	6.4
21-30	2.3	18.8	8.1
31-40	16.3	27.4	20.2
41+	81.1	36.1	65.2
Tenure (years)			
1-10	16.3	25.9	19.7
11-20	18.2	33.6	23.6
21-30	16.1	19.7	17.4
31-40	21.1	11.9	17.9
41+	28.4	8.9	21.5
Sample size	1,204	660	1,864

Table 3: *Percentages in Receipt, by Income Quartile*

MALE	1st	2nd	3rd	4th	All
Contributory State pension	56.5	80.7	76.1	71.2	71.0
Non-contributory State pension	28.0	16.7	7.4	4.0	15.0
Occupational pension	8.7	33.4	75.8	95.2	49.3
Private pension	3.7	5.4	8.3	8.9	6.4
Social welfare	12.6	11.0	11.0	7.5	10.8
Asset income	25.1	58.8	59.0	73.8	52.4

Table 3: *Percentages in Receipt, by Income Quartile (Contd.)*

FEMALE	1st	2nd	3rd	4th	All
Contributory State pension	28.5	85.9	71.2	62.3	60.8
Non-contributory State pension	32.0	12.8	14.2	5.1	17.3
Occupational pension	25.9	5.3	43.9	91.8	38.1
Private pension	2.9	0.9	8.8	5.8	4.5
Social welfare	24.6	4.6	24.6	11.5	16.9
Asset income	48.3	39.3	64.1	72.7	54.8

Table 4: *Percentage of Income from Different Sources, by Income Quartile*

MALE	1st	2nd	3rd	4th	All
Contributory State pension	59.7	71.4	46.4	20.7	42.1
Non-contributory State pension	28.3	14.0	4.2	1.0	7.9
Occupational pension	4.8	8.0	39.5	68.2	41.0
Private pension	1.6	1.6	3.1	4.0	3.0
Social welfare	3.4	1.7	2.4	0.8	1.7
Asset income	2.1	3.2	4.4	5.3	4.3
Total income	100.0	100.0	100.0	100.0	100.0
FEMALE	1st	2nd	3rd	4th	All
Contributory State pension	32.8	83.7	57.6	23.6	46.1
Non-contributory State pension	36.1	12.1	11.0	1.8	11.5
Occupational pension	15.9	1.0	20.3	67.2	33.8
Private pension	0.5	0.3	0.9	0.8	0.7
Social welfare	10.5	1.8	6.1	1.8	4.2
Asset income	4.2	1.2	4.1	4.8	3.8
Total income	100.0	100.0	100.0	100.0	100.0

The significance of the length of working history is depicted in Figure 1. On average, individuals with long working careers – between 40 and 50 years – have higher retirement income levels than those who have either worked for less than 40 or for more than 50 years. Individuals with long working histories have been able to accumulate more substantial retirement wealth by acquiring supplementary pensions. The average amount of contributory State welfare pension income increases with the length of working career, as expected, as the pension entitlement is relative to the amount of Pay Related Social Insurance (PRSI) credits accumulated. However, individuals with working histories of 50 years or longer have lower average retirement income levels, which may be explained by the lower education levels within this group compared to those who have shorter work histories. Of the

individuals who have worked for 50 years or more 7 per cent have third level education, compared to 16 per cent of those who have worked for less than 50 years.

Figure 1: *Retirement Income Level and Components, by Length of Work History*
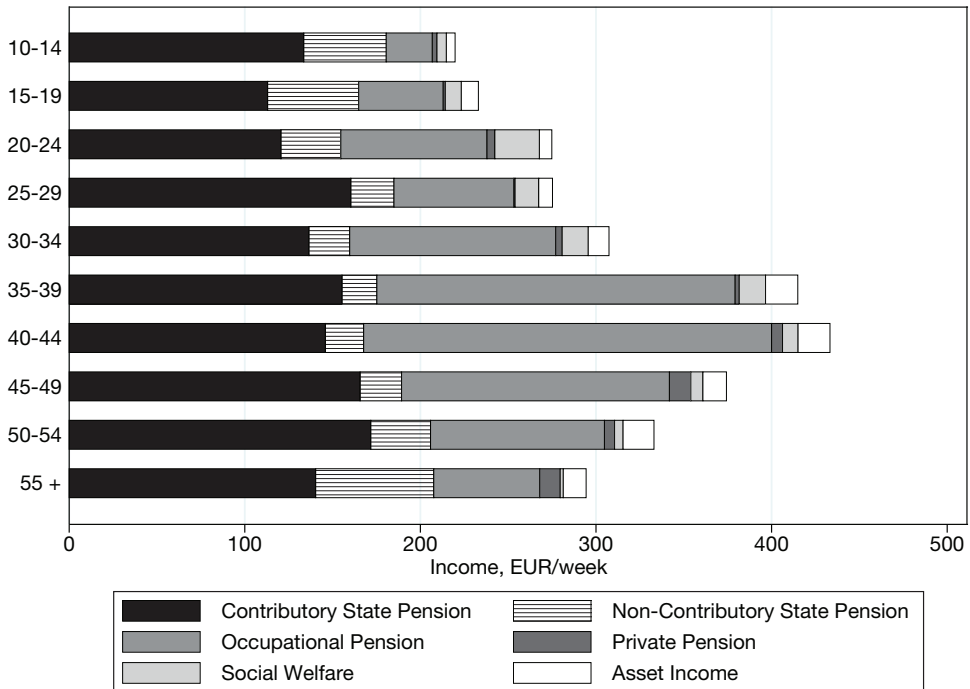
The sizeable difference in income levels and compositions between those previously employed in the private sector and in the public sector is depicted in Figure 2. The income of individuals whose last employment before retirement was in the public sector is on average 43 per cent higher than the income of those who worked in the private sector. The findings are broadly in line with those of existing studies using Irish data. Stewart (2011), using data from the *2004/2005 Household Budget Survey*, finds mean weekly pension incomes of €377 and €293 for public and private sector employees, respectively. Occupational pensions make up more than half of total income of public sector retirees, whereas private sector retirees receive less than a quarter of their total retirement income from occupational pensions.

Figure 2: *Retirement Income Level and Components, by Sector of Former Employment*
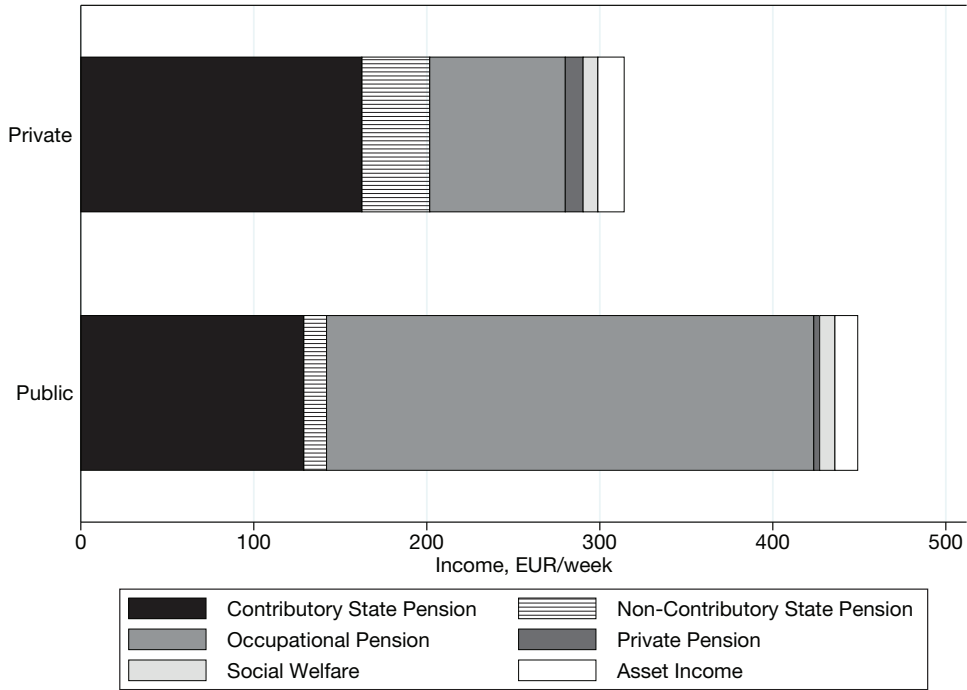
IV SUPPLEMENTARY PENSIONS

An examination of the data in Table 4 reveals that the share of supplementary pensions of total retirement income increases substantially within higher income groups, therefore revealing the importance of supplementary pensions in the income provision of Irish retirees. This section of the paper examines the patterns of supplementary pension coverage and its determinants. Because occupational pension coverage among public sector workers in Ireland is almost universal, the analysis is carried out using data on former private sector employees. First, simple descriptive statistics of supplementary pension coverage among different socio-economic and work history groups are presented and the broad patterns of pension coverage examined. Then, the probability of an individual receiving income from a supplementary pension is examined in a multivariate setting.

Tables 5 and 6 present supplementary pension coverage rates for private sector workers by socio-economic and work history characteristics, separately

Table 5: *Supplementary Pension Coverage*
(Private Sector Only)

| | Gender | | |
	Male Mean	Female Mean	Total Mean
Age			
65-69	49.0	26.3	41.8
70-74	40.9	29.2	37.4
75-79	45.8	24.0	37.6
80+	37.9	36.3	37.4
Children			
0	29.1	31.1	29.8
1-2	44.4	24.7	37.5
3-4	51.0	23.9	42.6
5+	44.7	36.9	42.6
Married/widow			
No	28.6	32.5	29.9
Yes	46.8	27.2	40.6
Divorced			
No	43.9	28.5	39.0
Yes	38.5	22.5	32.7
Single (never married)			
No	46.4	26.9	40.2
Yes	25.5	35.9	29.0
Education			
Primary/none	33.8	23.7	31.0
Secondary	56.3	30.8	46.4
Third/higher	72.2	40.8	61.2
Poor as child			
No	43.9	28.9	38.7
Yes	42.7	25.8	38.3
Homeowner			
No	25.3	28.3	26.4
Yes	46.1	28.2	40.5
Health			
Poor/Fair	39.5	20.2	33.0
Good	43.9	32.8	40.4
Very good/Excellent	47.9	31.8	42.9
Location			
Dublin	67.6	41.0	56.6
Another town/city	45.6	18.1	36.3
Rural	31.4	24.6	29.7
Sample size	856	385	1,241

Table 6: *Supplementary Pension Coverage*
(Private Sector Only)

| | Gender | | |
| | Male | Female | Total |
	Mean	Mean	Mean
Firm size			
1-5	22.4	18.7	21.3
6-15	45.3	24.9	37.6
16-24	43.8	22.7	35.8
25-199	58.6	32.0	49.8
200-499	66.1	47.1	61.0
500+	80.3	62.5	75.3
Occupation			
Professional	74.3	42.1	70.7
Managerial	71.9	36.3	59.0
Non-manual	46.9	31.2	36.9
Skilled manual	40.0	11.1	33.7
Semi-skilled	52.8	25.7	44.1
Unknown/unskilled	28.9	33.1	30.4
Farmer	12.4	26.7	13.9
Years worked			
11-20	0.0	29.0	27.8
21-30	23.7	25.1	24.8
31-40	44.9	31.1	38.5
41+	44.3	27.4	41.3
Tenure (years)			
1-10	41.1	20.5	32.1
11-20	37.5	30.3	34.1
21-30	49.0	28.1	42.0
31-40	66.1	37.6	59.8
41+	36.8	35.8	36.7
Sample size	856	385	1,241

for men and women. Overall, 49.8 per cent of the individuals in the sample report having supplementary pension income, with women being less likely to have supplementary pensions than men (41.4 versus 54.3 per cent). The coverage rates for supplementary pension plans are highly differentiated depending on individual characteristics. For men, pension coverage generally declines with age and increases with the number of children and being married. Pension coverage also increases with education, with being a home owner, with better subjective health and is highest among Dublin residents.

When it comes to job history characteristics, pension coverage increases with the size of the firm and total number of years worked. Coverage is highest

among high-skilled occupations. When it comes to tenure in the last employment before retirement, pension coverage generally increases with longer tenure, but falls quite dramatically for those who have tenures exceeding 40 years. This again is likely to be explained by the lower education levels within this group compared to those who have shorter tenures. The results for women are similar to those of the men, although coverage rates are generally lower. The differences between genders can be found in the family characteristics: pension coverage decreases with being married and with having children. The tenure effect does not appear as strong for women as for men, however the sample size of women with tenures exceeding 40 years is very small.

In order to examine the effects of individual characteristics while controlling for other covariates, the next part of the analysis uses a probit estimation technique modelling the probability of a retired individual receiving income from a supplementary pension. The analysis is again restricted to individuals who report having worked in the private sector before retirement. The models are estimated separately for men and women as the covariates may have effects which are different in magnitude and direction depending on gender. As the coefficients of a probit model cannot be interpreted directly, the marginal effects calculated at the means of the explanatory variables are reported.

The findings are presented in Table 7. Both job characteristics and individual socio-economic characteristics are significant in determining supplementary pension coverage, although results differ somewhat for men and women. The findings are largely as expected. Having secondary or third level education (as opposed to no education or primary level education) has a positive effect for men, as expected. For women, the education effect disappears when job history characteristics are added to the model. Having asset income (proxy for income) has a positive effect for both genders. The coefficient on being a home owner is only positive and significant in the case of men. Living outside of Dublin has a negative and significant effect on supplementary pension receipt for both men and women. As expected, the coefficients are positive and significant for larger firm size (firm size of 1-5 employees being the reference category). The coefficient also grows in magnitude with firm size. For men only, the coefficients for managerial, professional and non-manual occupations have significant positive coefficients, compared with the reference category of unskilled or unknown occupations. A dummy variable for having spent at least 6 months living abroad is positive and significant for women.

Interestingly, years worked is not significant for men or for women (model specification with years worked not reported here), but tenure has a positive

Table 7: *Probit Marginal Effects at Means, Private Sector Employees Only (Dependent Variable Equals 1 if Individual Receives Income from a Supplementary Pension, 0 Otherwise)*

	(1) Male Mfx	(2) Female Mfx
Age	.0008	.0057
Children	.0157	.0190
Married/widow	.0320	−.0389
Primary/None (omitted)	0	0
Secondary	.1489***	.0253
Third level/Higher	.1800**	.0992
Health	.0135	.0300
Mental health	−.0116	.0294
Homeowner	.1570**	−.0285
Has asset income	.1538***	.1255**
Lived abroad	.0582	.1760***
Dublin (omitted)	0	0
Another town/city	−.1952***	−.2453***
Rural	−.1856***	−.1875***
1-5 employees (omitted)	0	0
6-15 employees	.2214***	.1016
16-24 employees	.2240***	.0224
25-199 employees	.3401***	.1493**
200-499 employees	.3623***	.3023***
500+ employees	.5207***	.4212***
Permanent job	.0195	−.0031
Professional	.3309***	.0681
Managerial	.3371***	.0494
Non-manual	.1707*	−.0992
Skilled manual	.1147	−.2252**
Semi-skilled	.2351***	−.0913
Unknown/unskilled (omitted)	0	0
Farmer	−.0087	.0032
Tenure	.0038**	.0051**
Constant	***	**
Observations	825	374

* $p < 0.10$, ** $p < 0.05$,*** $p < 0.01$.

and statistically significant effect. The mechanism behind this finding may be that the length of time with the same employer is a key determinant of pension coverage rather than the total number of years spent in work, because the latter can be non-continuous. Also, length of job tenure in the last employment before retirement is likely to have a significant impact on pension

saving behaviour as individuals are likely to prepare for their retirement the further they are in their working careers. There is an issue of possible reverse causality explaining the significance of job tenure. Perhaps individuals do not acquire a pension because of a long-term employment contract but rather they remain in the same job due to generous pension entitlements, especially in later stages of their career.

V RETIREMENT INCOME REPLACEMENT RATES

In order to draw conclusions about the quality of pension provision, the extent to which pension incomes replace labour earnings needs to be assessed. This section of the paper examines retirement income replacement rates which measure the percentage of past earnings that is replaced by retirement income. The retirement income replacement rate is calculated as a ratio of current income (or a component of it) to inflation-adjusted pre-retirement labour income.

For the calculation of retirement income replacement rates, data from both the first and the second wave of TILDA is used. The reason for using wave 2 data is that the retrospective questions of income from last employment before retirement was asked in a more comprehensive way in the wave 2 questionnaire compared with wave 1. As a result of using wave 2 data, the sample size is smaller for the remaining part of the analysis (n=526).[11] Two different specifications are used for the calculation of the retirement income replacement rate for this analysis:

$$RR = \frac{\text{total retirement income}}{\text{pre-retirement earnings}} \times 100 \qquad (1)$$

$$RR \text{ (suppl.)} = \frac{\text{supplementary pension income}}{\text{pre-retirement earnings}} \times 100 \qquad (2)$$

The mean retirement income replacement rate using total retirement income (Equation 1) is 66.4 per cent, with the average figure for public sector workers being 70.5 per cent and the corresponding figure for private sector workers 64.6 per cent. Comparing replacement rates with the Irish government target figures, 36.5 per cent of the sample have a replacement

---

[11] The respondents also report the year in which they left this employment, and which currency they referred to if they had retired before January 1st 2002 (when the Euro was introduced in Ireland).

rate of less than 50 per cent. When only taking supplementary pension income into the calculation (Equation 2), the mean overall replacement rate is 24.5 per cent (45.8 per cent in the public sector, 15.4 per cent in the private sector).

Mean retirement income replacement rates by socio-economic and job history characteristics are shown in Table 8, using total retirement income and supplementary pension income. Due to the smaller sample size, the figures are calculated jointly for men and women in order to avoid cells with very few observations. As entitlement to State welfare pensions is only a function of PRSI contributions – and therefore closely linked to the length of work history – the retirement income replacement rates calculated using Equation 1 do not vary systematically across most of the individual characteristics. Interestingly, there is a U-shaped relationship between the

Table 8: *Mean Values of Retirement Income Replacement Rates. The First Column Reports Total Replacement Rates, The Second Column Supplementary Pension Replacement Rates*

	RR	RR (supp)		RR	RR (supp)
Age			Firm size		
65-69	68.3	25.9	1-5	64.0	9.5
70-74	65.6	25.1	6-15	68.3	20.4
75-79	62.1	24.1	16-24	75.7	25.2
80+	70.3	22.9	25-199	67.5	29.7
Children			200-499	59.1	26.6
0	70.2	23.4	500+	66.3	40.8
1-2	64.4	21.1	Years worked		
3-4	68.4	30.4	11-20	24.3	7.9
5+	61.8	20.8	21-30	59.6	15.2
Married/widow			31-40	72.1	34.1
No	69.1	21.8	41+	68.2	22.7
Yes	65.7	25.1	Tenure (years)		
Education			1-10	55.1	11.5
Primary/none	65.1	12.9	11-20	62.3	15.7
Secondary	63.9	28.8	21-30	69.4	26.3
Third/higher	75.5	51.7	31-40	72.0	39.2
Health			41+	69.3	26.2
Poor/Fair	67.3	18.5	Earnings quartile		
Good	60.5	21.5	1st	99.4	18.0
Very good/Excellent	72.1	33.1	2nd	64.2	24.7
Location			3rd	53.3	30.0
Dublin	65.3	30.8	4th	39.3	26.6
Another town/city	66.6	26.9			
Rural	66.7	18.9	N	526	526

replacement rate and education – individuals in the lowest education category have higher replacement rates than those with secondary level education.

Examining the figures in the second column of Table 8, supplementary pension replacement rates vary systematically with education, health status, geographical location, firm size, length of work history and tenure in the last employment. Interestingly however, the supplementary pension replacement rate falls at the highest categories of years worked, tenure and labour earnings.

Figure 3 depicts the variation of replacement rates (using different retirement income sources in the numerator) across pre-retirement earnings levels for private and public sector workers. The progressivity of the retirement income system is evident when examining the data in Figure 3. The progressivity is especially pronounced in the case of the individuals who have worked in the private sector. Individuals belonging to the lowest pre-retirement earnings quintile replace more than 100 per cent of their earnings in retirement, whereas the corresponding figure is less than 40 per cent for those in the highest pre-retirement earnings quintile. These findings can be attributed to the flat-rated nature of the State welfare pensions and the lower supplementary pension coverage in the private sector.

Table 9 presents results from OLS regression models, with retirement income replacement rate as the dependent variable. Columns 1-2 use the total retirement income replacement rate, and columns 3-4 use the supplementary pension income replacement rate as the dependent variable. Reflecting the results from the simple bivariate analysis of Table 8, most of the coefficients are statistically insignificant in regression models 1-2. The U-shaped effect of education is still reflected in the coefficient signs, but the effects are not

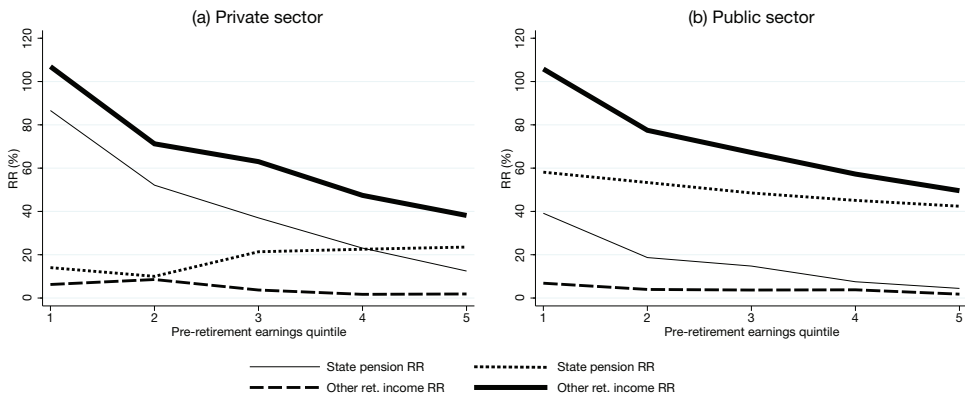Figure 3: *Replacement Rates From Different Sources, by Pre-Retirement Earnings Quintile*

Table 9: OLS Regression Models (Public and Private Sectors Included). Dependent Variable in Models 1-2: Retirement Income Replacement Rate (Using Total Retirement Income) Dependent Variable in Models 3-4: Retirement Income Replacement Rate (Using Supplementary Pension Income)

	(1) RR		(2) RR		(3) RR (suppl.)		(4) RR (suppl.)	
Age	0.170	(0.48)	0.186	(0.54)	0.0184	(0.07)	0.0158	(0.07)
Children	−1.400	(−1.59)	−1.493*	(−1.68)	−0.522	(−0.87)	−0.723	(−1.18)
Married/widow	−1.892	(−0.32)	−0.731	(−0.12)	1.435	(0.34)	3.404	(0.81)
Primary/None (omitted)	0	(.)	0	(.)	0	(.)	0	(.)
Secondary	0.140	(0.03)	−0.858	(−0.19)	7.929**	(2.50)	6.402**	(2.09)
Third level/Higher	10.27	(1.55)	9.273	(1.36)	16.10***	(3.22)	14.94***	(2.91)
Health	1.279	(0.44)	1.579	(0.52)	3.091	(1.61)	2.866	(1.51)
Mental health	0.676	(0.33)	−0.322	(−0.15)	−0.397	(−0.26)	−1.319	(−0.85)
Homeowner	2.928	(0.43)	2.435	(0.35)	−3.897	(−0.79)	−4.905	(−1.01)
Lived abroad	−1.127	(−0.25)	0.686	(0.15)	2.635	(0.83)	5.922*	(1.86)
Dublin (omitted)	0	(.)	0	(.)	0	(.)	0	(.)
Another town/city	−0.581	(−0.12)	−0.511	(−0.10)	−1.440	(−0.43)	−1.919	(−0.60)
Rural	−2.202	(−0.48)	−2.032	(−0.44)	−2.753	(−0.86)	−3.064	(−0.98)
1-5 employees (omitted)	0	(.)	0	(.)	0	(.)	0	(.)
6-1 employees	7.309	(0.88)	7.647	(0.89)	3.390	(0.72)	4.280	(0.88)
16-24 employees	9.476	(1.15)	11.49	(1.39)	0.178	(0.03)	2.171	(0.42)
25-199 employees	2.718	(0.45)	2.990	(0.49)	8.458**	(2.10)	8.551**	(2.15)
200-499 employees	−4.215	(−0.71)	−5.680	(−0.95)	7.138*	(1.71)	5.755	(1.40)
500+ employees	1.869	(0.26)	−0.595	(−0.08)	15.09***	(2.93)	13.23***	(2.60)
Permanentjob	3.343	(0.44)	5.350	(0.70)	8.240**	(2.00)	7.199*	(1.68)
Professional	−11.83	(−1.07)	−10.51	(−0.99)	15.55*	(1.80)	14.62*	(1.78)
Managerial	−0.236	(−0.03)	−2.155	(−0.28)	21.48***	(4.90)	19.02***	(4.37)

Table 9: OLS Regression Models (Public and Private Sectors Included). Dependent Variable in Models 1-2: Retirement Income Replacement Rate (Using Total Retirement Income) Dependent Variable in Models 3-4: Retirement Income Replacement Rate (Using Supplementary Pension Income) (Contd.)

	(1) RR		(2) RR		(3) RR (suppl.)		(4) RR (suppl.)	
Non-manual	-5.514	(-0.64)	-8.371	(-1.01)	14.35***	(2.66)	12.09**	(2.38)
Skilled manual	-4.048	(-0.56)	-6.155	(-0.86)	1.749	(0.51)	-0.881	(-0.27)
Semi-skilled	8.762	(1.12)	9.659	(1.26)	3.486	(0.83)	4.446	(1.05)
Unknown/unskilled (omitted)	0	(.)	0	(.)	0	(.)	0	(.)
Farmer	7.022	(0.66)	1.518	(0.14)	7.557	(1.30)	-2.586	(-0.44)
Sector of employment	4.560	(1.00)	3.572	(0.76)	18.66***	(5.47)	17.40***	(5.22)
Years worked	3.518***	(3.09)			2.035***	(2.75)		
Sq years worked	-0.0379**	(-2.46)			-0.0215**	(-2.15)		
Tenure			1.019*	(1.85)			0.807**	(2.52)
Sq tenure			-0.0125	(-1.20)			-0.00494	(-0.80)
Constant	-31.15	(-0.88)	30.89	(1.13)	-56.61**	(-2.44)	-21.08	(-1.21)
Observations	513		510		513		510	
R²	0.0819		0.0581		0.343		0.358	

t statistics in parentheses.
* p < 0.10, ** p < 0.05, *** p < 0.01.

statistically significant. Virtually, the only significant determinant of retirement income replacement rates (using total retirement income) is the length of work history, and the effect diminishes as work history lengthens, indicated by the negative and significant coefficient on the quadratic term. The result that the model has low explanatory power is to be expected, as the State welfare pensions are flat-rated, and the entitlement depends on the PRSI contribution accumulation of the individual, regardless of individual characteristics or the type of employment. The State welfare pension payment rates are not related to earnings, therefore equalising income differentials among retirees.

When it comes to the determinants of supplementary pension income replacement rates, however, many of the variables that are correlated with the replacement rate in a bivariate setting (Table 8) are also significant in the multivariate framework. Education has a significant positive effect across the specifications, as do firm size and occupational dummies. The public sector dummy has a large and highly significant *ceteris paribus* effect on the replacement rate, with former public sector employees having 17 percentage points higher replacement rate compared with private sector workers. Years worked has a positive and significant diminishing effect, whereas the effect of tenure is smaller, as can be seen in column 4. The results are virtually the same when the models are estimated for former private sector employees only (not reported).

VI CONCLUSIONS AND DISCUSSION

This paper attempts to develop a deeper insight into the structure of the incomes of Ireland's retirees. The purpose of the analysis is to examine how the pension system has shaped the incomes of those who have now left the labour force. The research aims to inform pension policy which affects current labour market participants.

With regard to retirees' incomes, the analysis reveals that the flat-rated State welfare pensions provide the majority of retirement income for a large fraction of the current retiree cohorts. Therefore, a reduction in State welfare pension rates would negatively impact the incomes of a significant group of retirees, and the effect would be highly regressive. The proportion of the total retiree population that heavily relies on the State welfare pensions is likely to be larger than the group identified in this paper as this research only focuses on individuals with a relatively substantial work history, therefore, omitting individuals who have not participated in the labour force. However, the most striking feature emerging from the analysis of retirees' incomes is the crucial

role that supplementary pensions play in retirement income provision. Prompted by this finding, the exploration of factors that determine whether or not a retiree is in receipt of income from a supplementary pension is carried out.

The multivariate analysis of the determinants of supplementary pension coverage reveals that former public sector employees are significantly more likely to be covered than former private sector workers. Focusing on retirees who have worked in the private sector before retirement, findings suggest that both work history and individual socio-economic characteristics are significant in explaining supplementary pension coverage. Individuals with low education levels, with no asset income, those who live outside Dublin and those previously employed in small firms or with short tenures in their last employment are less likely to receive income from a supplementary pension.

If policy aims to increase supplementary pension coverage, the mechanisms through which individuals acquire supplementary pensions need to taken into consideration. The results presented here suggest that, for some groups of retirees, not having a supplementary pension is largely influenced by their occupational and other job characteristics. The finding provides support for the theory of segmented labour markets, according to which not having a pension is a restriction for a certain section of the labour force, imposed by the job type of the individual, the selection into which in turn is influenced by socio-economic characteristics. Focusing measures to increase supplementary pension coverage on women in particular could be optimal as women are disproportionally represented in the groups of workers with low earnings and non-continuous labour market participation patterns.

The final part of the analysis calculates retirement income replacement rates and analyses how they vary across individuals. In this context, two important features emerge, as shown in Figure 3. First, the structure of Ireland's pension system – in particular the flat-rated State welfare pension – leads to a high degree of progressivity in the system. Replacement rates fall continuously across the pre-retirement earnings distribution, with the rate of decline faster among former private sector employees compared to the public sector. Second, supplementary pensions add an earnings-related component to the overall pension system and insulate post-retirement incomes of middle- and high-earners to some degree.

Two criticisms that are often expressed about Ireland's pension system are that i) the State welfare pensions are virtually flat-rated and not linked to earnings, and ii) tax deductibility of contributions to supplementary pension schemes makes the system regressive because the tax relief is given at the marginal rate of income tax of the individual. Looking at these two issues in isolation, the criticisms can be justified. However, the analysis in this paper

shows that the two issues should not be assessed separately. First, even though tax deductibility of pension contributions is regressive, the overall system appears highly progressive – and possibly more so than many elements of public spending in Ireland. Second, while the basic State welfare pension is not earnings-related, (tax-incentivised) supplementary pensions provide an earnings-related dimension to the pension system.

By viewing these dimensions of Ireland's pension system together, the findings of this paper suggest that caution should be exercised in reviewing elements of the pension system in isolation. Currently, the various elements in combination produce an outcome which is progressive while providing an earnings-related component. Therefore, any changes to one element could alter the overall outcome of the system.

REFERENCES

BARONI, E. and C. O'DONOGHUE, 2009. *Poverty Impact of State Pension Reform on the Elderly: An Analysis of Reform Proposals in the 2007 Irish Green Paper*, Dublin: Combat Poverty Agency.

BARRETT, A., G. SAVVA, V. TIMONEN and R. A. KENNY, 2011. *Fifty Plus in Ireland 2011: First Results from The Irish Longitudinal Study on Ageing (TILDA)*, Technical Report, Dublin: TCD.

BARRIENTOS, A., 1998. "Pension Reform, Personal Pensions and Gender Differences in Pension Coverage", *World Development*, Vol. 26, No. 1, pp. 125-137.

BASSETT, W. F., M. J. FLEMING and A. P. RODRIGUES, 1998. *How Workers Use 401(K) Plans: The Participation, Contribution, and Withdrawal Decisions*, Staff Reports 38, New York: Federal Reserve Bank.

BLACKWELL, J., 1984. *Income and Assets of Elderly Households*.

CENTRAL STATISTICS OFFICE, 2011. *Survey on Income and Living Conditions (SILC): Thematic Report on the Elderly 2004 and 2009*. Technical Report, Dublin: CSO.

CONNELL, P. and J. STEWART, 2004. "Income of Retired Persons in Ireland: Some Evidence from Household Budget Surveys" in G. Hughes and J. Stewart (eds.), *Reforming Pensions in Europe: Evolution of Pension Financing and Sources of Retirement Income*, Cheltenham: Edward Elgar Publishing Limited.

DEPARTMENT OF SOCIAL AND FAMILY AFFAIRS, 2002. *Sustainable and Adequate Pension Provision for an Ageing Population: Irelands National Strategy Report to the EU Commission on its Pension System*, Technical Report, Dublin: The Stationery Office.

DEPARTMENT OF SOCIAL AND FAMILY AFFAIRS, 2007. G*reen Paper on Pensions*, Dublin: The Stationery Office.

DEPARTMENT OF SOCIAL AND FAMILY AFFAIRS, 2010. *National Pensions Framework*. Technical Report, Dublin: The Stationery Office.

DOMINGUEZ-BARRERO, F. and J. LOPEZ-LABORDA, 2007. "Why do People Invest in Personal Pension Plans?", *Applied Economics*, Vol. 39, No. 9, pp. 1115-1126.

DUMMANN, K., 2008. "What Determines Supply and Demand for Occupational Pensions in Germany?", *Journal of Pension Economics and Finance*, Vol. 7, No. 2, p. 131.

ENGEN, E. M., W. G. GALE, C. E. UCCELLO, C. D. CARROLL and D. I. LAIBSON, 1999. "The Adequacy of Household Saving", *Brookings Papers on Economic Activity*, Vol. 2, pp. 65-187.

EUROSTAT, 2012. *1st January Population by Sex and 5-year Age Groups*. Retreived from: http://ec.europa.eu/eurostat/product?code=proj 10c2150p&language=en& mode=view.

GHILARDUCCI, T., 1992. *Labor's Capital: The Economics and Politics of Private Pensions*. The MIT Press.

GUARIGLIA, A. and S. MARKOSE, 2000. "Voluntary Contributions to Personal Pension Plans: Evidence from the British Household Panel Survey", *Fiscal Studies*, Vol. 21, No. 4, pp. 469-488.

HOLZMANN, R., T. PACKARD and J. CUESTA, 2000. *Extending Coverage in Multi-Pillar Pension Systems: Constraints and Hypotheses, Preliminary Evidence and Future Research Agenda*. World Bank Social Protection Discussion Paper, 2.

HONIG, M., 1996. "Retirement Expectations: Differences by Race, Ethnicity and Gender", *The Gerontologist*, Vol. 36, No. 3, pp. 373-382.

HUGHES, G. and B. NOLAN, 1999. "Competitive and Segmented Labour Markets and Exclusion from Retirement Income", ESRI Working Paper 108, Dublin: The Economic and Social Research Institute.

LAYTE, R., T. FAHEY and C. WHELAN, 1999. *Income, Deprivation and Well-Being Among Older Irish People*, National Council on Ageing and Older People, Report No. 55, Dublin.

MATH, A., 2004. *Reforming Pensions in Europe: Evolution of Pension Financing and Sources of Retirement Income*, Chapter "The Impact of Pension Reforms on Older People's Income: A Comparative View", p. 105. Edward Elgar Publishing.

MOORE, J. F. and O. S. MITCHELL, 1997. *Projected Retirement Wealth and Savings Adequacy in the Health and Retirement Study*. Technical Report, National Bureau of Economic Research.

ORGANISATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT, 2013. *Review of the Irish Pension System*, Paris: OECD.

SCHOLZ, J. K., A. SESHADRI and S. KHITATRAKUN, 2006. "Are Americans Saving 'Optimally' for Retirement?", *Journal of Political Economy*, Vol. 114, No. 4, pp. 607-643.

STEWART, J., 2011. "New Development: Public Sector Pay and Pensions in Ireland and the Financial Crisis", *Public Money and Management*, Vol. 31, No. 3, pp. 223-228.

THE PENSIONS BOARD, 1998. *Securing Retirement Income: National Pensions Policy Initiative: Report of The Pensions Board to the Minister for Social, Community and Family Affairs*, Technical Report.

WOLFF, E. N., 2002. *Retirement Insecurity: The Income Shortfalls Awaiting the Soon-to-Retire*, Economic Policy Institute.

YABIKU, S. T., 2000. "Family History and Pensions: The Relationships Between Marriage, Divorce, Children and Private Pension Coverage", *Journal of Aging Studies*, Vol. 14, No. 3, pp. 293-312.

APPENDIX

A   The Irish Pension System

Traditionally, state pension systems can be divided into two main types: Bismarckian and Beveridgean, the first of which are typical of continental Europe. Bismarckian state pensions are in general compulsory for workers, entitlements are strongly linked to contributions, and retirement income replacement rates are high. Beveridgean state pension systems on the other hand are traditional in Anglo-Saxon countries. Membership is universal and the link between contributions and benefits is weaker, with the state providing a flat-rate payment which guarantees a minimum level of retirement income. The Irish system is of the Beveridgean type.

The Irish pension system can be divided into three pillars: State welfare pensions, occupational pensions and private pensions:

- *State welfare pensions* are flat-rated and are not linked to earnings, and therefore act as a safety net to keep retirees' incomes from falling below a certain threshold. The State welfare pensions consist of contributory and non-contributory pensions. Entitlements to the former are built up over the working career of an individual through the accumulation of Pay Related Social Insurance (PRSI) credits. In 2010 (when the majority of TILDA wave 1 data was collected), the contributory State welfare pension was payable from age 66 and the maximum payment rate was €230.30 per week. Transition State welfare pension was payable from the age of 65, but had higher contribution requirements than the contributory State welfare pension. The second type of State welfare pension is the non-contributory pension, which is means-tested and, in 2010, was payable from age 66 and capped at €219 per week. For all State welfare pensions, there are additional payments for dependants (Department of Social and Family Affairs, 2010).
- *Occupational pensions* are common in public sector employment in Ireland but are also a feature of private sector employment, especially in larger firms. Public service occupational pension schemes are in place for staff in the civil service, local authorities, Garda Síochána (the Irish police), the defence forces, the health and education sectors and non-commercial State bodies.
- *Private pensions* are voluntary and consist of Retirement Annuity Contracts (RACs) which are commonly used by the self-employed, and Personal Retirement Savings Accounts (PRSAs) which were introduced in 2002 with an aim to increase pension coverage among low-coverage employee groups.

Contributions to supplementary (occupational and private) pensions are subsidised by the Irish State by being deductible in income taxation, however the income from these pensions is subject to income tax.

B Income Calculation

The gross weekly income for each individual is calculated by adding together income from:

- contributory State welfare pension
- non-contributory State welfare pension
- transition State welfare pension
- occupational pensions
- private pensions
- social welfare income:
  - Disability Allowance
  - Disability Benefit
  - Invalidity Pension
  - Carers Allowance
  - Supplementary Welfare Allowance
  - combined income from other social welfare payments[1]
  - foreign social welfare payments
- interest on savings*[2]
- interest on financial assets*[3]
- rental income*
- other assets*[4]

* Only asked of the Financial Respondent within the household. Therefore, asset income is assumed to be divided equally between spouses if respondent is married/cohabiting.

[1] Pre-retirement Allowance, Back To Work Allowance, Back To Work Enterprise Allowance, Back To Education Allowance, Part-time Job Incentive Scheme, Farm Assist Scheme, Widow's or Widower's Non-Contributory Pension, Widowed Parent Grant, Deserted Wife's Benefit, Bereavement Grant, Injury Benefit, Disablement Benefit, Blind Pension, Constant Attendance Allowance, Infectious Diseases Maintenance Allowance and Medical Care Scheme. The income from these sources is reported jointly, and therefore can not be disaggregated.

[2] If an individual reports having savings but does not know or refuses to report the interest income, 3 per cent return on savings value assumed.

[3] If an individual reports having financial assets but does not know or refuses to report the interest income, 3 per cent return on asset value assumed. If asset value reported as a range, the mid-point of that range recorded as asset value.

[4] Land, a firm or business, an inheritance or money owed, etc. If an individual reports having other assets but does not know or refuses to report the interest income, 3 per cent return on asset value assumed.

C   Unfolding Brackets and Data Imputation

As is common in surveys, some TILDA respondents answer questions – especially financial ones – with "I don't know" or "I'd rather not say". To overcome the issue of missing data, TILDA uses unfolding brackets in many of the questions. A large fraction of initial non-respondents are willing to answer the unfolding bracket questions. For example in wave 2,676 individuals were asked about their past labour income, and while 303 individuals (45 per cent) gave a numerical answer, 266 individuals (39 per cent) provided an income bracket. If a bracket value was provided, the median point of the range was used to replace the missing value for the point estimate.

Imputation – a technique of replacing missing data with plausible values – is common in household surveys, especially for sensitive financial information. A smaller sample resulting from resorting to complete-case analysis results in loss of efficiency and deleting missing data can yield biased inference when the probability of item non-response is correlated with the variable itself. Missing data can be described as "missing completely at random" (MCAR) if the probability that data are missing does not depend on observed or unobserved data. Under the MCAR assumption, the missing values are a random sample of all values (missing and non-missing), and therefore analyses excluding the missing values is consistent, although less efficient. As a more realistic alternative in survey data, data are defined as missing at random (MAR) if the probability that data are missing does not depend on unobserved data but may depend on observed data. Under MAR, the probability that data is missing is not a function of the missing data values themselves. In the MAR case, listwise deletion of data can lead to biased results. If the missingness of the data depends on the missing data values, the missing-data mechanism is called missing not at random (MNAR). For such missing data, the reasons for its missingness must be accounted for in the model. This can be argued to be the case for missing income data, as it is likely that people with either low or high incomes do not report their income levels. In practice, it is difficult to test the ignorability assumption formally because the MAR mechanism can be distinguished from the MNAR mechanism only through the missing data that are not observed (Stata Corp, 2013).

Predictive mean matching was used to impute missing income component values (and no bracket was provided). Out of the 6 main income components, 2 had more than 5 per cent missing observations (occupational pensions and asset income, with 6.3 per cent and 19.5 per cent missing observations, respectively). The missing values were imputed by replacing them with predicted values obtained by regressing the income component in question against a group of covariates for those individuals with non-missing data. The predicted value of the income component was then estimated for those with

missing income data, using covariate values and the estimated coe cients. The covariates used were age, education level, number of years worked, and dummy variables indicating the presence of children, the sector of previous employment, home ownership, gender, and being married (or cohabiting).

REFERENCES

DEPARTMENT OF SOCIAL AND FAMILY AFFAIRS, 2010. *Rates of Payment 2010 –* SW19.

STATA CORPORATION, 2013. *Stata Multiple-imputation Reference Manual: Release 13*, Texas: Stata Press.