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Incentives of Retirement Transition for Elderly Workers: An Analysis of Actual and Simulated Replacement Rates in Ireland

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ABSTRACT

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Retirement behaviours and elderly poverty issues have been the subject of much attention and discussion in recent years as most countries are facing a rapidly ageing society. Ireland enjoys a relatively young population compared with other European countries, but is also struggling with increasing fiscal pressures. This paper analyses the retirement pattern and the replacement rate observed in Ireland using the Living in Ireland panel dataset. Since traditional empirical estimations may have selection bias issues as people with low replacement rates may not choose to retire, the paper adopts a combined method with both synthetic household simulation and empirical estimates. The study reveals the social economic attributes patterns associated with the replacement rates and retirement behaviours, and explores the heterogeneities of replacement rates among retirees.

JEL Classification: J14

Keywords: retirement, replacement rates, microsimulation

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I. INTRODUCTION

Retirement behaviours and elderly poverty issues have been the subject of much attention and discussion in recent years as most countries are facing a rapidly ageing society. Ireland enjoys a relatively young population compared with other European countries, but is also struggling with increasing fiscal pressures. Although Ireland has reformed its pension system over the past few years (Whelan, 2007), little work has been undertaken to understand what contributes to the pattern of retirement in Ireland, and what monetary incentives are introduced by the existing regulations.

There are many reasons for people to retire: retirement regulations, financial incentives, health status etc., may all contribute. From the supply side of the labour market, an individual may choose to retire if the expected post-retirement income is sufficiently high. Meanwhile, from the demand side, employers may use incentives to keep productive employees working as long as possible in order to save the total pay-out of occupational pension. While many factors are weighted when an individual makes the transition to retirement, it is impossible to analyse all the factors at once. Therefore, this paper focuses only on the monetary incentive, which is one of the most quantifiable and used variables.

From a social policy point of view, the absolute amount of postretirement income is important since it determines the minimum living standard that a retiree is able to secure during their retirement, whilst the absolute benefit level determines the public expenditure necessary to finance the pension system. While economists may be more interested in the smoothing of marginal utility rather than the income per se, the data required for the calculations does not exist. Instead, most researchers have taken an indirect approach by comparing income before and after retirement by using the replacement rate. This is defined as the ratio of a person's consumption or income after retirement to before retirement, and has become a popular measurement for analysing post-retirement welfare.

In order to analyse the potential replacement rates for elderly workers under differing scenarios, it is necessary to build the analysis around a dataset with rich social economic variables and a tax-benefit microsimulation tool. A sub-component of the LIAM model was used to facilitate the analysis based on a long dataset derived from the LII dataset. The framework built around this dataset allows the labour market trajectory of each potential retiree to be investigated. Previous literature on the effect of the Irish state pension regulations on retirement behaviour is relatively rare. Some studies have looked at the work incentives in the Irish labour market through replacement rates (Callan *et al*., 2006; Immervoll and O'Donoghue, 2003a), while others have attempted to estimate the implicit tax rate for elderly workers (Blöndal and Scarpetta, 1997), and more recent studies (e.g. Hughes and Watson, 2005) have examined how the income of pensioners in 2000 has varied across social groups based on reported retirements. However, little attention has been paid to the individual's choice of actual retirement in Ireland. Existing research on retirement typically uses the reported retirement status, which suggests that almost everyone retires within one year of becoming eligible for the state pension (Raab and Gannon, 2009). By including working individuals, bias may be introduced with regard to the real incentives behind retirement behaviour, meaning that the potential behaviour change resulting from regulation change cannot be inferred.

Ireland, in some aspects of its retirement regulations, is different from many other countries. The state pension is not linked to employment status, which means an individual can claim his/her pension whilst still working full time. This type of regulation effectively creates two retirement time points:

classified as retired and receiving state pension, and actually exiting the labour market. While the first time point of retirement is mostly the result of an individual's age and job sector, the second time point is more interesting from the policy point of view as it is an active individual choice instead of a passive transition. One of the primary concerns of the pension policy is that retirees should have an income sufficient to secure a reasonable standard of living. Analysing the retirement income based solely on the official status may introduce a bias towards the living standard of the retirees as this is a mixed group containing also individuals employed in full time jobs.

This paper examines the monetary incentives behind the tax benefit system for elderly workers in Ireland using an estimated replacement rate and compares the monetary incentives with the pattern of retirement. A combined method of synthetic household simulation and empirical estimations from the panel dataset LII is used. By performing simulations with the synthetic household data, the existing incentives embedded in the state pension regulation can be understood, and by relating the replacement rate information to an empirical micro dataset, it is possible to analyse the factors behind different observed replacement rate levels and retirement ages (e.g. benefit levels, household composition etc). With this combined approach, it is possible to analyse the monetary driving forces behind retirement and to investigate how it compares with the retirement patterns observed in Ireland.

The institutional features of the state pension system in Ireland are outlined briefly in section 2 and the methodology and measurements of the replacement rates are discussed in section 3. Section 4 describes some of the details of the simulation model used in the tax-benefit calculation and is followed by a description of the data in section 5. The results of the analysis are presented in sections 6, 7 and 8. Section 6 reports the result of the replacement rate analysis via a set of synthetic households and section 7 takes a closer look at the distribution of replacement rates estimated from the panel dataset from different aspects. Finally, section 8 compares the distribution of retirement with replacement rates.

II. DESCRIPTION OF THE IRISH TAX-BENEFIT SYSTEMS FOR ELDERLY

The Irish tax-benefit system is in many respects similar to the Anglo welfare state, with relatively insignificant social insurance systems in place. In this type of system, means testing and progressive income taxes are more important than in equivalent continental social security systems (Esping-Andersen, 1996). Many welfare benefits in Ireland are flat rate based and are not earnings related (Evans *et al*., 2000; Callan, 1997). Ireland has a set of categorical instruments, covering contingencies such as unemployment, old age disability, lone parenthood etc., with different means tests and eligibility conditions, but similar levels of benefit (O'Donoghue, 2001).

The Irish pension system is frequently presented as a multi-pillar system with a relatively small mandatory first pillar consisting of a flat (i.e. no earnings related) social insurance system, and means-tested social assistance. The occupational and private pension systems (the second and third pillars) play a major role in the replacement of earnings. Public pensions are in general pay as you go (PAYG), with the private sector providing funded occupational or private pensions to about half of the workers in 2005. Table 1 provides an overview of the components of the relevant welfare benefits for the elderly in Ireland[1].

[1] This section aims to give a brief description of the current Irish pension system. For a more detailed description of the tax benefit system in Ireland and its pension system, please refer to O'Donoghue (2001; 2003) and Baroni & O'Donoghue (2009)

Table 1 Irish Pension System

1st Pillar	Old Age Non-Contributory Pension
	Old Age Contributory Pension
	Invalidity Pension
	Widow, Widower ,Orphan and other Pensions Benefits
2nd Pillar	Public service pay-as-you-go schemes
	Funded occupational pension schemes set up by employers
3rd Pillar	Supplementary private pensions arranged by individuals

First Pillar: State Pension System

The state pension applies automatically to everyone who lives and works in Ireland and consists of several different provisions which together constitute the social welfare pension. It includes the basic old age non-contributory pension, an old age contributory pension, and smaller pension items such as invalidity, widow's pension etc. The non-contributory pension is independent of employment trajectory and covers residents aged over 66 with an income below the threshold level set via a means-test. Only those people whose income satisfies the test are entitled to the full means-tested benefit. If an individual's income is above certain income threshold then the benefit is withdrawn completely. The amount of pension received by an individual is determined by age and household composition (e.g. whether the individual is living alone etc.)

The old age contributory pension, as suggested by its name, requires an established contribution record from an individual before it can be drawn. The amount of contribution that a worker pays depends on the earnings and the type of work. In Ireland, contributions are referred to as PRSI (Pay Related Social Insurance). The nature and the wage of the job determine the type of class and rate of contribution paid by an employee. According to the Irish regulations, the recipient of a contributory pension must have paid or credited at least 260 social insurance full-rate contributions during their working years (counted from either 1953 or the date when they started insurable employment, to when they reach the age of 56). This qualifies an individual to be eligible for a flat rate non-earnings related weekly benefit once they retire from the labour market at the age of 65 or when they reach 66, regardless of their current employment status. The PRSI contribution conditions may be based on either of the spouses' records but cannot be combined.

Second Pillar: Occupational and Private Pension Membership

Ireland places an important emphasis on supplementary funded occupational and private pensions (second and third pillars) as do other countries with multi-pillar systems. The system is however still relatively immature since it only covers around half of the working population and elder workers are likely to be excluded due to the inexistence of private pension plans during their early ages.

Depending on the nature of their job, type of employment etc., individuals may be eligible for additional pension plans. This may include an occupational pension or a private pension. Table 2 gives an overview of the occupational and private pension coverage in Ireland in 2001. Occupational pensions in Ireland are usually organized by employers and the plans can be divided between those guaranteed by the state, covering all public sector employees, and those provided by firms. The latter category is much newer and has a relatively lower coverage. Since 2003, employers who do not offer an occupational plan are now obliged to provide access to a private retirement saving account. According to the pension question survey in the QNHS Q1-2002, conducted by Ireland's Central Statistics Office (CSO), nearly 20% of the working population contributed to a private pension fund

and around 40% of workers had occupational pension coverage. Approximately 47% of all workers do not have additional pension rights besides the state coverage. Appendix A provides a more detailed overview of pension coverage by gender.

Table 2 Occupational and private pension coverage among Irish workers

Overall pension status for workers	*Freq.*	*Percentage*
Self-employed with a private pension	1,967	8.3
Employee with an occupational pension only	8,645	36.3
Employee with a private pension only	1,083	4.6
Employees with both occupational and private pension	709	3.0
Employees with no pension	8,823	37.0
Self-employed with no pension	2,574	10.8

(Source: QNHS Q1-2002, and author's calculation)

Retirement Age

The working population in Ireland, as in most other parts of the world, does not have a single fixed retirement age. The earliest retirement age with full rights varies according to occupation and job sector.

As stated earlier, the state old age pension is either means tested or contribution based. There is no penalty for retirees who retire early, although they cannot claim the benefit until aged 65/66. For occupational pensions, the retirement age is usually set out in the contract of employment. Some contracts of employment have a mandatory retirement age and also contain provisions for earlier retirement, generally and/or on the grounds of ill health. Public sector workers who started working before 1 April 2004 have to retire at age 65, with the exception of a limited number of occupations, e.g. the defence forces, who have provisions for earlier retirement. For people who joined the public sector after 1 April 2004, the earliest retirement age is 65 except a few occupations such as police and fire fighters.

Since receiving certain old age benefits (e.g., old age contributory pension) does not necessarily mean that an individual is out of the labour market, a more strict definition of retirement was used in this study. Here, it is defined as an individual who has stopped working or receiving unemployment benefit after the age of 55 and who does not re-enter the labour market.

III. METHODOLOGY I: REPLACEMENT RATE MEASURES

Replacement Rate

Replacement rates are often used to assess how well elderly people can maintain their pre-retirement level of consumption once they stop working (Munnell and Soto, 2005). The idea behind the replacement rate concept is that a person's welfare being or living standard in retirement can be measured as a proportion of their living standard during their working life. It is usually defined as the ratio of a person's consumption or income after retirement compared to before retirement.

There are a number of different approaches when conducting replacement rate analyses. Some research (e.g. Central Planning Bureau, 1995) uses one or a few artificially created synthetic households to illustrate the effect of the tax benefit system on the replacement rate, while other studies (e.g. Engen *et al*., 1999; Scholz *et al*., 2004; Immervoll and O'Donoghue, 2003b) have used

simulation techniques to calculate the counterfactual income to estimate the replacement rate. Depending on what type of data is used, the methods can be grouped into three categories: synthetic analysis, empirical data based analysis, and simulated data based analysis. A discussion of the usage of each method can be found in Immervoll and O'Donoghue (2002).

Synthetic or stylised household analysis is widely used within the tax-benefit literature. This uses one or a set of "average households" to estimate the benefit level. The most common type of calculations assume a set of average characteristics (e.g., in-work income of an average production worker) which is considered appropriate for the household type under consideration, and apply the relevant tax and benefit rules to find out its replacement rate levels. Research investigating effective tax rates e.g. OECD (1994, 1998, 1999), use this method to evaluate the replacement rates. This type of analysis allows the part of the tax-benefit rules under investigation to be isolated, and offers straightforward and easy to interpret results. There are however, a number of problems with this approach as it attempts to reduce complex tax-benefit systems to a single (or few) point estimates (Immervoll and O'Donoghue, 2002). Therefore, this analysis is likely to miss many of the important features of the tax-benefit system, which although not applicable to the average household, may affect a large part of the population.

Another approach taken to study replacement rates is to use a representative household panel. This method typically looks at time-series information for individuals and records the changes. In this way, the problems of assumed homogeneity within stylised households can be avoided. One common criticism of this method is its potential selection bias, as it only looks at people whose status changes during the year and excludes those for whom it does not. For example, if the low replacement rate after retirement makes it less likely for someone currently employed to retire, then only measuring for people who decide to retire will result in higher replacement rate estimates than if all people currently working were taken into account. One possible solution is to also compute replacement rates for people whose status does not change by simulating the income they would receive in an alternative labour market situation (Immervoll and O'Donoghue, 2003b).

An alternative way to study the replacement rate is to use a simulated dataset. Essentially, this would need to simulate all the possible statuses within the labour market (working, unemployed, retired etc.) in the panel dataset, and would use the simulated replacement rates for the analysis. Due to the complexity of the possible retirement choices and modelling, there have only been a few papers published where this method has been used in retirement studies, although the method has been well used in tax rate analyses in Europe (e.g. Immervoll and O'Donoghue, 2003b; Berger *et al*., 2003). This method overcomes some of the shortcomings of synthetic analysis by taking the actual population structure into account. However, as a natural consequence of simulation, the accuracy of the results is highly dependent on the quality of the model and the dataset.

This paper uses a combined analysis from both the synthetic household and panel data approaches and there are a number of reasons for this choice. First, individuals are very different, and a benchmark is needed; second, the interest here is in the replacement rates in the real world; and third, a simulation approach would potentially offer more information on why people are retiring. However, this type of analysis is restricted to only those individuals whose history can be reconstructed. Although a historical dataset is available for LII (Li & O'Donghue, 2010), it only contains the individuals presented in the first wave, as certain variables were only collected in this segment. Therefore, there is a trade-off between more detailed simulated information and fewer actual observations, and less detailed simulated information and an increased number of actual observations. Since the value from actual transitions has a higher accuracy than the simulated one, the decision was made to use as many

actual values as possible within this paper in order to reflect the actual replacement rate distribution of retirees in Ireland.

Constructing Replacement Rates

There are a number of approaches for estimating the replacement rate of the elderly, Immervoll and O'Donoghue (2003b) presented some of the analytical choices faced in calculating replacement rates (see also Atkinson and Micklewright, 1991). The two basic dimensions that are relevant in this context are: (1) which income components to include in the numerator and the denominator of the replacement rate and for whom; and (2) which direction of labour market transition to compute the replacement rate for.

There are different measures in the existing literature which may lead to confusion and different estimations regarding the replacement rates (e.g. Steuerle, Spiro, and Carasso, 2000). In order to be consistent with the original intentions of this study, the total net disposable income prior to retirement was selected as the dominator. This is because it is available for many datasets and is commonly used, thereby allowing the results of this study to be compared to others. Also, some pensions, especially occupational pensions, are largely correlated to an individual's income immediately prior to retirement. This makes the replacement rate useful for predicting retirement behaviours and analysis of the incentives for individuals to retire. Therefore, the replacement rate in this paper is defined as the net disposable income following retirement divided by the net income immediately prior to retirement, as suggested in equation (1).

$$RR = \frac{\text{Net Disposable Income}_{OW}}{\text{Net Disposable Income}_{t-1}} \times 100\% \qquad (1)$$

Therefore, the household replacement rate can be defined as:

$$RR_h = \frac{\text{Net Household Income}_{OW}}{\text{Net Household Income}_{t-1}} \times 100\% \qquad (2)$$

In general, the higher the replacement rate, the more protected an individual is from the impact of losing their work income. High replacement rates however, may reduce individuals' effort to stay within employment and provide incentives to retire early. The labour market opportunities that are faced by unemployed may be such that accepting the jobs offered to them would result in no or little financial gain. This may be particularly true for low-skilled individuals. Similarly, those currently employed on a low income may not lose much by entering unemployment or retirement.

The replacement rate offers a direct way of analysing monetary incentives and income smoothing. However, it is also worth noting that the change of welfare being can only be indirectly inferred from the replacement rate. Due to the different consumption patterns, a replacement rate lower than 100% of pre-retirement income may still be sufficient to maintain a living standard as the cost of living can decline in the transition from work to retirement. For instance, a retiree will have less work-related expenses such as clothing and transportation, but may have an increased health-related expenditure.

Income Decomposition

In order to analyse what drives the replacement rate, the sources of income before and after retirement also need to be studied. In most countries, an individual typically has more than one source of income; however, the fluctuation of these income sources may depend on the status of retirement. For instance,

if after becoming fully retired, there is a sharp decline of labour income, whilst at the same time, the dividend from a fund that was previously accumulated may start to be received together with money from private and public pensions. Therefore, the driving force of replacement rate cannot be fully understood unless all the possible income sources are explored. In this paper, the income sources are grouped into five categories: labour and capital income, state pension, occupational and private pension, social benefit, and tax (negative income).

While the transition from one labour market state to another is a process at the individual level, the subsequent change in income potentially affects the well-being of other household members. Concurrently, the incomes of others within the household will influence the welfare measure of the individual or may even be sufficiently strong to change an individual's behaviour. In addition, the employment status and incomes of individual household members can have important consequences for the amounts of taxes paid or benefits received by other household members (e.g. due to a joint income tax system or the assessment of total household income for computing means tested benefits). As a result, replacement rates at both the individual and household level are computed in this paper.

IV. METHODOLOGY II: THE USE OF TAX-BENEFIT MICROSIMULATION MODEL

The paper uses a sub-component of the LIAM model to facilitate the calculation of tax benefits for synthetic individual cases. The tax benefit model is derived from LIAM, a dynamic microsimulation model designed to evaluate potential reforms of the Irish pensions system and other policies in terms of changes to life-cycle incomes, with a particular focus on old age income replacement rates, poverty and inequality measures (O'Donoghue *et al*., 2009).

Simulations are run on the LII and synthetic dataset based on the systems of tax and benefit rules for the corresponding year. The synthetic based simulation uses the year 2000 data for the baseline analysis and the variables simulated and relevant for this exercise are income taxes, various family benefits (e.g. child benefit, lone parent benefit), pensions (e.g. state contributory pension, state non-contributory pension, survivors' pension etc.), and other benefits (e.g. unemployment benefits, disability benefit etc.). In simulating post-retirement income and computing the relevant replacement rates, a number of noteworthy assumptions are made:

- Any provisions made for special retirement compensation in collective agreements are disregarded
- Partial retirement is disregarded and individuals are treated as part-time workers
- In the case of transitions from work to retirement, it is assumed that the individuals are no longer employed or claiming pension at the start of the current tax year
- In computing incomes, in-kind benefits such as the provision of social/subsidised housing or child-care are not included. Also not taken into account are work-related expenses (union fees, costs of commuting to work, costs of providing care for dependants during working hours, etc.), any discounts or rebates that may be available to benefit recipients (e.g. for utilities and phone bills, public transport, medical expenses, or school-related expenses such as books or uniforms).

V. DATA AND SAMPLE SELECTION

This paper uses the 1994-2001 Living in Ireland Survey (ECHP-LII) dataset for a simple exercise of labour participation simulation. The LII survey constitutes the Irish component of the European Community Household Panel (ECHP). It is a representative household panel survey conducted on the Irish population annually for eight waves until 2001. The data contains information on demographic,

employment, and other social economic characteristics of around 3500 households in each wave. Since the pension eligibilities and entitlements are often linked with career trajectories which are not readily available in the LII dataset, a back-simulation module was developed in order to recreate the working histories by exploitation of the existing variables. This module extracts the retrospective information from the LII dataset and applies a dynamic microsimulation in a reversed direction to simulate population histories. With some calibrations and alignments at both the cross-sectional and longitudinal levels, a simulated historical dataset that matched over 95% of the individual pension entitlements was recreated together with a labour market history that matched the macro statistics to a fairly high degree (Li and O'Donoghue, 2010). During this exercise, a partial working history was used to recalculate the pension eligibility for the simulation of early retirement.

Overview of Retirements in LII

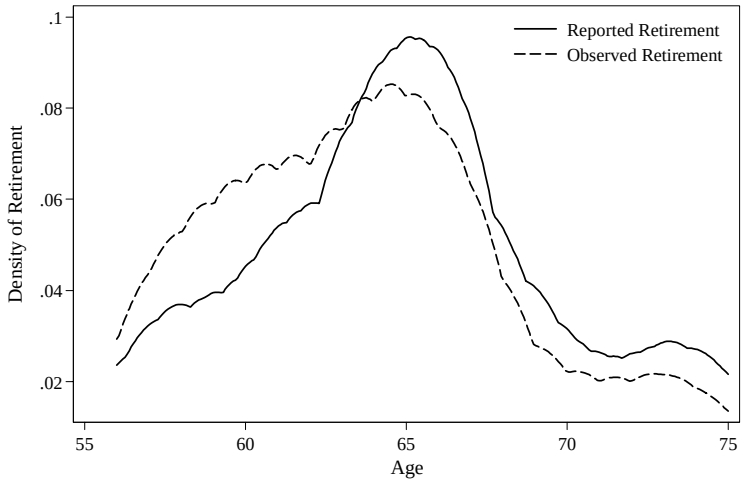
This paper looks at retirement from the perspective of individual choices. Retirement is defined in this paper as exiting the labour market after the age of 55. This definition is different from the official retirement status, but it is more closely linked to an individual's engagement in the labour market. Individuals between 55 and 75 years old who made the transition to retirement during the 8 waves of the panel were selected for the analysis. Since being a pensioner does not automatically mean quitting the Irish labour market, the reported retirement status cannot be used directly. In practice the following groups were included: individuals who had stopped working and were claiming pensions, individuals who had stopped working and who had not returned to the labour market for at least 3 of the waves (thus excluding temporary unreported unemployment), and individuals who had stopped claiming unemployment benefits without returning to work. Figure 1 compares the difference between reported retirement and observed retirement. As seen, the observed retirement results in a more flattened curve than the reported retirement due to the inclusion of unreported early retirement. The observed retirement pattern has a lower density around the age of 65/66, while the general trend looks similar to the pattern observed for reported retirement.

Among nearly 24,000 individuals included in the LII dataset, there were around 4000 individuals in the age group 55-75, and in total, 257 transitions to retirement were observed. Table 3 describes the details of the observation filtering in this analysis.

Table 3 Observation Filtering in LII

Condition	*Case*
Total Number of Observations	100,639
Total Number of Individuals	23,955
Exclude Zero Weight	22286
Age 55-75 in the dataset	3970
Number of Retirement Observed within the Panel	257
Transition from work	218
Transition from unemployment	39

Figure 1 Comparison of reported retirement and observed retirement



N.B. The observed retirement is calculated using the criteria listed in this paper, while reported retirement uses the variable from the original dataset

Figure 2 gives an intuitive presentation of how the observed retirements are distributed within the LII dataset. Since this is a panel dataset with attritions over time, a gradual drop of the qualifying individuals over waves was expected. In addition, those reporting retirements in the first wave were excluded as the transition for these individuals could not be observed. In general, what was observed was as expected except for the last two waves and the particular pattern observed is due to two reasons. First, in order to distinguish unreported unemployment from retirement, an individual was required to remain outside of the labour market for at least three waves. Since the panel ends in 2001, it is impossible to test unemployment in 2000 and 2001using the same method, and therefore results in a reduction of observed retirement. Second, to account for the data attrition, the LII dataset introduces some new individuals in wave of year 2000. The additional individuals enlarge the base of our analysis and increases the number of retirement transitions observed in 2001.

Income Level of Elderly Workers in Ireland

Among those aged 55 to 75, the median income level of the elderly working population was €9,272 in 1994 and €12,680 in 2001. The average income of the elderly followed a similar pattern over this period except for a small dip in 1996. On average, public sector workers received an annual income of around €30,656, while private sector workers earned on average €10,200. Those classed as self-employed on average had an annual labour income of €28,429 per year.

Figure 2 Retirement Transitions Reported in the LII Survey

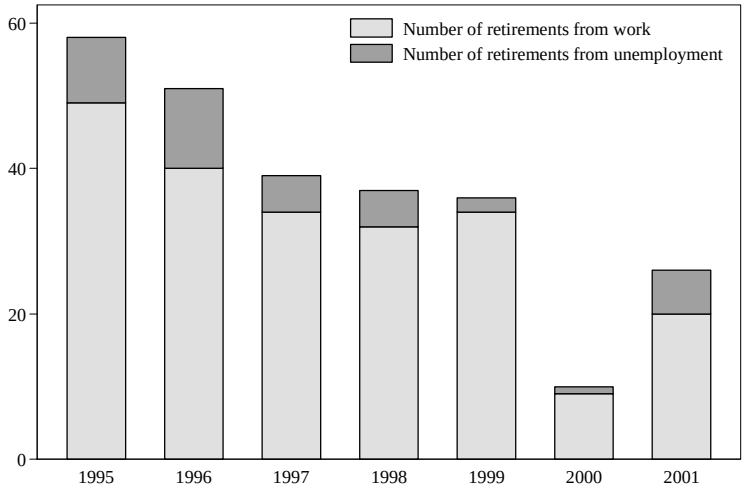
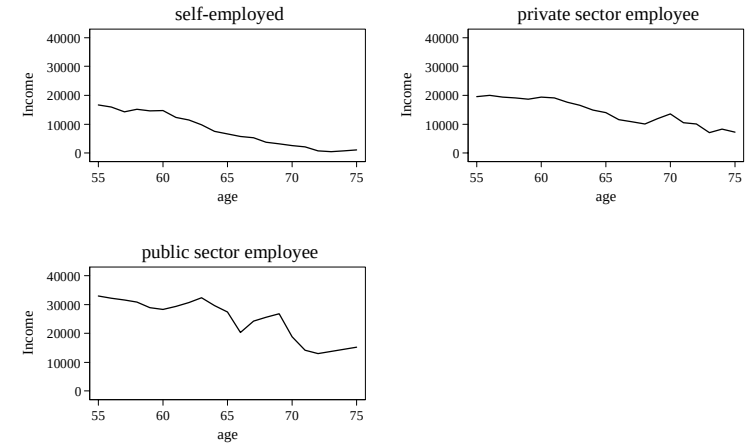


Table 4 Average Earnings between the ages of 55 and 75 in Ireland for 1994-2001

Group	*Earnings*	*Usual hours of work*
Public sector employee	19,617.0	35.3
Private Sector employee	14,101.2	45.4
Self-employed	15,780.7	40.0
Average	15,187.3	42.1

Figure 3 illustrates the age-earning patterns of elderly workers in Ireland. As a general trend, the average income declines gradually as age increases. This result is typically what is found when ignoring cohort effects in estimating age-earnings profiles (Thornton, 1997; Polachek and Sidbert, 1993). However, since the older people in the dataset represent a different cohort to the younger people, a large amount of the wage differences can be explained by the cohorts' effect and their gap in education.

Figure 3 Age-Earning Profile for Elderly workers in Ireland



Income is smoothed using three years average

Figure 4 illustrates the composition of the individual income for working and retired individuals in the age group 55-75. As can be seen, the labour and capital income dramatically declines after retirement, while the size of pension income increases correspondingly. Welfare benefits, including child benefit and various other benefits, play a larger role after retirement, although the absolute size of the benefits received alters little on average.

VI. RESULTS I – SYNTHETIC REPLACEMENT RATE OF IRISH TAX-BENEFIT SYSTEM

Tax benefit systems are typically complex and highly dependent on the household composition and employment histories. Consequently, the incentive structure of the retirement income support system might not be precisely measured due to the complex interactions of various social policies. Therefore, in order to better understand the Irish system, the analysis was commenced using a set of simple synthetic households with relatively simple employment trajectories. Through a synthetic simulation, it is possible to isolate the complex interactions of employment history, family composition, dynamics of earnings etc., and therefore observe the "pure" effect of the tax benefit system. The synthetic household starts with the following simple household structure:

- The household consists of only a single male member who has an average income level for the 55-75 age band
- The synthetic individual is assumed to have worked in the same sector and contributed to the occupational pension for 10 years
- The worker has worked long enough and meets the eligibility criteria to receive the state contributory old age pension after the age of 66.

Figure 4 Income Decomposition of Working and Retired Individuals in Reported in the LII Survey

In the analysis, 20 possible ages (56-75) for exiting the labour market were simulated, combined with four possible retirement paths; namely exiting from the public sector, private sector, self-employment or unemployment. For this synthetic calculation, only the individual replacement rate was calculated, as the inclusion of extra household members may eradicate the pattern due to the assumptions of employment trajectories of other members which would increase the complexity of the interpretations.

For the calculation of the replacement rate with synthetic individuals, this paper uses the last year's disposable income, instead of the simulated counterfactual one as the denominator. There are for two reasons for this:

First, one of the main goals of replacement rate analysis is to evaluate how well the welfare standard is maintained after retirement. By using the counterfactual income as the denominator, the rate excludes the impact of changing the labour earning level as people age. This may not be a major issue for synthetic analysis if a constant income stream is assumed. The earning level in real life however, may not be stable. As a result, the replacement rate based on the counterfactual income under-represents the change of earnings, and consequently the consumption level and welfare being also.

Second, in order to compare the replacement rate between a synthetic and a real life dataset, it is important to have a consistent definition of the replacement rate. Since counterfactual earnings do not exist within the real dataset, a variable which can be derived from both the synthetic and real-life datasets needs to be identified. The variable earning prior to retirement serves this purpose well, since it is available in both datasets and also correlates to the counterfactual earnings.

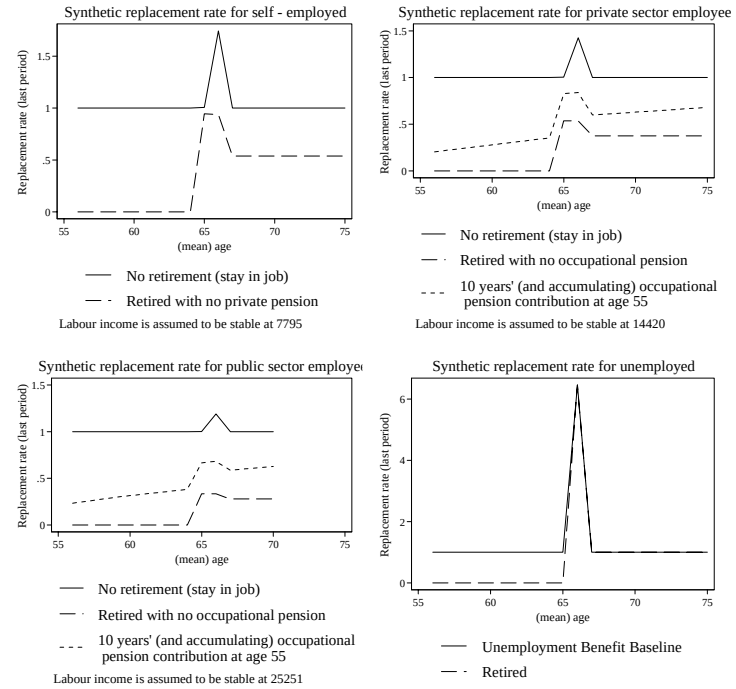
Figure 5 illustrates the distribution of the replacement rate if an individual qualifies for the old age contributory pension. Although the actual contribution periods needed to qualify for the contributory state pension may vary depending on an individual's occupation (PRSI classification) and the year of retirement, it was assumed that this synthetic individual has contributed to the system for at least 10 years before the age of 65 and therefore is eligible for the contributory pension under existing Irish regulations.

The graph reveals the replacement rate if individuals decide to retire at a given age. An obvious surge of replacement rate is observed for all scenarios at age 65/66, the official retirement age for receiving

the state pension. This pattern is also reflected in the income decomposition graphs presented in Appendix B. Since the pension entitlement is independent of the working status after the age of 66, earnings in all scenarios are increased, despite retirement from the labour market. The higher level of income prior to retirement increases the size of the denominator in the replacement rate calculation and as a result, the replacement rate starts to fall after age 66.

For the self-employed, the replacement rate dramatically increases at age 65 for retirees and reaches around 100% when assuming that an individual had a previous income of €7795. For private sector workers, the replacement rate is lower due to the higher average income level. An average single private sector retiree may have the highest replacement rate (53%) at age 66 if no additional occupational pension is received. Public sector workers have a similar pattern although the replacement rate is lowered to 33% due to their high income level. For the unemployed, the spike is most obvious as the contributory old age pension is much higher than the unemployment benefit and can increase to 640% of the unemployment benefit level. Since an individual cannot claim transitory pension if unemployed, the spike of replacement rate starts at age 66 instead of 65.

Figure 5 Synthetic Replacement Rate with stable income and old age contributory pension



Assuming the individual is eligible for the state old age contributory pension. All reported rates are net replacement rates.

In the above analysis, it was assumed that income is stable between the ages of 55 and 75, and although this might be the case for some employees, it is not necessarily true for all. By combining the average wage level in the age group into the replacement rate analysis, a more realistic distribution of replacement rate can be obtained. Figure 6 illustrates how this earning profile affects the synthetic replacement rate. As shown, although some extra volatility has been introduced into the replacement rate, the general trend remains the same. The replacement rate for public sector workers after age 70 is not reported as they are required to retire at age 65 except a limited number of exceptions.

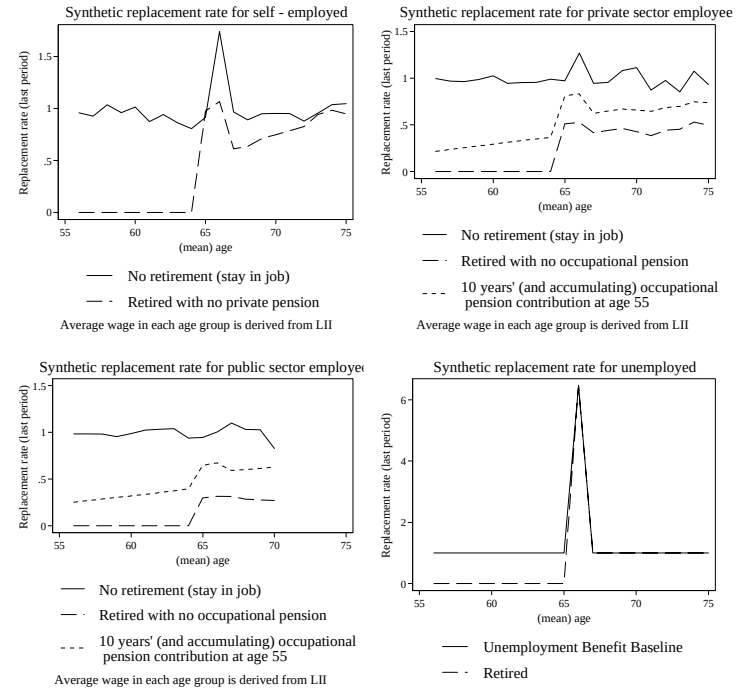
Despite the change in income level, the surge of replacement rate at age 65/66 can be easily spotted, which indicates that the pension entitlement can potentially provide a strong incentive for retiring at at this age[2]. However, for private and public sector employees, there is an earnings rebound immediately after retirement age 65/66. It is likely that these retirement decisions could be endogenous, which means that people with a lower income retire as soon as the legal retirement age is reached, while higher income earners postpone their retirement, thus increasing the average wage for the post-retirement age.

The synthetic analysis provides valuable information regarding the existing financial patterns in the tax-benefit system and illustrates the impacts when retiring at different ages. Since retirement income is often highly correlated to the previous employment trajectory, which varies greatly across the population, the synthetic analysis is likely to miss many of the important features of the tax-benefit system, which although not applicable to the synthetic household, may affect a large part of the population.

In the synthetic analysis, a single household individual was used in order to prevent the influence of the choices of other household members. However, over 90% of people aged over 55 live in a household with at least two members. Although extra individuals can be included within the synthetic household, it would remain a "non-typical" or "non-representative" household, no matter what assumptions used. The additional household member may have a very different employment trajectory or benefit entitlement which could dramatically change the replacement rate. In order to mitigate this problem, Immervoll *et al*. (2000) computed a wide range of stylised households with different income levels to investigate the dynamics of tax-benefit systems. However, in the case of replacement rates, it is not only the design of the tax-benefit system per se that is of interest but also how it applies to existing populations. As a result, further analysis was conducted using a representative household survey dataset (LII).

[2] The effective retirement age in Ireland has been declining since the 1970s. However, mostly thanks to a rise in older female employment participation rates in the late 1980s, as well as a high level of self-employment, retirement ages among the elderly are still high by EU standards: in 2000 it was 63.4 for males and 60.1 for females, compared to the EU effective average retirement age of 58.

Figure 6 Synthetic Replacement Rate with Changing Income and Old Age Contributory Pension



Assuming the individual is eligible for the state old age contributory pension. All reported rates are net replacement rates.

VII. RESULTS II – THE DISTRIBUTION OF REPLACEMENT RATES

Distribution of Net Replacement Rates for Retired

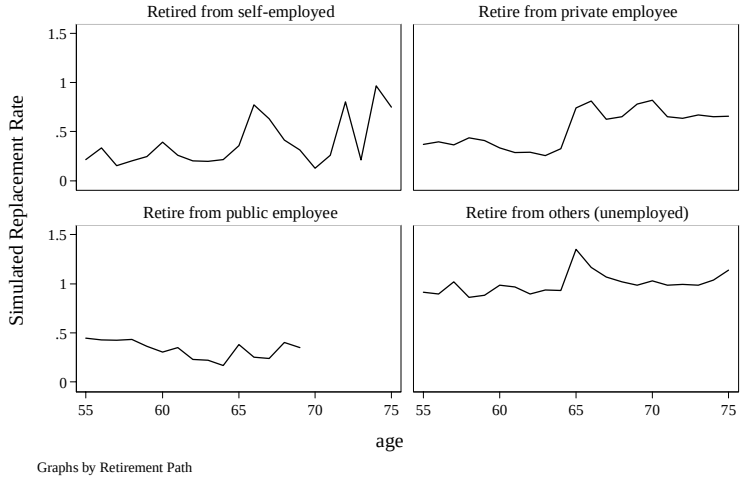
While the synthetic replacement rate provides in-depth analysis on the potential replacement rate for one particular scenario, notably a single person with an average income, this pattern may look very different if all the possible scenarios are pooled together from a real life dataset. Figure 7 presents the average net replacement rate for each of the four types of transition while an overview of the replacement rate by age and sector is reported in Appendix C and D. It seems that the actual replacement rate, to some extent, resembles part of the replacement rate pattern for an individual with 10 years of occupational pension with the exception of retiring from unemployment.

Figure 7 Average Individual Replacement Rate (net) by Working Sector

Distributions of Simulated Replacement Rate

By only looking at people whose status changes during the year and excluding those for whom it does not, a potential sample selection problem arises. If replacement rates have an influence on people's behaviour and people whose status remains unchanged face different replacement rates than those who experience transitions into or out of employment, then excluding one of these groups will result in a systematic bias. In order to determine whether replacement rates have an impact on retirement decisions it is necessary to measure them for both groups. Figure 8 reports the potential replacement rates for all individuals who are not retired. An obvious peak of replacement is observed in all four retirement paths around the age of 65/66, corresponding to the popular choice for retirement in Ireland.

Figure 8 Average individual replacement rate (net) by working sector (Simulated)



The Socio-Economic Characteristics of Retired Individuals with Different Replacement Rates

As the data suggests, individual and household replacement rates have a very wide range in Ireland. This implied that they might also have very different career trajectories and patterns in social economic behaviours. A wide variety of summary statistics were used to determine how socio-economic characteristics are related to the replacement rate level. Table 5 briefly describes the 15 measures which were found to be relevant in describing the socio-economic characteristics of individuals with different replacement rates.

When looking at three groups of individuals with differing replacement rates (lower than 40%, 40-80%, and more than 80%), these groups exhibited very different patterns in behaviour. When comparing the low net replacement rate group with the other groups, then this group, on average, had an individual replacement rate of merely 11.1%. However, the household replacement rate was dramatically higher for this group and amounted to 91.1%. In addition, this group has the youngest retirement age amongst the three groups, which may indicate that this particular group retires early due to the stable income stream of other household members. This also explains why individuals with zero replacement rates still retire before being able to claim the state old age pension.

The mid net replacement rate group seemed to be dominated by people retiring from work. Over 94% of these people were either employees or self-employed before they started to claim their pension. In addition, this group has the highest education attainment amongst the three groups.

The high net replacement rate group on average has a replacement rate of over 123%, which suggests that their post-retirement earnings are higher than their pre-retirement income. This group exhibited some distinct patterns, it had the lowest educational attainment compared with the other groups and also much lower pre-retirement earnings compared with any other group. These two observations tally, as workers with a lower education attainment tend to have lower wages, which decreases the size of denominator. Additionally 20% of the individuals in this group retired from unemployment compared with less than 6% in the mid replacement rate group. Finally, welfare benefits played a larger role percentage wise in the post-retirement income of this group compared with other groups.

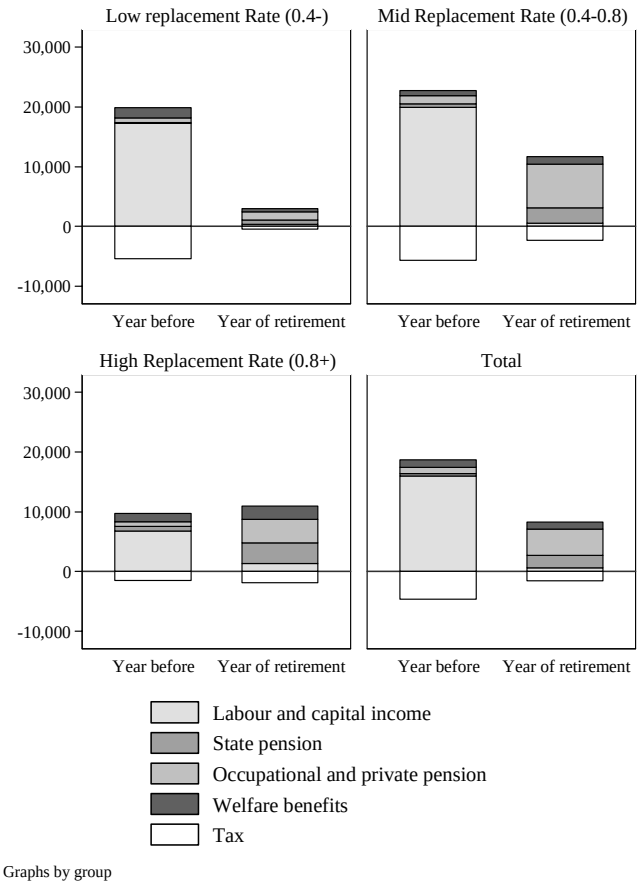
Table 5 Socio-Economic Characteristics of High/Mid/Low replacement rate group

Group	*Low Replacement Rate (-0.4)*	*Mid Replacement Rate (0.4-0.8)*	*High Replacement Rate (0.8+)*	*Total*
Percentage with higher education	14.89%	25.71%	8.62%	17.90%
Individual net replacement rate	11.10%	55.90%	123.20%	54.70%
Household net replacement rate	91.10%	75.80%	108.20%	88.70%
Male	54.26%	74.29%	89.66%	70.43%
Have a spouse	79.79%	87.62%	79.31%	82.88%
Chronic Illness	2.13%	3.81%	17.24%	6.23%
Still have a mortgage to pay	14.63%	14.56%	11.11%	13.81%
Household size	3.1	3.0	3.1	3.1
Retire from work (%)	77.66%	94.29%	79.31%	84.82%
Usual working hours per week before retirement (if working)	34.21	35.26	30.20	33.84
Was in public sector (if working)	20.55%	37.37%	8.70%	25.69%

Average retirement age	62.8	64.1	64.8	63.8
Individual Disposable Income after retirement	2501	9310.2	9054.4	6761.9
Household Disposable Income after retirement	19788.8	20494.0	19396.7	19988.4
Individual disposable income before retirement	14410.9	17062.9	8191.6	14090.8
Proportion of people in this group	36.58%	40.86%	22.57%	100.00%

Figure 9 further analyses the income decompositions amongst high and low replacement rate groups. By comparison, the high replacement rate group derived a larger share of their post retirement income from state pension and other welfare benefits, than the other two groups. Occupational and private pensions were the main source of income for the group with the mid replacement rate, which for the years 1994-2001, accounted for 79.0% of their post retirement income, compared with 42.9% for the high replacement rate group and 54% for the low replacement rate group.

Figure 9 Income Decomposition by Replacement Rate Group



Time dependency of the replacement rate and earning decomposition

In addition to the level of replacement rate measured immediately after retirement, it is also interesting to look at how the level of income and replacement rate fluctuates following a few years of retirement. If the net disposable income prior retirement is kept as the common denominator for replacements rate in all years, then the replacement rate changes over time. The addition of a time dimension would therefore allow both the short and long term monetary incentives of retirement to be understood.

Figure 10 presents a graph which adds the time dimension into the replacement rate analysis. The figure shows that for people retiring before the age of 60, the replacement rate remained relatively stable for the 6 years after retirement. This suggests that there is not much change in the total income level as all the rates were calculated using earnings before retirement as the common denominator. For the population who retired after the age of 60, the replacement rate exhibited a slow upwards trend. This increase is mostly driven by the state pension for people who retire before the age of 65, as they have had to wait for a few years before they can claim this pension. Among the population who retired later, capital income accounts for most of the increase observed. The increase in capital income might come from the maturation of previous investments and certain private pension arrangements.

If the observations are grouped by their level of replacement rate instead of retirement age, as in Figure 11, then it seems that the total income level, as well as the replacement rates, is more or less stable except for the low replacement rate group, who appears to have more fluctuated income due to their lower income level, and the later years of the high replacement rate group (see also Appendix E). This indicates that retirees in the low replacement rate group typically do not have as stable an income source as the retirees in the other groups. This pattern may also explain why these people belong to the low replacement rate group to start with. Among the mid and high replacement rate groups, capital income, on average slowly increased after retirement, a finding which is consistent with the results from the previous analysis.

Figure 10 Individual Replacement Rate over time (By Retirement Age)

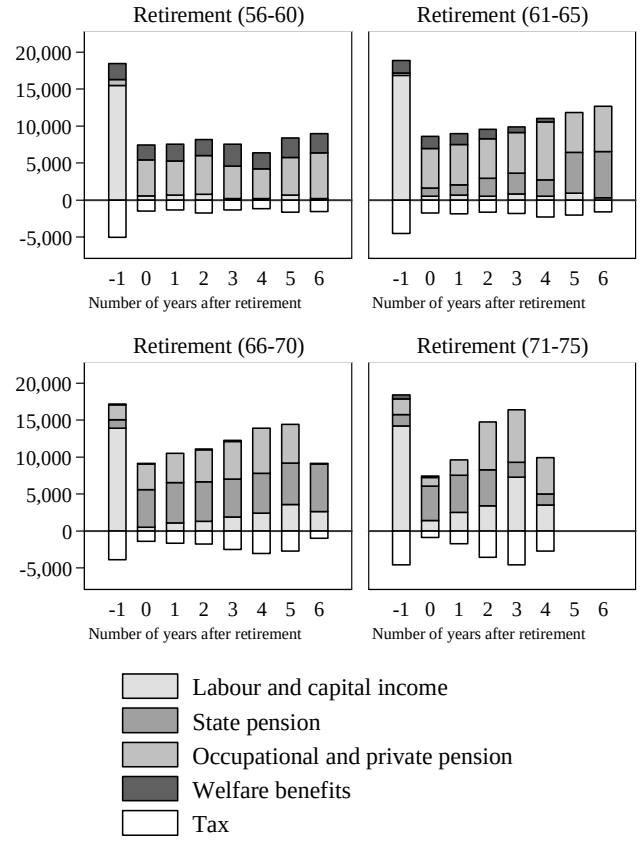
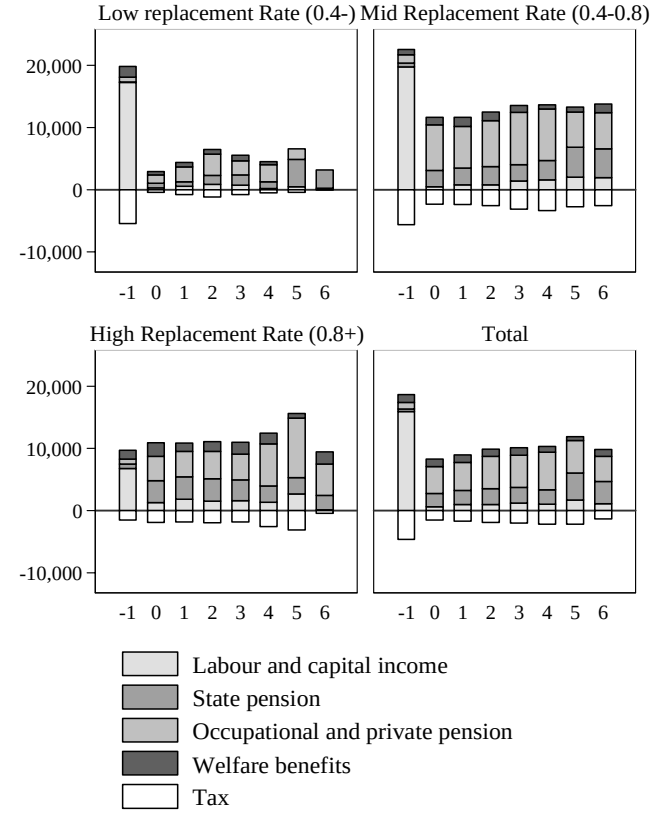


Figure 11 Individual Replacement Rate Over time (By Replacement Rate)



VIII. THE RETIREMENT PATTERN AND REPLACEMENT RATES

Observed Retirement Pattern and the Observed Replacement Rates

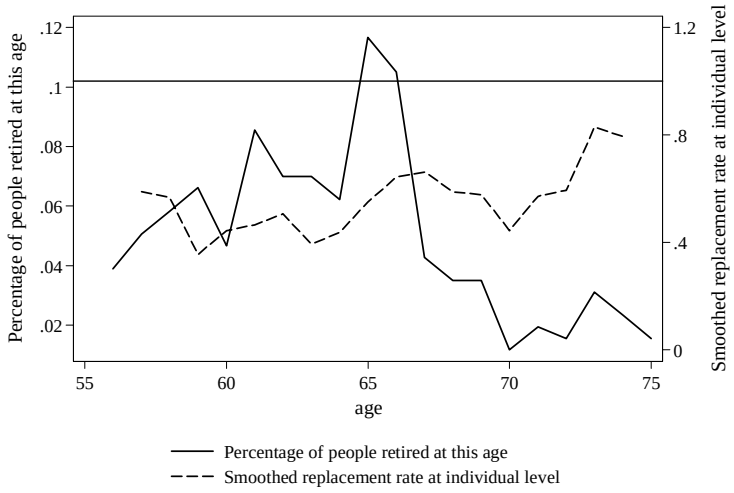
This section compares the replacement rate patterns and the retirement patterns, to examine whether monetary incentives play a role in the retirement decision. The Irish regulations, as reviewed earlier, suggest that the system provides a strong incentive to retire at age 65/66. At the same time, the estimations from the synthetic and LII datasets confirm the rise of replacement rate at around age 65 and 66, two crucial ages in the Irish tax system in terms of pension eligibility. It would therefore be interesting to investigate whether the retirement pattern matches the replacement rate pattern.

Figure 12 overlaps the age-retirement pattern with the individual replacement rate profile. The age-replacement rate curve measures the fluctuations of earnings level as well as the monetary incentive of retirement introduced by the social welfare system. As can be seen, although the two patterns do not resemble each other completely and the scales are different, nevertheless the retirement pattern does respond to change in the replacement rates.

Figure 13 uses the household based replacement rates instead of the individual replacement rates. Since a household usually consists of several people who may not all retire at the same time, this replacement rate is less volatile when compared with the individual based replacement rate. Because

the curve is smoother, the matching is less obvious graphically, although the replacement rates still correspond to the change in the number of retirees.

Figure 12 Observed Retirement and Individual Replacement Rate



Previous figures suggest that the relationship between the net replacement rates and retirement crudely correspond in terms of the peak period at the age of 65/66. However, the benefits and entitlements of the Irish tax benefit system are usually highly related to the job sector and previous contributions. As a result, the retirement and replacement rate patterns were investigated further by grouping individuals according to their employment status prior to retirement, as shown in Figure 14 and Figure 15.

It seems that the replacement rate matches well with the retirement pattern for people who retired from work as indicated in Figure 14. Figure 15 looks at the nature of the retiree's last job, shows that the correlation between replacement rate and the number of retired seems to be strongest for those who retire from the private sector. The vast majority of public sector workers retire at age 65 despite a relatively flat replacement rate curve, although this is mainly due to the mandatory retirement age present in the public sector.

Figure 13 Observed Retirement and Household Replacement Rate

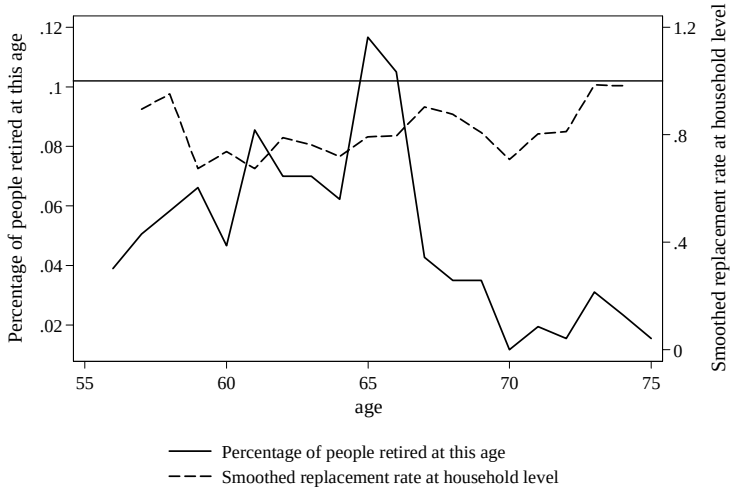


Figure 14 Retirement and Individual Replacement Rate by Retirement Path 1

Figure 15 Retirement and Individual Replacement Rate by Retirement Path 2

Social-Economic Characteristics of the Early and Late Retirement Groups

As presented in the previous tables and graphs, the age of 65/66 is the most popular choice for retirement in Ireland. Nonetheless, there are still many individuals who retire much earlier or later than at the average age. Table 6 highlights some of the main social economic characteristics found for the four different retirement age groups.

Table 6 Socio-Economic Characteristics of the early and late retirement group

Group	*Retirement (56-60)*	*Retirement (61-65)*	*Retirement (66-70)*	*Retirement (71+)*	*Total*
Percentage with higher education	16.42%	18.27%	22.03%	11.11%	17.90%
Individual net replacement rate	43.84%	50.95%	69.60%	63.26%	54.67%
Household net replacement rate	105.11%	79.66%	84.15%	92.49%	88.67%
Male	58.21%	75.00%	69.49%	85.19%	70.43%
Have a spouse	80.60%	84.62%	79.66%	88.89%	82.88%
Chronic Illness	5.97%	6.73%	5.08%	7.41%	6.23%
Still have a mortgage to pay	22.81%	17.35%	5.17%	0.00%	13.81%
Household size	3.42	3.06	2.88	2.52	3.05
Retirement from work (%)	73.13%	80.77%	98.31%	100.00%	84.82%
Usual working hours per week before retirement (if working)	31.18	36.98	33.25	30.15	33.84
Was in public sector (if working)	30.61%	39.29%	13.79%	0.00%	25.69%
Average retirement age	58.12	63.13	67.15	73.00	63.79

Individual Disposable Income after retirement	5902.98	6807.06	7624.12	6835.57	6761.93
Household Disposable Income after retirement	24342.53	19291.70	17333.24	17669.57	19988.43
Individual disposable income before retirement	13376.59	14507.87	13666.70	15183.44	14090.81
Proportion of people in this group	26.07%	40.47%	22.96%	10.51%	100.00%

There are several noteworthy trends from Table 6. First, it seems that the age of retirement is negatively correlated with the individual replacement rate but not the household replacement rate. In fact, the group that retires earliest also has the highest household replacement rate, indicating that some early retirements may be induced by the monetary incentives provided by other household members. In addition, a higher replacement rate also implies a relatively lower cost of retirement.

Second, the average household size is declining as retirement age increases, for which there may be two reasons. The higher mortality rate at the later age may result in a smaller household size or, alternatively, a smaller household might be the reason behind later retirement as there are less people to pool resources.

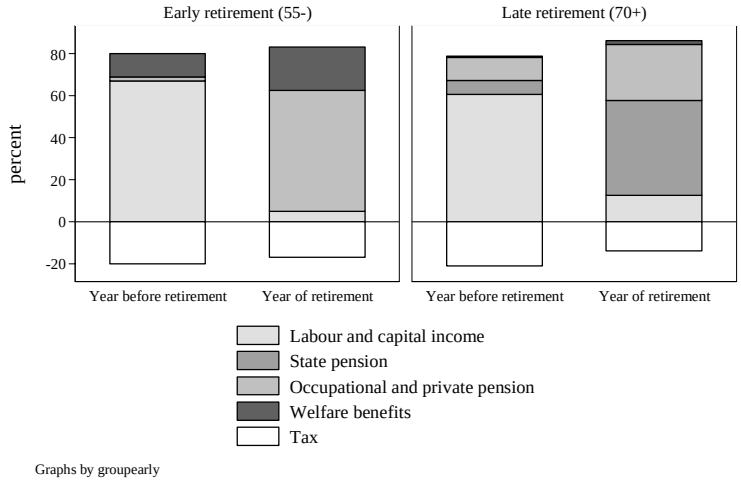
Third, people who retired before the age of 65 were found to have a higher chronic illness rate when compared to the group who retired at age 66-70. This might indicate that the chronic illness may drive people to retire earlier; however, the chronic illness rate is highest for people who retire after the age of 71. This pattern may suggest that the incentive structure in the current legislation may push more physically healthy people out of the labour market at age 66-70 than for the other age brackets.

Fourth, retiring from unemployment tends to occur at an earlier stage. As shown in Table 6, the percentage of people who retired from work increased steadily as the retirement age rose. In the LII dataset, more than 98% of people who retired after the age of 66 made the transition from work, compared with only 73% if they retired before the age of 60. This suggests that the early retirees might have had to retire early because they could not find another job. It is also worth noting that the percentage of elderly retiring from unemployment might be under-reported for late retirees. Since the unemployment benefit is same as the state pension benefits, there is no additional benefit by applying for unemployment benefit for elderly people if they are eligible for both benefits. This might lead to some underreporting of the retirement transition from unemployment.

To further analyse the differences between early and late retirees, the income sources in the year prior to retirement and in the year of retirement were decomposed (Figure 16). This showed that early retirees relied much more heavily on welfare benefits compared to those retired later.

Figure 16 shows that not only does the level of income differ between early and late retirees as illustrated in Table 6, but that their income sources are also largely different. Between 1994 and 2001 when the LII survey was conducted, occupational and private pensions were the largest source of income for those retired at age 55 or earlier. This accounted for 82.4 per cent of their disposable income on average, compared with 17.6 per cent for retirees who retired after age 70. In addition, it seems that early retirees rely more heavily on welfare benefits (33.9%), which is much higher than the late retirees (2.9%). In general, early retirees rely mostly on welfare benefits and occupational pension, while later retirees have more diverse income sources.

Figure 16 Income Decomposition for Early and Late Retirees (Percentage)



IX. CONCLUSION

This paper analyses the retirement pattern and the replacement rate observed in Ireland using the LII panel dataset. Due to the fact that the Irish regulations allow working while receiving the state pension, this paper used the observed retirement instead of the reported retirement status to address the potential differences between pension eligibility and retiring from the labour market.

The paper found that the average replacement rate for newly retired workers using the LII dataset was approximately 54.7% but this figure has a high standard deviation value and this suggests that there is a large inequality of replacement rates among retirees. Workers from different sectors had very different earning profiles and replacement rates according to the synthetic calculation performed. A typical self-employed worker would be able to maintain an income that is more than 50% of his/her pre-retirement earnings, while workers from other sectors had a dramatically lower replacement rate, mostly due to their higher pre-retirement earnings.

The observed replacement rates and earning profiles present in the dataset had a high degree of fluctuation due to the complexities in the household structure and employment trajectories. In addition, the relatively low number of observations resulted in graphs less smooth than expected. Individuals with high and low replacement rates were found to have very different social economic characteristics. The high replacement rate group tended to be less educated, had a lower income and a higher dependency on social benefits. Individuals in the low replacement rate group, however, had a high household replacement rate of 91% on average. The state pension was a major source of income for all categories except for those retiring earlier than 65, who relied heavily on occupational and private pensions.

In addition, the paper found that the number of people going through retirement roughly corresponded to the individual worker replacement rate, especially for those who retired from the private sector or who were self-employed. The replacement rate is not stable as people remain retired for longer and, on average, there was a slight increase due to welfare benefits and capital income. It seems that the growth rate of the replacement rate is positively correlated to the age of retirement.

Although replacement rate is one of the most intuitive measurements that can be obtained from the dataset, it is still simplistic and potentially inaccurate for measuring welfare being as it does not account for employment status related expenditures and savings, e.g. transportation costs, medical costs. However, it does give an overview of the general trend and an analysis of the incentive structure among retirees in Ireland. This paper could potentially benefit from further research using a larger dataset where greater heterogeneities can be further explored.

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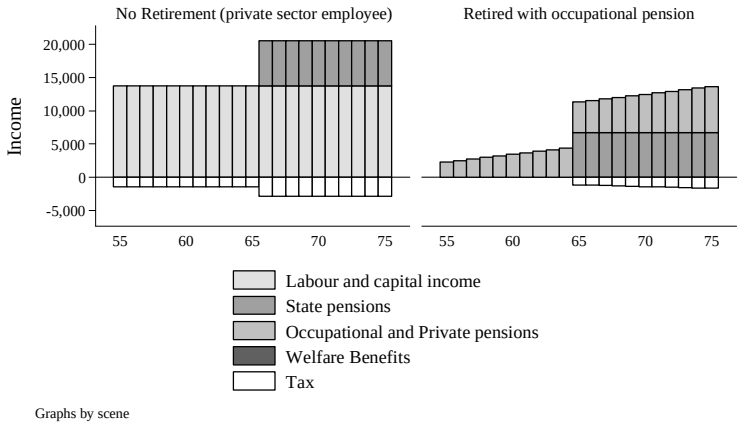
APPENDICES

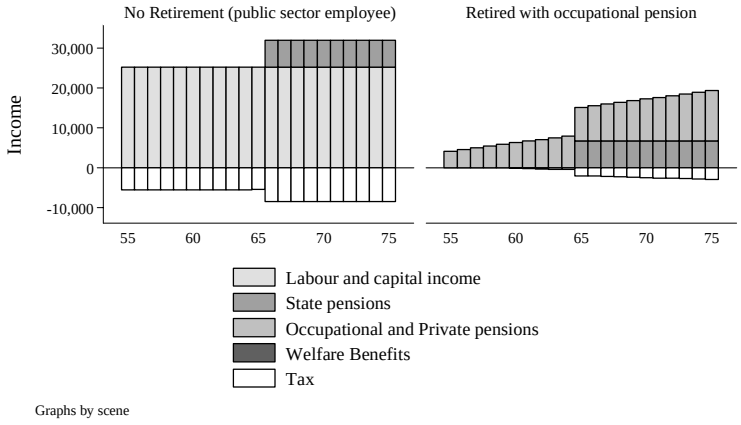
Appendix A Private and Occupational Pension Coverage (Percentage) in 2002

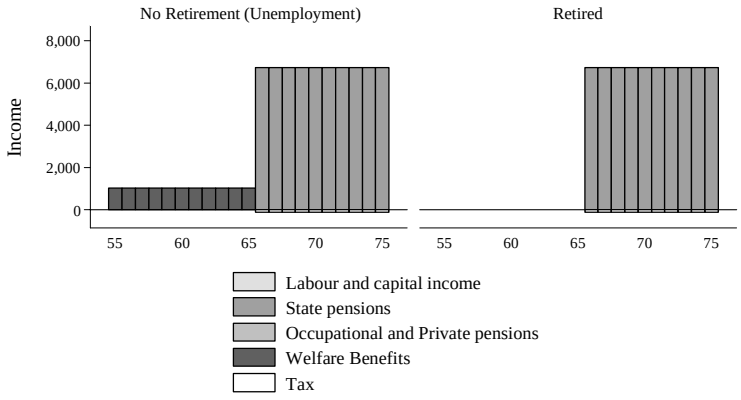
Age Group	*20*	*25*	*35*	*45*	*55*	*65 +*	*Total 20-65*
Males							
Self-Employed with Employment Pension	0.6	6.9	15.2	18.9	19.8	19.7	12.3
Employees with an Employer's Pension Only	21.7	36.2	40.2	38.6	29.7	7.4	35.1
Employees with a Personal Pension Only	1.3	5.5	6.6	4.8	5.0	2.2	5.0
Employees with both Employer's and Personal Pension	0.7	2.8	4.3	5.1	3.2	1.1	3.4
Employees with no Pension	71.7	37.9	19.6	16.5	18.6	16.8	30.8
Self-Employed with no Pension	3.8	10.7	14.0	16.0	23.7	52.8	13.3
Females							
Self-Employed with Employment Pension	0.0	1.5	3.3	4.3	4.3	6.3	2.4
Employees with an Employer's Pension Only	22.5	40.1	42.8	35.6	27.4	11.5	36.2
Employees with a Personal Pension Only	0.8	3.6	3.9	4.9	4.9	6.0	3.6
Employees with both Employer's and Personal Pension	1.0	2.3	2.4	2.8	1.9	0.0	2.2
Employees with no Pension	74.7	48.2	41.7	45.0	48.2	50.8	50.2
Self-Employed with no Pension	1.0	4.3	5.9	7.4	13.3	25.3	5.4

(Source: QNHS 2002-Q1)

Appendix B Income Decomposition for Synthetic Analysis







Graphs by scene

Appendix C Replacement Rate by Age

Age	*Individual Replacement Rate*	*Household Replacement Rate*
56	67.8%	100.5%
57	54.0%	90.3%
58	21.8%	122.2%
59	39.4%	120.3%
60	46.6%	82.1%
61	53.9%	80.8%
62	63.6%	76.7%
63	39.7%	86.3%
64	31.7%	99.4%
65	58.3%	66.0%
66	77.6%	88.1%
67	63.3%	73.1%
68	62.0%	83.5%
69	58.8%	72.9%
70	75.6%	125.2%
71	34.2%	81.2%
72	70.9%	102.4%
73	72.4%	83.5%
74	75.1%	92.3%
75	55.9%	114.9%

Appendix D Individual and Household Replacement Rate by Sector and Age Group

Age Group	*Retirement Path*			
Individual Replacement Rate	Self-employed	Employee (Private)	Public	Unemployment
Retirement Age group (56-60)	1.59%	47.53%	49.84%	42.06%
Retirement Age group (61-65)	41.06%	56.86%	46.63%	46.97%
Retirement Age group (66-70)	71.01%	73.61%	55.21%	0.00%
Retirement Age group (71-75)	17.20%	66.95%		
Household Replacement Rate				
Retirement Age group (56-60)	53.61%	111.30%	66.80%	138.17%
Retirement Age group (61-65)	87.16%	90.27%	58.46%	88.33%
Retirement Age group (66-70)	67.84%	91.70%	59.52%	46.48%
Retirement Age group (71-75)	74.55%	93.93%		

Appendix E Replacement Rate by Years of Retirement

Years in Retirement	*Individual Replacement Rate*	*Household Replacement Rate*
-1 (Year before Retirement)	100.0%	100.0%
0 (Retirement Year)	57.9%	89.1%
1	72.3%	98.7%
2	92.1%	109.1%
3	92.2%	104.3%
4	87.3%	125.6%
5	105.8%	130.8%
6	60.8%	157.7%