Designing a Feasible National Auto-Enrolment Pension Scheme: The case of Ireland

Liam A. Gallagher*
DCU Business School, Dublin City University, Dublin 9, Ireland.
Telephone: +353 1 7005399, E-mail: liam.gallagher@dcu.ie

Fionnuala Ryan
Central Bank of Ireland, PO Box 11517, Dublin 1, Ireland.
Telephone: +353 1 2246856, E-mail: fionnuala.ryan@centralbank.ie

* Presenter and corresponding author.

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Abstract

This paper investigates the feasibility of a national auto-enrolment pension scheme in Ireland, including the requirements for reform and the rationale behind the OECD and National Pensions Framework proposals on auto-enrolment, and the impact of the recent financial crisis on pension provision. The design of an auto-enrolment scheme for Ireland is motivated by international experiences of auto-enrolment. The empirical analysis uses a bootstrap approach to model historical returns for a number of hypothetical portfolios over a 40 year period. The purpose of this is to determine what strategies will best meet the target income replacement ratio for a typical member of a national auto-enrolment scheme, having regard to the probable low risk appetite of the member. The analysis provides valuable insights for the design and feasibility of a national auto-enrolment scheme for Ireland. The framework also provides a feasibility test for other developed and emerging countries in considering an auto-enrolment scheme.

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I. Introduction

A key part of the International Labour Organization (ILO) Convention 102 relates to the protection and provision of old-age benefit for all citizens beyond the working life or a person, normally aged 65. In a recent report from the OCED (2013), Ireland was found to be at the lower end of the pension spending scale and with over 90% of defined benefit schemes in deficits and scheme wind-ups a regular occurrence (see IAPF), a severe "pension gap" has emerged. The credit crisis has highlighted the vulnerability of the current pension and old-age benefit system in Ireland (D'Addio and Whitehouse, 2010).

It is difficult to determine the single best national system for pension provision due to variations in the objectives, e.g. poverty relief and risk-sharing, variations in constraints and differences in political processes (Barr, 2009). Over the years, many countries have undertaken considerable reforms of national pension structures, most notably Chile (Arenas de Mesa et al., 2008; Berstein et al., 2006), Sweden (Hedesstrom et al., 2004), Australia (Basu and Drew, 2010; Warren, 2009), New Zealand (O'Connell, 2009; MacDonald et al., 2012) and more recently, the UK (Clark and Knox-Hayes, 2009; Curry, 2008).

The last number of years have been extremely turbulent for Irish pension funds. A recent IAPF survey estimated that over 90% of defined benefit schemes are in deficit and scheme wind-ups are now an all-too frequent occurrence.

At the request of the Irish Government, the Organisation for Economic Co-Operation and Development (OECD) conducted a review of the Irish Pension System in 2012/2013. The OECD maintain that Ireland is at "the lower end of the pension spending scale." In order to rectify the "pensions gap" i.e. amongst older workers and amongst lower earners and

alleviate concerns over pensioner poverty, Ireland should look to voluntary private pension schemes. The OECD suggest mandating pensions on top of public plans as a means to do this. Compulsion would be the less costly and most effective approach, while auto-enrolment is the second best approach. According to the OECD, however, increased pension coverage is heavily dependent on how such an auto-enrolment scheme would be designed.

The UK have recently introduced a national auto-enrolment pension scheme, and given the emphasis that has been placed on mandatory or quasi-mandatory pension provisioning in both the National Pensions Framework Review and the OECD Review, it seems clear that this issue has been placed firmly on the agenda in Ireland. It is therefore timely to examine how such a system may be designed.

There are several academic works which have examined the concept of "default funds" and "optimal asset allocation" in the context of national mandatory or auto-enrolment pension schemes; however much of the literature on private pension provisioning in Ireland centres on behavioural elements. While the behavioural aspects are very relevant, it is intended that this research will further explore the investment considerations for an auto-enrolment scheme in an Irish context, an area that has been relatively unexplored to date. This is relevant given the emphasis that is been placed on the design of default funds by the OECD.

Prior to the financial crisis, Irish pension schemes tended to rely on traditional investment techniques where the objective was simply to maximise return within an acceptable level of risk. A 2007 Survey by the Irish Association of Pension Funds showed that the industry was heavily weighted towards traditional asset classes, in particular equities and property. The value of Irish equities decreased by 26% in 2007, causing significant losses for Irish pension

funds. Post crisis, the most significant investment change has been the switch from asset classes such as equities and properties into bonds and cash. The proportion of Defined Contribution funds invested in cash has increased from 5.5% in 2007 to 16.8% in 2011.[1]

This paper investigates the feasibility of a national auto-enrolment pension scheme in Ireland, including the requirements for reform and the rationale behind the OECD and National Pensions Framework proposals on auto-enrolment, and the impact of the recent financial crisis on pension provision. We examine investor behaviour and highlight the importance of the adequate design of a default pension fund given the complexities associated with human decision-making (see, for example, Benartzi and Thaler, 2007; Tapia and Yermo, 2007). An examination of the international experiences of auto-enrolment will motivate the design of an auto-enrolment scheme for Ireland. We also consider the various asset classes used in traditional pension fund portfolios and outline the various considerations for formulating investment strategies for pension funds (see, for example, Barr, 2009; Blake et al., 2001; Lucas, 2001; Lucas and Zeldes, 2006; Viceira, 2009). As with all pension schemes we provide an in-depth analysis on Life Style strategies and how they compare with alternative strategies, while drawing on previous empirical analysis and research conducted in this area (see, for example, Bodie et al., 2009; Booth and Yakoubov, 2000; Ellement and Lucas, 2007).

The main focus of the empirical analysis is to bootstrap a series of returns for a number of hypothetical portfolios over a 40 year period. The purpose of this is to determine what strategies will best meet the target income replacement ratio for a typical member of a national auto-enrolment scheme, having regard to the probable low risk appetite of the

[1] Irish Association of Pension Funds DC Survey 2011.

member. This analysis will provide valuable insights for the design and feasibility of a national auto-enrolment scheme for Ireland. The framework should also provide a feasibility test for other developed and emerging countries in considering an auto-enrolment scheme (see, Barr, 2009; Lucas, 2001).

Section II outlines the current pension system in Ireland, including the requirements for reform and the rationale behind the OECD and National Pensions Framework proposals on auto-enrolment. Section III examines investor behaviour and highlights the importance of the adequate design of a default pension fund given the complexities associated with human decision-making while Section IV examines the international experiences of auto-enrolment, with a particular focus on the UK and New Zealand. Section V outlines the various asset classes used in traditional pension fund portfolios and outlines the various considerations for formulating investment strategies for pension funds. Within this section, an in-depth analysis on Life Style strategies is given, including how they compare with alternative strategies. The data, methodology and empirical results are presented in Section VI. A final section concludes.

2. Pension Reform in Ireland

The Irish pension system is based on the on the Beveridgean system and is essentially a two-pillar system; Irish citizens pay Pay-Related Social Insurance which entitles them to receive the State Contributory Pension and other benefits at age 65 years and they can also avail of private pensions such as occupational pensions, a Personal Retirement Savings Account or a Personal Pension Plan in order to top up their benefits. This system is supplemented with means-tested benefits for those who have not contributed enough to qualify for the State

Contributory pension. Private pension coverage is generally voluntary, although in certain sectors such as the public service and semi-state sector, pension membership is compulsory.

To incentivise people to contribute to private pensions, tax relief applies to pension contributions subject to certain limits. The contribution rate for the State Contributory Pension is based on a percentage of earnings (circa 4%); however the benefits derived are the same regardless of the levels of contribution made.

In a recent comprehensive report in 2012 by TILDA (The Irish Longitudinal Study on Ageing), the Pensioner Support Ratio in Ireland is projected to decrease from 5.4 to 1 in 2010 to 2.3 to 1 in 2055. Although the Irish population will age later than European counterparts, the country faces a challenge of growing pension costs and it is anticipated that gross public pension expenditure will increase from 7.5% of GDP in 2010 to 11.4% of GDP in 2050. The government has estimated there is a projected pension shortfall of €13.4 billion by 2066.

In Ireland, private pension coverage has remained largely static since 2005 at circa 55% of those in employment. In addition, there are certain sectors of industry which have very poor private pension coverage e.g. hotels, catering and retail. The National Pensions Policy Initiative set a target supplementary pension coverage ratio of 70% of the workforce over the age of thirty and a target income replacement rate of 50% of gross pre-retirement income.

Mandatory Pensions and Auto-enrolment

The 2010 National Pensions Framework envisaged a framework for radical and wide-scale reform of the Irish pension system. Under this framework, the Government committed to developing an auto-enrolment system for employees, with mandatory employer contributions

and a matching State Contribution equal to 33% tax relief. The scheme is designed to encourage a more equitable pension provision than the current system of marginal tax relief. Furthermore, another advantage of the scheme is that it is "quasi-mandatory" meaning that the opt-out mechanism allows people to temporarily take a break from saving for retirement when they need to do so. However, the scheme currently offers little in the way of the investment strategy for this auto-enrolment scheme – it is this aspect which we address in the paper.

Irish employees would be automatically enrolled into this pension scheme unless they are a member of their employer's scheme and that scheme provides higher contribution levels or is a defined benefit scheme. It was envisaged that the total employee contribution would be 4% of earnings, and total contributions would therefore be 8%, within a band of earnings. These contributions will be collected vis-a-vis the PRSI system.

While the National Pensions Framework originally implied that the total contribution rate for a national auto enrolment scheme would be 8% of salary, the recent OECD report suggests that this level of contribution will not be sufficient to meet the needs of participants in retirement and have recommended a total contribution of 15% of salary.

III. Pension Investment Behaviour

Segmented labour market theory suggests that pension scheme participation is not determined by choice but by constraints experienced by certain groups of workers e.g. industry, unionisation and firm size. Behavioural economic theories suggest that some do not contribute due to the costs of acquiring information, myopia or hyperbolic discounting.

Moreover, there is a tendency for procrastination in retirement savings, where people agree that they should save but delay action (Choi, 2001). This supports the argument for an auto-enrolment pension scheme for Irish citizens.

The "life-cycle" hypothesis developed by Modigliani and Brumberg (1980) is the benchmark economic theory for modelling pension saving. The basic premise of the theory is that consumption is smoothed over an individual's life-time. The life cycle model implies that investment decisions should be based on the size and riskiness of a person's human capital, i.e. the present value of their future earnings. The model implies that the optimal investment policy incorporates the changing composition of human capital and financial wealth over the life-cycle.

Fernandez-Lopez et al. (2010) found that country factors play a crucial role in saving attitudes of citizens. Studies such as that carried out by Iyengar et al. (2004) support the idea that complexity leads to deferral of investment decisions by individuals. They found a strong negative relationship between the number of funds offered and the participation rate. Furthermore, choices are influenced by "framing", that is how they are presented, and "herd instincts". Barr (2009) advocates keeping choices simple to address information problem, by offering only a small number of clearly differentiated funds.

Default Options for Pension Investments

Neoclassical economic theory purports that agents will opt out of any default fund that does not maximise their utility regardless of the nature of the default. This does not bear out in practice. For example, in the UK, it is estimated that over 90% of Defined Contribution

pension savers are included in default funds.[2] The lack of financial sophistication of participants may further explain the tendency to gravitate towards default funds. These findings have been borne out by studies by Madrian and Shea (2001) and Choi (2006) who found that automatic enrolment has its largest impact on participation for those workers who appear to have the least amount of financial awareness and sophistication. For these individuals, the default fund may be perceived as an endorsement for a particular course of action and they will concede that an employer or government specified default must be in the best interest of participants.

There are many other ideas explored with respect to why people tend towards default investment options for pensions. There is evidence that women show a greater risk aversion in asset allocation (Agnew, Balduzzi and Sunden, 2003) but also that level of risk aversion falls with increased financial education (Dwyer, Gilkeson and List, 2002). Chernev (2004) discussed the extremeness aversion and the tendency to go for the compromise option while Benartzi and Thaler (2002) found employees can adopt a naïve diversification and a tendency to choose the middle option. Hedesstom, Svedsater and Garling, (2004) came to a similar conclusion on investigating pension fund asset allocations in Sweden.

In anticipation of the introduction of the UK auto-enrolment scheme, the Personal Accounts Delivery Authority (PADA) conducted extensive research into fund choice for members and determined that alternatives to the default fund would be required to cater for a wide range of members with different needs, aspirations and values. Examples of fund choice available include a Sharia Fund, an Ethical Fund and a Growth Fund[3]. Zuckerman (1978) suggests that choice is desirable and motivating for consumers and individuals feel safer when they have a

[2] Sourced from the Department of Work and Pensions
[3] "Building Personal Accounts: Designing an Investment Approach", Personal Accounts Delivery Authority, May 2009.

degree of control over their investments. Limited choice may lead to increased opt-outs from the scheme if the fund choice does not meet the diverse needs of the target group. However, there may be extra management/administrative costs associated with offering more fund choice.

IV. International Experiences of Pension Reform

It is difficult to determine the single best national system for pension provision due to variations in the objectives, i.e. poverty relief and risk-sharing, variations in constraints and differences in political processes (Barr, 2009). Over the years, many countries have undertaken considerable reforms of national pension structures, most notably Chile, Sweden, Australia, New Zealand and most recently, the UK.

Chile is cited by many when discussing examples of countries that have undergone extensive pension scheme reform which incorporated a shift from public to private pension provisioning. Since 1981, the country has had a system of mandatory, funded and privately managed individual pension accounts for citizens. However, the Chilean government recognised that unless accompanied by a robust system of poverty relief, a system consisting exclusively of individual accounts would not be sufficient and in 2008, they introduced a non-contributory pension financed by taxation which would be payable to two-thirds of the population.

The Swedish system underwent considerable change in the 1990's and their system now consists of a funded system of individual accounts and a partially funded guaranteed minimum level of pension. In terms of individual accounts, there is an extensive range of

funds to choose from and a default fund for those who do not choose, the latter being the choice of most.

The fund choice for auto-enrolment schemes tends to vary significantly from country to country. For example, in Chile, investors may only choose from a selection of five funds. In contrast, under the Swedish mandatory system there were 776 funds for investors to choose from (Tapia and Yermo, 2007). The US Thrift Saver Scheme offers only 9 funds, while in New Zealand there are approximately 36 providers, all of whom offer a choice of funds. However, too much choice may actually reduce actual choice exercised. For example, over 90% in the Swedish system opted for the default fund, while only 40% of members of the US Thrift Saver Scheme opted for the default fund.

The concept of home bias (see, Fama and French, 1991) is also an important consideration which Irish policymakers may consider if creating a default portfolio for a national auto enrolment scheme. Tversky and Kahneman (1974) also assert that relevant decision factors are too numerous or complex to process easily and so investors rely on heuristics or rules of thumb which can be unreliable under specific situations. Home bias is one such heuristic, where people rely on domestic stocks (and assets) they know and have a physical connection with.

Gerrans et al. (2006) found for Western Australian based public sector pension fund, members did not display evidence of home bias and when subsequent investment changes are made, historical performance appears a stronger explanation for asset allocation. Members chose to decrease their exposure to international equity due to recent poor performance. Gerrans et al. (2006) also found that members appeared to respond to information supplied to

them, highlighting the importance of information provided by pension schemes. In the New Zealand context however, Warren (2009) found that, while other nations exhibit a strong home equity bias, New Zealand's institutional investors have a greater affinity for global diversification than elsewhere due to the small size and narrow breadth of the New Zealand market.

The Kiwi-Saver and NEST Schemes

While in both the UK and New Zealand, active membership of workplace pensions had been falling, the proportion of working age New Zealanders making provisions for retirement was approximately half of that in the UK. The New Zealand government's approach differed to that of the UK in that the rationale was partially macroeconomic; i.e. by encouraging saving behaviour, this would in turn lead to national savings and develop local capital markets. In the same way, Chile experienced a very large increase in private saving since the introduction of personal pension accounts (Bosworth and Burtless, 2004). The UK, however, already had large and well developed capital markets and therefore macroeconomic concerns were not a feature of the auto enrolment debate in the UK.

NEST was launched in 2012 in the UK as a trust based occupational scheme aimed at low to moderate income workers and is subject to national and European legislation. It is essentially a personal accounts system and its key distinctive features are that it is simple and charges are kept to a minimum. The scheme currently has a contribution limit of £3,600 per annum and there is a general ban on transfers into and out of the scheme. Total contributions must be a minimum of 8% of employee earnings and the employer must contribute a minimum of 3%. Tax relief applies to employee contributions.

Kiwi-Saver came into effect in New Zealand in 2007, members are automatically enrolled between the ages of 18 and 65 years if in employment but can choose to opt-out between day 14 and day 56 of their employment. In order to discourage opt-outs, the New Zealand government provides a NZ$1000 tax-free "kick-start" to the individual's savings account. As well as minimum contributions from employers and employees, the government has a subvention.

The Kiwi-Saver and NEST (UK) schemes differ in terms of design features; in the UK employers are responsible for ensuring employees enrolled in the scheme. The employee holds a personal account, and can choose for their contributions to be invested in a limited choice of funds. However, in line with expectations, most have opted for the default fund and therefore personal accounts essentially constitute one large fund which is invested at arm's length by the investment managers chosen by a PADA. In this context, competition will arise though contracts set up by PADA rather than by individual consumers making their own choices. Cost savings and simplicity were the main drivers behind the design of the UK model. In addition, the perception is that participants will not want to choose how to invest and do not have financial literacy to choose well.

The Kiwi-Saver Scheme, on the other hand, allows any provider to apply to provide the accounts to consumers once they comply with some predefined guidelines on the structure of the product. There are approximately 31 different providers, and of these, six have been selected to provide default funds. The Kiwi Saver Scheme, therefore, appears to place more emphasis on providing opportunities for participants to exercise control over their investment choices and to choose a product which is appropriate to their circumstances.

V. Investment Strategies for Default Portfolios

For the most part, pension funds rely primarily on four asset classes – equities, bonds, property and cash. Traditionally, equities have offered higher returns but are inherently riskier assets, as evidenced by the recent losses suffered by Irish pension schemes during the financial crisis due to their high allocation to equities. Alternative asset classes, such as commodities, are recently becoming increasingly attractive for pension investors. These assets have the benefit of being less correlated with traditional assets and improve diversification gains.

Formulating Investment Strategy for Pension Schemes

There are three main considerations which are central to formulating the risk objective of an auto-enrolment scheme; the level of risk that future members should take, the level of returns needed to ensure their contributions grow to meet their retirement expectations and the capacity to reduce the dispersion of outcomes that the investment approach generates, particularly closer to retirement age.[4]

The standard approach for determining the asset allocation of any portfolio is mean-variance optimisation. Default funds of many DC pension schemes have very high equity weightings for long periods whereas defined benefit schemes tend to have a more balanced investment approach with a greater mix of assets. Absolute Returns or Diversified Growth strategies which combine equities, bonds, cash and alternative investments are also increasingly popular. Tactical asset allocation is an alternative to strategic asset allocation and involves

[4] Personal Accounts Delivery Authority, 2009.

increasing investment when markets are attractive and reducing holdings in less attractive markets.

Another key decision for pension fund managers is whether the fund should be actively or passively managed. That decision depends on the strategic asset allocation and preferences in relation to risk (active management carries security selection risk while passive management carries mainly benchmark risk). The cost is the other main factor as fees associated with active management are considerable.

In the UK and Ireland, members can take 25% of pension saving in a tax-free cash lump sum and convert the remainder into a pension. Changing the asset allocation to ensure it is made up of the assets required at retirement is seen as a sensible approach and a good way to ensure legislative requirements are met, based on the assumption that members will retire at a single retirement age and their attitude to loss will change as a result of this. Traditional life styling generally involves switching from riskier assets such as equities to safer assets like bonds within five to ten years of retirement. Target date funds are similar but instead of switching from units in a higher to lower risk fund, the switch generally occurs at the level of the fund that corresponds to the individual's expected retirement date. Stochastic life styling involves predicting the most probable investment outcome based on stochastic simulations which will define the target range of final pension pot values. When the value of savings enters a target range, money is switched into lower risk investments in order to minimise the risk of future losses.

In the UK NEST Scheme, the switch occurs within each member's individual account and it is generally performed automatically using a fixed formula based on how close the member is

to retirement age. The availability of target date funds enables members to change their expected retirement date, for example moving from the 2020 fund to the 2025 fund. According to the Institute, target date funds also are advantageous in that they focus members on the outcome and draw attention away from short-to-medium term volatility. Without having an impact on the member's unit holdings, trustees would have considerable flexibility in determining the underlying asset allocations, investment styles and fund manager switching. The ability to purchase a given level of pension in retirement is driven by the price of annuities at retirement.

Life-Styling Approach to Asset Allocation Strategies

A popular investment theory that is often used is the "life-cycle hypothesis". However, in their 2012 Pensions Outlook Report, the OECD cautions that such life cycle investment strategies may need to be carefully regulated to ensure that workers are offered sufficient diversification and protection from market shocks in old age.

Life Cycle funds are also referred to as Target-date funds and they were approved by the American Pension Protection Act of 2006 as a qualified default option for US Defined Contribution plans. Broadly speaking, these funds reduce equity exposure as a predetermined retirement date approaches. There has been some concern about the asset allocation and performance of these funds in the US, as many of these funds have not rebalanced their allocation away from equities on the grounds that retirees continue to need a heavy equity allocation to offset the danger of outliving their savings. Booth and Chang (2011) examined the asset allocation and performance of target-date funds from January 2006 to May 2009 and found that target date funds increased their common equity allocation and reduced cash reserves immediately before and during the 2008 financial crisis. The study found evidence

that fund managers tried to maximise returns on short-dated funds close to their target date by retaining high allocations in equities and also a lack of dynamic rebalancing on the part of fund managers as they let their winners grow.

Some research suggests that the life-styling approach does not benefit the average member (see, for example, Booth and Yakoubov, 2000) and that a diversified equity-based portfolio can outperform lifestyle strategies. Life-styling has also been criticised as a blunt instrument that does not recognise differences in individual's work or retirement plans, resulting in individuals being invested in asset classes that are not suitable for their retirement needs.

Research conducted by Bodie, Merton and Samuelson (1992) appears to offer support to the validity of life cycle investment strategies and argue that if an individual's human capital, i.e. future labour income is less risky than equity, then at younger ages this capital will constitute a relatively high proportion of the individual's financial wealth in risky assets. As time moves on, the share of wealth accounted for by human capital declines and it is sensible to reduce the risk attached to financial wealth.

The key considerations that should be borne in mind in relation to the life-cycle model are that assumptions may not always be realistic as future labour income is not always risk free; however Viciera (2009) shows that future earnings have to be extremely volatile before an individual moves to a more conservative investment policy. Secondly, labour supply can be flexible. Bodie, Merton and Samuelson (1992) show that individuals can invest even larger proportions of their financial wealth in risky investments if labour supply is adjusted and Viciera (2009) suggests that individuals may also apply this approach where future earnings are not risk-free. Thirdly, the correlation between labour income growth and stock returns are

important. Viciera (2009) shows that a positive correlation between earnings and stock market returns leads to a significant reduction in the desired position in stocks and a high positive correlation can lead to young workers being less willing to hold stocks than older workers (see also Benzoni, 2001).

Life cycle funds that mimic the average optimal life cycle portfolio allocation of the investor can be approximately optimal (see, Gomes, Kotlikoff and Viciera, 2008), however forcing all investors to invest in the same fund can be costly unless they all have a similar risk tolerance. Ellement and Lucas (2007) use retirement income replacement analysis to determine how well a series of lifecycle funds will adequately meet the retirement funding needs of participants and conclude that, while this constitutes a valuable part of the analysis, other factors such as the risk tolerance must also be considered in constructing a default portfolio.

Comparing the Life-Styling Investment Strategy with Alternative Investment Strategies

With regard to other types of managed funds, Pang and Warshawsky (2008) use simulation analysis to compare the investment performance of a balanced fund and a lifecycle fund using average asset allocations observed on the market. The results of this analysis show that the balanced fund is more likely to outperform the lifecycle fund; it also increases the risk to participants in the year's immediately preceding retirement.

There appears to be a certain level of support for high allocations of equities versus life style investment strategies in the construction of the default portfolio. Booth and Yakoubov (2000) use historical data returns to investigate the retirement income implications of five different investment strategies; one with a constant 70% equity/20% bonds/10% cash mix and four varying life cycle strategies. The findings indicated that there is weak support for the

superiority of life cycle approaches and that an-equity based fund in the ten years preceding retirement stochastically dominates the cash and fixed income strategies because of higher expected return. Similarly, Blake (2001) use a stochastic simulation model to investigate various default fund asset allocation strategies and found that the overall distribution of potential outcomes is very wide and that a well-diversified, high equity strategy provides best overall outcome. While the lifecycle strategy avoids some of the worst potential outcomes, it significantly reduces the level of pension provision. Hibbert and Mowbray (2002) conducted similar analysis and found that a 100% equity strategy produces the highest expected value but with a wide range of potential outcomes. Lifecycle strategies significantly narrow the range of potential outcomes but at expense of reduced expected value, particularly where life cycle switch begins 15 years from retirement.

The critical flaws of target-date funds are two-fold: first, a lower equity exposure does not necessarily mean lower risk and neither equity risk nor correlations between asset classes are consistent over time and second, target date fund providers confuse consumers by adopting differing investment approaches (Tretiakova and Yamada, 2011). Using a target retirement capital of 70% of income replacement, Tretiakova and Yamada (2011) employ a dynamic equity glide path. Over time, the portfolio's actual accumulated value is compared with the capital accumulation path (CAP) and when the portfolio value falls below the estimated CAP, more risk is taken. The maximum risk constraint is a 60% equity weight at retirement. From Monte Carlo simulation and historical data testing against six benchmarks (including all equities, all bonds, a balanced fund and two dynamic strategies suggested by Basu and Drew (2010) and an allocation comprised of the asset-weighted average of the three largest American TDF providers) Tretiakova and Yamada (2011) found an improvement in

probability of achieving retirement goals from 50% for the fixed glide path to 68% for the dynamic equity glide path.

A further alternative to the Life-Styling strategy is the Safety First Strategy, which is already in use in a number of countries, aims to maximise the probability of achieving at least a minimum level of required retirement income. Plan assets are divided into a large portfolio of risk free bonds and a smaller portfolio of risk bearing securities. Bodie (2008) argues that that these minimum income guarantees should be the default option in retirement investments because they reduce moral hazard in the provision of retirement products and therefore there are lower marketing and distribution costs, they create greater transparency for consumers and reduce the need for costly financial education and they make consumers aware of the risk of stocks. The drawback of this approach, however, is that it requires inflation-linked bonds to lock in a protected inflation amount and these can be limited in supply (Broeders and Rijsbergen, 2010).

VI. Empirical Analysis

The empirical international pensions literature shows that retirement wealth is primarily dependent on asset allocation, asset returns and contributions. Blake (2007) and Basu and Drew (2010) used stochastic approaches to examine potential retirement wealth outcomes over an entire working life.

For the empirical analysis we construct a number of 40 year pension portfolios comprising of different asset classes which are typical to traditional pension funds. Some portfolio asset allocations will remain fixed for the 40 year period and others will incorporate a life-styling

strategy. The main objective is to simulate outcomes for the next 40 year period based on historical returns and in doing so, determine the likelihood of accruing an amount which will generate a target pension figure for a typical member of an Irish auto-enrolment scheme. We follow McDonald et al. (2012) and use bootstrap resampling to improve the information derived.

In the case of New Zealand, McDonald et al. (2012) found that in the accumulation phase, the lowest risk was associated with cash and the highest occurred in equities. The distribution of outcomes showed that when the contribution rate increased to 6%, investors had a 40% probability of attaining their retirement target. In the decumulation phase, the hypothetical investor on average replaces 60% of their final gross earnings up to age 95 years.

McDonald et al. (2012) measure retirement success in terms of multiples of final earnings of between five and eight times final salary (Basu and Drew (2010) also use eight). It is taken that 70% is a reasonable income replacement benchmark. However, Ghilarducci (2010) suggests that middle and high income people need close to 95% to 100% of income to maintain living standards because more elderly are in debt and still paying mortgages while health care costs are increasing.

In this paper, an annual contribution rate of 8% and 15% per annum will be applied over the 40-year period, based on the above-mentioned average contribution rates for DC Schemes and the higher optimum contribution rate which was recently recommended by the OECD.

Most pensions' literature broadens optimal portfolio choice by examining other empirical variables such as contribution rates, time varying investment and dollar weighted returns and

other market returns (McDonald et al, 2012). Some use static assumptions, for example, Mitchell and Moore (1998), while others such as Blake, (2001) allow for stochastic behaviour. However, it is difficult to source a single broadly accepted measure of retirement adequacy.

We adopt a similar approach to McDonald et al. (2012) and create twenty-four portfolios based on the asset allocations for other auto-enrolment schemes and typical asset allocation strategies referred to in previous literature, including life-styling strategies. However, unlike previous research, we create stylised portfolios based on the default portfolios of specified national auto-enrolment schemes.

The historical returns for equity, bonds, property and cash for the period between 1973 and 2012 will be used to generate outcomes for the subsequent 40 year[5] period through the use of bootstrap resampling. It is envisaged that the bootstrapping simulation will produce varying time series of returns which will then be analysed to calculate terminal value. Contributions are assumed to be invested at year end and accumulated fund at year end is reinvested at the subsequent rate. It is assumed that assets are unrelated and taxes and charges do not apply.

In regular historical simulation, current portfolio weights are applied to the historical sample (e.g. 250 trading days). The bootstrap differs because it is "with replacement" as each simulated day can select from the entire historical sample with replacement. Thus, rather than just running through a series of past returns, a sampling distribution is created by drawing returns with replacement from the series randomly. Advantages of the bootstrapped method

[5] A 40-year period will be taken as indicative of the typical pensions saving period, in line with Irish societal norms.

proffered are that it can model fat-tails and by generating repeated samples, estimate precision can be ascertained.

To create a simulation model for the accumulated fund on retirement, it is necessary to create a profile for a hypothetical investor. Research by the Irish National Pensions Policy Initiative and TILDA indicates that there are particular economic sectors which have little or no private pension provision, and for this reason, average CSO earnings data for the retail, catering and hospitality sectors will be used. The replacement rate will be 75% of pre-retirement earnings in accordance with benchmark literature and OECD recommendations; however allowance will be made for the State Contributory Pension in the decumulation phase. The working lifetime is assumed to be between 25 and 65 years. For our analysis, the hypothetical investor will be male.

In terms of salary inflation, information available from the CSO indicates that average earnings inflation between 1998 and 2010 was 4.2%; however the Society of Actuaries in Ireland apply a salary inflation assumption of 3% for forecasting pension accrual and therefore earnings inflation of 3% per annum will be assumed for consistency.

To determine the adequacy of the pension fund at retirement, annuity rates at age 65 years for the hypothetical investor will be used to determine the pension that can be purchased at retirement. The current annuity factor for a 25 year old male at age 65 years is 25.5:1, and this includes pension increases at a rate of 3% per annum. The forecasted value of the State Contributory Pension will also be added to the annual pension amount and the sum will be compared with earnings on retirement to determine whether the 75% target replacement rate has been met. For the purposes of calculating the future value of the State Contributory

Pension, an indexation rate of 2% will be used in line with anticipated CPI increases (Actuarial Review of the Social Insurance Fund, 2010). This will produce a more accurate view of the adequacy of the fund at retirement than the earnings multiple techniques used by McDonald et al. (2012) and others.

Data and Summary Statistics

The data is representative of the four main asset classes which pension funds predominantly invest in i.e. equities, bonds, cash and property. The analysis will focus on hypothetical portfolios which contain varying combinations of Irish and global asset allocations. Given the lack of breadth in the Irish equity and bond market, the historical returns for US, UK and global bonds and equities will also feature in the simulations.

Tables 1-3 provide a breakdown of the asset allocations of some of the default portfolios in UK, Australian and New Zealand, respectively, of auto-enrolment or mandatory schemes.

The historical return data has been derived from a number of sources. All equity prices (including indices – MSCI World, S&P500, FTSE100, and ISEQ Overall) are from Bloomberg and converted to euros (or Irish Pounds) using exchange rate date from the Central Bank of Ireland. Global bond returns are from the BoFA Merrill Lynch Global Broad Market Index and the UK bond returns are the JP Morgan Life UK Long Dated Bond Fund returns, both are expressed in euros and from MoneyMate Investment Data Management Limited. Property prices are from Hibernian Investment Managers, Irish Treasury Bill Returns data are given in the Dimson, Marsh and Staunton dataset for 2002 and we also use the Jones Lang Wootton Irish Property Index. Cash returns from 2000 were sourced from

Irish Life and property returns from 2000 were sourced from the Department of the Environment.

Methods and Investment Framework

A number of hypothetical portfolios are created based on the strategic asset allocations of the Kiwi-Saver Scheme, the UK NEST Scheme, and the average asset allocation of Australian mandatory pension accounts. Irish equities, cash and property will be used in place of the domestic allocations of the aforementioned schemes. Due to insufficient available information on Irish bonds returns,[6] UK bond returns will be used in place of domestic bond allocations.

The average returns and standard deviations for each of the asset classes for the period 1973 to 2012 are given in Table 4. Equities exhibit relatively high volatility compared to all other asset classes.

Portfolios have also been constructed which also best represent the strategic asset allocations of Irish pension funds in 2000, 2007 and 2011. Others represent asset allocations specified in previously referenced literature. Finally, 10 portfolios which incorporate the phased transition to less risky assets (Life Style Strategy) are constructed. This process is generally carried out between 5 and 10 years to retirement. The IAPF Defined Contribution Survey 2011 confirms that the preferred default strategy for Irish defined contribution schemes is the lifestyle strategy. 80% of schemes de-risked over a 5-12 year period while 20% of funds de-risked over a 15 year period or upward.

[6] As the Irish Government do not issue government bonds consistently, there is no readily available index for Irish bonds.

The list of portfolios constructed and their respective asset allocations is provided Table 5. Following the analysis of the historical returns, we generate a series of annual returns for each of the portfolios based on the asset allocations assigned. The annual salary is set at €23,000 in 2013 in accordance with salary data obtained from the CSO and increased by 3% per annum. Based on contribution rates of 8% and 15%, we use the bootstrap method with 10,000 iterations to simulate final account balances at the end of the 40 year period. The average total returns, and returns at the 5th and 95th percentile can be viewed below.

In the decumulation phase, the final account balances are divided by the relevant annuity factor to determine the annual pension that can be purchased on behalf of the hypothetical investor. The current State Contributory Pension of €11,975.60 is also increased by 2% per year, added to the annual pension amount and the total is compared with the target of 75% of final salary at age 65 years. The extent to which the target is met in each of the scenarios is illustrated in Table 6.

Empirical Results and Analysis

As can be viewed in Table 6, at the 5th percentile and a contribution level of 8% of salary none of the portfolios generated sufficient returns to achieve the target replacement income level. However, at a contribution level of 15%, six of the twenty-four portfolios generated sufficient return at the 5th percentile and three of these were life-style portfolios.

At the 8% contribution level, fourteen of the portfolios generated sufficient average returns to achieve the target income replacement level and seven of these were life-style portfolios. All twenty-four portfolios generated sufficient average returns when the contribution rate of 15% was applied.

Portfolios with a high allocation of equities, such as Portfolio 1, 2, 3 and 24 exhibit very high standard deviations and also generated high returns at the 95th percentile. None of these achieved the average target replacement rate at the 8% contribution rate; however the historic returns for equities did appear to be unexpectedly lower than the returns for other asset classes and therefore it is unsurprising that portfolios with high equity allocation rates did not perform as well as other portfolios.

Three of the four Kiwi-Saver funds generated sufficient average returns at the 8% contribution level and both the Default Fund and Conservative Fund generated sufficient returns at the 5th percentile at a contribution rate of 15%. The Balanced Fund and the Growth Fund appear to exhibit a lower standard deviation than the Conservative and Default Funds which is somewhat surprising.

The NEST Pre-Retirement Fund performed well in terms of adequacy, although again this is primarily due to the very high allocation to UK bonds. The average returns of NEST Foundation Portfolio also met the target, while the Global Fund was just below the target at a proportion of 0.98:1 (total pension to final average salary).

The portfolios replicating the average asset allocation for Irish Pension Funds in 2000, 2007 and 2011 did not generate sufficient average return at the 8% contribution level to meet the target rate; however when life-styling is introduced (Portfolios 15 and 16), average replacement rates of 1.1 and 1.14 respectively are achieved at the 8% contribution level.

With regard to the remaining Life-styling portfolios, all achieved average returns in excess of the target replacement rate at the 8% contribution level with the exception of the Kiwi-Saver Growth Fund with life-styling over 10 years, which achieved a rate of 0.98.

The considerable contributions that UK and global bonds make to the final outcome in this analysis contrasts with the findings of Tretiakova and Yamada (2011), who found that the probability of a portfolio with a 100% bonds allocation achieving the desired income level was less than 2%, while for a 100% equity allocation it was 62%. Previous literature by Blake (2001) and Basu and Drew (2010) also found that 100% equity allocations provided superior result to lifestyle strategies. However, in terms of the performance of equities, McDonald et al. (2012) find that New Zealand equities earn lower returns than all other New Zealand and US asset classes and that New Zealand bonds uncharacteristically outperform New Zealand equities in their sample data.

In terms of adequacy, McDonald et al. (2012) found that at the 5^{th} percentile, the KiwiSaver Conservative Fund produced the highest result, which is consistent with our findings.

The contribution rates of 4% and 6% which were examined by McDonald et al. (2012) were found to be insufficient to meet the target replacement rate. In our analysis, the 8% contribution level is adequate only in some cases; however a 15% contribution level appears to be more than adequate to accrue the target amount. It should be borne in mind that the State Contributory Pension has also been incorporated into the final outcome and although state pensions are payable to pension investors in New Zealand, these were not incorporated into the analysis of McDonald et al. (2012). Incorporating the State Contributory Pension

does impact considerably on the calculation of the final outcome given that the current State Pension is approximately half the hypothetical investor's starting salary in this case.

VII. Conclusion

Traditional pension investment strategies in Ireland are found to be inadequate to meet the target replacement ratios and have been for a number of years. Anecdotal and statistical evidence on the losses incurred by Irish pension funds in recent years suggests that a new approach to strategic asset allocation which considers both the final outcome and risk may be required.

With regard to the contribution rates which should apply, it seems clear that an 8% contribution rate may not be sufficient and a contribution of between 8% and 15% may be more likely to achieve the desired results. Of course, the results may vary depending on the target group and salary levels. While this analysis assumes that the typical investor will be earning a low level of income, it is quite possible that the target group may broaden, particularly given that many private sector defined benefit schemes are now in the process of winding up.

The empirical analysis has examined a number of portfolios with varying degrees of risk, many of which have been successful in meeting the target income replacement rate. This will be useful in selecting a default portfolio which best matches the likely target group's low risk appetite while still generating an adequate income on retirement. The analysis also provides support for the practice of life-styling in order to reduce risk immediately prior to retirement

and the empirical analysis provides evidence of how successful life-cycling strategies can be in also generating the target replacement income level on retirement.

Furthermore, there is much that can be learned from other national auto-enrolment schemes in terms of the design of the default fund. The portfolios which were based on the traditional asset allocations of the Kiwi-Saver Scheme, NEST and Australian pension funds were more successful than Irish funds in meeting the target income replacement rate.

Authors:
Liam Gallagher is Professor of Finance in the Business School, Dublin City University, Dublin, Ireland. He was appointed to this position in 2002. He has held posts in University College Cork, Oxford and University of St.Thomas, Minnesota. He has published in top international journals in economics, finance and business, including, *International Business Review*, *Journal of International Money and Finance*, *Journal of Business Finance & Accounting*, *Applied Economics*, *Economics Letters*, *Southern Economic Journal*, and *Economic Inquiry*.

Fionnuala Ryan is a researcher at the Markets Operations Desk of the Financial Markets Division at the Central Bank of Ireland.

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Figure 1: Historical Asset Returns 1973 -2012

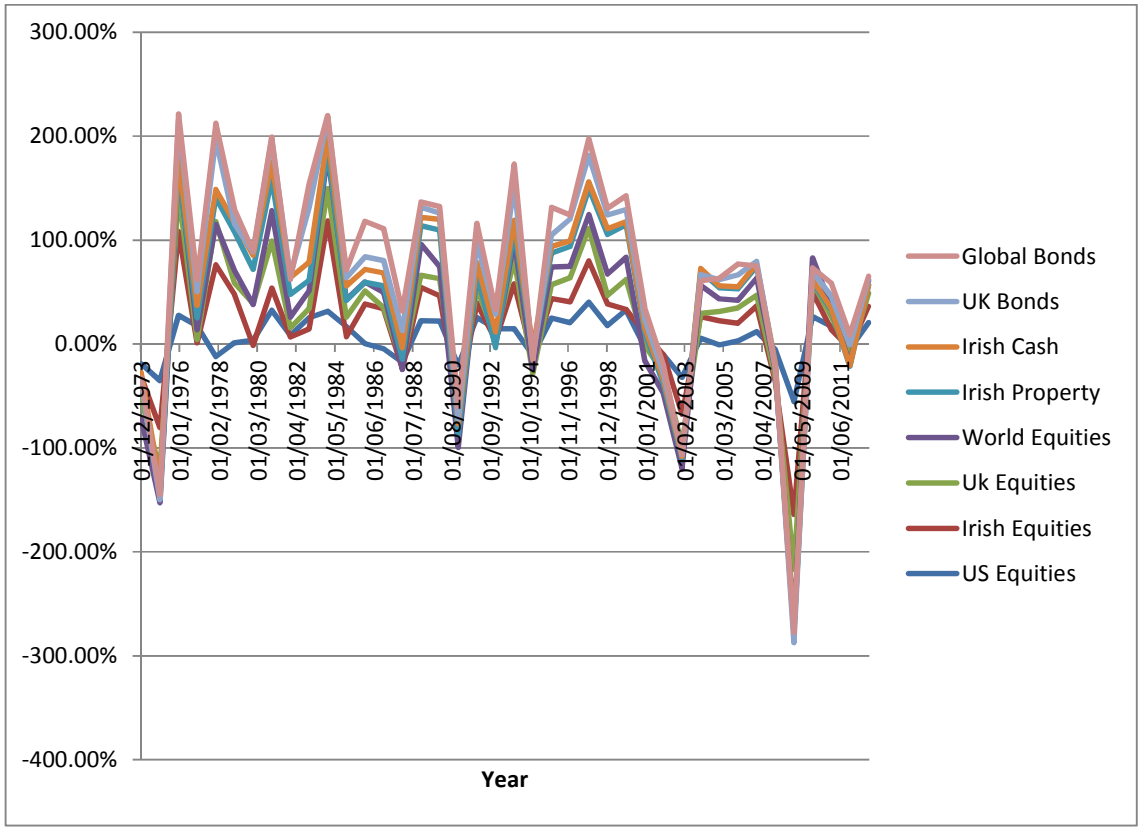

Table 1: Average Benchmark Asset Allocations for top ten Kiwi-Saver Schemes

KiwiSaver Fund Type	NZ Cash	NZ Bonds	NZ Property	NZ Equities	International Bonds	International Equities
Default	39%	14%	3%	6%	26%	12%
Conservative	22%	27%	4%	6%	29%	12%
Balanced	10%	17%	8%	15%	19%	30%
Growth	11%	5%	10%	24%	7%	43%

Source: McDonald, (2012)

Table 2: Average Benchmark Allocations for NEST Target Date Funds

NEST Fund Type	UK Cash	UK Bonds	UK Property	UK Equities	International Bonds	International Equities
Pre-Retirement	24.8%	75.2%				
Foundation Phase 2055	9.5%	38%	1.9%	10.6%	13.8%	26.3%
Growth Phase 2040	5.4%	22.2%	2.6%	15.8%	19.7%	34.1%

Source: nestpensions.org.uk

Table 3: Average Benchmark Allocations for Australian Superannuation Default Funds

Sector	AZ Cash	AZ Bonds	AZ Property	AZ Equities	International Bonds	International Equities	Other Assets
Corporate	6%	13%	9%	32%	7%	25%	8%
Industry	6%	5%	12%	31%	7%	23%	17%
Public Sector	9%	9%	9%	28%	5%	26%	15%
Retail	14%	20%	7%	25%	6%	21%	7%

Source: IOPS Working Paper on Effective Pension Supervision, No 18

Table 4: Average Returns and Standard Deviations 1973-2012 (40 years) by asset class

	World Equity	US Equity	UK Equity	Irish Equity	World Bonds	UK Bonds	Irish Property	Irish Cash
Average Return	5.74%	6.31%	8.08%	10.37%	9.00%	10.83%	12.45%	8.06%
St Dev.	0.1926	0.2097	0.2109	0.3606	0.0931	0.1464	0.1463	0.0492

Table 5: Hypothetical Portfolios Constructed

No	Strategic Asset Allocation	Details	Total Equity Weighting
1	World Equities (40%), US Equities (20%), Irish Equities (20%), UK Equities (20%),	Based on Booth and Yakabouv (Diversified Equity Portfolio)	100%
2	World Equities (25%), US Equity (15%), Irish Equity (15%), Global Bonds (20%), Irish Cash (10%)	Based on Booth and Yakabouv (Constant Balanced Portfolio)	70%
3	World Equities (20%), US Equity (13%), UK Equity (13%), Irish Equity (14%), Global Bonds (20%), UK Bonds (20%)	Based on Treitikova (Balanced Fund)	60%
4	World Equities (30%), Irish Equity (15%), Irish Property (8%), Global Bonds (20%), UK Bonds (17%), Irish Cash (10%)	Kiwi-Saver Balanced Fund	45%
5	World Equities (12%), Irish Equity (6%), Irish Property (4%), Global Bonds (29%), UK Bonds (27%), Irish Cash (22%)	Kiwi-Saver Conservative Fund	18%
6	World Equities (12%), Irish Equity (6%), Irish Property (3%), Global Bonds (26%), UK Bonds (14%), Irish Cash (39%)	Kiwi-Saver Default Fund	18%
7	World Equities (43%), Irish Equity (24%), Irish Property (10%), Global Bonds (7%), UK Bonds (5%), Irish Cash (11%)	Kiwi-Saver Growth Fund	67%
8	UK Bonds (75%), Cash (25%)	NEST Pre-Retirement Fund	0%
9	World Equities (26%), Irish Equity (10%), Irish Property (2%), Global Bonds (14%), UK Bonds (38%), Irish Cash (10%)	NEST Foundation Fund	36%
10	World Equities (34%), Irish Equity (16%), Irish Property (3%), Global Bonds (20%), UK Bonds (22%), Irish Cash (5%)	NEST Growth Fund	50%
11	World Equities (26%), Irish Equity (31%), Irish Property (11%), Global Bonds (8%), UK Bonds (14%), Irish Cash (10%)	Average Australian Default Fund	57%
12	World Equities (45%), Irish Equity (19%), Irish Property (7%), Global Bonds (18%), UK Bonds (4%), Irish Cash (7%)	Average Irish Pension Fund Allocation (2000)	64%
13	World Equities (20%), US Equity (15%), UK Equity (15%), Irish Equity (16%), Irish Property (10%), Global Bonds (13%), UK Bonds (6%), Irish Cash (5%)	Average Irish Pension Fund Allocation (2007)	76%
14	World Equities (23%), UK Equity (10%), Irish Equity (20%), Global Bonds (20%), Irish Property (4%), UK Bonds (6%), Cash (17%)	Average Irish Pension Fund Allocation (2011)	53%
15	Phase 1: World Equities (20%), US Equity (15%), UK Equity (15%), Irish Equity (16%), Irish Property (10%), Global Bonds (13%), UK Bonds (6%), Irish Cash (5%) Phase 2 at Year 34: Global Bonds (40%), UK bonds (35%), Cash (25%)	Average Irish Pension Fund Allocation (2007) with Life Styling (7 years)	Phase 1: 76% Phase 2: 0%
16	Phase 1: World Equities (23%), UK Equity (10%), Irish Equity (20%), Global Bonds	Average Asset Allocation Irish Pension Funds 2011 with LifeStyling (5 years)	Phase 1: 53% Phase 2: 0%

	(20%), Irish Property (4%), UK Bonds (6%), Cash (17%) Phase 2 at Year 36: UK Bonds (75%), Cash (25%)		
17	Phase 1: World Equities (23%), UK Equity (10%), Irish Equity (20%), Global Bonds (20%), Irish Property (4%), UK Bonds (6%), Cash (17%) Phase 2 at Year 31: World Equities (12%), UK Equity (5%), Irish Equity (10%), Global Bonds (37%), Irish Property (4%), UK Bonds (15%), Cash (17%) Phase 3 at Year 36: UK Bonds (75%), Cash (25%)	Average Asset Allocation Irish Pension Funds 2011 with Phased LifeStyling (10 and 5 years)	Phase 1: 53% Phase 2: 27% Phase 3: 0%
18	Phase 1: World Equities (26%), Irish Equity (31%), Irish Property (11%), Global Bonds (8%), UK Bonds (14%), Irish Cash (10%) Phase 2 at Year 33: UK Bonds (75%), Cash (25%)	Average Australian Default Fund with Life Styling (8 Years)	Phase 1: 57% Phase 2: 0%
19	Phase 1: World Equities (34%), Irish Equity (16%), Irish Property (3%), Global Bonds (20%), UK Bonds (22%), Irish Cash (5%) Phase 2 at Year 34: UK Bonds (75%), Cash (25%)	NEST Growth Fund with Life-Styling (7 years)	Phase 1: 50% Phase 2: 0%
20	Phase 1: World Equities (34%), Irish Equity (16%), Irish Property (3%), Global Bonds (20%), UK Bonds (22%), Irish Cash (5%) Phase 2 at Year 39: World Equities (22%), Irish Equity (10%), Irish Property (3%), Global Bonds (25%), UK Bonds (25%), Irish Cash (15%) Phase 3 at Year 35: UK Bonds (75%), Cash (25%)	NEST Growth Fund with Phased Life-styling (12 years and 6 years)	Phase 1: 50% Phase 2: 32%
21	Phase 1: World Equities (43%), Irish Equity (24%), Irish Property (10%), Global Bonds (7%), UK Bonds (5%), Irish Cash (11%) Phase 2 at Year 31: Global Bonds (40%), UK Bonds (35%), Cash (25%)	Kiwi-Saver Growth Fund with Life-Styling (10 years)	Phase 1: 67% Phase 2: 0%
22	Phase 1: World Equities (43%), Irish Equity (24%), Irish Property (10%), Global Bonds (7%), UK Bonds (5%), Irish Cash (11%) Phase 2 at Year 36: Global Bonds (40%), UK Bonds (35%), Cash (25%)	Kiwi-Saver Growth Fund with Life-Styling (5 years)	Phase 1: 67% Phase 2: 0%
23	Phase 1: World Equities (43%), Irish Equity (24%), Irish Property (10%), Global Bonds (7%), UK Bonds (5%), Irish Cash (11%)	Kiwi-Saver Growth Fund with Phased Life- Styling (at 15 years and 7 years)	Phase 1: 67% Phase 2: 36% Phase 3: 0%

	Phase 2 at Year 26: World Equities (22%), Irish Equity (12%), Irish Property (7%), Global Bonds (24%), UK Bonds (20%), Irish Cash (15%) Phase 3 at Year 34: Global Bonds (40%), UK Bonds (35%), Cash (25%)		
24	Phase 1: World Equities (40%), US Equity (20%), Irish Equity (20%), UK Equities (20%) Phase 2 at Year 21: World Equities (35%), US Equity (15%), Irish Equity (15%), UK Equities (15%), Global Bonds (15%), UK Bonds (5%) Phase 3 at Year 31: World Equities (30%), US Equity (10%), Irish Equity (10%), UK Equities (10%), Global Bonds (20%), UK Bonds (10%), Cash (10%)	Basu and Drew Reducing Equity (20 years and 10 years)	Phase 1: 100% Phase 2: 80% Phase 3: 60%

Table 6: Portfolio Historical Statistics and Probability of Meeting Annual Target Return

	Portfolio Average Historical Return	Portfolio Historic Variance	Portfolio Historic Standard Deviation	Contribution Rate	5th Percentile	Proportion of Target	Average	Proportion of Target	95th Percentile	Proportion of Target
Portfolio 1	7.25%	0.04276	0.20678	8%	85553	0.53	442413	0.79	2036620	1.9
				15%	167163	0.59	807241	1.05	3862506	3.2
Portfolio 2	7.76%	0.02281	0.15103	8%	181681	0.6	570010	0.88	1633804	1.65
				15%	361357	0.73	1051039	1.23	3131755	2.72
Portfolio 3	8.44%	0.02284	0.15112	8%	212026	0.63	656064	0.95	1940673	1.87
				15%	406061	0.77	1256093	1.38	3573722	3.04
Portfolio 4	8.72%	0.00907	0.09524	8%	301081	0.69	763130	1.02	1860903	1.81
				15%	564639	0.88	1421781	1.5	3486369	2.98
Portfolio 5	9.11%	0.02274	0.15079	8%	493314	0.83	907576	1.13	1649418	1.66
				15%	950132	1.16	1699227	1.69	3087339	2.69
Portfolio 6	8.68%	0.03453	0.18581	8%	497301	0.83	831511	1.07	1369840	1.46
				15%	944637	1.15	1560584	1.59	2582770	2.33
Portfolio 7	8.26%	0.00604	0.07772	8%	171886	0.6	614821	0.92	1942564	1.87
				15%	330400	0.71	1135925	1.29	3545349	3.02
Portfolio 8	10.14%	0.01262	0.11232	8%	531333	0.85	1101844	1.26	2502256	2.27
				15%	1006267	1.2	2055141	1.95	4065163	3.78
Portfolio 9	8.96%	0.0141	0.11874	8%	339336	0.72	810421	1.06	1915703	1.85
				15%	625874	0.92	1519891	1.57	3689426	3.12
Portfolio 10	8.57%	0.0079	0.08890	8%	254165	0.66	703605	0.98	1924541	1.86
				15%	485682	0.82	1322386	1.42	3536027	3.01
Portfolio 11	9.12%	0.00636	0.07974	8%	208338	0.62	745495	1.01	2525687	2.29
				15%	384681	0.75	1399930	1.48	4545684	3.74
Portfolio 12	8.04%	0.01561	0.12496	8%	194163	0.61	599724	0.91	1722256	1.71
				15%	362620	0.73	1139207	1.29	3225063	2.79
Portfolio 13	8.43%	0.02355	0.15346	8%	209249	0.62	662346	0.95	1934295	1.86
				15%	393302	0.76	1241397	1.37	3689878	3.12
Portfolio 14	8.99%	0.02645	0.16263	8%	257620	0.66	715029	0.99	1817286	1.78
Portfolio 15	Phase1: 10.44% Phase2: 3.96%	0.01842 0.00137	0.13571 0.03706	8%	353593	0.73	866708	1.1	2186996	2.04
				15%	668884	0.95	1658809	1.67	4021432	3.36
Portfolio 16	Phase1: 10.1% Phase2: 6.6%	0.02101 0.00703	0.14494 0.08383	8%	408311	0.77	922856	1.14	2119111	2.0
				15%	752599	1.01	1716486	1.71	4076311	3.40

	Portfolio Average Historical Return	Portfolio Historic Variance	Portfolio Historic Standard Deviation	Contribution Rate	5th Percentile	Proportion of Target	Average	Proportion of Target	95Th Percentile	Proportion of Target
Portfolio 17	Phase1: 10.54% Phase2: 4.92% Phase3: 5.15%	0.02372 0.00230 0.00039	0.15402 0.04803 0.01985	8%	376170	0.74	842809	1.08	1945207	1.87
				15%	696437	0.97	1578995	1.61	3683199	3.12
Portfolio 18	Phase1: 11.54% Phase2: 4.49%	0.00514 0.00026	0.07171 0.01596	8%	685619	0.98	2013501	1.90	6008714	4.67
				15%	1326737	1.42	3715288	3.14	11057078	8.41
Portfolio 19	Phase1: 10.29% Phase2: 3.77%	0.00715 0.0003	0.08453 0.01721	8%	368258	0.74	853460	1.09	2022791	1.93
				15%	689196	0.97	1595183	1.61	3833096	3.22
Portfolio 20	Phase1: 11.63% Phase2: 3.57% Phase3: 4.07%	0.00685 0.00279 0.00035	0.08276 0.05289 0.01858	8%	387081	0.75	886537	1.11	2019636	1.92
				15%	749967	1.01	1659334	1.67	3851715	3.23
Portfolio 21	Phase1: 10.12% Phase2: 1.49%	0.00518 0.03577	0.07195 0.03861	8%	281298	0.68	710704	0.98	1808179	1.77
				15%	525552	0.85	1313837	1.42	3401551	2.92
Portfolio 22	Phase1: 10.10% Phase2: 5.7%	0.00539 0.00131	0.07343 0.0363	8%	356447	0.73	914967	1.13	2356442	2.17
				15%	664229	0.95	1693242	1.69	4467018	3.68
Portfolio 23	Phase1: 11.71% Phase2: 6.16% Phase3: 4.18%	0.00502 0.0050 0.00137	0.07088 0.07062 0.03706	8%	353149	0.73	860658	1.09	2131923	2.0
				15%	667630	0.95	1615572	1.63	3939537	3.30
Portfolio 24	Phase1: 9.67% Phase2: 7.81% Phase3: 3.15%	0.03886 0.02511 0.02212	0.19714 0.15849 0.14874	8%	161376	0.6	581495	0.89	2141752	2.0
				15%	310402	0.7	1100260	1.26	4022671	3.36