

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

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## **Overview**

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.

Determine what strategies will best meet the target income replacement ratio for a typical member of the scheme.

## **I. Introduction**

Over 90% of defined benefit schemes in Ireland are in deficits and scheme wind-ups a regular occurrence (see, OECD and IAPF), a severe “pension gap” has emerged.

Reforms of national pension structures: 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 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.

Comparison of life style strategies with alternative strategies (see, for example, Bodie et al., 2009; Booth and Yakoubov, 2000; Ellement and Lucas, 2007).

The bootstrap analysis will provide valuable insights for the design and feasibility of a national auto-enrolment schemes (see, Barr, 2009; Lucas, 2001).

## **II. Pension Reform in Ireland**

The Irish pension system is based on the Beveridgean system and is essentially a two-pillar system.

A tax relief applies to private pension contributions subject to certain limits.

Gross public pension expenditure is expected to increase from 7.5% of GDP in 2010 to 11.4% of GDP in 2050. With a projected pension shortfall of €13.4 billion by 2066.

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*

In 2010 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 proposed to be “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.

Employees would be automatically enrolled unless they are a member of their employer’s scheme and that scheme provides higher contribution levels or is a DB 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.

The National Pensions Framework estimated that the total contribution rate will be 8% of salary, however OECD recommends a total contribution of 15% of salary.

### **III. Pension Investment Behaviour**

The “life-cycle” hypothesis developed by Modigliani and Brumberg (1980) is the benchmark economic theory for modelling pension saving.

Behavioural issues: costs of acquiring information, myopia or hyperbolic discounting.

Country factors play a crucial role in saving attitudes of citizens (Fernandez-Lopez et al., 2010).

Complexity leads to deferral of investment decisions by individuals. Strong negative relationship between the number of funds offered and the participation rate.

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*

In the UK, it is estimated that over 90% of DC savers are included in default funds.

Lack of financial sophistication of participants may further explain the tendency to gravitate towards default funds.

Automatic enrolment has its largest impact on participation for those workers who appear to have the least amount of financial awareness and sophistication (Madrian and Shea, 2001 and Choi, 2006).

Other issues: Women show a greater risk aversion in asset allocation (Agnew, Balduzzi and Sunden, 2003); the level of risk aversion falls with increased financial education (Dwyer, Gilkeson and List, 2002). 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.

## **IV. International Experiences of Pension Reform**

The fund choice for auto-enrolment schemes tends to vary significantly from country to country.

Chile: investors may only choose from a selection of five funds.

Sweden: the mandatory system has 776 funds for investors to choose from.

US: the Thrift Saver Scheme offers only 9 funds

New Zealand: there are approximately 36 providers, all of whom offer a choice of funds.

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.

Home bias may also be an important consideration which Irish policymakers may consider if creating a default portfolio for a national auto enrolment scheme.

No evidence of home bias is found by Gerrans et al. (2006) for Western Australian or Warren (2009) for New Zealand.



## *The Kiwi-Saver NZ 2007 and NEST UK 2012 Schemes*

NEST 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.

For the Kiwi-Saver 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.

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. Most have opted for the default fund.

The Kiwi-Saver Scheme allows any provider to apply to provide the accounts, with 31 different providers, and of these, 6 have been selected to provide default funds. Provides 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.

Alternative asset classes, such as commodities, are recently becoming increasingly attractive for pension investors.

## *Formulating Investment Strategy for Pension Schemes*

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.

Asset allocation and mean-variance optimisation.

Actively or passively managed.

Lump sum against income at retirement: assets at retirement and target funds.

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*

Life Cycle funds are also referred to as Target-date funds, these funds reduce equity exposure as a predetermined retirement date approaches.

The life-styling approach does not benefit the average member and that a diversified equity-based portfolio can outperform lifestyle strategies (Booth and Yakoubov, 2000).

Life cycle funds that mimic the average optimal life cycle portfolio allocation of the investor can be approximately optimal (see, Gomes, Kotlikoff and Viciara, 2008), however forcing all investors to invest in the same fund can be costly unless they all have a similar risk tolerance.

Viciara (2009) shows that future earnings have to be extremely volatile before an individual moves to a more conservative investment policy.

Human capital and stock returns: negative or positive relation (see, Bodie, et al., 1992; Viciara, 2009; and Benzoni, 2001).

## *Comparing the Life-Styling Investment Strategy with Alternative Investment Strategies*

Using simulation analysis, Pang and Warshawsky (2008) find that the balanced fund is more likely to outperform the lifecycle fund; however, 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) find 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.

Blake (2001) and Hibbert and Mowbray (2002) 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.

The critical flaws of target-date funds are two-fold: (i) a lower equity exposure does not necessarily mean lower risk and neither equity risk nor correlations between asset classes are consistent over time and (ii) target date fund providers confuse consumers by adopting differing investment approaches (Tretiakova and Yamada, 2011).

The Safety First Strategy aims to maximise the probability of achieving at least a minimum level of required retirement income.

## **VI. 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.

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.

We also recreate 24 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.

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 period through the use of bootstrap resampling.

The bootstrapping simulation produce varying time series of returns which are then used to calculate terminal value. It is assumed that taxes and charges do not apply.



Profile for a hypothetical investor: male working between 25 and 65 and in the area of retail, catering and hospitality sector.

The replacement rate will be 75% of pre-retirement earnings, with allowance made for the State Contributory Pension (with an indexation rate of 2%).

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.

Annuity rates at age 65 years for the hypothetical investor will be used to determine the pension that can be purchased at retirement.

## *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.

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 data 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.

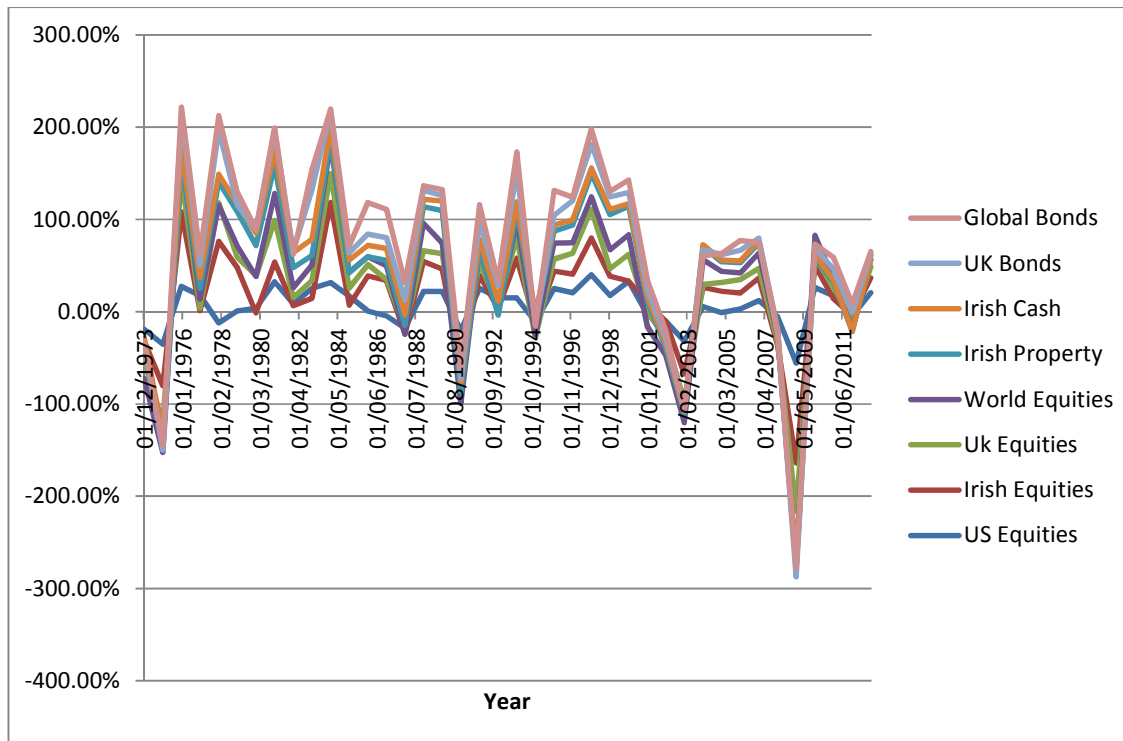
Property prices are from Hibernian Investment Managers, Irish T-Bill Returns are from Dimson, Marsh and Staunton.

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

**Table 1: Average Returns and Standard Deviations 1973-2012 (40 years) by asset class**

	<b>World Equity</b>	<b>US Equity</b>	<b>UK Equity</b>	<b>Irish Equity</b>	<b>World Bonds</b>	<b>UK Bonds</b>	<b>Irish Property</b>	<b>Irish Cash</b>
Average	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

**Figure 1: Historical Asset Returns 1973 -2012**



## *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, UK bond returns will be used in place of domestic bond allocations.

**Table 2: Average Benchmark Asset Allocations for top ten Kiwi-Saver Schemes**

<b>KiwiSaver Fund Type</b>	<b>NZ Cash</b>	<b>NZ Bonds</b>	<b>NZ Property</b>	<b>NZ Equities</b>	<b>Int.l Bonds</b>	<b>Int.l Equities</b>
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 3: Average Benchmark Allocations for NEST Target Date Funds**

<b>NEST Fund Type</b>	<b>UK Cash</b>	<b>UK Bonds</b>	<b>UK Property</b>	<b>UK Equities</b>	<b>Int.l Bonds</b>	<b>Int.l Equities</b>
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 4: Average Benchmark Allocations for Australian Superannuation Default Funds**

<b>Sector</b>	<b>AZ Cash</b>	<b>AZ Bonds</b>	<b>AZ Property</b>	<b>AZ Equities</b>	<b>Int.l Bonds</b>	<b>Int.l Equities</b>	<b>Other Assets</b>
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

24 portfolios constructed with different asset allocations.

10 of the 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. 80% of schemes de-risked over a 5-12 year period while 20% of funds de-risked over a 15 year period or upward.

**Table 5: Hypothetical Portfolios Constructed**

<b>No</b>	<b>Strategic Asset Allocation</b>	<b>Details</b>	<b>Total Equity Weighting</b>
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	Average Irish Pension Fund Allocation (2011)	53%



	Bonds (6%), Cash (17%)		
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 (20%), Irish Property (4%), UK Bonds (6%), Cash (17%)  Phase 2 at Year 36: UK Bonds (75%), Cash (25%)	Average Asset Allocation Irish Pension Funds 2011 with LifeStyling (5 years)	Phase 1: 53%  Phase 2: 0%
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%)	Average Australian Default Fund with Life Styling (8 Years)	Phase 1: 57%

	Phase 2 at Year 33: UK Bonds (75%), Cash (25%)		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%  Phase 3: 0%
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%)	Kiwi-Saver Growth Fund with Life- Styling (5 years)	Phase 1: 67%

	Phase 2 at Year 36: Global Bonds (40%), UK Bonds (35%), Cash (25%)		Phase 2: 0%
23	<p>Phase 1: World Equities (43%), Irish Equity (24%), Irish Property (10%), Global Bonds (7%), UK Bonds (5%), Irish Cash (11%)</p> <p>Phase 2 at Year 26: World Equities (22%), Irish Equity (12%), Irish Property (7%), Global Bonds (24%), UK Bonds (20%), Irish Cash (15%)</p> <p>Phase 3 at Year 34: Global Bonds (40%), UK Bonds (35%), Cash (25%)</p>	Kiwi-Saver Growth Fund with Phased Life- Styling (at 15 years and 7 years)	<p>Phase 1: 67%</p> <p>Phase 2: 36%</p> <p>Phase 3: 0%</p>
24	<p>Phase 1: World Equities (40%), US Equity (20%), Irish Equity (20%), UK Equities (20%)</p> <p>Phase 2 at Year 21: World Equities (35%), US Equity (15%), Irish Equity (15%), UK Equities (15%), Global Bonds (15%), UK Bonds (5%)</p> <p>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%)</p>	Basu and Drew Reducing Equity (20 years and 10 years)	<p>Phase 1: 100%</p> <p>Phase 2: 80%</p> <p>Phase 3: 60%</p>

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.

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 median returns, 5<sup>th</sup> and 95<sup>th</sup> percentile returns from the bootstrap is given below. As is the extent to which the target is met in each of the scenarios.

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

	<b>Avg Return</b>	<b>Std Dev</b>	<b>Contrib Rate</b>	<b>5<sup>th</sup> Per'ile</b>	<b>Target</b>	<b>Median</b>	<b>Target</b>	<b>95<sup>th</sup> Per'ile</b>	<b>Target</b>
<b>1</b>	7.25%	0.207	8%	85553	0.53	442413	0.79	2036620	1.90
			15%	167163	0.59	807241	1.05	3862506	3.20
<b>2</b>	7.76%	0.151	8%	181681	0.60	570010	0.88	1633804	1.65
			15%	361357	0.73	1051039	1.23	3131755	2.72
<b>3</b>	8.44%	0.151	8%	212026	0.63	656064	0.95	1940673	1.87
			15%	406061	0.77	1256093	1.38	3573722	3.04
<b>4</b>	8.72%	0.095	8%	301081	0.69	763130	1.02	1860903	1.81
			15%	564639	0.88	1421781	1.50	3486369	2.98
<b>5</b>	9.11%	0.151	8%	493314	0.83	907576	1.13	1649418	1.66
			15%	950132	1.16	1699227	1.69	3087339	2.69
<b>6</b>	8.68%	0.186	8%	497301	0.83	831511	1.07	1369840	1.46
			15%	944637	1.15	1560584	1.59	2582770	2.33
<b>7</b>	8.26%	0.078	8%	171886	0.60	614821	0.92	1942564	1.87
			15%	330400	0.71	1135925	1.29	3545349	3.02
<b>8</b>	10.14%	0.112	8%	531333	0.85	1101844	1.26	2502256	2.27
			15%	1006267	1.20	2055141	1.95	4065163	3.78
<b>9</b>	8.96%	0.119	8%	339336	0.72	810421	1.06	1915703	1.85
			15%	625874	0.92	1519891	1.57	3689426	3.12
<b>10</b>	8.57%	0.089	8%	254165	0.66	703605	0.98	1924541	1.86
			15%	485682	0.82	1322386	1.42	3536027	3.01

<b>11</b>	9.12%	0.080	8%	208338	0.62	745495	1.01	2525687	2.29
			15%	384681	0.75	1399930	1.48	4545684	3.74
<b>12</b>	8.04%	0.125	8%	194163	0.61	599724	0.91	1722256	1.71
			15%	362620	0.73	1139207	1.29	3225063	2.79
<b>13</b>	8.43%	0.153	8%	209249	0.62	662346	0.95	1934295	1.86
			15%	393302	0.76	1241397	1.37	3689878	3.12
<b>14</b>	8.99%	0.163	8%	257620	0.66	715029	0.99	1817286	1.78
<b>15</b>	Phase1: 10.44%	0.136	8%	353593	0.73	866708	1.1	2186996	2.04
	Phase2: 3.96%		15%	668884	0.95	1658809	1.67	4021432	3.36
<b>16</b>	Phase1: 10.1%	0.145	8%	408311	0.77	922856	1.14	2119111	2.00
	Phase2: 6.6%		15%	752599	1.01	1716486	1.71	4076311	3.40
<b>17</b>	Phase1: 10.54%	0.154							
	Phase2: 4.92%		8%	376170	0.74	842809	1.08	1945207	1.87
	Phase3: 5.15%		15%	696437	0.97	1578995	1.61	3683199	3.12

<b>18</b>	Phase1: 11.54%	0.072	8%	685619	0.98	2013501	1.90	6008714	4.67
	Phase2: 4.49%	0.016	15%	1326737	1.42	3715288	3.14	11057078	8.41
<b>19</b>	Phase1: 10.29%	0.085	8%	368258	0.74	853460	1.09	2022791	1.93
	Phase2: 3.77%	0.017	15%	689196	0.97	1595183	1.61	3833096	3.22
<b>20</b>	Phase1: 11.63%	0.083							
	Phase2: 3.57%	0.053	8%	387081	0.75	886537	1.11	2019636	1.92
	Phase3: 4.07%	0.019	15%	749967	1.01	1659334	1.67	3851715	3.23
<b>21</b>	Phase1: 10.12%	0.072	8%	281298	0.68	710704	0.98	1808179	1.77
	Phase2: 1.49%	0.039	15%	525552	0.85	1313837	1.42	3401551	2.92

<b>22</b>	Phase1: 10.10%	0.073	8%	356447	0.73	914967	1.13	2356442	2.17
	Phase2: 5.7%	0.036	15%	664229	0.95	1693242	1.69	4467018	3.68
<b>23</b>	Phase1: 11.71%	0.071							
	Phase2: 6.16%	0.071	8%	353149	0.73	860658	1.09	2131923	2.00
	Phase3: 4.18%	0.037	15%	667630	0.95	1615572	1.63	3939537	3.30
<b>24</b>	Phase1: 9.67%	0.197	8%	161376	0.6	581495	0.89	2141752	2.00
	Phase2: 7.81%	0.158	15%	310402	0.7	1100260	1.26	4022671	3.36
	Phase3: 3.15%	0.149							



## *Empirical Results and Analysis*

At the 5<sup>th</sup> percentile and a contribution level of 8% of salary none of the portfolios generated sufficient returns to achieve the target replacement income level. At a contribution level of 15%, six of the twenty-four portfolios generated sufficient return at the 5<sup>th</sup> percentile and three of these were life-style portfolios.

At the median level, for 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 95<sup>th</sup> percentile. At the median, none of these achieved the target replacement rate at the 8% contribution rate.

At the median, three of the four Kiwi-Saver funds (#4-7) generated sufficient returns at the 8% contribution level and both the Default Fund (#6) and Conservative Fund (#5) generated sufficient returns at the 5<sup>th</sup> percentile at a contribution rate of 15%.

The NEST Pre-Retirement Fund performed well in terms of adequacy, although 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 near target at 0.98.

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 (#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 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.

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**

An 8% contribution rate may not be sufficient and a contribution of between 8% and 15% may be more likely to achieve the required replacement ratio

While this analysis assumes that the typical investor will be earning a low level of income, it is easy to expand to consider other income classes.

The bootstrapping results provides support for the practice of life-styling in order to reduce risk immediately prior to retirement and provides evidence of how successful life-cycling strategies can be in also generating the target replacement income level on retirement.

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.