



Challenger Limited

## **Comparing Retirement Income Strategies**

August 2014



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# Section 1: Introduction

- 1.1 Towers Watson has been commissioned by Challenger Group Services Pty. Ltd. (“Challenger”) to model various strategies for generating income in retirement and to compare these using a range of measurement approaches or “metrics”.

## Previous work

- 1.2 The report uses substantially the same modelling framework, and many similar concepts, as the following previous reports conducted for Challenger:

- “Retirement income modelling” – issued in September 2009 by Watson Wyatt (a predecessor firm of Towers Watson); and
- “Superannuation Modelling – Accumulation Phase” – issued December 2009 by Watson Wyatt.

## Project Objectives and Focus

- 1.3 The objective of this investigation is to quantitatively assess how well the various strategies deliver income that match a given goal or “target” level of income throughout a retiree’s period of retirement up until death. The target income levels may be either flat or shaped to reflect specific patterns of retirement income. With this objective in mind, we have utilised a number of well-established metrics as well as what we believe to be a substantially new metric (which we term the “goodness of fit index”, or “GOFI”) in order to compare the various strategies.

- 1.4 The model employed in previous reports has been extended to include strategies which use:

- Deferred annuities; and
- Group self-insured annuities

as well as account based pensions and immediate annuities.

- 1.5 A range of scenarios are examined, including strategies using combinations of the above products, and variations to the target income levels and shapes, and to annuity prices. In producing the results for this report, a number of other scenarios were modelled to help understand the drivers behind the results. As a result, this report contains only a sample of the results available, and we would be pleased to provide further results upon request.

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## Section 2: Modelling Framework

### Retiree Investor Profile

- 2.1 Our investigations have been based on a model retiree who is a single male who has just retired at age 65.
- 2.2 The income and account balance results in this report are expressed as a percentage of the initial superannuation account balance. We have assumed the retiree's notional account balance at retirement is \$400,000. However, as age pension is not included in the modelling, the results are substantially the same when applied to any account size. (The dollar amount of account balance affects only some asset based fees applied, which have only a marginal effect on results).

### Retirement Income Strategies

- 2.3 The following strategies for generating retirement income are considered:
- Strategy 1: 100% invested in an account based pension (ABP);
  - Strategy 2: 30% invested in an immediate lifetime annuity and 70% invested in an account based pension;
  - Strategy 3: 100% used to purchase an immediate lifetime annuity;
  - Strategy 4: 10% used to purchase a 20 year deferred lifetime annuity and 90% invested in an account based pension;
  - Strategy 5: 50% invested in a group self-insured annuity (GSA) and 50% invested in an account based pension; and
  - Strategy 6: 100% invested in a GSA
- 2.4 In each strategy where an account based pension is included, the account is assumed to be invested in 70% 'growth assets' and 30% 'defensive assets', with annual rebalancing. A breakdown of the assumed allocation of growth and defensive portfolios into various asset classes is detailed in Appendix C.

### Group Self-Insured Annuity

- 2.5 A group self-insured annuity is a pooled mortality crediting arrangement. Under a GSA, the retiree invests in a pooled group of assets with other participating members. As members of the pool die, their share of the pool is divided amongst the surviving members. The additional return to the surviving members is known as a 'mortality credit'.

- 2.6 There are a range of GSA designs possible. In this investigation, we assume that the GSA distributes mortality credits to surviving participants annually, as an additional lump sum credit to the account. In all other respects, the GSA operates in the same way as an account based pension.
- 2.7 In modelling the GSA, we assume that every participant in the pool (including the model retiree) is the same age, has the same initial balance, invests in the same way and draws down the same dollar amount from the GSA each year, so that the exposure of each surviving participant in the GSA in any year is the same as that of the model retiree.

## Target Income Framework

- 2.8 Consistent with our previous reports, we have adopted a “target income” framework in this investigation. Under this framework, the retiree endeavours to draw a specified level of retirement income each year until death, drawing upon all sources available under the strategy. To the extent that a strategy is unable to deliver target income in any year (for example, once an account based pension has been exhausted) the retiree draws the maximum amount available (which may be zero).
- 2.9 As the target income (which may vary with age) is the same across all strategies being assessed, a target income framework allows the use of metrics such as the residual account balance at a given age to assist in comparing the success of each of the strategies at meeting this target over the retiree’s lifetime.
- 2.10 In this investigation, target income is specified as a percentage of the initial superannuation account balance at retirement (e.g. an income of 7.5% of the initial account). The target income in each year is assumed to be indexed with CPI to maintain its purchasing power over retirement.

## Target Incomes Considered

- 2.11 Our core scenario considers “flat” (i.e. constant real) target incomes at three levels, as follows:

Flat Target Income	Percentage of initial balance
High	8.5%
Medium (Core scenario)	7.5%
Low	6.5%

2.12 A flat target income effectively assumes the retiree’s desired spending level remains constant in real terms over retirement. There are a number of alternative spending patterns that may be considered applicable to retirees. In order to investigate these we have also modelled the following target incomes:

- “tapered” – the target income reduces when the retiree moves from the active to passive stage of retirement, and reduces again from the passive to frail stages of retirement. This shape reflects reducing spending needs as the retiree’s level of activity declines.
- “U-shaped” – the target income reduces when the retiree moves from the active to passive stage of retirement, but increases when the retiree moves from the passive to frail stage of retirement. This shape reflects increased aged care costs incurred in the frail stage of retirement.

2.13 The flat, tapered and U-shaped target incomes modelled are shown in the Table below.

Target Income	Percentage of initial balance
Tapered	9.5% from age 65 to 74; 8.5% from age 75 to 84; and 7.5% thereafter
U-shaped	8.5% from age 65 to 74; 7.5% from age 75 to 84; and 8.5% thereafter

**Real Dollars**

2.14 All dollar amounts have been deflated at CPI in order to present results in today’s dollars.

**Asset Returns**

2.15 All investment returns and other market indicators used in the modelling in this report are generated using the Towers Watson Global Asset Model. This is a projection tool which generates stochastic rates of investment returns, interest rates, and other market indicators such as the level of Consumer Price Indexation (CPI) and Average Weekly Ordinary Time Earnings (AWE). The model includes most of the major global asset classes and a correlation matrix has been developed as part of this model to ensure results are as consistent as possible with real world outcomes. Further details of that model and the underlying assumptions are contained in Appendix D.

2.16 As agreed with Challenger, Towers Watson’s standard asset model has been modified to remove some short-term effects which were incorporated to reflect the current state of financial markets. These adjustments were deemed appropriate as this research is intended to reflect a long-term view on the performance of different retirement products and strategies and therefore should avoid any bias in outcomes as a result of current financial market conditions.

## Annuity Pricing

- 2.17 The framework for pricing immediate and deferred lifetime annuity rates has been discussed with Challenger to provide a specific return to the policyholder allowing for our assumptions on cohort mortality. The return to the policyholder is specified as a prescribed margin over prevailing swap rates.
- 2.18 A summary of the annuity rates provided and a more detailed description of this process is set out in Appendix C. The income from the annuities increases annually in line with the Consumer Price index (CPI), with a minimum of 0%;
- 2.19 The mortality assumed in pricing the immediate and deferred annuities; of the cohort investing in the GSA; and for the purpose of calculating the probability of success and GOFI metrics, is detailed in Appendix C. This mortality is assumed to be lighter than population mortality, thus reflecting a degree of self-selection of annuity purchasers and GSA participants.

## Age Pension

- 2.20 All of the modelling and analysis performed in this report excludes any income provided by the Government Age Pension.

## Account based Pension Fees

- 2.21 Account based pension platform and administration fees, detailed in Appendix C, are in line with the FSC Superannuation Fees Report 2013 published by Rice Warner Actuaries for Retail Retirement Income Products.

## Section 3: Charts and Metrics

- 3.1 This section describes the charts and metrics used to assess and compare the various strategies considered in this report.

### Total Income Distribution Charts

- 3.2 These charts (included in Appendix A) show the progression of total income from each strategy and how it compares against our chosen target income level.
- 3.3 The stochastic nature of the underlying investment model means that our model results in a probabilistic range of retirement income results from which we are then able to use to draw conclusions. The charts show the 5<sup>th</sup>/25<sup>th</sup>/median/75<sup>th</sup>/95<sup>th</sup> percentiles of total income at each age.

### Available Assets

- 3.4 For any strategy, the 'available assets' represents the portion of assets remaining to the credit of the retirees at the assumed date of death (or given age). This amount represents the bequest that the retiree would leave to their estate if they were to die at that age. This is determined as the balance remaining in the account based pension. Balances remaining in a GSA on death do not form part of this amount, as any such balances are shared with remaining GSA participants. Strategies incorporating an annuity take a portion of their assets out of the account based pension and thereby reduce the amount available on death.
- 3.5 The tables in the next section set out, for each strategy, the median and 5<sup>th</sup> percentile of the age at which available assets on death falls to zero, and also the 5<sup>th</sup> percentile, median and 95<sup>th</sup> percentile of the amount of the available assets at age 85. The charts (included in Appendix B) show the full distribution of the available account based on death at each future age.

### Probability of Success

- 3.6 Given the objective of delivering target income through the retiree's lifetime, a natural metric to consider in a stochastic modelling framework is the probability of achieving "success".
- 3.7 We define a particular strategy to have achieved "success" in a particular simulation if the strategy delivers (within the target income framework) target income in all years of retirement up to the year of the retiree's death. The probability of success metric is then defined as the proportion of all simulations that achieve success.
- 3.8 Probability of success is a useful summary metric for comparing different strategies. However, it does not distinguish between scenarios where the strategy just falls short of delivering a successful outcome, and where it fails comprehensively. This is addressed by our next metric.

## Goodness of Fit

3.9 Towers Watson has developed a substantially new metric which we denote the “Goodness of Fit Index” (GOFI).

3.10 The GOFI aims to measure how well a given product or strategy delivers retirement income in line with a pre-determined desired or “target” income. Hence, a pre-condition to measuring GOFI is an agreed target income for the retiree. The target income is specified in terms of the notional purchase price (e.g. an income of 7.5% of the initial capital, indexed with CPI, continuing until death). Clearly a range of target incomes could be selected, and the relative GOFI measures of different products will differ for different target incomes.

3.11 For a given product or strategy, the projected (real) cash flows and the shortfall of these cash flows relative to target income (shortfall<sub>i</sub>) are determined for each projection year  $i = 1, 2, 3, \dots$ . The GOFI for that set of cash flow projections is then calculated as:

$$\text{Goodness of Fit Index (GOFI)} = 1 - \sqrt{\frac{\sum_i (\text{shortfall}_i)^2}{\sum_i (\text{Target Income}_i)^2}}$$

where the summations are over each projection year up to the end of the specified target income period (e.g. until death, or a fixed age).

3.12 Generally the projected cash flows will be dependent on a market variable. For example, income from an account based pension will depend on market returns, and the income from an annuity will depend on the prevailing interest rates at the date(s) of purchase. In such cases a set of simulated cash flows would be derived stochastically, and the GOFI determined for each such simulation up to the simulated date of death.

3.13 The GOFI for the product or strategy is then taken to be the weighted average of the GOFIs across all investment market simulations.

3.14 Features of the GOFI include:

- GOFI lies between 0 and 1; 1 indicates a perfect fit to the target income, 0 indicates no income (so that the shortfall equals the target income at all times).
- GOFI takes into account how well the “shape” of income produced by a product/strategy matches target income. For example, an income producing product would have a higher GOFI than a lump sum of the same value. Other than reflecting shortfalls up to date of death only, the GOFI metric does not assume a preference for “earlier” rather than “later” cash flows, in the way a discounted cash flow metric may.
- GOFI factors in the extent to which income produced by a product or strategy falls short of delivering the target income over a lifetime. Hence a term annuity which may cease prior to an individual’s death would have a lower GOFI than a life time annuity at the same income level.

- Intuitively, the GOFI can be regarded as the "average" proportion of target income delivered allowing for downside (but not upside) differences.
- GOFI reflects presumed relative risk aversion of retirees on a year by year basis. That is, a product or strategy which results in a large shortfall in a single year produces a lower GOFI than a strategy that delivers a smaller shortfall across a number of years, even if the aggregate shortfall is the same for each.
- GOFI is not a simple measure (it requires a stochastic framework for it to be calculated for most strategies) and (as noted above) the GOFI measure depends among other things on a prescribed target income. However in our view it captures and summarises different product design aspects in a way that measures like the probability of success cannot, and therefore is a valuable tool in comparing different retirement income strategies.

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## Section 4: Results

### Core Results

4.1 The table below summarises key results for a target income of 7.5% of the initial balance.

**Table 1: Core results**

Strategy	Age at which available assets fall to zero		Available assets at age 85*			Probability of success	GOFI
	Median	5th Percentile	5th percentile	Median	95th percentile		
St 1 - Account Based Pension (ABP)	86	78	0%	14%	150%	49%	73%
St 2 - ABP + Lifetime Annuity	88	79	0%	13%	106%	51%	83%
St 3 - Lifetime Annuity	65	65	0%	0%	0%	66%	99%
St 4 - ABP + Deferred Annuity from 85	84	77	0%	0%	115%	47%	80%
St 5 - ABP + GSA	87	78	0%	6%	67%	59%	78%
St 6 – GSA	65	65	0%	0%	0%	65%	81%

\* Available assets expressed as a percentage of the Initial retirement account balance

- 4.2 The table above illustrates the trade-offs associated with the various strategies. For example, investing all of the retirement account in a lifetime annuity or GSA leaves no available assets on death immediately from the date of purchase. Conversely, strategies which leave part of the capital in an account based pension are more likely to keep assets available upon the retiree's death (e.g. for bequest purposes).
- 4.3 A GSA strategy generally improves outcomes relative to an account based pension, on account of mortality credits. However, a GSA strategy leaves reduced (or no) assets on death as these are shared with remaining participants.
- 4.4 The median age at which available assets are exhausted illustrates the period of time some assets would be available to dependents on the death of the retiree. An age of 65 indicates that all assets have been used to purchase a product that does not have any assets available on death.
- 4.5 Probability of success is in the range 40% – 70% across all strategies, illustrating the difficulty in achieving “success” across all market conditions. However, the GOFI metric, which captures not only whether a strategy falls short of success but the extent of the shortfall, indicates more positive results of between 70% and 100%.

- 4.6 Strategies involving account based pension produces lower GOFIs, relative to the corresponding probability of success. This follows from the fact that where an account based pension falls short of target income, this indicates the account has run out and hence income falls to zero. Annuity strategies can fall short of target but still produce incomes, improving the GOFI score. In the remaining tables in this section, we have shown only median 'age available assets exhausted' and GOFI to compare the strategies using different underlying assumptions. Full results in the format above are shown in Appendix A.

### Impact of Target Income Level

- 4.7 The table below summarises key results for higher and lower flat target incomes. More detailed tables of results for each scenario can be found in Appendix A and charts in Appendix B.

**Table 2: Impact of Target Income Level**

Target Income (% of initial balance)	7.5%		6.5%		8.5%	
Strategy	Age at which available assets fall to zero - Median	GOFI	Age at which available assets fall to zero - Median	GOFI	Age at which available assets fall to zero - Median	GOFI
St 1 - Account Based Pension (ABP)	86	73%	94	84%	82	63%
St 2 - ABP + Lifetime Annuity	88	83%	101	93%	82	71%
St 3 - Lifetime Annuity	65	99%	65	100%	65	92%
St 4 - ABP + Deferred Annuity from 85	84	80%	105	90%	80	68%
St 5 - ABP + GSA	87	78%	94	88%	83	66%
St 6 – GSA	65	81%	65	91%	65	70%

- 4.8 Where the target income is lower, all strategies naturally perform well, as evidenced in particular by GOFI scores of above 80% under all strategies for the low target income (6.5%). As target income increases, probability of success and GOFI scores fall fairly uniformly for all strategies except the GOFI for the 100% lifetime annuity, which falls at a lower rate than other strategies due to the fact that GOFI better captures the continuation of the annuity income stream throughout retirement even where the annuity level falls short of target.

## Impact of Target Income Shape

4.9 The table below summarises key results for varying shapes of target incomes.

**Table 3: Impact of Target Income Shape**

Target Income (% of initial balance)	Flat (7.5%)		Tapered (9.5%/8.5%/7.5%)		U-Shaped (8.5%/7.5%/8.5%)	
Strategy	Age at which available assets fall to zero - Median	GOFI	Age at which available assets fall to zero - Median	GOFI	Age at which available assets fall to zero - Median	GOFI
St 1 - Account Based Pension (ABP)	86	73%	80	60%	83	66%
St 2 - ABP + Lifetime Annuity	88	83%	79	68%	84	75%
St 3 - Lifetime Annuity	65	99%	65	86%	65	93%
St 4 - ABP + Deferred Annuity from 85	84	80%	79	63%	81	73%
St 5 - ABP + GSA	87	78%	81	62%	84	70%
St 6 – GSA	65	81%	65	65%	65	73%

4.10 Relative to annuities, an account based pension is flexible enough to meet a varying target income, especially in the earlier years before the account is depleted. Hence, strategies that contain an account based pension drawdown do relatively better under varying target incomes than flat. The flat 7.5% target income has higher GOFI scores for all strategies as it has the lowest target income overall. However, if we compare the tapered and U-shaped strategies to the higher flat 8.5% target income in Table 2, we see that the relative decrease in the GOFI for a lifetime annuity is larger than the decrease for the other strategies that have this drawdown flexibility.

## Impact of Annuity Pricing

4.11 The table below shows the impact of pricing the annuity as the return to the policyholder using a lower specified margin above swap rates.

**Table 4: Impact of Annuity Pricing**

Strategy	Base Scenario		Lower Annuity Prices	
	Age at which available assets fall to zero - Median	GOFI	Age at which available assets fall to zero - Median	GOFI
St 1 - Account Based Pension (ABP)	86	73%	86	73%
St 2 - ABP + Lifetime Annuity	88	83%	88	79%
St 3 - Lifetime Annuity	65	99%	65	94%
St 4 - ABP + Deferred Annuity from 85	84	80%	84	78%
St 5 - ABP + GSA	87	78%	87	78%
St 6 – GSA	65	81%	65	81%

4.12 The lower annuity prices reduce the GOFI scores for the annuity strategies. However, the GOFI scores remain above other strategies, reflecting the fact that providing a certain income through a retiree's lifetime, even when falling short of target income, provides a better fit to the target income objective overall than a strategy which meets target income for some years and then falls to zero prior to the retiree's death.

## Section 5: Reliances and Limitations

### Reliances

- 5.1 In carrying out our analysis and producing this report we have relied without independent verification upon the accuracy and completeness of the data and information provided to us, both in written and oral form, by Challenger which was the primary source of information discussed in the Report.
- 5.2 Reliance has been placed upon, but not limited to, the framework for pricing annuity rates discussed with Challenger and described in Appendix C.

### Limitations

- 5.3 The Report has been prepared by Towers Watson on an agreed basis to meet the specific purposes of Challenger Group Services Pty Ltd communicated to Towers Watson and must not be relied upon for any other purpose.

The Report has been prepared solely for use by persons technically competent in the areas covered.

Except with the written consent of Towers Watson, the Report and any written or oral information or advice provided by Towers Watson must not be reproduced, distributed or communicated in whole or in part to any other person, or be relied upon by any other person. No reference shall be made to Towers Watson in any report, accounts or other published documents without our prior written consent.

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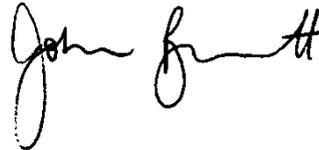
If reliance is placed contrary to the requirements set out above, Towers Watson and its directors, employees and related bodies corporate disclaim any and all liability which may arise as a consequence.

- 5.5 Assumptions are made about future experience, including mortality and asset class returns. These assumptions have been made on the basis of reasonable estimates. However, actual future experience is likely to differ from these assumptions, due to random fluctuations, changes in the operating environment, and other factors. Such variations in experience could have a significant effect on the results and conclusions of this Report. No warranty is given by Towers Watson that the assumptions made in this Report will be reflected in actual future experience.

- 5.6 This Report was based on data available to Towers Watson at, or prior to, 25 August 2014, and takes no account of developments after that date. The suitability of this Request for Challenger's purposes may be affected by subsequent changes to the legal, regulatory, economic and financial environments. In the event of such changes, further advice should be sought from Towers Watson as to the suitability of this Request for reliance purposes.
- 5.7 This Report is provided subject to the terms and limitations, including limitation of liability, set out in our engagement letter of 21 July 2009.



Nick Callil  
Head of Retirement Income Solutions, Australia



Review: John Burnett

26 August 2014

Towers Watson Australia Pty Ltd  
Level 23, 55 Collins Street  
Melbourne  
VIC 3000  
Australia

T +61 3 9655 5163  
F +61 3 9654 8227

## Appendix A: Further Results

**Table 5: Key results – Target Income = 6.5% of initial balance**

Strategy	Age at which available assets fall to zero		Available assets at age 85*			Probability of Success	GOFI
	Median	5th Percentile	5th percentile	Median	95th percentile		
St 1 - Account Based Pension (ABP)	94	80	0%	49%	167%	66%	84%
St 2 - ABP + Lifetime Annuity	101	83	0%	46%	121%	76%	93%
St 3 - Lifetime Annuity	65	65	0%	0%	0%	99%	100%^
St 4 - ABP + Deferred Annuity from 85	105	79	0%	21%	140%	70%	90%
St 5 - ABP + GSA	94	81	0%	23%	75%	77%	88%
St 6 – GSA	65	65	0%	0%	0%	82%	91%

^Due to rounding

**Table 6: Key results – Target Income = 8.5% of initial balance**

Strategy	Age at which available assets fall to zero		Available assets at age 85*			Probability of Success	GOFI
	Median	5th Percentile	5th percentile	Median	95th percentile		
St 1 - Account Based Pension (ABP)	82	76	0%	0%	123%	35%	63%
St 2 - ABP + Lifetime Annuity	82	76	0%	0%	77%	31%	71%
St 3 - Lifetime Annuity	65	65	0%	0%	0%	11%	92%
St 4 - ABP + Deferred Annuity from 85	80	76	0%	0%	71%	29%	68%
St 5 - ABP + GSA	83	77	0%	0%	56%	41%	66%
St 6 – GSA	65	65	0%	0%	0%	47%	70%

**Table 7: Key results – Target Income = Tapered**

Strategy	Age at which available assets fall to zero		Available assets at age 85*			Probability of Success	GOFI
	Median	5th Percentile	5th percentile	Median	95th percentile		
St 1 - Account Based Pension (ABP)	80	75	0%	0%	91%	28%	60%
St 2 - ABP + Lifetime Annuity	79	75	0%	0%	46%	23%	68%
St 3 - Lifetime Annuity	65	65	0%	0%	0%	1%	86%
St 4 - ABP + Deferred Annuity from 85	79	74	0%	0%	41%	23%	63%
St 5 - ABP + GSA	81	76	0%	0%	43%	33%	62%
St 6 – GSA	65	65	0%	0%	0%	38%	65%

**Table 8: Key results – Target Income = U-Shaped**

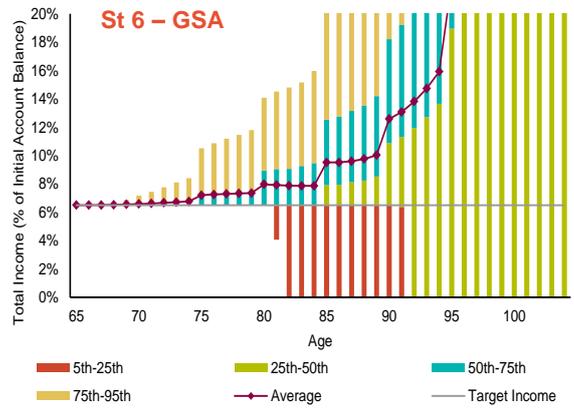
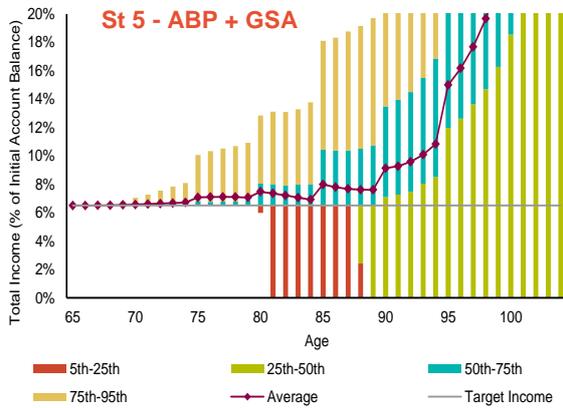
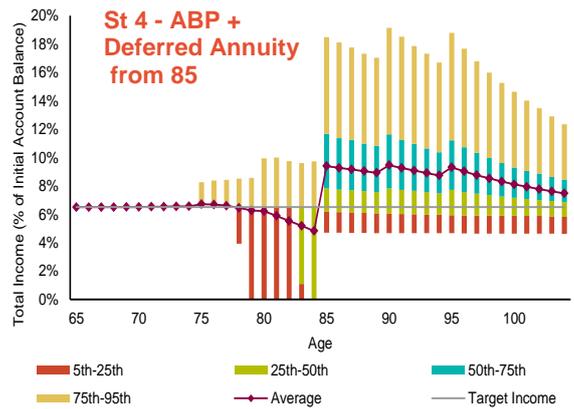
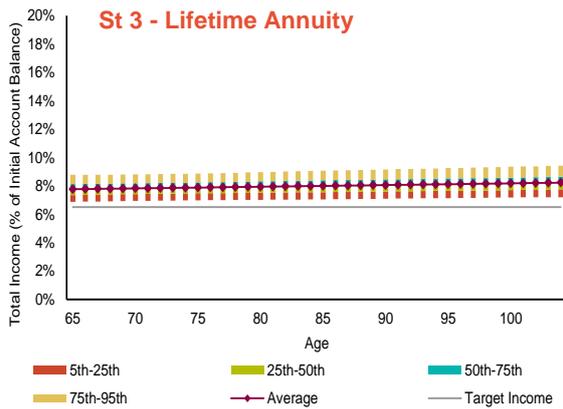
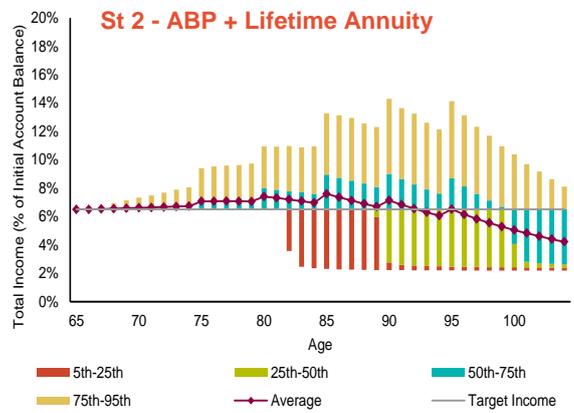
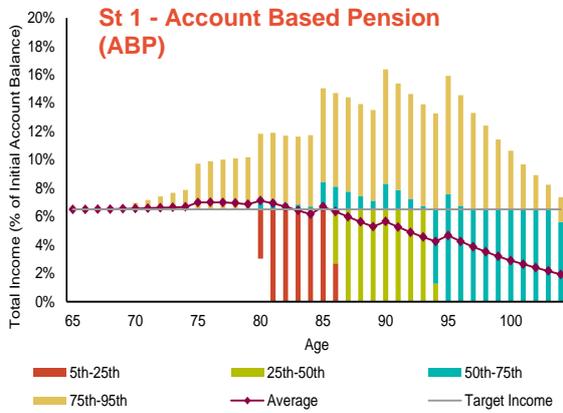
Strategy	Age at which available assets fall to zero		Available assets at age 85*			Probability of Success	GOFI
	Median	5th Percentile	5th percentile	Median	95th percentile		
St 1 - Account Based Pension (ABP)	83	76	0%	0%	128%	38%	66%
St 2 - ABP + Lifetime Annuity	84	77	0%	0%	84%	36%	75%
St 3 - Lifetime Annuity	65	65	0%	0%	0%	11%	93%
St 4 - ABP + Deferred Annuity from 85	81	76	0%	0%	85%	33%	73%
St 5 - ABP + GSA	84	77	0%	0%	58%	46%	70%
St 6 – GSA	65	65	0%	0%	0%	52%	73%

**Table 9: Key results – Target Income = 7.5%, Lower Annuity Pricing**

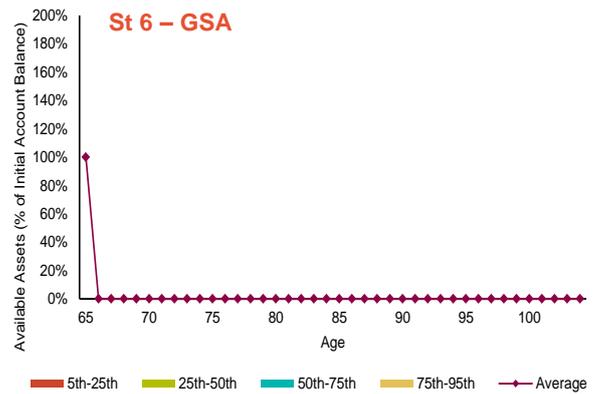
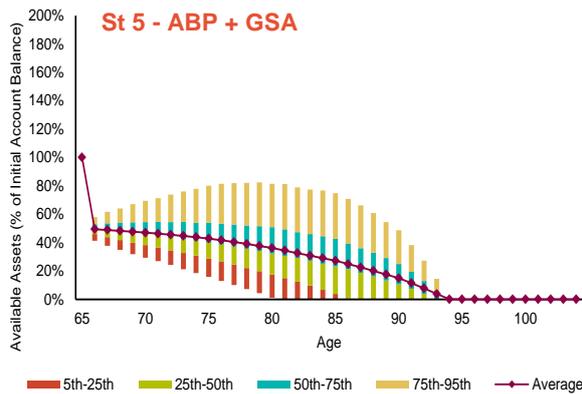
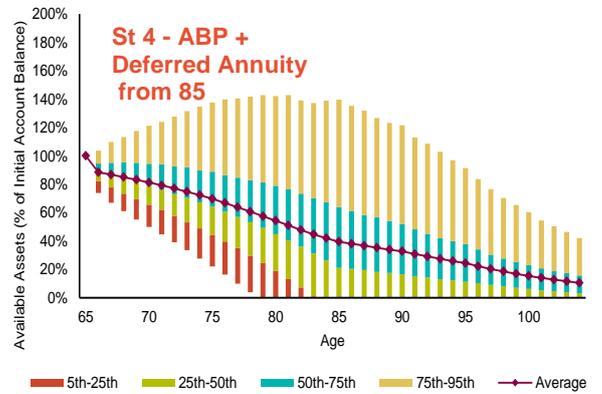
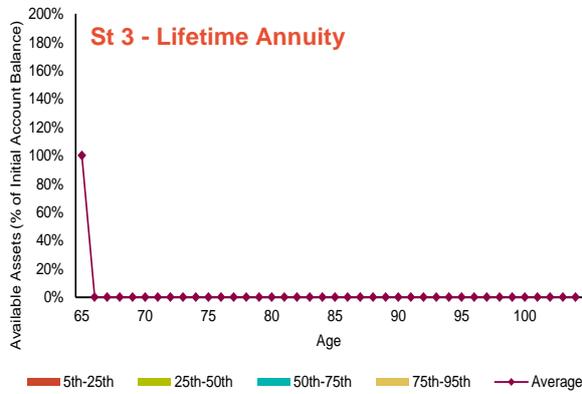
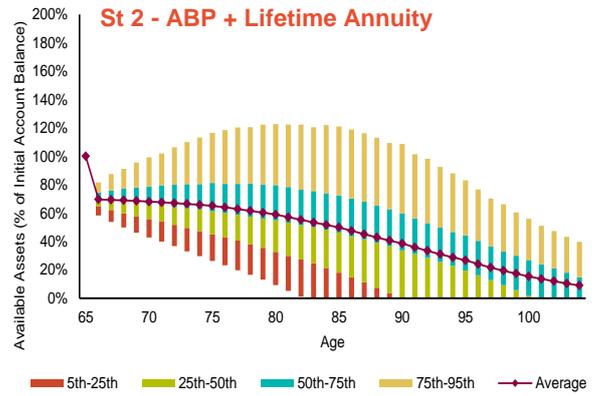
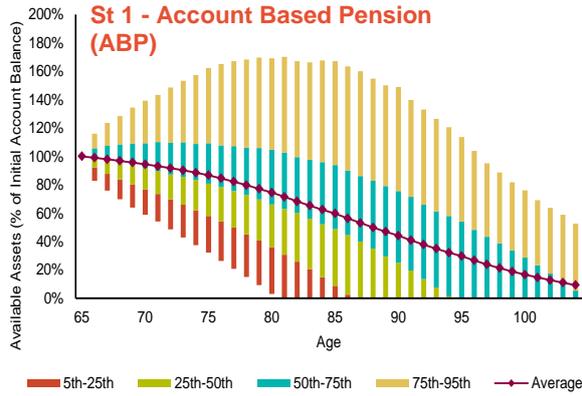
Strategy	Age at which available assets fall to zero		Available assets at age 85*			Probability of Success	GOFI
	Median	5th Percentile	5th percentile	Median	95th percentile		
St 1 - Account Based Pension (ABP)	86	78	0%	14%	150%	49%	73%
St 2 - ABP + Lifetime Annuity	88	79	0%	13%	106%	46%	79%
St 3 - Lifetime Annuity	65	65	0%	0%	0%	18%	94%
St 4 - ABP + Deferred Annuity from 85	84	77	0%	0%	115%	44%	78%
St 5 - ABP + GSA	87	78	0%	6%	67%	59%	78%
St 6 – GSA	65	65	0%	0%	0%	65%	81%

# Appendix B: Charts

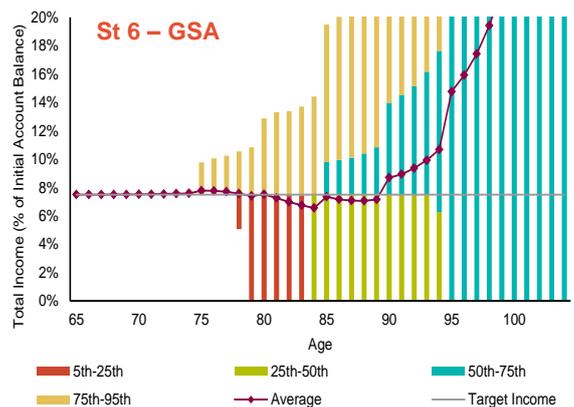
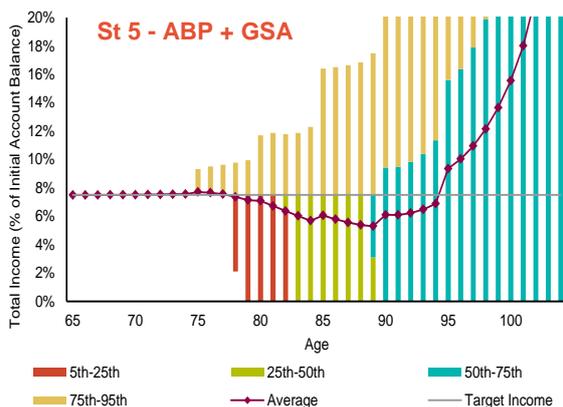
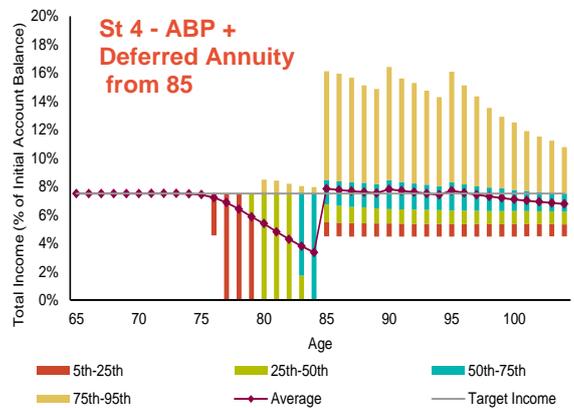
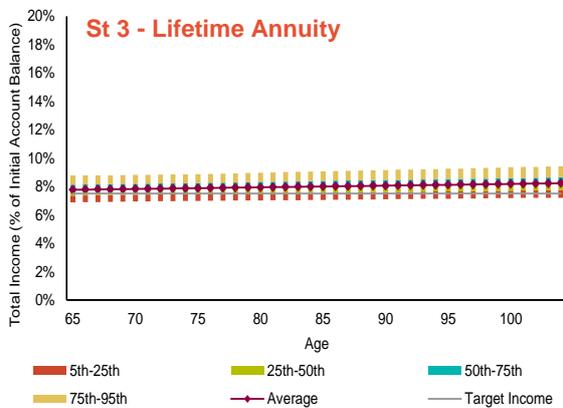
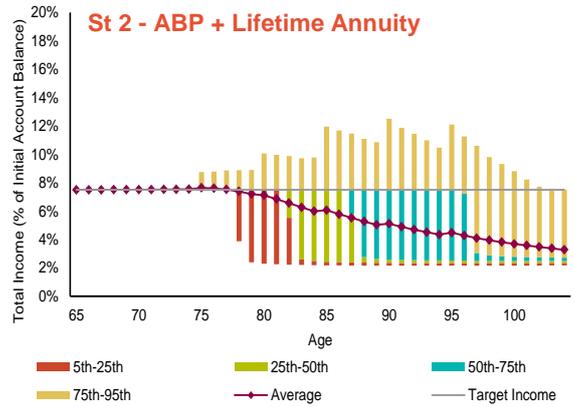
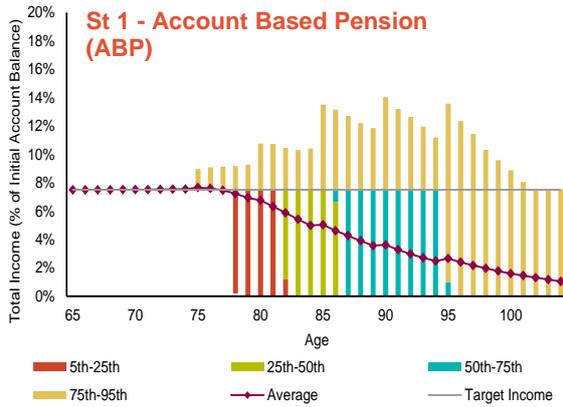
## Distribution of Total Income - Target Income – Flat 6.5%



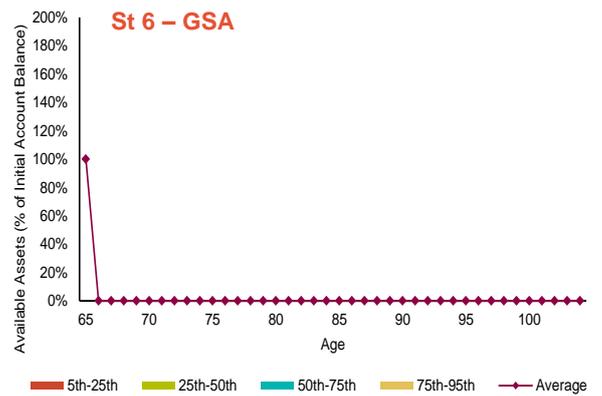
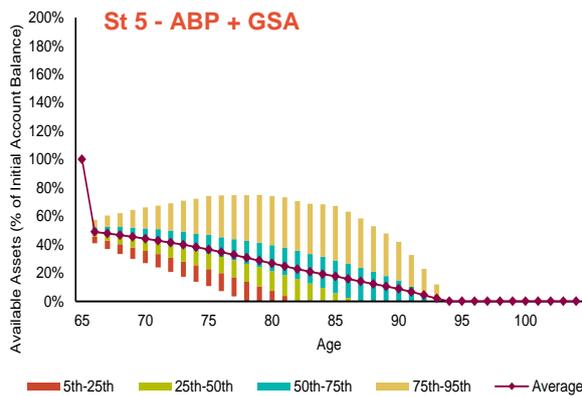
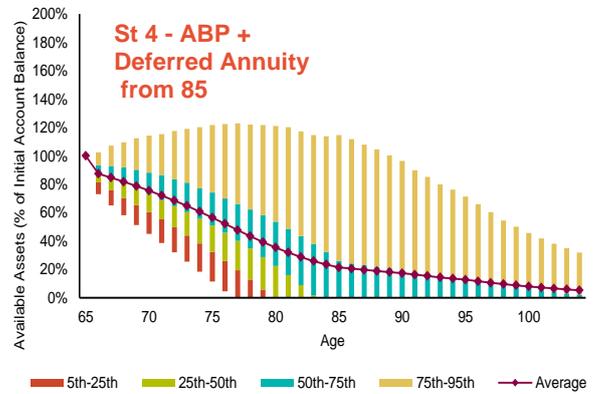
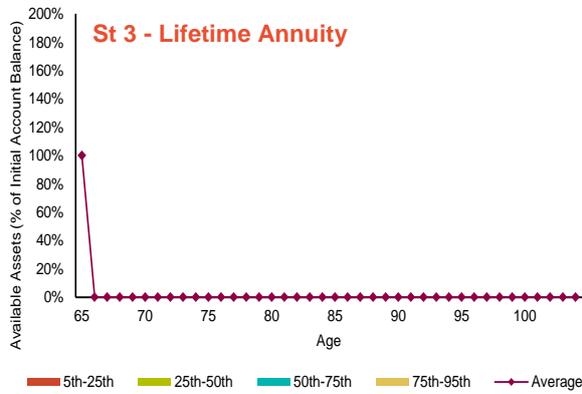
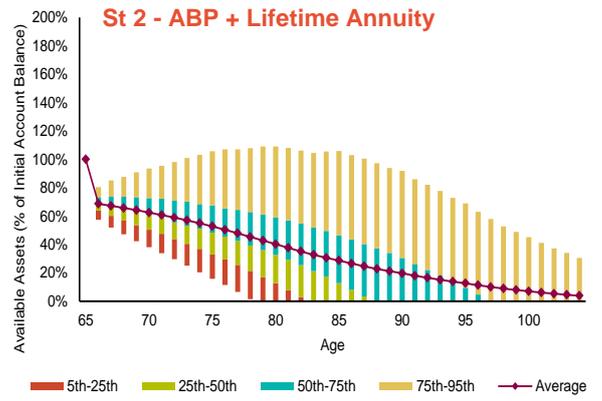
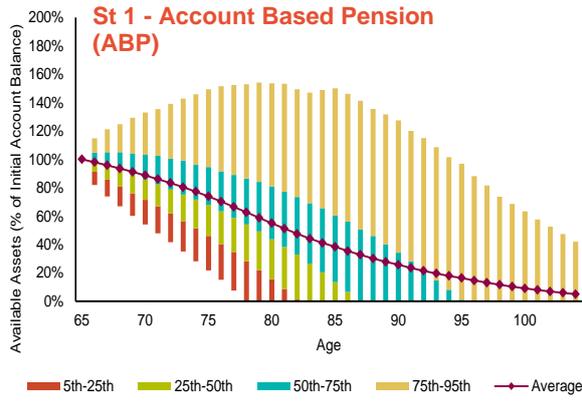
**Distribution of Available Assets- Target Income – Flat 6.5%**



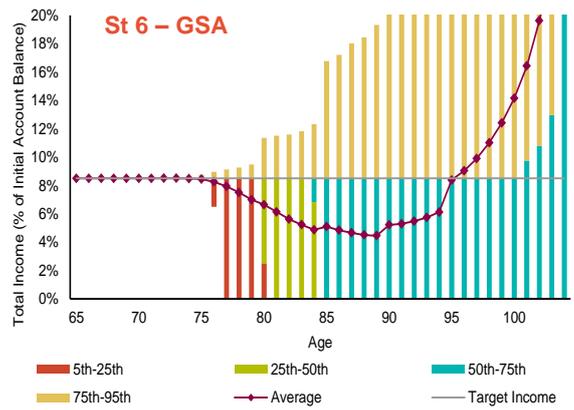
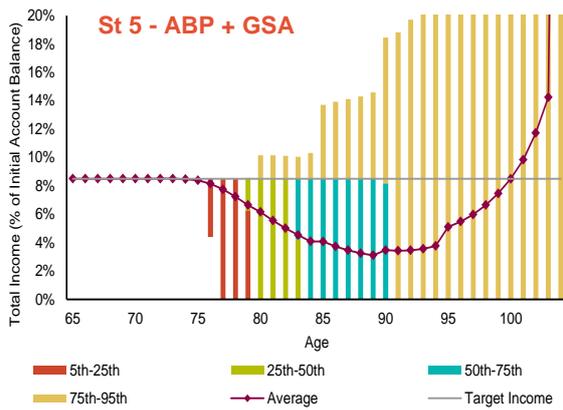
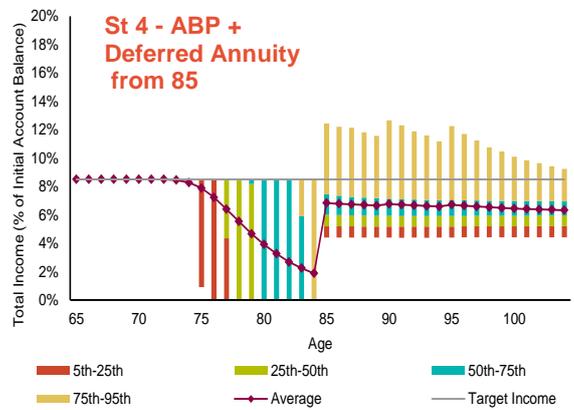
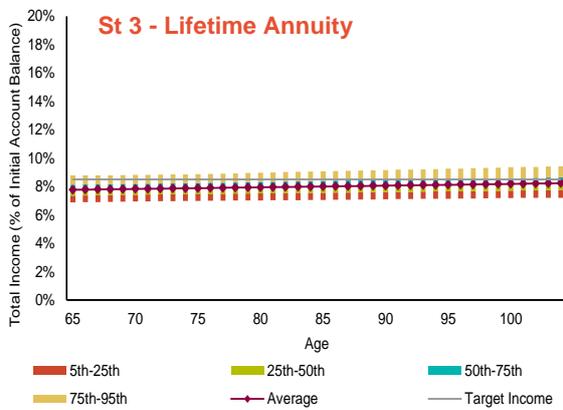
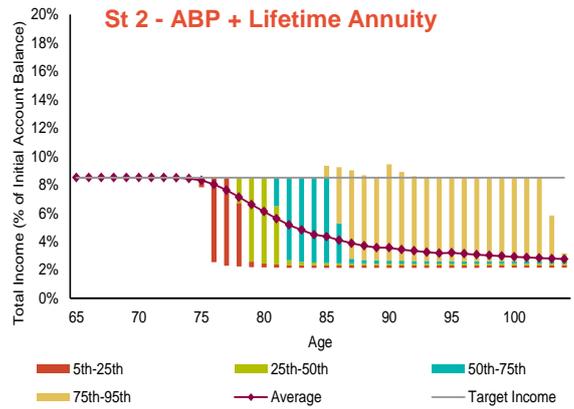
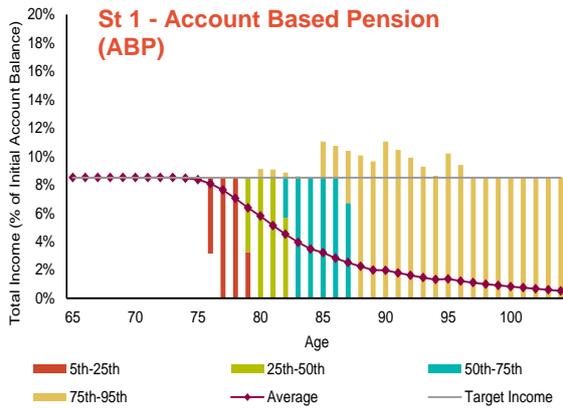
**Distribution of Total Income - Target Income – Flat 7.5%**



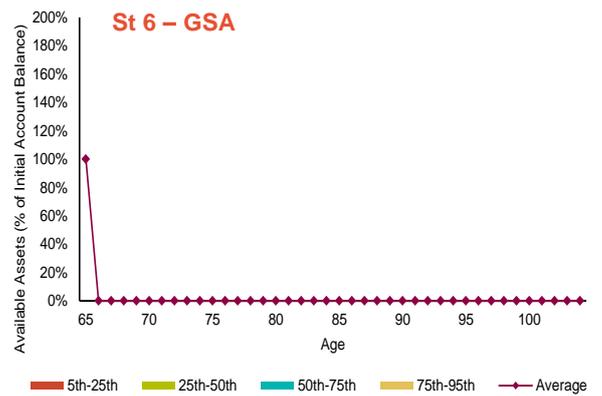
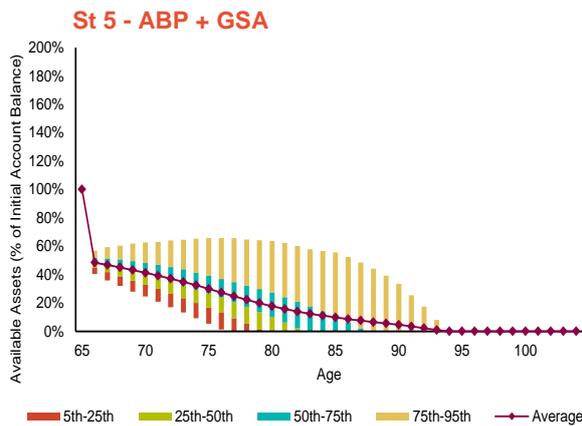
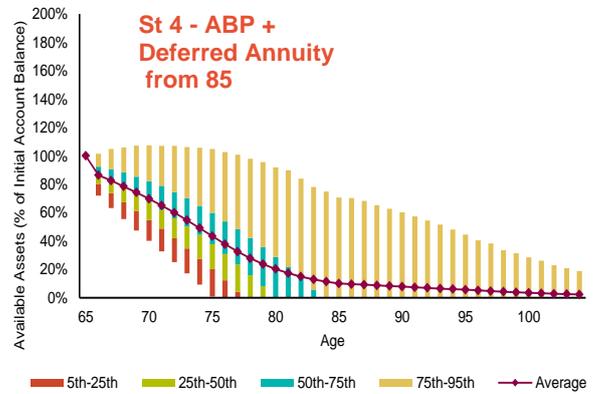
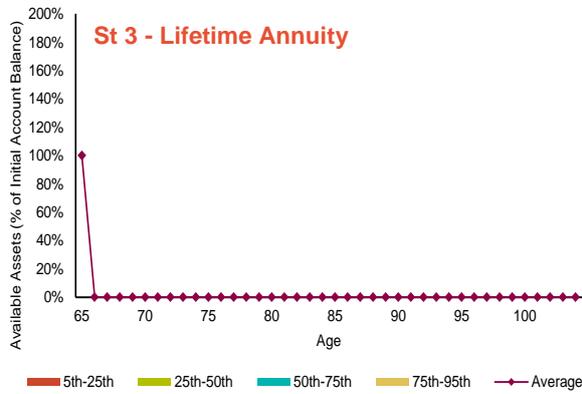
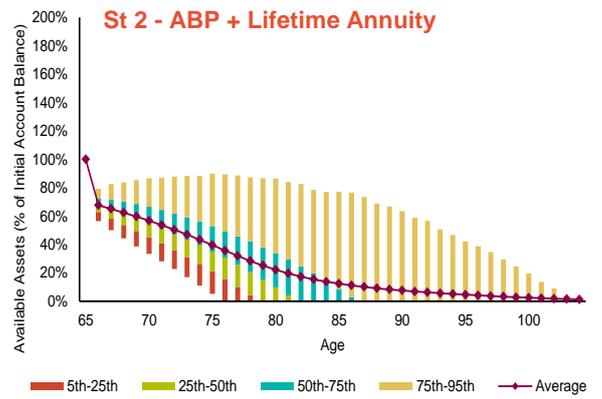
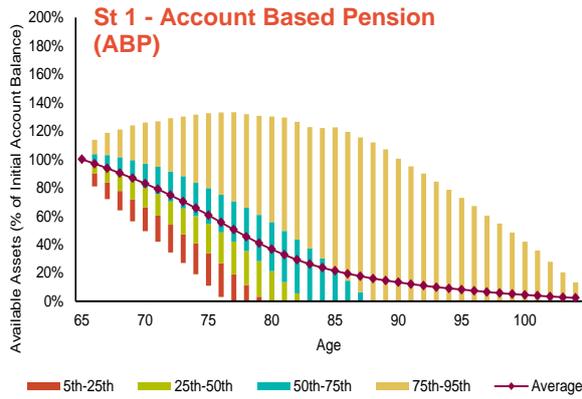
**Distribution of Available Assets - Target Income – Flat 7.5%**



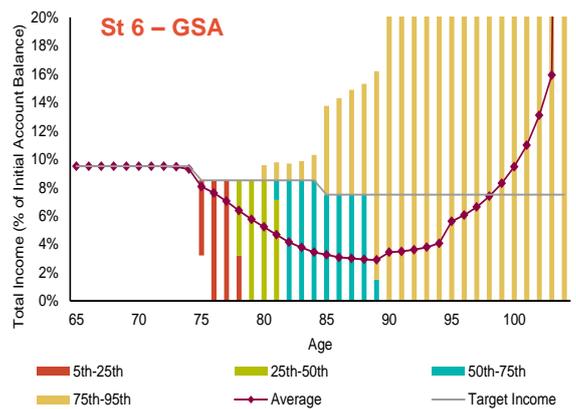
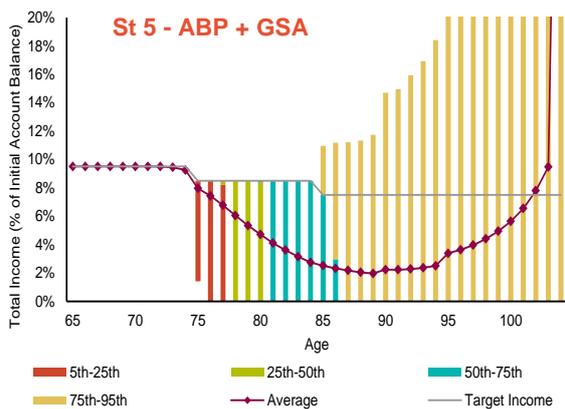
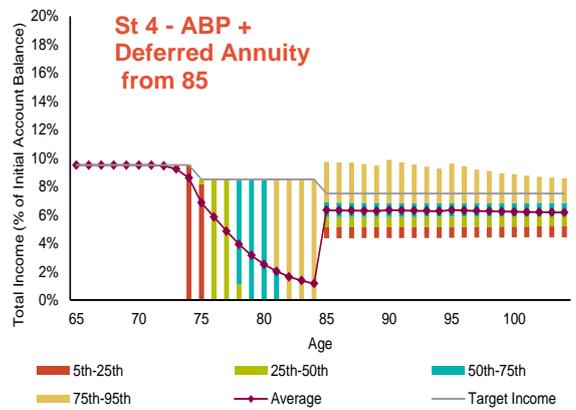
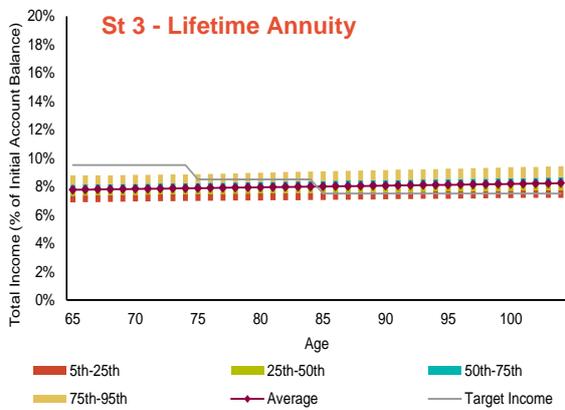
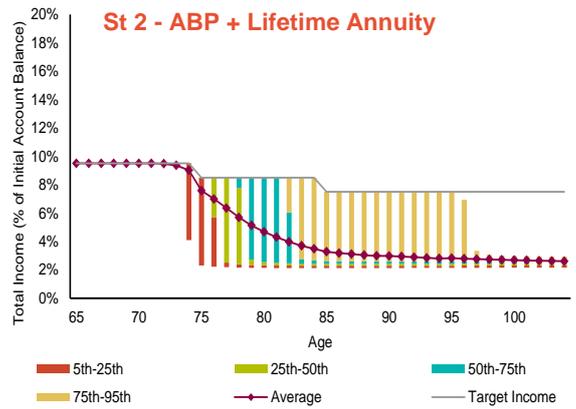
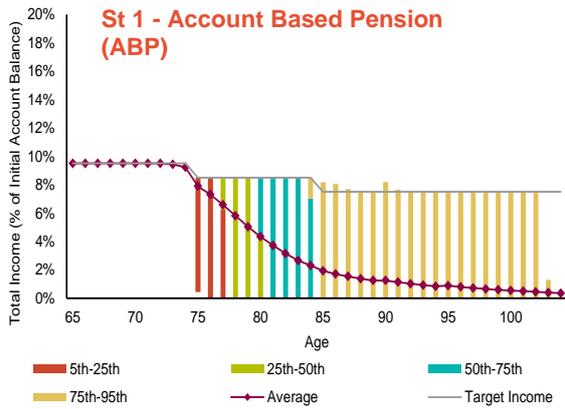
**Distribution of Total Income - Target Income – Flat 8.5%**



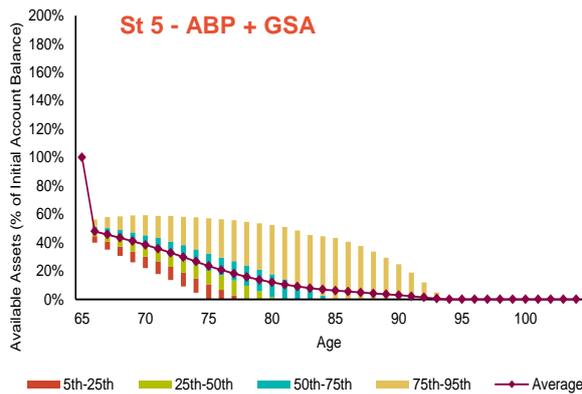
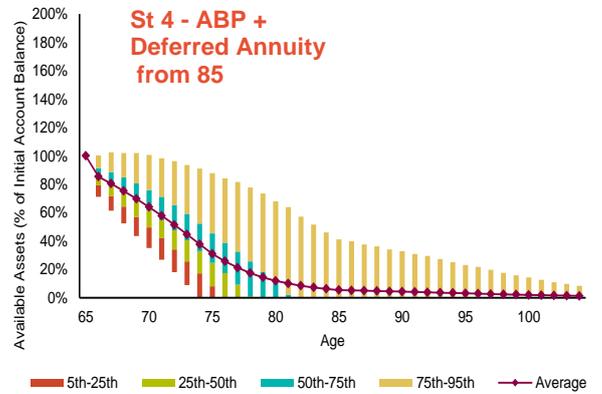
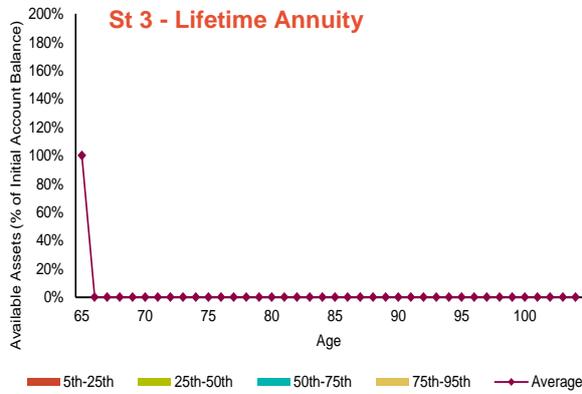
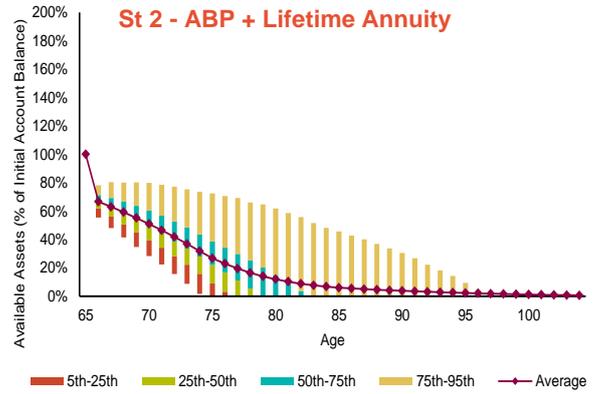
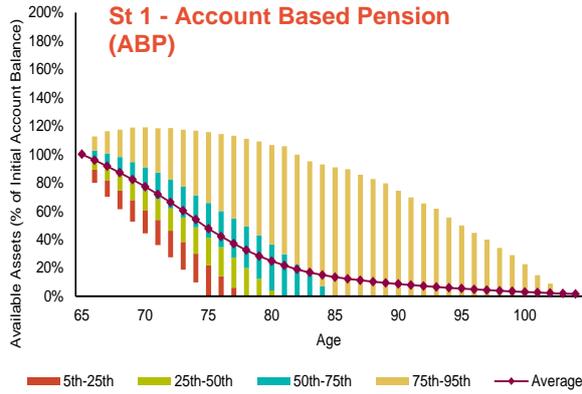
**Distribution of Available Assets - Target Income – Flat 8.5%**



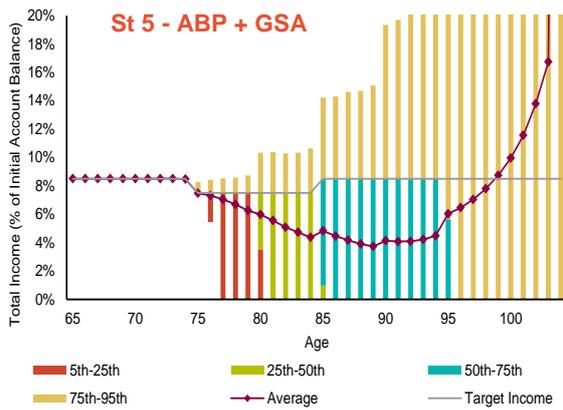
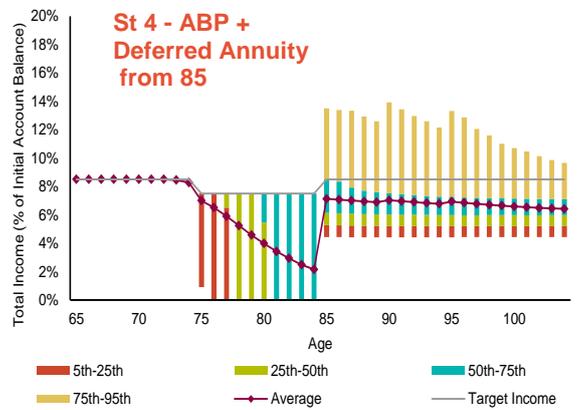
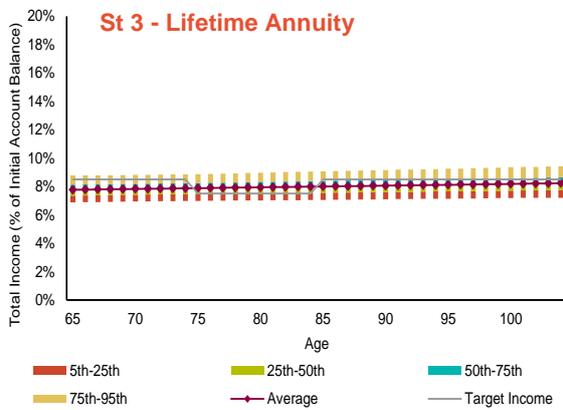
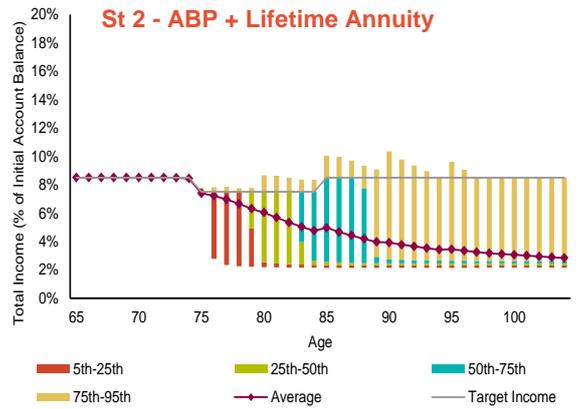
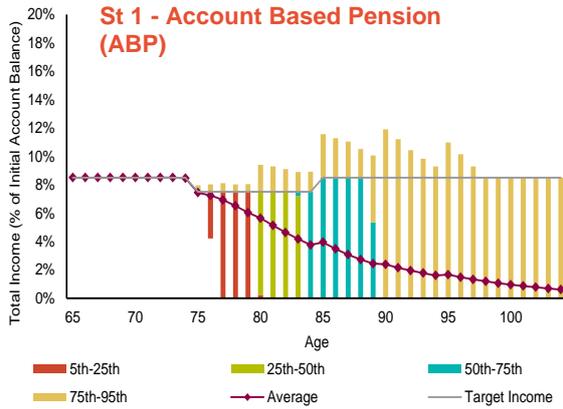
**Distribution of Total Income - Target Income – Tapered (9.5%/8.5%/7.5%)**



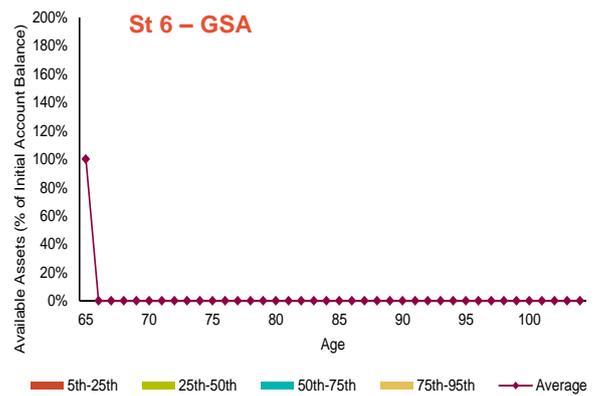
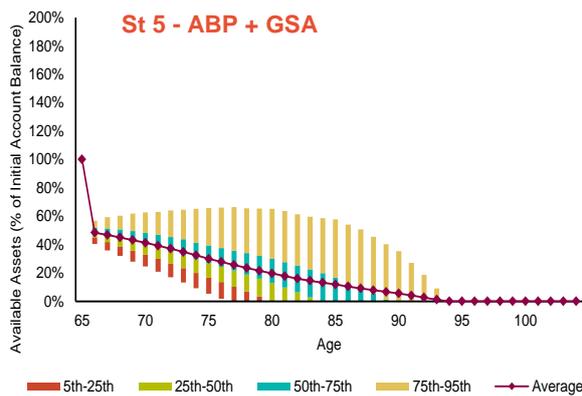
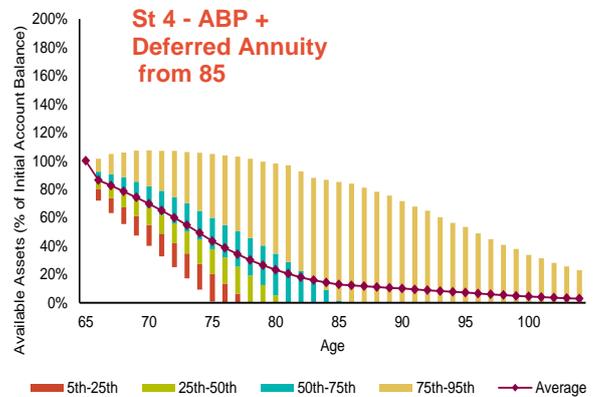
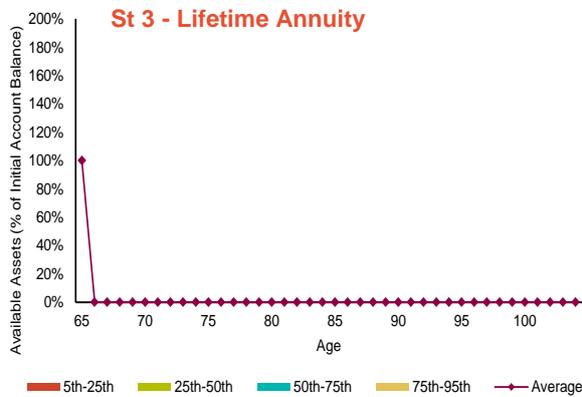
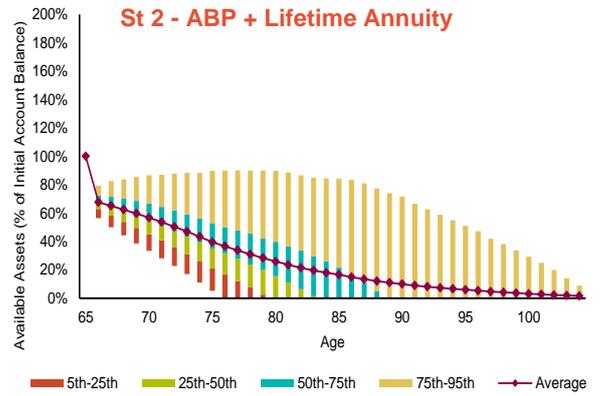
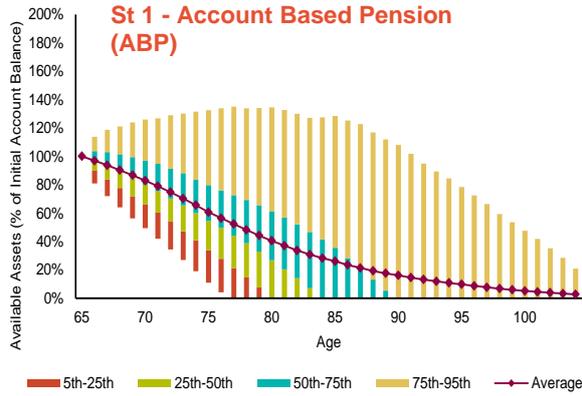
**Distribution of Available Assets - Target Income – Tapered (9.5%/8.5%/7.5%)**



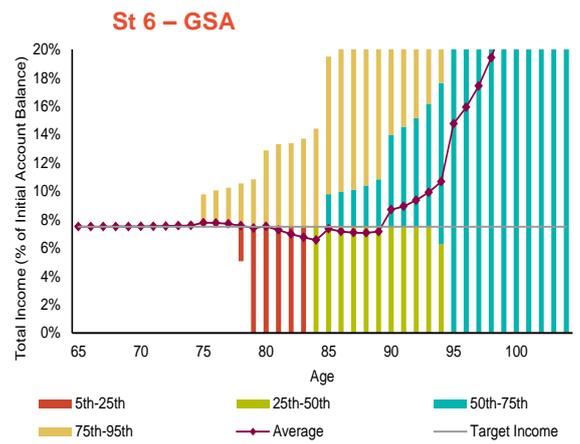
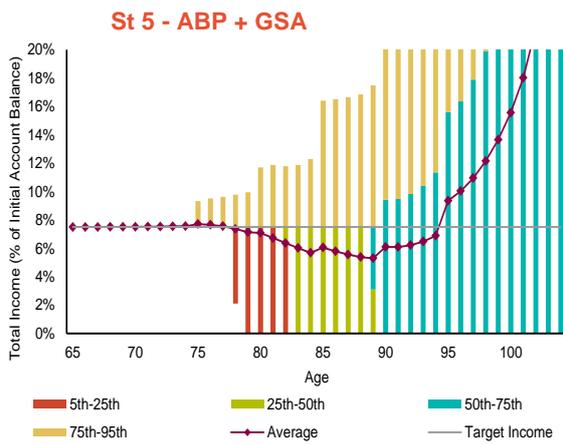
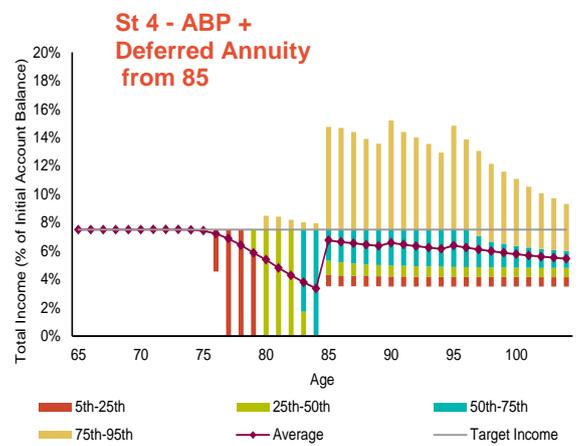
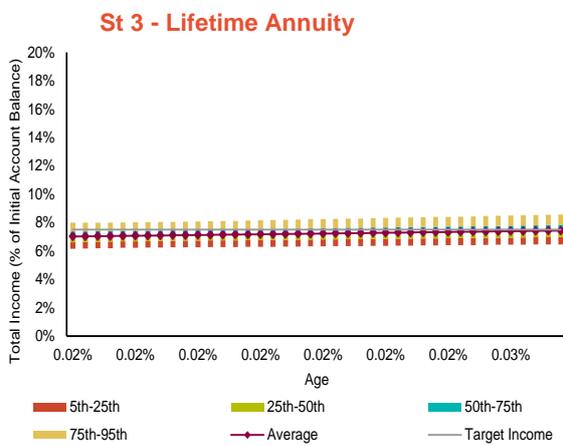
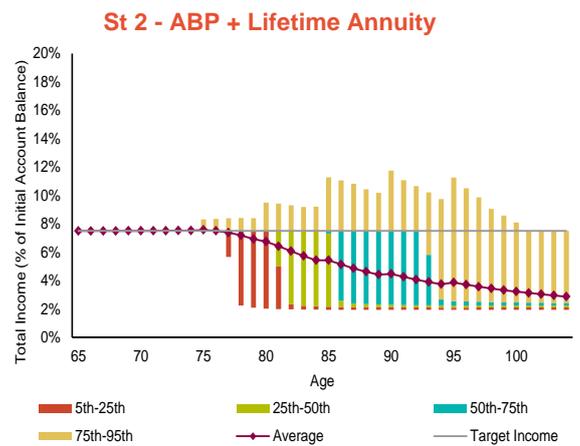
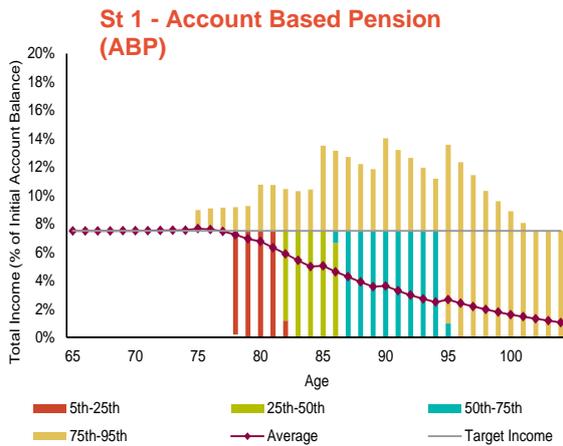
**Distribution of Total Income - Target Income – U-Shaped (8.5%/7.5%/8.5%)**



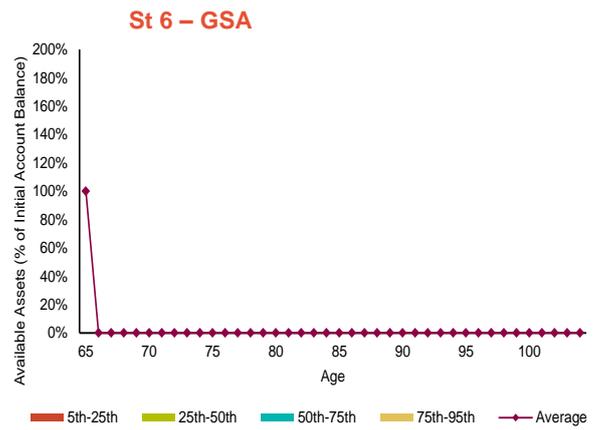
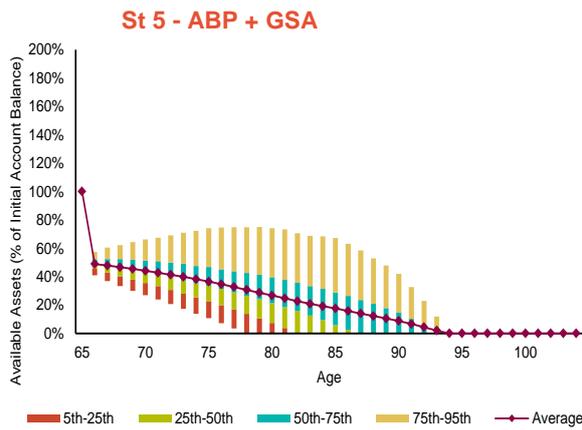
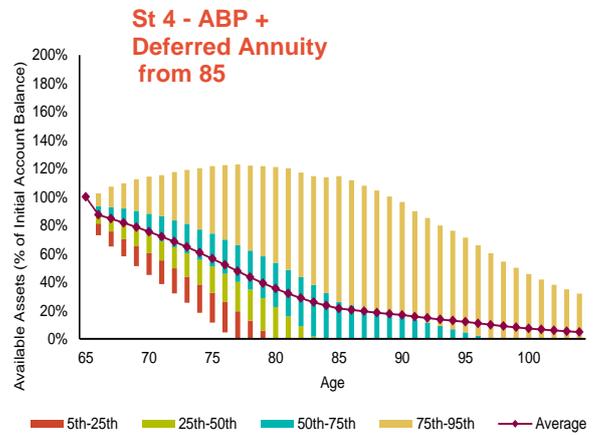
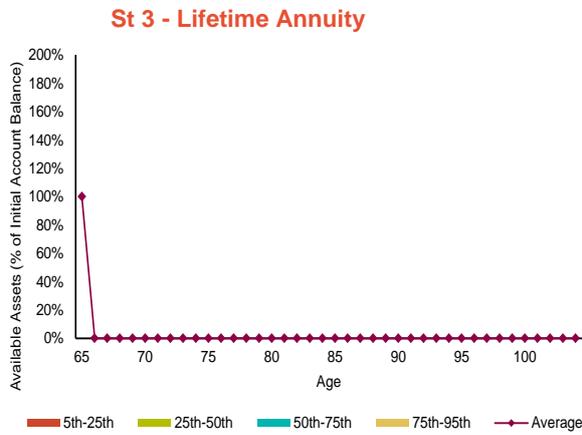
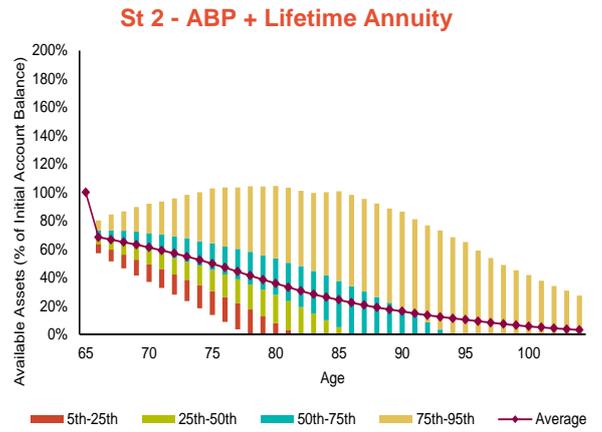
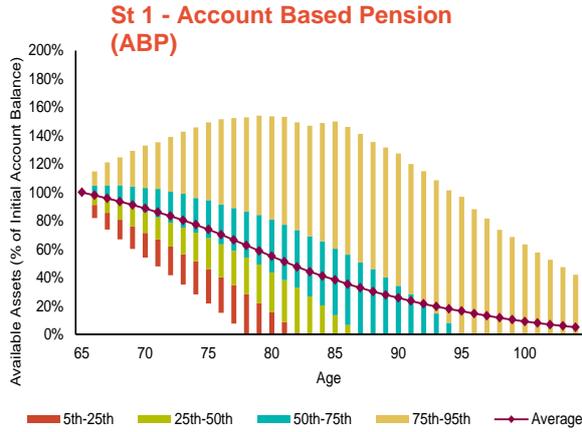
**Distribution of Available Assets - Target Income – U-Shaped (8.5%/7.5%/8.5%)**



**Distribution of Total Income - Target Income – 7.5%, Lower Annuity Pricing**



**Distribution of Available Assets - Target Income – 7.5%, Lower Annuity Pricing**



# Appendix C: Modelling Assumptions

## Mortality Assumptions and Life Expectancies

In order to make a direct comparison between retirement products or strategies over an individual's lifetime, much of the analysis has been performed without regard to underlying mortality rates. This is necessary since incorporating mortality would dilute the average outcomes through members dying and hence removing a particular stochastic investment scenario from the model before fully describing the possible income stream generated.

By allowing the individual continually "survive" mortality, we are able to better analyse the income stream generated until assets are exhausted.

The Probability of Success and Goodness of Fit Index measure are the exceptions to this. These measures are described in Section 3 of the report and do allow for the probability of death at each future age. In this case, the based table mortality assumption adopted is the Australian Life Tables 2005-07.

We have adjusted these tables to reflect the general principle that socio-economic status is a key driver behind differences in health and therefore mortality. On this basis we have assumed that retirees with larger superannuation savings exhibit lighter mortality than the general population due to access to better healthcare and a better general standard of living.

In addition, we have also made a further adjustment to the mortality tables to make a specific allowance for improvements in the rates of mortality experienced in the future.

The actual adjustments made are:

- Socio-economic status (SES) allowance: 75% of base rates at age 60 rising linearly to 95% of table at age 100 and 100% of the base rates at ages below 60 and above 100; and
- Mortality Improvement: 25-year improvement factors in Australian Life Tables 2005-07 (Australian Government Actuary).

Based on the adjusted mortality, the expected future lifetime of a male aged 65 today is 23 years.

## Lifetime and Deferred Annuity Rates

Challenger has provided us with a pricing framework for Lifetime and Deferred Annuity Rates for use in this research. We have determined the price as follows:

- The policyholders exhibit mortality as per the tables described above; and
- The policyholder achieves a specific return from the annuity.

After discussion with Challenger, we have determined the return to the policyholder as a prescribed margin over swap rates as follows:

**Table 10: Annuity pricing**

	Core	Sensitivity (Core – 100bps)
Lifetime Annuity	Swap rate + 110bps	Swap rate + 10 bps
Deferred Annuity	Swap rate + 60bps	Swap rate – 40 bps

The Deferred Annuity rates relate to a lifetime annuity commencing in 20 years. We have calculated rates for a male retiree at age 65 for a number of different interest rates to be used in a stochastic model environment. A summary of the annuity rates used in this investigation is set out below.

**Table 11: Annuity Rates for a 65 year old male - CPI indexed - Core**

Swap Rate (Real)	Lifetime Annuity Annuity Rate (\$ pa per \$100,000)	Deferred Annuity commencing in 20 years Annuity Rate (\$ pa per \$100,000)
1%	5,878	29,333
2%	6,579	37,550
3%	7,313	47,883
4%	8,077	60,832
5%	8,869	77,007
6%	9,684	97,139
7%	10,522	122,129
8%	11,379	153,054
9%	12,254	191,207
10%	13,143	238,159

**Table 12: Annuity Rates for a 65 year old male - CPI indexed – Lower Annuity Pricing**

Swap Rate (Real)	Lifetime Annuity Annuity Rate (\$ pa per \$100,000)	Deferred Annuity commencing in 20 years Annuity Rate (\$ pa per \$100,000)
1%	5,212	22,821
2%	5,878	29,333
3%	6,579	37,550
4%	7,313	47,883
5%	8,077	60,832
6%	8,869	77,005
7%	9,684	97,139
8%	10,522	122,129
9%	11,379	153,052
10%	12,254	191,209

The Towers Watson Global Asset Model does not generate swap rates which are required in the table above. We have therefore derived a real swap rate from the asset model at the start of the projection period as follows:

- The real yield on Commonwealth Government Bonds; plus
- One third of the AA corporate bond spread.

The average real swap rate generated is 3.5% pa, which implies an average annuity rate of \$7,695 pa per \$100,000 on the core assumption.

### Asset Allocation

We have modelled the following 70/30 Growth/Defensive portfolio for the investment of the account based pension:

**Table 13: Portfolio asset allocation**

Asset Class	Asset Allocation	Nominal Return (Arithmetic Average)
Australian Shares	31.5%	10.8%
International Shares (Unhedged)	10.5%	9.5%
International Shares (Hedged)	14.0%	10.3%
Emerging Equity (Unhedged)	3.5%	11.0%
Australian Listed Property	7.0%	8.1%
Global Listed Property	3.5%	9.0%
<b>Total Growth Assets</b>	<b>70%</b>	
Australian Fixed Interest	7.5%	6.2%
Global Fixed Interest (Hedged)	7.5%	6.1%
Australian Indexed Linked Bonds	7.5%	5.8%
Global Indexed Linked Bonds (Hedged)	7.5%	5.4%
<b>Total Defensive Assets</b>	<b>30%</b>	
<b>Total</b>	<b>100%</b>	<b>8.8%</b>

### Account based Pension Fees

As agreed with Challenger, we have assumed the operating fees (administration and platform) to be those set out in the FSC Superannuation Fees Report 2013 prepared by Rice Warner Actuaries. The table below sets out an extract from that report detailing the average fees for Retail Retirement Income Products which we have incorporated into our model.

**Table 14: Account Based Pension Fees**

Account Balance	Operating Fee
>\$1 million	0.35%
\$500,000 - \$1 million	0.39%
\$250,000 - \$500,000	0.44%
\$100,000 - \$250,000	0.51%
\$50,000 - \$100,000	0.61%
\$25,000 - \$50,000	0.75%
<\$25,000	1.06%

\* Allocated pension Open Products Expense Rate (%) – Retail Retirement Income Products, FSC Superannuation Fees Report 2013, Rice Warner Actuaries.

A further 30bps is charged for the GSA investments.

No additional fees are to be incorporated into the lifetime annuity element of the calculations as we understand that the annuity rates already include a margin for expenses.

We have not included an explicit assumption for investment management fees. Returns from the Global Asset Model are assumed to be net of these fees.

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## Appendix D: A Summary of Towers Watson Asset Modelling Assumptions

The tables below and the charts overleaf show the summary statistics for the major asset classes included in the Towers Watson Global Asset Model as at 31 March 2014 from the perspective of an Australian investor who is valuing his or her investments in Australian dollars. All figures are “best estimate”.

We believe that we are currently in an abnormal environment in which economic uncertainty remains elevated and that this may last for some time before more “normal” conditions resume. For the purpose of our modelling we have used the normative assumptions, represented by the year twenty results from our model, removing the short term effects to reflect the current state of financial markets

These assumptions are before allowing for the effects of tax and investment management expenses.

**Global Asset Model Assumptions (Normative) at 31 March 2014**  
**Nominal returns, denominated in AUD, gross of tax**

Asset class	Arithmetic Average	Standard Deviation
Price Inflation (CPI)	2.5	2.2
Wage Inflation (AWOTE)	4.0	2.7
<b>Cash &amp; Bonds</b>		
Cash	5.0	1.7
Australian 10yr Govt Bonds	6.6	10.2
Australian All Maturity Govt Bonds	6.0	5.8
Australian Fixed Interest	6.2	5.3
Australian Inflation-Linked Bonds	5.8	6.2
Global Bonds (Govt, hedged)	5.6	3.9
Global Bonds (Aggregate, hedged)	6.1	4.4
Global Inflation-Linked Bonds (hedged)	5.4	6.4
<b>Equities</b>		
Australian Equities	9.6	20.3
Australian Small Cap Equities	10.1	24.4
Global Equities (ex Aus, unhedged)	9.5	16.5
Global Equities (ex Aus, hedged)	10.3	17.4
Emerging Market Equities (unhedged)	11.0	24.9
<b>Property</b>		
Australian Unlisted Property	8.1	9.9
Australian Listed Property	8.9	17.6
Global Listed Property (hedged)	9.0	16.5
<b>Credit</b>		
Australian Investment Grade Credit	6.9	4.9
Global Investment Grade Credit (hedged)	6.8	6.0
Emerging Market Debt (USD, hedged)	7.3	10.3
High Yield Debt (hedged)	8.1	11.3
Loans (hedged)	7.1	7.6
Australian RMBS	5.7	2.7
Global ABS (hedged)	6.6	6.3
<b>Alternative assets</b>		
Fund of Hedge Funds (hedged)	7.4	7.6
Private Equity FoFs (global, unhedged)	9.8	25.0
Unlisted Infrastructure (hedged)	10.0	17.7
Commodity Futures (hedged)	6.5	10.5
Timber (unhedged)	9.3	22.1
Reinsurance (hedged)	7.2	8.3
Emerging Market Cash (unhedged)	7.1	7.7
Local Currency EMD (unhedged)	7.8	11.5
<b>Equity Risk Premium</b>		
Aus equities - Aus cash	4.6	
Global equities (hedged) - Aus cash	5.3	

**Global Asset Model Assumptions (Normative) as at 31 March 2014**  
**Real returns, denominated in AUD, gross of tax**

Asset class	Arithmetic average	Standard Deviation
<b>Cash &amp; Bonds</b>		
Cash	2.4	1.9
Australian 10yr Govt Bonds	4.0	10.6
Australian All Maturity Govt Bonds	3.4	6.4
Australian Fixed Interest	3.7	6.0
Australian Inflation-Linked Bonds	3.2	5.5
Global Bonds (Govt, hedged)	3.1	4.1
Global Bonds (Aggregate, hedged)	3.5	4.6
Global Inflation-Linked Bonds (hedged)	2.8	6.2
<b>Equities</b>		
Australian Equities	6.9	19.8
Australian Small Cap Equities	7.4	23.8
Global Equities (ex Aus, unhedged)	6.8	16.0
Global Equities (ex Aus, hedged)	7.6	17.0
Emerging Market Equities (unhedged)	8.3	24.2
<b>Property</b>		
Australian Unlisted Property	5.3	8.6
Australian Listed Property	6.2	17.0
Global Listed Property (hedged)	6.3	16.1
<b>Credit</b>		
Australian Investment Grade Credit	4.4	5.5
Global Investment Grade Credit (hedged)	4.2	6.0
Emerging Market Debt (USD, hedged)	4.7	10.2
High Yield Debt (hedged)	5.5	11.2
Loans (hedged)	4.5	7.5
Australian RMBS	3.2	2.7
Global ABS (hedged)	4.0	6.2
<b>Alternative assets</b>		
Fund of Hedge Funds (hedged)	4.8	7.5
Private Equity FoFs (global, unhedged)	7.1	24.3
Unlisted Infrastructure (hedged)	7.4	17.6
Commodity Futures (hedged)	3.9	10.3
Timber (unhedged)	6.6	21.4
Reinsurance (hedged)	4.6	8.2
Emerging Market Cash (unhedged)	4.5	7.5
Local Currency EMD (unhedged)	5.2	11.3

The return assumptions given for each mainstream asset class (i.e. equities, property, bonds, credit and cash) and certain alternatives (i.e. commodity futures, local currency emerging market debt) represent the expected market average (index) returns that an institutional investor could expect to achieve through a passive investment management approach. As such, they do not include expected premia for active investment management, or any offsets for the risks and costs of managing active strategies.

The return assumptions for private equity, infrastructure and fund of hedge funds are based on the return net of fees that could be expected from a low (active) risk, well diversified exposure such as through a fund of funds

## Correlation Assumptions

Correlation is a statistical measure that describes the extent to which the returns from two asset classes are linked. The correlations of returns between the different asset classes describe important characteristics of the Global Asset Model in addition to the expected annual return and the standard deviation of annual returns. Recent and long-term history is used as a guide to setting these parameters, as well as a view as to what is 'reasonable'.

The table on the next page shows the key correlations of nominal 1-year returns between assets used in the Global Asset Model. To help in interpreting these numbers, a figure below 0.3 (positive or negative) is indicative of low correlation, a figure between 0.3 and 0.5 indicates moderate correlation and a figure of above 0.5 indicates a high degree of correlation.

# Correlation Matrix

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35		
		10yr Govt Bond Yield	10yr Real Yield	Price Inflation (CPI)	Wage Inflation (AWOTE)	Australian Cash	Australian 10yr Govt Bonds	Australian All Maturity Govt Bonds	Australian Fixed Interest	Australian Inflation-Linked Bonds	Global Bonds (Government, hedged)	Global Bonds (Aggregate, hedged)	Global Inflation-Linked Bonds (hedged)	Australian Equities	Australian Small Cap Equities	Global Equities (ex Aus, unhedged)	Global Equities (ex Aus, hedged)	Emerging Market Equities (unhedged)	Australian Unlisted Property	Global Listed Property	Australian Investment Grade Credit	Global Investment Grade Credit (hedged)	Emerging Market Debt (USD, hedged)	High Yield Debt (hedged)	Loans (hedged)	Australian RMBS	Global ABS (hedged)	Fund of Hedge Funds (hedged)	Private Equity FoFs (global, unhedged)	Unlisted Infrastructure (hedged)	Commodity Futures (hedged)	Timber (unhedged)	Reinsurance (hedged)	Emerging Market Cash (unhedged)	Emerging Market Debt (local currency, unhedged)			
Yields & Inf	1 10yr Govt Bond Yield	1.0	0.2	0.5	0.1	0.7	-0.1	0.0	0.1	0.3	0.3	0.2	0.3	0.1	0.1	0.1	0.1	0.1	0.0	0.2	0.2	0.1	0.1	0.2	0.6	0.2	0.2	0.1	0.0	0.1	0.0	0.2	0.2	0.1	0.0	0.2	0.2	0.1
	2 10yr Real Yield	0.2	1.0	0.2	0.0	0.2	-0.1	-0.1	-0.1	-0.3	-0.2	-0.2	-0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.1	-0.1	-0.1	0.1	0.2	0.1	0.0	0.0	-0.3	0.0	0.0	0.1	0.0	-0.1	0.1	
	3 Price Inflation (CPI)	0.5	0.2	1.0	0.7	0.6	-0.2	-0.2	-0.2	0.4	0.2	0.1	0.2	0.1	0.1	0.1	0.1	0.5	0.1	0.0	-0.1	0.1	0.1	0.1	0.1	0.4	0.2	0.1	0.1	-0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
	4 Wage Inflation (AWOTE)	0.1	0.0	0.7	1.0	0.2	-0.1	-0.1	-0.1	0.3	0.1	0.1	0.1	0.0	0.0	0.1	0.0	0.1	0.4	0.0	0.0	-0.1	0.0	0.0	0.1	0.2	0.1	0.0	0.1	0.0	0.0	0.1	0.0	0.1	0.0	0.1	0.0	0.1
Bonds & Cash	5 Australian Cash	0.7	0.2	0.6	0.2	1.0	-0.1	-0.2	-0.1	0.3	0.4	0.3	0.3	0.1	0.1	0.1	0.1	0.1	0.2	0.1	0.1	0.0	0.2	0.2	0.1	0.2	0.8	0.3	0.2	0.1	0.0	0.2	0.1	0.2	0.2	0.1	0.1	0.0
	6 Australian 10yr Govt Bonds	-0.1	-0.1	-0.2	-0.1	-0.1	1.0	0.9	0.9	0.0	0.6	0.5	0.1	0.0	0.0	-0.1	-0.1	-0.1	-0.2	-0.1	0.0	0.8	0.4	0.2	0.2	-0.1	-0.4	-0.1	0.0	-0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.2
	7 Australian All Maturity Govt Bonds	0.0	-0.1	-0.2	-0.1	-0.2	0.9	1.0	1.0	0.0	0.5	0.5	0.1	-0.1	0.0	-0.1	-0.1	-0.2	-0.1	0.0	0.9	0.4	0.2	0.2	-0.1	-0.4	-0.1	-0.1	-0.1	0.1	0.0	0.0	0.0	0.0	-0.1	0.2	0.1	0.2
	8 Australian Fixed Interest	0.1	-0.1	-0.2	-0.1	-0.1	0.9	1.0	1.0	0.0	0.5	0.5	0.1	0.0	0.0	-0.1	0.0	0.0	-0.2	0.0	0.9	0.5	0.2	0.3	0.0	-0.3	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.2
	9 Australian Inflation-Linked Bonds	0.3	-0.3	0.4	0.3	0.3	0.0	0.0	0.0	1.0	0.3	0.2	0.7	0.1	0.0	0.1	0.0	0.1	0.2	0.1	0.0	0.1	0.2	0.1	0.1	0.0	0.2	0.0	0.1	0.0	0.3	0.0	0.1	0.1	0.1	0.1	0.1	0.1
	10 Global Bonds (Government, hedged)	0.3	-0.2	0.2	0.1	0.4	0.6	0.5	0.5	0.3	1.0	0.9	0.4	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.5	0.7	0.5	0.4	0.1	0.1	0.1	0.1	0.1	0.3	0.1	0.0	0.1	0.1	0.1	0.1	0.1	0.4
	11 Global Bonds (Aggregate, hedged)	0.2	-0.2	0.1	0.1	0.3	0.5	0.5	0.5	0.2	0.9	1.0	0.4	0.2	0.2	0.2	0.2	0.1	0.1	0.1	0.2	0.6	0.9	0.7	0.7	0.4	0.2	0.1	0.1	0.3	0.2	0.0	0.1	0.1	0.1	0.1	0.1	0.6
	12 Global Inflation-Linked Bonds (hedged)	0.3	-0.2	0.2	0.1	0.3	0.1	0.1	0.1	0.7	0.4	0.3	1.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.1	0.3	0.2	0.1	0.0	0.2	0.1	0.1	0.0	0.5	0.1	0.0	0.1	0.0	0.1	0.0	0.1	0.1
	Equities	13 Australian Equities	0.1	0.0	0.1	0.0	0.1	0.0	-0.1	0.0	0.1	0.1	0.2	0.0	1.0	0.9	0.8	0.8	0.5	0.0	0.6	0.6	0.1	0.2	0.5	0.4	0.4	0.3	0.4	0.5	0.5	0.4	0.5	-0.1	0.1	0.2	0.4	0.4
14 Australian Small Cap Equities		0.1	0.0	0.1	0.0	0.1	0.0	0.0	0.0	0.1	0.2	0.0	0.0	0.9	1.0	0.6	0.7	0.5	0.0	0.6	0.5	0.1	0.2	0.4	0.4	0.3	0.3	0.5	0.4	0.3	0.4	-0.1	0.1	0.2	0.4	0.4		
15 Global Equities (ex Aus, unhedged)		0.1	0.0	0.1	0.1	0.1	-0.1	-0.1	-0.1	0.1	0.1	0.2	0.0	0.6	0.6	1.0	0.8	0.7	0.1	0.4	0.6	0.0	0.2	0.5	0.4	0.4	0.2	0.4	0.5	0.7	0.3	0.4	0.2	0.1	0.2	0.5	0.5	
16 Global Equities (ex Aus, hedged)		0.1	0.0	0.1	0.0	0.1	-0.1	-0.1	0.0	0.0	0.1	0.2	0.0	0.8	0.7	0.8	1.0	0.6	0.0	0.5	0.7	0.1	0.3	0.6	0.5	0.3	0.5	0.6	0.5	0.4	0.6	-0.2	0.2	0.3	0.6	0.6		
17 Emerging Market Equities (unhedged)		0.1	0.0	0.1	0.1	0.1	-0.1	-0.1	0.0	0.1	0.1	0.1	0.0	0.5	0.5	0.7	0.6	1.0	0.0	0.3	0.5	0.0	0.1	0.4	0.3	0.2	0.3	0.4	0.6	0.3	0.4	0.1	0.1	0.2	0.3	0.3		
18 Australian Unlisted Property		0.1	0.0	0.5	0.4	0.2	-0.2	-0.2	-0.2	0.2	0.1	0.1	0.1	0.0	0.0	0.1	0.0	0.0	1.0	0.3	0.0	-0.2	0.0	0.0	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.1	0.0	0.0	
19 Australian Listed Property		0.1	0.0	0.1	0.0	0.1	-0.1	-0.1	0.0	0.1	0.1	0.1	0.0	0.6	0.6	0.4	0.5	0.3	0.3	1.0	0.3	0.0	0.1	0.3	0.2	0.2	0.2	0.2	0.3	0.3	0.2	0.3	-0.1	0.1	0.1	0.2	0.2	
Credit	20 Global Listed Property (hedged)	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.1	0.2	0.0	0.6	0.5	0.6	0.7	0.5	0.0	0.3	1.0	0.1	0.2	0.4	0.4	0.3	0.2	0.3	0.5	0.5	0.3	0.4	-0.1	0.2	0.2	0.4		
	21 Australian Investment Grade Credit	0.2	0.0	-0.1	-0.1	0.0	0.8	0.9	0.9	0.1	0.5	0.6	0.1	0.1	0.1	0.0	0.1	0.0	-0.2	0.0	0.1	1.0	0.6	0.4	0.5	0.3	0.0	0.3	0.0	0.0	0.1	0.0	-0.1	0.0	0.0	0.4	0.4	
	22 Global Investment Grade Credit (hedged)	0.2	-0.1	0.1	0.0	0.2	0.4	0.4	0.5	0.2	0.7	0.9	0.3	0.2	0.2	0.2	0.3	0.1	0.0	0.1	0.2	0.6	1.0	0.8	0.9	0.6	0.3	0.6	0.2	0.1	0.3	0.2	0.0	0.1	0.1	0.8	0.8	
	23 Emerging Market Debt (USD, hedged)	0.1	-0.1	0.1	0.0	0.2	0.2	0.2	0.2	0.1	0.5	0.7	0.2	0.5	0.4	0.5	0.6	0.4	0.0	0.3	0.4	0.4	0.8	1.0	0.8	0.8	0.6	0.3	0.6	0.4	0.3	0.3	-0.1	0.1	0.3	0.8	0.8	
	24 High Yield Debt (hedged)	0.1	-0.1	0.1	0.0	0.1	0.2	0.2	0.3	0.1	0.4	0.7	0.1	0.4	0.4	0.4	0.6	0.3	0.0	0.2	0.4	0.5	0.9	0.8	1.0	0.8	0.4	0.8	0.3	0.3	0.3	0.3	-0.1	0.1	0.2	0.8	0.7	
	25 Loans (hedged)	0.2	0.1	0.1	0.1	0.2	-0.1	-0.1	0.0	0.0	0.1	0.4	0.0	0.4	0.3	0.4	0.5	0.3	0.0	0.2	0.3	0.3	0.6	0.6	0.8	1.0	0.5	1.0	0.3	0.2	0.2	0.2	-0.1	0.1	0.2	0.7	0.7	
	26 Australian RMBS	0.6	0.2	0.4	0.2	0.8	-0.4	-0.4	-0.3	0.2	0.1	0.2	0.2	0.3	0.3	0.2	0.3	0.2	0.2	0.2	0.2	0.0	0.3	0.3	0.4	0.5	1.0	0.6	0.3	0.2	0.1	0.2	0.0	0.2	0.2	0.3	0.3	
	27 Global ABS (hedged)	0.2	0.1	0.2	0.1	0.3	-0.1	-0.1	0.0	0.0	0.1	0.4	0.1	0.4	0.3	0.4	0.5	0.3	0.0	0.2	0.3	0.3	0.6	0.6	0.8	1.0	0.6	1.0	0.3	0.3	0.2	0.3	-0.1	0.1	0.2	0.7	0.7	
	Alt. assets	28 Fund of Hedge Funds (hedged)	0.2	0.0	0.1	0.0	0.2	0.0	-0.1	0.0	0.1	0.1	0.2	0.1	0.5	0.5	0.5	0.6	0.4	0.0	0.3	0.5	0.0	0.2	0.4	0.3	0.3	0.3	0.3	0.3	0.4	0.3	0.4	-0.1	0.2	0.2	0.4	0.4
29 Private Equity FoFs (global, unhedged)		0.1	0.0	0.1	0.1	0.1	-0.1	-0.1	0.0	0.0	0.1	0.1	0.0	0.5	0.4	0.7	0.5	0.6	0.0	0.3	0.5	0.0	0.1	0.3	0.3	0.2	0.2	0.3	0.4	1.0	0.3	0.3	0.2	0.1	0.2	0.3	0.3	
30 Unlisted Infrastructure (hedged)		0.0	-0.3	-0.1	0.0	0.0	0.1	0.1	0.1	0.3	0.3	0.3	0.5	0.4	0.3	0.3	0.4	0.3	0.0	0.2	0.3	0.1	0.3	0.4	0.3	0.2	0.1	0.2	0.3	0.3	1.0	0.2	0.0	0.1	0.2	0.1	0.2	0.2
31 Commodity Futures (hedged)		0.1	0.0	0.1	0.0	0.2	0.0	0.0	0.0	0.0	0.1	0.2	0.1	0.5	0.4	0.4	0.6	0.4	0.0	0.3	0.4	0.0	0.2	0.3	0.3	0.2	0.2	0.3	0.4	0.3	0.3	1.0	-0.1	0.1	0.2	0.4	0.4	
32 Timber (unhedged)		0.0	0.0	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.1	-0.1	0.2	-0.2	0.1	0.1	-0.1	-0.1	-0.1	0.0	-0.1	-0.1	-0.1	0.0	-0.1	0.2	-0.1	-0.1	1.0	0.1	0.2	0.3	0.3	0.3	
33 Reinsurance (hedged)		0.2	0.1	0.1	0.0	0.2	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.1	0.2	0.0	0.1	0.1	0.1	0.1	0.2	0.1	0.1	0.1	0.1	0.0	1.0	0.2	0.3	0.3	0.3	
34 Emerging Market Cash (unhedged)		0.2	0.0	0.1	0.1	0.2	0.0	-0.1	0.0	0.1	0.1	0.1	0.0	0.2	0.2	0.2	0.3	0.2	0.1	0.1	0.2	0.0	0.1	0.3	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.2	0.0	0.1	0.2	0.0	1.0	0.1
35 Emerging Market Debt (local currency, unhedged)		0.1	-0.1	0.1	0.0	0.1	0.2	0.2	0.2	0.1	0.4	0.6	0.1	0.4	0.4	0.5	0.6	0.3	0.0	0.2	0.4	0.4	0.8	0.8	0.8	0.7	0.3	0.7	0.4	0.3	0.3	0.3	-0.1	0.1	0.5	1.0	0.1	

High correlation (between +0.5 and +1.0)  
 Moderate correlation (between +0.3 and +0.5)  
 Low correlation (less than +0.3)

## Confidentiality and Disclaimer

The assumptions shown in this section have been derived by Towers Watson through a blend of economic theory, historical analysis and the views of investment managers. The assumptions inevitably contain an element of subjective judgement.

These assumptions are intended to be used in conjunction with the Towers Watson Global Asset Model for the purpose of setting long term or strategic asset allocations.

The assumptions included in the analysis cover the likely future behaviour of the investment markets. These include expected future returns from different asset classes, the likely volatility of those returns, and their inter-relationship. The key component of an asset allocation study is the way in which the assets are modelled. The structure of the asset model is based on historical analysis of investment returns, although Towers Watson has incorporated its subjective judgement to complement the information provided by historical returns. The model is designed to illustrate the future range of returns stemming from different asset classes and their inter-relationship. It should be noted that no economic model could be expected to perfectly capture future uncertainty, particularly the risk of extreme events.

In particular it should be noted that our timeframe in establishing our asset model and the assumptions used in this study is long-term, and as such it is not intended to be precisely reflective of the likely course of the investment markets in the short-term. Furthermore, our opinions and return forecasts are not intended to imply, nor should be interpreted as conveying, any form of guarantee or assurance by Towers Watson, either to the recipient or any third party, of the future performance of the asset classes in question, either favourable or unfavourable. Past performance should not be taken as representing any particular guide to future performance.