Lifecycle Design – To and Through Retirement

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1. Executive summary

1.1 Background

Effective default investment strategies are fundamental to member outcomes in Australia's superannuation system. Research suggests that approximately 80% of accumulation accounts in Australian Prudential Regulation Authority (APRA) regulated defined contribution funds are invested in a fund's default superannuation investment option[1]. This includes members who have not engaged with investment strategy and who have been placed in their employers' chosen MySuper product as well as members who have deliberately considered the default option and have selected it as their choice option.

The percentage of members impacted by default strategies is even higher than these figures would suggest, as many members making investment choices start by building their balances up as default members.

Most default strategies can be categorised either as single strategies or as "lifecycle" strategies based on age. This paper explores a wider range of levers, including balance as a driver of what strategies are likely to be optimal, and the concept of investment horizon in the context of superannuation as a lens through which the construction of these options might be analysed and optimised. Using this information, the paper then investigates how an investment strategy could be designed based on the drivers of this investment horizon to provide better outcomes to members.

1.2 Investment horizon

1.2.1 Relevance of investment horizon

Investment literature indicates that an investor's investment horizon is a key determinant of an optimal asset allocation[2]. This is a consequence of longer investment horizons allowing investors to 'spread' the volatility of uncertain investments over a larger timeframe and thereby increase portfolio allocations to risky assets that have a higher expected return.

1.2.2 Investment horizon in superannuation

In the context of superannuation, a member's investment horizon is composed of the time:

- From the point the member joins the fund until the point of retirement, known as the pre-retirement (or accumulation) phase.
- From the point of retirement until the point that the member withdraws the last of their savings, which we refer to as the retirement phase.

In the pre-retirement phase, members contribute to their account with little-to-no ability to withdraw their balance until the member elects to retire. At the time of writing, Australian legislation requires that a member reach a pre-determined age before making the election to retire, with this age depending on the member's year of birth (and moving to age 60).

[1] Rice Warner, Super Insights 2019
[2] Warren, G.J, "How Investment Risk Evolves with Horizon", ANU Working Paper, September 2018

Once a member has made the election to retire, they either:

- Transfer their account balance into a retirement product, often an Account-based Pension (ABP).
- Withdraw their superannuation balance from the superannuation system.

For members who do transfer into a retirement product, our analysis suggests that the member's investment horizon is related to their age and balance. This can be seen in that as a member's:

- Balance falls below $100,000 the member typically withdraws a greater proportion of their total assets each year, indicative of the largely fixed minimum cost of living (that is, the cost of rent and food), resulting in a shorter time horizon.
- Balance remains above $100,000, they will typically have a longer time horizon, drawing down at low rates initially and at higher rates as they grow older, likely indicative of the:
  - Minimum legislated drawdown rate which increases with a member's age.
  - Higher aged care and personal care costs that older individuals often face.

In addition to having shorter time horizons within a retirement product, members with modest balances are relatively likely to take most or all their balance in cash at retirement, potentially using much of it to pay down mortgages and other debt. This further reinforces the picture of optimal strategy depending on balance through the impact of balance on time horizon.

1.2.3 Implications

Based on this analysis, we consider that a member's investment horizon is not bounded by the date that they choose to retire (though this point is relevant). This is as a member is likely to hold a substantial proportion of their superannuation well into the retirement phase, unless their balance is low.

One consequence of this is that investment strategies which consider this retirement investment horizon may deliver better outcomes for members – both to and through retirement. This is because as a member's account balance grows, sequencing risk becomes less relevant allowing higher allocations to growth assets. Examples of strategies which might achieve this include investment strategies which allocate:

- High portions of the portfolio to growth assets where members are young (that is, below age 50).
- High portions of the portfolio to growth assets where members are approaching retirement or actively drawing down but have large balances (that is, above age 50 and balances over a threshold).
- Reduced portions of the portfolio to growth assets where members are approaching retirement or actively drawing down but have small balances (that is, above age 50 and balances under a threshold).

1.3 Lifecycle design

1.3.1 Methodology

In testing the hypothesis of Section 1.2 (Investment horizon) we consider several candidate default superannuation investment strategies as applied to several hypothetical members throughout their lifetime. This aims to assess, in relative terms, the distribution of outcomes realised by members under various investment strategies to establish whether adjustments can be made to provide members with better outcomes.

We have considered:

- Five investment strategies, namely a:
  - **Balanced Strategy** which adopts a fixed 70% allocation to Growth assets.
  - **High Growth strategy** which adopts a fixed 85% allocation to Growth assets.
  - **First-generation Lifecycle (Lifecycle 1 (Age))** with a focus on defensive assets and de-risking at young ages.
  - **Second-generation Lifecycle (Lifecycle 2 (Age))** with a focus on growth assets and de-risking at older ages.
  - **Multi-dimensional Lifecycle (Lifecycle (Age and Balance))** which adopts a high allocation to growth assets unless a member is at an advanced age and has a low balance.
- Six member profiles selected to capture low, moderate and high wealth members at different ages to reflect the differing membership profiles that funds may face. Table 1 outlines these profiles.

Table 1. Member cameos

Cameo	Age	Starting balance ($)	Annual contributions ($)
Cameo 1	30	7,900	1,500
Cameo 2	30	26,900	3,800
Cameo 3	30	89,900	10,550
Cameo 4	60	14,500	1,500
Cameo 5	60	52,700	3,500
Cameo 6	60	338,000	38,000

Using these candidate strategies and member profiles we consider the distribution of expected lifetime income provided to members (inclusive of Age Pension entitlements) under a range of investment scenarios using a stochastic model, further details of which are in Appendix C (Investment model). This allows comparison of the income provided to members under each strategy in a range of investment situations and as a result allows a relative assessment of each strategy.

1.3.2 Results – members aged 30

Tables 2 through 4 reflect the impact of different investment designs on the total income provided in retirement to a member aged 30 today. This is calculated by estimating the expected lifetime income the member derives from the strategy (inclusive of the Age Pension) and comparing that level of income with that provided by a single-strategy Balanced fund comprising of a 70% allocation to Growth assets.

Table 2. Cameo 1 – age 30, account balance $7,900 – projected change in total retirement income

	High Growth Strategy (85/15) (%)	Lifecycle 1 (Age) (%)	Lifecycle 2 (Age) (%)	Lifecycle (Age and Balance) (%)
Low (10th Percentile)	0.1	0.0	0.1	0.2
Median	1.2	-0.8	0.9	1.1
High (90th Percentile)	3.3	-2.2	2.9	3.5

Table 3. Cameo 2 – age 30, account balance $26,900 – projected change in total retirement income

	High Growth Strategy (85/15)	Lifecyle 1 (Age)	Lifecyle 2 (Age)	Lifecycle (Age and Balance)
	(%)			
Low (10th Percentile)	0.2	0.0	0.4	0.4
Median	2.6	-1.8	2.3	2.8
High (90th Percentile)	10.2	-7.2	7.3	12.6

Table 4. Cameo 3 – age 30, account balance $89,900 – projected change in total retirement income

	High Growth Strategy (85/15)	Lifecyle 1 (Age)	Lifecyle 2 (Age)	Lifecycle (Age and Balance)
	(%)			
Low (10th Percentile)	1.1	-1.3	0.9	1.0
Median	9.1	-6.8	4.5	13.1
High (90th Percentile)	24.1	-22.3	11.9	35.1

Table 5 outlines the relative probabilities that each considered strategy (on rows) outperforms the other strategies considered (on columns) for a member aged 30 with a balance of $26,900 and contributions of $3,800 per annum. For example, a balanced strategy with 70% in growth assets outperformed a simple lifecycle strategy in 86.2% of our simulations.

Table 5. Probability of comparative outperformance, member aged 30 with an account balance of $26,900

	Balanced Strategy (70/30)	High Growth Strategy (85/15)	Lifecyle 1 (Age)	Lifecyle 2 (Age)	Lifecycle (Age and Balance)
	(%)				
Balanced Strategy (70/30)	-	8.4	86.2	7.4	8.2
High Growth Strategy (85/15)	91.6	-	89.6	72.6	26.8
Lifecyle 1 (Age)	13.8	10.4	-	8.8	8.8
Lifecyle 2 (Age)	92.6	27.4	91.2	-	15.4
Lifecycle (Age and Balance)	91.8	73.2	91.2	84.6	-

1.3.3 Results – Members aged 60

Table 6 through 8 reflect the impact of different investment designs on the total income provided in retirement to a member aged 60 today. This is calculated by estimating the expected lifetime income the member derives from the strategy (inclusive of the Age Pension) and comparing that level of income with that provided by a single-strategy Balanced fund comprising of a 70% allocation to growth assets.

Table 6. Cameo 4 – age 60, account balance $14,500 – projected change in total retirement income[3]

	High Growth Strategy (85/15)	Lifecycle 1 (Age)	Lifecycle 2 (Age)	Lifecycle (Age and Balance)
	(%)			
Low (10th Percentile)	-0.1	0.1	0.0	0.0
Median	0.0	-0.1	0.0	0.0
High (90th Percentile)	0.2	-0.2	0.1	0.1

Table 7. Cameo 5 – age 60, account balance $52,700 – projected change in total retirement income

	High Growth Strategy (85/15)	Lifecycle 1 (Age)	Lifecycle 2 (Age)	Lifecycle (Age and Balance)
	(%)			
Low (10th Percentile)	-0.3	0.3	-0.1	-0.1
Median	0.2	-0.2	0.1	0.1
High (90th Percentile)	0.8	-0.9	0.2	0.2

Table 8. Cameo 6 – Age 60, Account Balance $338,000 – projected change in total retirement income

	High Growth Strategy (85/15)	Lifecycle 1 (Age)	Lifecycle 2 (Age)	Lifecycle (Age and Balance)
	(%)			
Low (10th Percentile)	-1.0	1.0	0.1	-1.8
Median	2.2	-3.6	0.1	2.3
High (90th Percentile)	3.4	-5.8	0.3	4.4

Table 9 outlines the relative probabilities that each considered strategy (on rows) outperforms the other strategies considered (on columns) for a member aged 60 with a balance of $118,300 and contributions of $3,500 per annum.

[3] We note that that accounts with low balances that belong to individuals close to retirement will typically be consolidated into a larger account ahead of retirement or withdrawn in cash at retirement.

Table 9. Probability of comparative outperformance, member aged 60 with an account balance of $52,700

	Balanced Strategy (70/30)	High Growth Strategy (85/15)	Lifecyle 1 (Age)	Lifecyle 2 (Age)	Lifecycle (Age and Balance)
	(%)				
Balanced Strategy (70/30)	-	29.2	71.0	27.6	27.6
High Growth Strategy (85/15)	70.8	-	71.2	69.6	69.6
Lifecyle 1 (Age)	29.0	28.8	-	28.2	28.0
Lifecyle 2 (Age)	72.4	30.4	71.8	-	28.9
Lifecycle (Age and Balance)	72.4	30.4	72.0	71.1	-

1.4 Implications

Overall the results suggest that:

- For members aged 30:
  - High Growth strategies can provide significant scope for outperformance with minimal risk of underperformance relative to a Balanced fund due to the members' long investment horizon.
  - First-generation Lifecycle strategies will typically underperform each of the other strategies considered except where investment outcomes are poor for a protracted period. This underperformance is a result of the defensive allocation of these strategies being compounded over the member's long investment horizon.
  - Second-generation Lifecycle can mitigate the risk faced by the members over their lifetime, albeit at the cost of a reduced expected return on their portfolio relative to a portfolio with a higher constant allocation to growth assets.
  - Lifecycle strategies which adjust based on multiple factors are able to manage the risk and return trade-off inherent to investments in a more effective way than single strategies or Lifecycle strategies only based on age. This is a result of the increased tailoring allowing the portfolio to adopt a more aggressive stance when members are young and thereby accumulate a high balance and extend their investment horizon further. This leads to this portfolio often outperforming the other strategies considered in this report.

- For members aged 60:
  - High Growth strategies can provide significant outperformance in strong investment conditions. This comes at the cost of a modest level of underperformance in a poor investment scenario (a reduction in total lifetime income for members ranging between 2% and 5% relative to a Balanced fund).
  - First-generation Lifecycle strategies will underperform in neutral or strong market conditions due to their lack of growth assets. In cases where investment performance is poor these strategies outperform the other strategies considered particularly for those with low levels of wealth (due to their short investment horizons).
  - Two-dimensional Lifecycles provide enhanced risk management (but not necessarily better expected performance) by providing:
    - Protection for members who are vulnerable to sequencing risk with short investment horizons (low and moderate wealth profiles) by adopting a Balanced stance.
    - High allocations to growth for members whose investment horizon is long (high wealth profiles).

1.5 Conclusions

Based on this we conclude that:

- Investment horizon is a critical driver in the setting an appropriate investment strategy. Given this we consider it prudent that funds develop investment strategies which account for the range of investment horizons to which members are likely to be subject, both before and after retirement.
- Adopting high allocations to growth assets is not inherently a poor strategy, even in cases where members are approaching retirement. This is as these portfolios will typically provide:
  - Improved outcomes in cases where members are young, or investment performance is strong;
  - Marginally weaker outcomes where members are older and investment performance is weak.
- In the context of current products offered in the Australian market:
  - Strategies which involve low allocations to growth assets are likely to become less relevant as account balances grow following the introduction of legislation to aggregate unused accounts.
  - Second-generation Lifecycle investment strategies (focused on growth assets and late de-risking) will typically outperform first generation strategies (which are focused on defensive assets and de-risking when a member is young).
  - Growth-oriented constant strategies will typically outperform First-generation Lifecycle strategies, except where investment performance is poor.
- Designing Lifecycle strategies that use further factors in addition to age (such as balance) provide the ability to better tailor a portfolio to provide enhanced outcomes to members by:
  - Adopting a more growth-oriented stance while a member has a long investment horizon.
  - Shifting to defensive assets when a member's investment horizon grows short.

In making these comments we concede that our analysis is subject to several limitations, namely that:

- We have not considered factors aside from age and balance which may provide better outcomes than the two-dimensional portfolios considered in this report.
- We have not considered members across the full spectrum of age and balance profiles, within which different 'optimal' investment structures may arise.

Despite these limitations, we are of the view that there is evidence to suggest that it is in members best interest that funds review the:

- Cohorts of members for which they have designed their default solution to ensure that these segments are appropriate to the funds changing membership.
- Design of their My Super investment option to ensure that it is designed in a way that is consistent with both the funds:
  - Internal investment outlook in terms of strong, neutral or weak performance.
  - Expected future investment horizon of members.

2. Background

Australia's superannuation system is driven partly by default. This is demonstrated by Rice Warner's Super Insights research which suggests that approximately 80% of accounts in the system are invested in a fund's default superannuation investment option as opposed to a member-elected choice option.

Fortunately, on a historical basis Australia's superannuation defaults have delivered strong outcomes.

Within the current market paradigm most funds adopt a constant investment structure as their default investment option. Under this approach all members, irrespective of their personal circumstances, receive the same default investment strategy. These strategies have typically provided strong outcomes to members as a result of their high allocations to growth assets which have allowed the harvesting of various risk premiums over a member's tenure within their fund.

Despite the strong performance of these constant-structure options, funds are increasingly adopting 'Lifecycle Strategies' based on the popular 'Target Date' funds designed in the United States. These funds aim to deliver an investment strategy which provide a member with the maximum possible balance at a pre-set point (typically at the point of retirement).

This paper explores the concept of investment horizon in the context of superannuation as a lens through which the construction of these options might be optimised in combination with other levers. Using this information, the paper then investigates how an investment strategy could be designed based on a selection of the drivers of investment horizon to provide better outcomes to members.

The paper is structured as follows:

- Section 3 (Investment horizon) investigates investment horizon in the context of superannuation.
- Section 4 (Investment default design) investigates how these insights might be applied to the design of default superannuation investments for the betterment of members.

3. Investment horizon

3.1 Relevance of investment horizon

Investment literature indicates that an investor's investment horizon is a key determinant of an optimal asset allocation[4]. This is a consequence of longer time periods allowing investors to 'spread' the volatility of uncertain investments over a larger timeframe and thereby increase portfolio allocations to risky assts with higher expected returns.

Table 10 illustrates this concept through the probability that a portfolio comprising entirely of Australian equities will outperform a portfolio comprised entirely of bonds over a range of time horizons[5]. It reflects that over longer investment horizons, the likelihood that a portfolio of risky assets (such as equities) will underperform a portfolio of defensive assets (such as bonds) reduces as the investment horizon increases.

Table 10. Probability of outperformance over various time horizons best returns

Asset class	1 year	5 years	10 years	20 years
	Probability of outperformance (%)			
Bonds	37	33	28	21
Equities	63	67	72	79

3.2 Investment horizon in superannuation

3.2.1 Components of investment horizon

In the context of superannuation, a member's investment horizon is composed of the time:

- From the point the member joins the fund until the point of retirement, known as the pre-retirement (or accumulation) phase.
- From the point of retirement until the point that the member withdraws the last of their savings, known as the retirement phase.

Figure 1 depicts these components through two illustrative examples. It demonstrates that there can be significant variations in the length of time that members occupy each of these phases due to the differing times that:

- Members join their superannuation fund, for example due to some members attending university before commencing employment.
- Members elect to retire, for example some members retiring early for leisure or health reasons.
- Retirees' use their fund to draw an income, for example due to different expenditure patterns.

[4] Warren, G.J, "How Investment Risk Evolves with Horizon", ANU Working Paper, September 2018
[5] Based on the results of Rice Warner's prospective stochastic model which simulates potential investment returns based on historical data

Figure 1. Components of superannuation investment horizon

3.3 Determinants of investment horizon

3.3.1 Methodology

Due to the variation in individual member experience, establishing the determinants of a member's investment horizon is difficult as it requires analysis of individual member data. This data is often difficult to obtain which restricts super funds analysis of their own data which is often limited (particularly in the retirement phase).

In analysing the determinants of investment horizon, we have used Rice Warner's Super Insights research which is an aggregated database of over 15 million member records from both the pre-retirement and retirement phase of superannuation. Using this data, we have estimated the future investment horizon of a member in the:

- Pre-retirement phase by estimating the age at which members will elect to retire.
- Retirement phase by analysing the pension payments made from ABPs to draw an analogy to the timeframe over which a member will draw from their portfolio.

For each of these components, we consider both age and balance as potential drivers of the future investment horizon. In doing this, we note that other drivers of a member's investment horizon may exist including gender and their level of engagement with superannuation.

The following sections explore how a member's investment horizon varies based on age and balance.

3.3.2 Pre-retirement

In the pre-retirement phase, a superannuation member contributes to their account with little-to-no ability to withdraw their balance[6]. This period spans the point a fund member joins the fund until the member withdraws their funding (as a lump sum) or rolls it over into an ABP after their preservation age. At the time of writing, legislation requires that a member reach a pre-determined age before making the election to withdraw or transfer their balance (with this age depending on the member's year of birth and trending to age 60).

[6] Legislative provisions exist for rare circumstances (such as in the event of a terminal medical diagnosis) that allow a member to withdraw their funds. We have not considered these provisions in this report.

Graph 1 shows the range of retirement ages for members of varying account balances based on Rice Warner's Super Insights research to reflect that:

- Members do not retire at the same point, rather members typically retire between age 55 and 70, which indicates that the difference between a member's age and age 55 provides an approximate minimum investment timeframe.
- Members with higher account balances ($500,000 to $1,000,000) retire earlier than members with lower account balances ($100,000 to $250,000), indicating that wealthier members may spend less time in the accumulation phase.

Graph 1. Retirement ages

3.3.3 Retirement

Once a member has made the election to retire, they will either:

- Transfer their account balance into a retirement product, typically an ABP.
- Withdraw their superannuation balance from the superannuation system (as a lump sum).

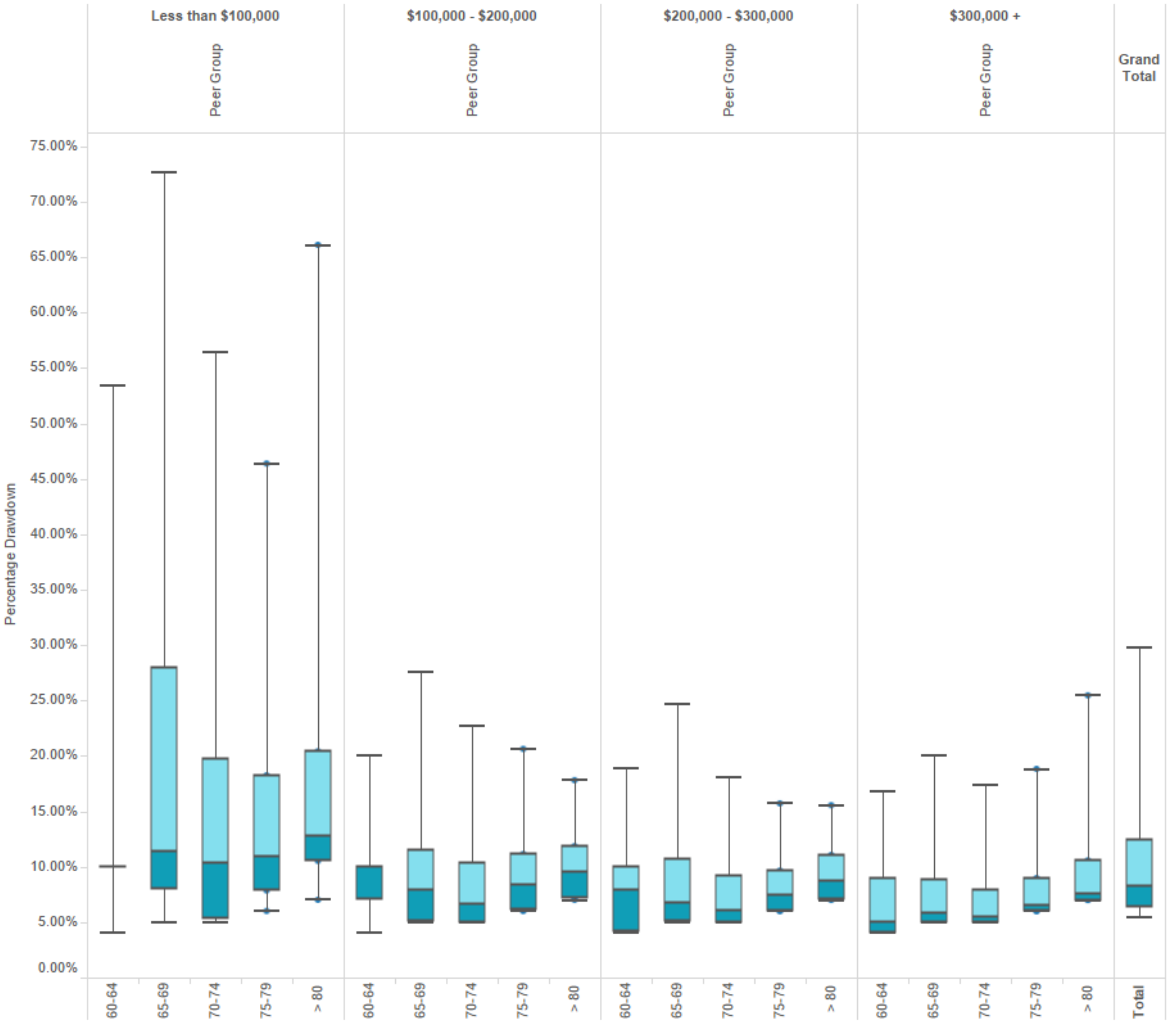
For members who do roll their superannuation balance over into the pension phase, a new journey begins. In this phase members withdraw funding from their account until their balance is expended. Aside from investment performance, this timeframe is governed by the:

- Amount that the individual transfers into the retirement phase at the point of retirement; and
- Annual withdrawal rate from the account (which is subject to legislated age-based minimum rates).
- Longevity of the member (which is borne by the member).

In line with these drivers, Graph 2 reflects the distribution of drawdown rates adopted by members based on several age and balance groupings. The graph reflects that that the distribution of the drawdown rate adopted by a given member is dependent on both age and balance in that as a member's:

- Balance falls below $100,000 they will tend to withdraw greater proportions of their assets, indicative of the largely fixed minimum cost of living (for example, the cost of rent and food).
- Balance remains above $100,000, they will typically drawdown at higher rates as they grow older, likely indicative of the:
  - Increase of the legislated minimum drawdown rate applicable to with age.
  - Higher aged care costs that older individuals often face.

Graph 2. Member drawdown behaviour (Age and Balance)*



* Extracted from Rice Warner's Super Insights research. In this chart the plot whiskers indicate the 5th and 95th percentiles to exclude outliers while the dark and light blue bars indicate the interquartile range.

For members who withdraw their balance from superannuation, the rates at which assets are drawn down is uncertain as their balance is no longer managed by the fund and therefore data becomes scarce. We anticipate that while members often adopt different investment strategies in the personal wealth system[7] their behaviours with respect to drawdown would not change dramatically.

[7] Rice Warner's Personal Investments Market Report 2019

3.4 Implications

Based on this analysis, we consider that a member's investment horizon is not bounded by the date that they choose to retire (though this point is relevant). This occurs since a member is likely to spend a substantial period in the retirement phase unless their balance is low. Further, we consider that a member's investment horizon is dependent on more variables than just age. We expect that there are several variables which provide a reliable indication of the members investment horizon, including age and their accumulated balance.

One consequence of this is that investment strategies which adjust to a member's changing investment horizon may deliver better outcomes for members – both to and through retirement. Examples of strategies which might achieve this include investment strategies which allocate:

- High portions of the portfolio to growth assets where members are young (that is, below age 50).
- High portions of the portfolio to growth assets where members are approaching retirement or actively drawing down but have large balances (that is, above age 50 and balances over a threshold).
- Reduced portions of the portfolio to growth assets where members are approaching retirement or actively drawing down but have small balances (that is, above age 50 and balances under a threshold).

In the remainder of the paper we will assess this proposition.

4. Investment default design

In this section we consider several candidate default superannuation investment strategies as applied to several hypothetical members throughout their lifetime. This aims to assess, in relative terms, the distribution of outcomes produced by these strategies. We have structured this section as follows:

- Section 4.1 (Methodology) outlines the methodology we have adopted to make this assessment.
- Section 4.2 (Results) outlines the results we have produced based on this methodology.
- Section 4.3 (Implications) draws out the implications of these results.

4.1 Methodology

In comparing the impact of different investment strategies on members we have considered a range of:

- Investment strategies to capture the range of MySuper strategies available in the market.
- Member cameos to capture the implications of differing membership profiles that funds may face.

Using these variables, we have leveraged Rice Warner's stochastic Member Outcomes model which provides an estimate of the distribution of the outcomes that might be realised by members.

4.1.1 Investment strategies

We have modelled five different investment strategies. These strategies are a:

- **Balanced Strategy** which adopts a 70% allocation to Growth assets and a 30% allocation to Defensive assets irrespective of a members age or balance.
- **High Growth Strategy** which adopts an 85% allocation to Growth assets and a 15% allocation to Defensive assets for all members irrespective of age and balance.
- **First-generation Lifecycle (Lifecycle 1 (Age))** with an emphasis on defensive assets that segment members by age and de-risk from a young age.
- **Second-generation Lifecycle (Lifecycle 2 (Age))** with higher allocations to growth up to age 55 before slowly de-risking to more defensive levels as members age.
- **Multi-dimensional Lifecycle (Lifecycle (Age and Balance))** which adopts a high allocation to growth assets unless a member is at an advanced age and has a low balance.

Appendix A (Lifecycle allocations) outlines the asset allocation of these strategies in detail. We note that these strategies are intended to be indicative of the outcomes produced by a type of strategy and not an 'optimal' default strategy. If an optimal solution or side-by-side comparison of two candidate strategies was required, we expect that these parameters would change.

4.1.2 Member profiles

In assessing these strategies, we have considered six member cameos to capture characteristics of a range of members. Table 11 outlines these cameos and the characteristics of the members that they represent. In using these profiles, we note that these profiles are not intended to capture all possible member cohorts, rather they aim to provide an indication of several critical profiles that are of interest.

For each of these member cameos we have assumed a series of contribution rates that aim to replicate the behaviour of a member within each respective age and balance segment. These assumptions have been estimated using Rice Warner's Super Insights database of member records.

Table 11. Member cameos

Cameo	Age	Starting balance ($)	Annual contributions ($)
Cameo 1	30	7,900	1,500
Cameo 2	30	26,900	3,800
Cameo 3	30	89,900	10,550
Cameo 4	60	14,500	1,500
Cameo 5	60	52,700	3,500
Cameo 6	60	338,000	38,000

After the point of retirement (taken to be the median retirement age of retirees in Rice Warner's Super Insights database) we have assumed that a member makes annual withdrawals at the minimum of the:

- Association of Superannuation Funds of Australia (ASFA) comfortable standard for a single person ($43,787 per annum, paid at the start of a given year and increased annually with inflation).
- Legislated minimum drawdown rate.

This aims to capture the multi-dimensional nature of member drawdown patterns in retirement that we have detailed in Section 3.3.3 (Retirement).

4.1.3 Member projections

In estimating the possible retirement outcomes produced for members we have leveraged Rice Warner's stochastic member projection model. This model projects the range of potential member experiences under an investment strategy through using a series of stochastic simulations. In aggregate this model allows for an estimation of the distribution of lifetime income a given member can expect to receive within a given investment strategy. This allows comparison of the income provided to members under each strategy in a range of investment situations and as a result allows a relative assessment of each strategy.

Further information on this model and the parameters which drive it can be found in:

- Appendix B (Member experience modelling approach) which provides further detail on the approach taken to model member experience.
- Appendix C (Investment model) which provides information on the investment component of this modelling.

4.2 Results

For each investment strategy and member cameo combination we have considered 500 simulations of the expected present value of the lifetime income produced by the strategy (inclusive of the income provided by the Age Pension). Using these results, we have estimated the implications of a:

- Poor investment outcome using the 10th percentile of the distribution of simulated lifetime income.
- Neutral investment outcome using the median of the distribution of simulated lifetime income.
- Strong investment outcome using the 90th percentile of the distribution of simulated lifetime income.

4.2.1 Age 30

Tables 12 through 14 reflect the impact of different investment designs on the total income provided in retirement to a member aged 30 today. This is calculated by estimating the expected lifetime income the member derives from the strategy (inclusive of the Age Pension) and comparing the income to that provided by a single-strategy Balanced fund comprising of a 70% allocation to growth assets. The figures reflect that:

- High Growth strategies can provide significant scope for outperformance with minimal risk of underperformance relative to a Balanced fund due to the members long investment horizon.
- Defensive Lifecycle strategies will typically underperform each of the other considered strategies. This is a result of the defensive allocation of these strategies being compounded over a young members long investment horizon.
- Second-generation Lifecycle provides a reduced risk option over the members lifetime, at the cost of reduced overall expected returns.
- Two-dimensional Lifecycle strategies provide scope for improvement by adopting a high allocation to growth assets early in a member's life and then controlling for risk when sequencing risk is high.

Appendix D (Additional results – member aged 30) sets out the dollar figures for the lifetime income derived from each product upon which these numbers are based.

Table 12. Cameo 1 – age 30, account balance $7,900

	High Growth Strategy (85/15)	Lifecyle 1 (Age)	Lifecyle 2 (Age)	Lifecycle (Age and Balance)
	(%)			
Low (10th Percentile)	0.1	0.0	0.1	0.2
Median	1.2	-0.8	0.9	1.1
High (90th Percentile)	3.3	-2.2	2.9	3.5

Table 13. Cameo 2 – age 30, account balance $26,900

	High Growth Strategy (85/15)	Lifecyle 1 (Age)	Lifecyle 2 (Age)	Lifecycle (Age and Balance)
	(%)			
Low (10th Percentile)	0.2	0.0	0.4	0.4
Median	2.6	-1.8	2.3	2.8
High (90th Percentile)	10.2	-7.2	7.3	12.6

Table 14. Cameo 3 – age 30, account balance $89,900

	High Growth Strategy (85/15)	Lifecyle 1 (Age)	Lifecyle 2 (Age)	Lifecycle (Age and Balance)
	(%)			
Low (10th Percentile)	1.1	-1.3	0.9	1.0
Median	9.1	-6.8	4.5	13.1
High (90th Percentile)	24.1	-22.3	11.9	35.1

Table 15 outlines the relative probabilities that each considered strategy (on rows) outperforms the other strategies considered (on columns) for a member aged 30 with a balance of $26,900 and contributions of $3,800 per annum. For example, a balanced strategy with 70% in growth assets outperformed a simple lifecycle strategy in 86.2% of our simulations.

The key themes from this analysis are that for a member of this profile:

- High Growth strategies will typically outperform Balanced strategies due to the higher expected return on these portfolios.
- First generation Lifecycle strategies will occasionally outperform Second generation Lifecycle strategies, typically when investment performance is poor.
- Two-dimensional Lifecycle strategies (on Age and Balance) will typically outperform each of the other strategies considered in this report.

Table 15. Probability of comparative outperformance, member aged 30 with an account Balance of $26,900

	Balanced Strategy (70/30)	High Growth Strategy (85/15)	Lifecyle 1 (Age)	Lifecyle 2 (Age)	Lifecycle (Age and Balance)
	(%)				
Balanced Strategy (70/30)	-	8.4	86.2	7.4	8.2
High Growth Strategy (85/15)	91.6	-	89.6	72.6	26.8
Lifecyle 1 (Age)	13.8	10.4	-	8.8	8.8
Lifecyle 2 (Age)	92.6	27.4	91.2	-	15.4
Lifecycle (Age and Balance)	91.8	73.2	91.2	84.6	-

4.2.2 Age 60

Tables 16 through 18 reflect the impact of different investment designs on the total income provided in retirement to a member aged 60 today. This is calculated by estimating the expected lifetime income the member derives from the strategy (inclusive of the Age Pension) and comparing the income to that provided by a single-strategy Balanced fund comprising of a 70% allocation to growth assets. The figures reflect that for an individual aged 60:

- High Growth strategies can provide significant scope for outperformance, at the cost of a level of tail-risk (underperformance of 5% relative to a Balanced fund) in a poor investment outlook scenario.
- Defensive Lifecycles (Lifecycle 1) will outperform other strategies in cases where investment performance is poor, particularly for those with low levels of wealth (as they have short horizons).
- Two-dimensional Lifecycle provides:
  - Downside protection broadly in line with a Balanced fund where wealth is low, investment horizon is commensurately short, and the implications of sequencing risk is therefore high.
  - Significant scope for outperformance, at the cost of a level of tail-risk (underperformance of 5% relative to a Balanced fund) in a poor investment outlook scenario.

Appendix E (Additional results – member aged 60) sets out the dollar figures for the lifetime income derived from each product and cameo upon which these numbers are based.

Table 16. Cameo 4 – age 60, account balance $14,500[8]

	High Growth Strategy (85/15)	Lifecycle 1 (Age)	Lifecycle 2 (Age)	Lifecycle (Age and Balance)
	(%)			
Low (10th Percentile)	-0.1	0.1	0.0	0.0
Median	0.0	-0.1	0.0	0.0
High (90th Percentile)	0.2	-0.2	0.1	0.1

Table 17. Cameo 5 – age 60, account balance $52,700

	High Growth Strategy (85/15)	Lifecycle 1 (Age)	Lifecycle 2 (Age)	Lifecycle (Age and Balance)
	(%)			
Low (10th Percentile)	-0.3	0.3	-0.1	-0.1
Median	0.2	-0.2	0.1	0.1
High (90th Percentile)	0.8	-0.9	0.2	0.2

[8] We note that that accounts with low balances belonging to individuals close to retirement will typically be consolidated into a larger accounts ahead of retirement or withdrawn in cash at the point of retirement.

Table 18. Cameo 6 – age 60, account balance $338,000

	High Growth Strategy (85/15)	Lifecyle 1 (Age)	Lifecyle 2 (Age)	Lifecycle (Age and Balance)
	(%)			
Low (10th Percentile)	-1.0	1.0	0.1	-1.8
Median	2.2	-3.6	0.1	2.3
High (90th Percentile)	3.4	-5.8	0.3	4.4

Table 19 outlines the relative probabilities that each considered strategy (on rows) outperforms the other strategies considered (on columns) for a member aged 60 with a balance of $118,300 and contributions of $3,500 per annum. For example, a balanced strategy with 70% in growth assets outperformed a simple lifecycle strategy in 71.0% of our simulations.

The key themes from this analysis are that for a member of this profile:

- High Growth strategies will typically outperform other strategies given the significant allocation to growth assets of the strategy relative to others, for example:
  - Second-generation Lifecycle strategies which have begun de-risking due to member age; and
  - Two-dimensional Lifecycle strategies which have begun de-risking due to the relatively short investment horizon of the member in question (approximately three years).
- First generation Lifecycle strategies will typically underperform other strategies due to their low allocations to growth assets relative to the other strategies we have considered.

Table 19. Probability of comparative outperformance, member aged 60 with an account balance of $52,700

	Balanced Strategy (70/30)	High Growth Strategy (85/15)	Lifecyle 1 (Age)	Lifecyle 2 (Age)	Lifecycle (Age and Balance)
	(%)				
Balanced Strategy (70/30)	-	29.2	71.0	27.6	27.6
High Growth Strategy (85/15)	70.8	-	71.2	69.6	69.6
Lifecyle 1 (Age)	29.0	28.8	-	28.2	28.0
Lifecyle 2 (Age)	72.4	30.4	71.8	-	28.9
Lifecycle (Age and Balance)	72.4	30.4	72.0	71.1	-

4.3 Implications

Overall the results suggest that:

- Adopting a high allocation to growth assets is not inherently a poor strategy, even in cases where members are approaching retirement. This is as these portfolios will typically provide:
    - Significantly improved outcomes in cases where members are young (as a result of the ability to spread risk over this investment horizon) without material risk of underperformance in poor investment scenarios.
    - Improved outcomes where members are approaching retirement and investment outcomes are either neutral or strong (due to the higher expected return on growth assets).
    - Marginally weaker outcomes (less than 5% underperformance over a member's lifetime) in cases where investment performance is weak.
- Defensively focused Lifecycle investments (for example, First-generation Lifecycle strategies) will typically underperform other strategies unless investment returns are poor and the members for whom it is designed are approaching or actively retired.
- Two-dimensional Lifecycle strategies provide the ability to access material excess return by adopting a more growth-oriented stance while still being able to control the level of risk adopted by members.

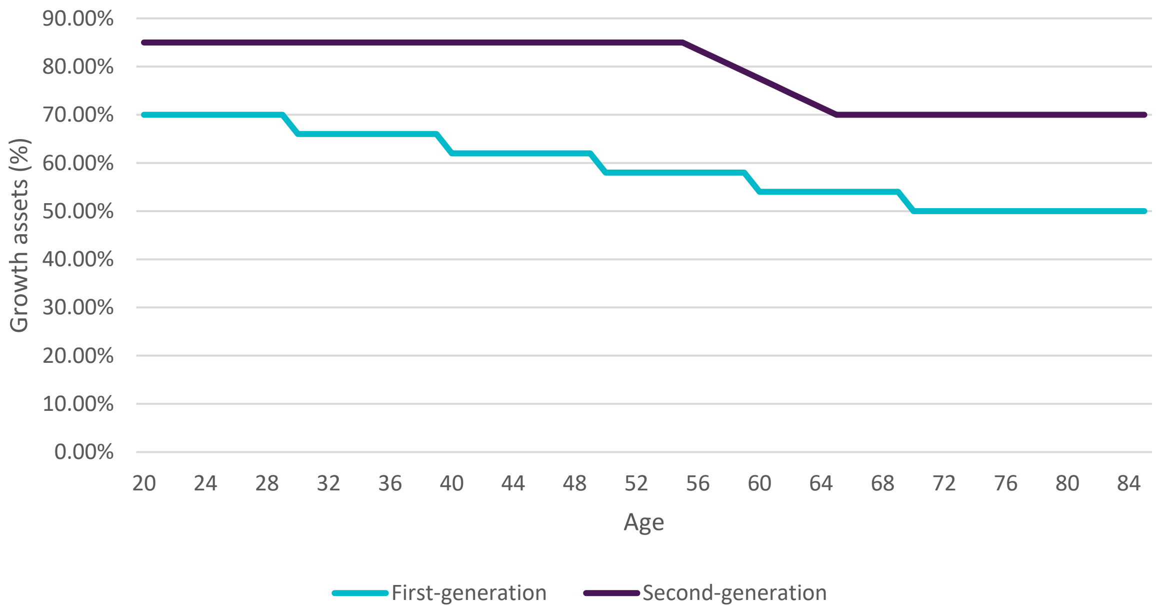
We would emphasise that it there is unlikely to be a single solution that meets the needs of all funds for all member cohorts. In ensuring that a funds default investment strategy design meets the needs of members, we anticipate that funds will need to regularly conduct regular reviews. We anticipate that these reviews will include refreshed analysis of member segments and investment outlook to ensure that the fund's proposition continues to optimise likely member outcomes.

Appendix A Lifecycle allocations

A.1 First-generation and Second-generation Lifecycle

Figure 2 depicts the allocation to growth assets for each age used in the First-generation and Second-generation Lifecycle strategy in this paper.

Figure 2. Growth allocations for First-generation and Second-generation Lifecycle strategy



A.2 Two-dimensional Lifecycle

Figure 3 depicts the allocation to growth assets for each age and balance combination used in the Two-dimensional Lifecycle strategy in this paper.

Figure 3. Growth allocations for First-generation Lifecycle strategy

Age	Account Balance ($)																							
	50,000 and under	52,500	55,000	57,500	60,000	62,500	65,000	67,500	70,000	80,000	90,000	100,000	110,000	120,000	130,000	140,000	150,000	160,000	170,000	180,000	190,000	200,000	210,000	220,000 and over
	Growth (%)																							
40 and under	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0
41	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0
42	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0
43	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0
44	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0
45	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0
46	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0
47	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0
48	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0
49	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0
50	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0
51	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0
52	89.5	89.5	89.5	89.5	89.5	89.5	89.5	89.5	89.5	89.5	89.5	89.5	89.5	89.5	89.5	89.5	89.5	89.5	89.5	89.5	89.5	89.5	89.5	90.0
53	88.0	88.0	88.0	88.0	88.0	88.0	88.0	88.0	88.0	88.0	88.0	88.0	88.0	88.0	88.0	88.0	88.0	88.0	88.0	88.0	88.0	88.0	89.0	90.0
54	86.5	86.5	86.5	86.5	86.5	86.5	86.5	86.5	86.5	86.5	86.5	86.5	86.5	86.5	86.5	86.5	86.5	86.5	86.5	86.5	87.0	88.0	89.0	90.0
55	85.0	85.0	85.0	85.0	85.0	85.0	85.0	85.0	85.0	85.0	85.0	85.0	85.0	85.0	85.0	85.0	85.0	85.0	85.0	86.0	87.0	88.0	89.0	90.0
56	83.5	83.5	83.5	83.5	83.5	83.5	83.5	83.5	83.5	83.5	83.5	83.5	83.5	83.5	83.5	83.5	83.5	84.0	85.0	86.0	87.0	88.0	89.0	90.0
57	82.0	82.0	82.0	82.0	82.0	82.0	82.0	82.0	82.0	82.0	82.0	82.0	82.0	82.0	82.0	82.0	83.0	84.0	85.0	86.0	87.0	88.0	89.0	90.0
58	80.5	80.5	80.5	80.5	80.5	80.5	80.5	80.5	80.5	80.5	80.5	80.5	80.5	80.5	81.0	82.0	83.0	84.0	85.0	86.0	87.0	88.0	89.0	90.0
59	79.0	79.0	79.0	79.0	79.0	79.0	79.0	79.0	79.0	79.0	79.0	79.0	79.0	80.0	81.0	82.0	83.0	84.0	85.0	86.0	87.0	88.0	89.0	90.0
60	77.5	77.5	77.5	77.5	77.5	77.5	77.5	77.5	77.5	77.5	77.5	78.0	79.0	80.0	81.0	82.0	83.0	84.0	85.0	86.0	87.0	88.0	89.0	90.0
61	76.0	76.0	76.0	76.0	76.0	76.0	76.0	76.0	76.0	76.0	77.0	78.0	79.0	80.0	81.0	82.0	83.0	84.0	85.0	86.0	87.0	88.0	89.0	90.0
62	74.5	74.5	74.5	74.5	74.5	74.5	74.5	74.5	75.0	76.0	77.0	78.0	79.0	80.0	81.0	82.0	83.0	84.0	85.0	86.0	87.0	88.0	89.0	90.0
63	73.0	73.0	73.0	73.0	73.0	73.0	73.0	74.0	75.0	76.0	77.0	78.0	79.0	80.0	81.0	82.0	83.0	84.0	85.0	86.0	87.0	88.0	89.0	90.0
64	71.5	71.5	71.5	71.5	71.5	71.5	71.5	74.0	75.0	76.0	77.0	78.0	79.0	80.0	81.0	82.0	83.0	84.0	85.0	86.0	87.0	88.0	89.0	90.0
65	70.0	70.0	70.0	70.0	70.0	70.0	70.0	74.0	75.0	76.0	77.0	78.0	79.0	80.0	81.0	82.0	83.0	84.0	85.0	86.0	87.0	88.0	89.0	90.0
66	70.0	70.0	70.0	70.0	70.0	70.0	70.0	74.0	75.0	76.0	77.0	78.0	79.0	80.0	81.0	82.0	83.0	84.0	85.0	86.0	87.0	88.0	89.0	90.0
67	70.0	70.0	70.0	70.0	70.0	70.0	70.0	74.0	75.0	76.0	77.0	78.0	79.0	80.0	81.0	82.0	83.0	84.0	85.0	86.0	87.0	88.0	89.0	90.0
68	70.0	70.0	70.0	70.0	70.0	70.0	70.0	74.0	75.0	76.0	77.0	78.0	79.0	80.0	81.0	82.0	83.0	84.0	85.0	86.0	87.0	88.0	89.0	90.0
69	70.0	70.0	70.0	70.0	70.0	70.0	70.0	74.0	75.0	76.0	77.0	78.0	79.0	80.0	81.0	82.0	83.0	84.0	85.0	86.0	87.0	88.0	89.0	90.0
and over	70.0	70.0	70.0	70.0	70.0	70.0	70.0	74.0	75.0	76.0	77.0	78.0	79.0	80.0	81.0	82.0	83.0	84.0	85.0	86.0	87.0	88.0	89.0	90.0

Appendix B Member experience modelling approach

Rice Warner's member projection model estimates the balance that a member could expect to receive at the point of retirement given a set of input assumptions. For the purposes of this report, various parameters were used for cameos 1 through 6. The model takes into consideration:

- Member, salary sacrifice and employer contributions
- Contributions tax
- Low Income Superannuation Tax Offset (LISTO)
- (Stochastic) Return
- Administration costs
- Investment costs
- Investment tax.

In each year projected the dollar administration fee and contributions have been indexed at the rate of real wage growth and so the balance at each age for the member is calculated in nominal terms. These values are then deflated at the rate of wage growth to provide results.

These projected results are produced by Rice Warner's stochastic model which:

- Considers expected asset class returns, volatilities, asset class correlations, skewness, kurtosis and the autocorrelation/mean reversion of returns
- Calibrates against both Australian and international experience, over 40 years.
- Provides a forward-looking view on potential investment returns and volatility of various asset classes

Appendix C Investment model

Rice Warner's stochastic investment model considers a wide range of economic and investment market factors, including expected asset class returns, volatilities, cross-correlations between asset classes, skewness and kurtosis. The model also factors in auto-correlation/mean reversion of returns.

It is based on and calibrated against Australian and international experience, often going back over 40 years. For unlisted/alternative assets, where historical data is limited, we adopt a range of proxy measures and overlay our judgment and knowledge to calibrate their return distribution.

We have supplemented historical data with our survey of major asset consultants and fund managers, regarding their expectations of the asset returns in the next ten years. We have used this to help form a forward-looking view on the potential investment returns and volatility of various asset classes.

The steps taken to determine the required stochastic asset returns are as follows:

1. To simulate the effect of the economic cycle, generate correlated sine curves which represent the expected return of various asset classes in different stages of the economic cycle:
    - i. Generate fluctuations around the expected return as correlated random variables for each asset class, based on the standard model assumptions.
    - ii. The expected return plus the random fluctuations form the one-year gross return of the asset.
    - iii. Repeat steps *1.i* and *1.ii* 80 times to simulate the 80 years of returns.
    - iv. Repeat steps *i.* to *iv.* to generate 500 sets of 80 years of returns distributions.
2. Calculate the portfolio's gross return by applying the correlated random variables to the portfolio's asset allocation, as described earlier in this report.

Appendix D Additional results – member aged 30

Tables 20 through 22 below show the expected total retirement income for each member over their lifetime (inclusive of the Age Pension).

Table 20. Cameo 1 – Age 30, Account Balance $7,900

	Single Strategy (70/30)	High Growth Strategy (85/15)	Lifecyle 1 (Age)	Lifecyle 2 (Age)	Lifecycle (Age and Balance)
	($)				
Low (10th Percentile)	$541,900	$542,500	$541,900	$542,600	$543,100
Median	$559,500	$565,900	$555,100	$564,400	$565,800
High (90th Percentile)	$590,000	$609,300	$577,200	$607,100	$610,500

Table 21. Cameo 2 – Age 30, Account Balance $26,900

	Single Strategy (70/30)	High Growth Strategy (85/15)	Lifecyle 1 (Age)	Lifecyle 2 (Age)	Lifecycle (Age and Balance)
	($)				
Low (10th Percentile)	$610,500	$611,600	$610,700	$612,900	$612,700
Median	$664,200	$681,300	$652,200	$679,200	$682,500
High (90th Percentile)	$772,700	$851,400	$717,400	$829,300	$870,100

Table 22. Cameo 4 – Age 30, Account Balance $89,900

	Single Strategy (70/30)	High Growth Strategy (85/15)	Lifecyle 1 (Age)	Lifecyle 2 (Age)	Lifecycle (Age and Balance)
	($)				
Low (5th Percentile)	$1,156,100	$1,169,100	$1,141,300	$1,166,200	$1,167,100
Median	$1,351,000	$1,474,500	$1,258,800	$1,411,900	$1,527,600
High (95th Percentile)	$2,019,200	$2,506,200	$1,569,100	$2,259,500	$2,728,200

Appendix E Additional results – member aged 60

Tables 23 through 25 below show the expected total retirement income for each member over their lifetime (inclusive of the Age Pension).

Table 23. Cameo 5 – age 60, account balance $14,500

	Single Strategy (70/30)	High Growth Strategy (85/15)	Lifecycle 1 (Age)	Lifecyle 2 (Age)	Lifecycle (Age and Balance)
	($)				
Low (10th Percentile)	$460,500	$460,000	$460,900	$460,300	$460,300
Median	$463,400	$463,700	$463,100	$463,500	$463,500
High (90th Percentile)	$466,500	$467,500	$465,400	$466,900	$466,900

Table 24. Cameo 6 – age 60, account balance $52,700

	Single Strategy (70/30)	High Growth Strategy (85/15)	Lifecycle 1 (Age)	Lifecyle 2 (Age)	Lifecycle (Age and Balance)
	($)				
Low (10th Percentile)	$498,000	$496,700	$499,500	$497,600	$497,600
Median	$508,100	$509,000	$507,000	$508,400	$508,400
High (90th Percentile)	$520,100	$524,100	$515,300	$521,400	$521,400

Table 25. Cameo 8 – age 60, account balance $338,000

	Single Strategy (70/30)	High Growth Strategy (85/15)	Lifecycle 1 (Age)	Lifecyle 2 (Age)	Lifecycle (Age and Balance)
	($)				
Low (10th Percentile)	$839,500	$830,900	$847,700	$840,000	$824,100
Median	$974,300	$995,400	$939,600	$975,600	$997,100
High (90th Percentile)	$1,087,000	$1,124,300	$1,023,900	$1,090,200	$1,135,300