Australian Government Productivity Commission	
Analysis of members' needs	Superannuation: Assessing Efficiency and Competitiveness, Inquiry Report no. 91 Technical Supplement 6
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The Productivity Commission

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6 Technical supplement: analysis of members' needs

This technical supplement provides documentation and further results from empirical analysis of some of the key aspects that determine whether the superannuation system meets members' needs.

Section 6.1 outlines the simulation methods used to explore the distribution of outcomes from various investment strategies, recognising that asset returns are volatile and that average results conceal the variety of outcomes that can occur. Members do not get average results in the same way that an individual lottery player does not get the average odds on a lottery ticket. Given that most people are risk averse, many will be willing to forgo some returns if that sufficiently reduces the risk of adverse outcomes. Simulations can also allow assessment of the effect of different designs of products on outcomes, for which there are no closed-form solutions.

Section 6.2 provides some simulation results about the degree of sequencing risks for superannuation balances as members approach retirement ages.

Life-cycle products have been developed to better meet income needs after retirement. They particularly aim to produce high returns during the earlier part of a person's working life, while mitigating the risks that arise from the adverse impacts of large negative shocks to growth asset values close to retirement (Chant, Mohankumar and Warren 2014; Minney sub. DR131, p. 2). As noted by Bell:

Effectively there is a large single point of risk event, namely the yield of the annuity / benchmark fixed income security at the time of retirement. To hedge this risk one can ladder into longer-dated bonds during the later years of the accumulation phase. This is one of the justifications of a lifecycle strategy. (sub. DR201, p. 3)

However, life-cycle products come in different forms, some of which do not effectively meet the objectives above. Examining the degree to which the various types of life-cycle products achieve a reasonable balance between expected returns and risk mitigation requires stochastic analysis, with the outcomes of various scenarios assessed in section 6.3. The Commission has undertaken more analysis of life-cycle products following evidence provided in response to the draft report.

As noted in chapter 4, some super funds offer thousands of options, raising concerns that these are associated with higher fees and lower net returns. Section 6.4 examines some of the empirical evidence underpinning those concerns.

Finally, members often have a limited understanding of their super funds or superannuation in general. While this can lead to poor decision making, it also can magnify uncertainty, distrust and lack of satisfaction. The links between various aspects of financial literacy and trust/satisfaction are explored in section 6.5.

6.1 Simulation approaches to testing the impacts of superannuation products

Throughout the inquiry report, the Commission uses two general assessment methods for considering the impacts of, among other factors, shifting to life-cycle products, high fees, low returns and the balance erosion that accompanies insurance:

- a deterministic cameo. In most instances, the Commission has considered the outcomes for a 'representative' member a young person entering the system now, retiring at age 67 and dying at age 88 years (described briefly in chapter 1 and in more detail below). However, the outcomes for people in other circumstances are also considered. One group are people with sporadic employment. Another comprises people who are retiring soon, and whose typically low superannuation savings reflect the immaturity of the superannuation system and low mandatory contribution rates in its formative years. It is important in designing a superannuation system to have an eye on the future, but not ignore the needs of people who will soon retire
- a stochastic approach drawing on the parameters of the deterministic approach. As beforehand, returns are not known, outcomes for members will partly depend on chance. Different super products will lead to differences in expected outcomes and their variance. Risk averse members will make a trade-off between products with average returns and the volatility of those returns (in effect, taking out insurance), with their risk appetite a function of their individual preferences, and their capacity for bearing risk in other ways (for example, through other asset holdings). Stochastic analysis can provide measures of the implicit insurance premium that people pay to reduce risk, which can inform judgments about whether products are likely to be suited to members. This approach is particularly valuable for assessment of life-cycle products where the mix of growth versus defensive assets changes during the accumulation phase.

The analytical strategies reflect heterogeneity in members and funds' objectives

The Commission has explored many scenarios in its stochastic analysis. In doing so, it has considered information on asset returns for nine asset classes, evidence about the portfolio weights of different MySuper products, a variety of employee types, the impacts of the Age Pension on retirement income, and the measures that best assess the outcomes for members (figure 6.1, box 6.1). Monte Carlo methods were mainly used for the analysis instead of bootstrapping (as used in the draft report), though the same qualitative conclusions can be drawn regardless of the form of stochastic analysis (box 6.2).

rigule 6.1 The scenarios explored			
Asset return types	Simulation of asset returns		
 9 asset classes classified into defensive and growth assets 	Monte CarloBlock bootstrap		
Employee types	MySuper products		
 Permanent full-time male non-managerial with moderate wage (Case A) Low wage, continuous employment (Case B) High wage, continuous employment (Case C) Woman bearing 2 children with interrupted employment (Case D) Part-time work close to retirement (Case E) 	 Single-strategy 'balanced' portfolio – 28% defensive and 72% growth assets A life-cycle product with a greater weighting to defensive assets on the glide path ('defensive life-cycle') A life-cycle product with a growth-oriented glide path ('growth life-cycle) All MySuper life-cycle products 		
Treatment of external factors	Outcome measures		
 Age Pension eligibility (asset and income tests) 	 Balance at retirement NPV of all retirement income including welfare payments and bequests NPV welfare income NPV bequests NPV super-funded retirement income, excluding bequests & welfare 		

~ 4

The most important ages for the representative member

The member enters the superannuation system in 2018 at age StartAge (with the default being 21 years), retires in 2064 at age RetireAge (with the default being 67 years) and dies in 2085 at age *DeathAge* (with a default value of 88 years). The assumed patterns of work, retirement and death will align with the expected experiences of many people.

The default retirement age is higher than the current observed rate, but various factors are likely to increase the average retirement age.¹ Improving life expectancy, rising labour force participation rates for older people and policies that have increased the age when people are eligible for withdrawals from superannuation (the preservation age) and access to the Age Pension will all tend to defer retirement ages. In particular, the shift to an Age Pension eligibility age of 67 years by 2023 is likely to have a marked impact. Regardless, even now a significant share of men retire at or after age 67 years.

¹ In 2016-17, the average retirement age for men aged 45 years and over was 58.8 years (ABS 2017e, table 3). Some 30 per cent had retired after age 65 years or more.

Box 6.1 Exploring different types of working life experiences

Case A: The default assumption is a full-time male non-managerial employee

There are multiple sources of wage data, but they do not provide contemporary wage estimates at the single year-age level. Nevertheless, several indicators suggest that an annual wage rate of about \$50 000 is a reasonable estimate for many full-time employees at age 21 years.

The average weekly total cash earnings of male permanent full-time non-managerial employees aged 21–24 years was \$1113 in May 2016, with a corresponding value of \$1003 for females (ABS 2017c, Data Cube 4, table 4). As wages tend to grow with age, this suggests that 21 year olds would be receiving less than the rate for the entire age group. On the other hand, wage rates have increased (somewhat) over the ensuing years to 2018. Drawing on ABS data, the combination of these two factors are consistent with the assumed starting wage (ABS 2017b, 2017a).

Cases B and C: These are like Case A, but assume starting wages of \$30 000 and \$80 000 respectively.

Case D: A woman with two children

Women bearing children generally have interrupted careers, tend to more often work part time, and given the nature of jobs and reduced experience, earn less than their male counterparts of the same age.

Controlling for the effects of economy-wide wage increases over time, the earnings profile of women with two children were estimated using the relationship found by Breusch and Gray (2004). A starting wage equivalent to that of a female non-managerial employee aged 21 years in 2018 (about \$30 000 per year) is used, based on the same ABS sources used in Case B.

Case E: Withdrawal from labour supply at older ages

Some older people commence working part time before retirement, which means that they are more exposed to the retirement income consequences of sequencing risks (unless they increase their working hours in response to an adverse asset price shock). The cameo in this instance is that the person works at 90 per cent of the full-time rate between ages 56 and 59 years exclusive, 80 per cent between the ages of 60 and 65 years exclusive, and 70 per cent from ages 66 to 67 years exclusive. All other variables follow those in Case A.

The life expectancy estimate is also higher than current levels, but is also plausible. The most recent life tables (2014–2016) suggest that someone reaching age 67 years in 2015, will live another 18 years, which would take them up to age 85 years (ABS 2017d). However, this projection is a period (not cohort) life expectancy, which takes as given the *current* mortality rates for each year after age 67 years. The general trend is for declining age-specific mortality rates (Kontis et al. 2017). Moreover, a later retirement age (which the age of 67 years is relative to current retirement ages) is protective of longevity, even after taking account of observed health status.

Box 6.2 Bootstrapping and Monte Carlo analysis

Bootstrapping

Bootstrapping from historical data has the advantage that no assumption need be made about the distribution of returns within any given class or the correlation between them. So long as the historical distribution of asset returns are stable over time, bootstrapping can provide more accurate estimates of the outcomes from different investment strategies.

Using this approach, for any given simulation, the estimated return for each of the years from 2018 to 2085 is determined as a random sample (with replacement) for the historical series of returns. As there is some serial dependence between asset returns over successive years, the 'stationary block bootstrap' is used (as in Ganegoda and Evans 2015) with a block length of a maximum of five. This samples from blocks of returns in successive years with the block length varying randomly to ensure stationarity of the series, reflecting the time series nature of asset returns (Politis and Romano 1994). The returns for a portfolio are derived from data on nine asset classes and assumptions about asset class shares consistent with typical life-cycle and single-strategy ('balanced') products (table 6.1). While Vanguard data are available from 1988, there is a significant structural break in the returns on defensive assets in the early 1990s (see below), which could confound bootstrap estimates. Accordingly, only returns from 1991 were used.

Monte Carlo analysis

An alternative to bootstrapping is Monte Carlo (MC) analysis based on assumptions about the probability distribution function, mean returns and variance of different asset classes. As the most crucial aspect of life-cycle products is that they shift asset allocation from high-risk to low-risk assets as a person ages, just two asset classes (defensive and growth) are simulated, with an asset allocation that remains fixed for single-strategy ('balanced' products and that shifts as a person's age increases for life-cycle products.

In most of the MC analysis, and drawing on Vanguard data from 1991 to 2017, the after tax return on defensive assets is 4.525 per cent (real) with a coefficient of variation of 0.84, while the after tax return on growth assets is 6.696 per cent with a coefficient of variation of 1.88.

Whereas the draft report used the bootstrapping approach, most analysis in this supplement uses the MC approach (with bootstrapping only used to test that the MC methods produce similar outcomes). The MC approach still captures the intrinsic differences between life-cycle and single-strategy products, while being simpler. Moreover, real cash rates in the early period of the data from 1988 to 2017 were often very high — a reflection of an unstable macroeconomic environment and high inflation rates. Future cash rates may not have the same implicit probability distribution as bootstrapping from history would suggest. The MC method readily allows for a lower future expected real return on defensive assets. The rates of returns for defensive and growth assets are assumed to be normally distribution of returns for a balanced portfolio, it is not so extreme that normality of the underlying distribution is statistically rejected.^a This suggests that the assumption of normality of rates of return may be a reasonable rule of thumb.

In either bootstrapping or MC analysis it is assumed that the funds undertake full annual auto-rebalancing to preserve the original risk strategy.

^a However, the log of the rate of returns is much less aptly described as normally distributed, though often this is how asset returns are characterised.

While many people work before age 21 years, the share doing so is still only about 40 per cent for males aged 15–19 years (in 2018), and this will often entail work that does not meet the minimum required threshold for mandatory superannuation contributions (ABS 2018). In contrast, the employment rates for males aged 20–24 years is more than 70 per cent.

Wage income and super contributions

Wages and fees are in real terms over the period of the analysis. Several factors are important in determining wage income over a lifetime:

- a starting wage, which is then subject to growth as the member ages
- the effect of experience (years working in a job). While this is correlated with age, it is a distinct concept as people of the same ages can have quite different numbers of years of work experience. The experience effect on wage rates is estimated (for males) as:

100 Ln $W_{age} = X\beta + \alpha Experience + \theta Experience^2$

where $X\beta$ represents the vector of individual traits (and their corresponding estimated parameters from a Mincer equation) that determine the starting wage of any given person, and \propto and θ (respectively 1.556 and -0.019) are the estimated coefficients describing the impacts of experience on wages.² Accordingly, the impact of experience on the wages of a person who commences work at age 21 years and is employed for every year afterwards is:

 $E_effect_{age} = exp^{0.01 (\alpha Experience + \theta Experience^2)}$ with experience = 0 for age 21 years, 1 for age 22 years and so on

- the impact of long-run productivity on wage growth, which is the major factor behind economy-wide wage rate trends. Estimated future labour productivity growth is 1.5 per cent per year, in line with the projections used in the 2015 *Intergenerational Report* (Treasury 2015)
- gender (with the base case reflecting male labour force experience over time)
- average working hours per week (assumed to be fixed at a full-time level in the base case)
- any interruptions to working, such as unemployment or exit from the labour force (which are not included in the base case described here, but can readily be included).

² The estimates are obtained from Forbes et al. (2010), whose model controls for many other aspects that determine wages. Similar results are obtained by Cai (2007) and Yu (2004), which have equally comprehensive models. Other models that have fewer control variables tend to find larger experience effects (Ganegoda and Evans 2015; Sinning 2014; Wei 2010), which may reflect omitted variable bias. Models with greater experience effects will lead to higher lifetime incomes and larger absolute impacts of any factors that erode member balances.

Given the above, wages as a member ages are given by the combined effect of the member's starting wage, the benefits of experience, and economy-wide productivity growth:

 $W_{age} = StartingWage \times (1 + 0.015) \times E_{effect_{age}}$

Additions to the members balance at each age are equal to:

 $Contributions_{age} = ContribRate \times (1 - ContribTax) \times W_{age}$

ContribRate is the current 9.5 per cent contribution rate for the Superannuation Guarantee. The analysis does not presuppose that the contribution rate will be subsequently increased to 12 per cent (as planned by Government) or that a member makes any voluntary contributions. Including these features would exacerbate the adverse impacts on retirement balances of higher fees or lower returns. *ContribTax* is the 15 per cent contribution tax.

Asset returns to members

In the stochastic analysis, overall investment performance depends on the asset allocation and on asset-specific returns sampled from plausible distributions (box 6.2). MySuper single-strategy products target the same 'balanced growth' asset allocation over the working life of a member. Table 6.1 shows the allocation across nine asset classes for a 'representative' single strategy. In contrast, life-cycle products involve a higher orientation to growth assets than single-strategy products when people are early in their working lives, and then shift gradually 'on a glide path' to a more defensive allocation as the typical retirement age approaches.

Net returns are affected by investment and administrative fees and charges for insurance (which are set out in chapter 1) and by taxes. Tax rates for growth and defensive assets were set at 4.1 and 12 per cent respectively, consistent with data from ASIC (2018). Even significant variations around these tax rates make little difference to the outcomes of the analysis.³

³ The tax rates on returns in superannuation funds vary by asset. Indeed, given imputation credits and deferred tax liabilities, they can be negative (ASX and Russell Investments 2018, p. 11) for some assets, though will typically be positive for defensive assets. Given the complications associated with accurately depicting tax, the simulations use the ASIC estimates without any detailed analysis. The inclusion of tax rates makes defensive assets less attractive relative to growth assets, which is why it is important to take some account of them. Tax rates in this supplement are approximations applying only to two broad groups of assets, and are therefore not as sophisticated as the elaborate and granular measures underpinning the Commission's supplementary paper on investment performance (though their weighted sum is consistent with that found in the supplementary paper).

	Single strategy ^a	Defensive ^b	Growth ^c
	%	%	%
Australian equities	25.8	0	33.7
Global equities	16.0	0	20.9
Global equities (hedged)	12.5	0	16.3
US shares	13.5	0	17.6
Australian bonds	7.2	30.6	0
Global bonds (hedged)	10.9	46.4	0
Cash	5.4	23.0	0
Australian property	3.2	0	4.2
Global property	5.6	0	7.3
Implied average real gross return ^d	6.5	5.1	7.0
Average after-tax real return	6.1	4.5	6.7

Table 6.1 Asset shares for the three key investment strategies

^a Vanguard (2017) provides a long series of data on returns for nine asset classes from 1991 to 2017, but the asset classes do not align with those for which the Australian Prudential Regulation Authority (APRA) reports asset allocations. Some funds also construct portfolios that include other asset classes (for example, unlisted companies and infrastructure), but the Vanguard data have the advantage that they extend further back than other asset return series. Accordingly, the Vanguard rates of return are used in this analysis, and with asset shares that are consistent with various published asset allocation assumes no holding of risky assets, with asset shares determined by the relative weight of these asset types in the single-strategy portfolio (as in Minney sub. DR131). ^c The growth allocation uses the same approach as for defensive asset allocations, except it excludes any safe assets. ^d The expected rates of return are based on weighting the historical long-run returns from the various asset classes from the Vanguard data for each portfolio type from 1991 to 2017, while the after tax rates take account of the tax treatment of the different broad asset classes.

Determining the member's net balance for each year of age

Until members retire, the net balance at the end of each year (t from 2018 to 2064) is derived as:

 $StartB_t = NetBalance_{t-1} + Contributions_t$, with $NetBalance_{t-1} = 0$ in the first year

 $NetBalance_t = StartB_t \times (1 + R_t - AdminFeeRate_t - InvestFeeRate_t) - AdminFeeFlat_t - Insurance_t$

where *StartB* is the starting balance for each year after any new contributions, *AdminFeeFlat* is a fixed administration fee unrelated to the amount of investment funds, and *AdminFeeRate* and *InvestFeeRate* are fees that vary with the stock of investments in the member's fund. These fee rates vary between pre-retirement and post-retirement periods, but are otherwise fixed within those phases of a member's life. Insurance costs (chapter 1) depend on the age of the member and cease at retirement.

At retirement, the member withdraws income, with no additional contributions to replenish the stock of funds (with *t* from 2065 to 2085):

 $Income_t = DrawR_t \times NetBalance_t$

 $StartB_t = NetBalance_{t-1} - Income_{t-1}$

Unless otherwise specified, it is assumed that members with draw at the minimum regulated rates.⁴

The Age Pension

As noted by several submissions to this inquiry (most notably, Warren sub. DR118), there are complex interactions between superannuation retirement incomes and the Age Pension and other welfare benefits that are important to the analysis of different product types.⁵ The detailed equations underlying the multiple asset and income tests for eligibility, and the various components of the Age Pension, concession cards and rent assistance are not shown here as they are complex. They are readily obtainable from the Australian Government's Social Security Guide and the *Social Security Act 1991*, with the parameters used in this modelling based on the policy settings in July 2018.

The set of equations above are in constant 2017 prices and therefore inflation rates are irrelevant. However, in the analysis of post-retirement outcomes shown below, the interaction of the Age Pension with superannuation retirement incomes requires a somewhat more complex treatment of inflation. This is because the Energy Supplement is not indexed at all, and so in a 'real prices' model must be discounted by the price index so that it effectively vanishes in real terms over the long run.

The Age Pension tests take into account the homeownership status of the person, whether they are in a couple, and any other assets they hold. The Commission's assessment of the effects of different products allows variations in all of these elements, but for simplicity, the results shown below relate only to a home-owning single person with limited other assets.

6.2 Sequencing risk

As super balances increase over time, the value at stake from any downturn in asset prices rises. This means that the sequence of returns matters greatly to the outcomes for members. Downturns in asset returns close to retirement have much larger effects on retirement balances than downturns early in the working life of a member — a problem sometimes

⁴ In 2018, these were 4 per cent for age less than 65 years; 5 per cent for age 65 to <75 years; 6 per cent for age 75 to <80 years; 7 per cent for age 80 to <85 years; 9 per cent for age 85 to <90 years; 11 per cent for age 90 to <95 years; and 14 per cent for age 95 years or greater.</p>

⁵ Ideally, the taxation of retirement income streams from large superannuation balances (of over \$1.6 million in 2018) would also be considered in any analysis. However, it is assumed that the threshold for taxing high-balance superannuation accounts will ultimately move with inflation, and so will be irrelevant to the analysis in most instances.

referred to as 'sequencing' risk. Sequencing risk is particularly high for people in funds with exposure to assets with volatile returns (say with a large weighting to equities).

While balances increase exponentially over time, so too do the extreme possibilities, as shown in the left hand panel of figure 6.2. For example, after working for 47 years, the expected balance of an employee holding a single-strategy product with the average after-tax return shown in table 6.1 is about \$1.1 million. However, there is a 5 per cent chance that their balance will be about \$2.1 million and a 5 per cent chance it will be below about \$500 000 (Case A). A good indicator of this pattern is the ratio of the standard deviation to the average of the member's balance as they age, which more than quadruples from the first to last year of the employee's working life (the right hand panel of figure 6.2).





^a Results are based on 10 000 bootstrapping replications with a block of 5 years. The upper 5 per cent upper fractile is the value of the balance above which 5 per cent of outcomes occur, while the 5 per cent lower fractile is the value of the balance below which 5 per cent of outcomes occur. The variation relative to the average balance is the coefficient of variation (the standard deviation of the balances at any given age and the average balance for that age from the simulations). The results were compared with the Monte Carlo program, and had a trivial impact on average balances. The 5th percentile balances were up to 12% less for the bootstrap results, but the effects on the 95th percentile were negligible. The coefficient of variation was higher for the bootstrap model by about 15%. Modelling of life-cycle outcomes produced smaller variations than these, and justified the use of the simpler and more flexible Monte Carlo method.

Source: PC calculations.

6.3 The impacts of life-cycle products

Life-cycle products come in all shapes and sizes

Life-cycle products do not seek to eliminate sequencing risks. Such a strategy would not be possible as no asset is free of risk — even 'safe' ones. Second, any strategy that involved investments in safer lower-returning assets over *all* of the years of a persons' working life would nearly always lead to lower balances at retirement than more risky strategies. Accordingly, life-cycle products include growth assets whose relative weight declines with member age (BT, sub. DR149, p. 13; Dimensional Fund Advisors, sub. DR135, attachment).

Different life-cycle product designs have divergent glide paths and underpinning assumptions about members' risk appetites. This results in different averages and variances of member retirement incomes. For example, even for members aged up to age 45 years, the target share of assets included in low-risk assets (cash and fixed income) ranges from about five to 25 per cent (figure 6.3 and table 6.2). Retail funds tend to adopt more defensive positions for their older members than industry funds (figure 6.4).

These variations in exposure to defensive assets could only be optimal if member needs were also distinctly different across funds, and if the design of the products met those needs better than alternative products. While some trustees take into account the characteristics of their members (such as their average balances, as in QSuper's product) in determining the level of asset risk with age, this is not yet typical. Accordingly, there will inevitably be some degree of mismatch between the preferences of members for risk versus return and the design of different life-cycle products.

However, this problem is not peculiar to life-cycle products as single-strategy products do not take into account members' risk aversion to adverse shocks close to retirement. In this vein, Colonial First State observed that:

The life-cycle approach has a range of positive benefits for default members particularly that it avoids the one size fits all approach of a single balanced option. While lifecycle is not perfect, offering the same strategy to all members in a fund regardless of age, gender, account balance or income is not a superior approach. (sub. DR163, p. 8)

Until superannuation products are more personally customised, as proposed by Bell (sub. DR201) and Tailored Superannuation Solutions (sub. DR156), among others, it is inevitable that there will be some mismatch between what people want and what a generic MySuper product can deliver. It is far from clear that a single-strategy product entails less mismatch than a (well-designed) life-cycle product, as analysed later.



^a The data relate to the target asset allocations reported by funds. *Source*: PC calculations based on data from APRA (2018).

Table 6.2Variations in defensive asset allocations between life-cycle
products are greater than those for single-strategy products

Product	Average	10 th percentile	90th percentile	Relative variation ^b
	%	%	%	Ratio
Single-strategy product	23	15	30	0.35
Life-cycle at age 25 years	8	1	18	0.88
Life-cycle at age 35 years	9	1	18	0.78
Life-cycle at age 45 years	13	5	25	0.62
Life-cycle at age 55 years	30	17	43	0.35
Life-cycle at age 65 years	51	36	63	0.29

Defensive assets allocations as a share of total assets, 30 June 2018^a

^{**a**} The data relate to the target asset allocations reported by funds. The value for the 10th percentile is the defensive share where 10 per cent of products have a *lower* share, while the 90th percentile is the defensive share where 10 per cent of products have a *higher* share **b** The relative variation is measured as the standard deviation divided by the average.

Source: Based on analysis of data from APRA (2018).



^a The results are the averages for the four fund types (and all funds) at any given age. *Source*: PC calculations based on data from APRA (2018).

Member outcomes from life-cycle products

How can the impacts of life-cycle products be assessed?

A prelude to any discussion of impacts is the distinction between the historically-realised investment performance of various superannuation funds and expected outcomes (given asset allocations and the underlying distribution of asset returns). It may well be that a given fund — life-cycle or not — is poorer than others at realising returns for any given asset class, but that is not relevant to assessment of optimal *asset allocation*. Equally, at a given time, chance rather than the poor acumen of investment managers can lead to lower returns for particular assets even though the underlying distribution of those returns has not changed. As noted by Mercer:

Given the strong market returns we've experienced throughout the benchmark period, you'd expect any fund with a lower allocation to growth assets to underperform the benchmark. (sub. DR175, p. 12)

These features of investment are why it is important to use common assumptions for rates of return by asset class when examining the impacts of different asset allocations.

There are several measures that shed light on the performance of life-cycle and other superannuation products. One is the expected value and variance of members' balances at a representative retirement date. This has several advantages. Where a member is exiting a super fund at retirement, its trustees do not necessarily know the member's retirement income strategy and it is prudent for trustees to base allocations through the accumulation phase on a measure they can observe. Equally, the retirement balance is the relevant measure when a member immediately takes up an annuity at retirement or where the member is likely to use the balance to reduce debt or make some other expenditure.

Another approach is to focus on member incomes during retirement, which ultimately is the target of the retirement income system. There are several possible income measures. Warren (sub. DR118) suggested the appropriate measure was members' total retirement incomes (taking into account any interactions with Age Pension eligibility and bequests), with the assumption that members draw down their account-based pensions (ABPs) at the regulated minimum drawdown rates. The implication of this measure is that different products will entail different contributions by the Australian Government through the social security system, which, given their budgetary implications, should also be highlighted. Some products with much the same total retirement incomes will have quite different budgetary effects.

An alternative method is to maximise the present value of members' expected utility subject to eligibility for the Age Pension, regulated minimum drawdown rates and the degree to which bequests are valued. This approach has several conceptual advantages over those above. The method can place a value on risk aversion (thus measuring any insurance benefits of life-cycle products) and can provide a measure of the degree to which members value bequests. Members would often draw down their balances at rates above the regulated minimum, recognising that people can smooth consumption over a number of years if there are transitory shocks.

There has been considerable conceptual analysis of a utility-based approach (for example Bell, Liu and Shao 2017), and some super funds are developing methods for determining the optimal asset allocation strategies. The main drawbacks of such methods are that the calculation of optimal glide paths requires dynamic programming, they are computationally-intensive even for simple versions (as in Asher, Butt and Kayande 2015), estimation of risk aversion is not straightforward, and data limitations abound. Nevertheless, there are increasingly sophisticated ways of discovering more about people's value of risk reduction in many contexts using field data (Barseghyan et al. 2018), and no long-term insuperable obstacles to the derivation of estimates for different groups of people. While sophisticated utility-based approaches will provide a sound *future* basis for assessment of different superannuation products by funds and regulators, the Commission has used the other simpler metrics for considering life-cycle products in this report.

Impacts on retirement balances

The Commission analysed the outcomes for retirement balances of three investment strategies — a 'typical' single-strategy product, a defensive life-cycle product and a growth life-cycle product (box 6.3).

Box 6.3 Assumptions about glide paths for life-cycle products

The analysis below considers two life-cycle products. The first is a defensive life-cycle product that has lower exposure to growth assets throughout members' working lives and a faster transition to lower rates as people age. The defensive life-cycle product allocates funds to defensive assets (d) as follows:

- if age is less than or equal to 47 then d = 0.2
- if age is greater than or equal to 48 and age is less than 57 then d = 0.4
- if age is greater than or equal to 57 then d = 0.60

This resembles some MySuper life-cycle product types.

The second life-cycle product is a growth life-cycle product as modelled by Minney (sub. DR131, p. 2). The allocation to defensive (d) assets for the growth life-cycle product at different ages is as follows:

- if age is less than 45 then d = 0.0
- between ages 45 and 49, d = 0.2
- between ages 50 and 54 years, d = 0.3
- between ages 55 and 59, d= 0.4
- 60 or greater years, d = 0.5.

The single-strategy product has a defensive weight of 28 per cent during the accumulation phase and 50 per cent in the retirement phase.

A shift to a defensive life-cycle product will *typically* relinquish significant superannuation returns (figure 6.5). Overall, simulations show that the defensive life-cycle product produces an expected retirement balance of about \$60 000 lower than the single-strategy product. It also produces very poor outcomes for retirement balances where asset returns are high. However, for highly risk-averse members, this defensive life-cycle product *marginally* outperforms the single-strategy product because it reduces the adverse outcomes associated with large turndowns in asset prices — as shown by the results for the 5th and 10th percentiles. However, the effective premiums paid for reducing downside risks are very substantial.

While highly defensive life-cycle products perform relatively poorly, a life-cycle product that is more heavily weighted to growth assets at younger ages produces balances comparable to a single-strategy product and, as shown later, provides significant advantages in managing risks.



Figure 6.5 **The distribution of retirement balances under life-cycle** versus single-strategy portfolios^a

^a 10 000 simulations based on Monte Carlo using Case A parameters. Note that the *difference* between the three sets of outcome for any given percentile is not a valid indicator of the effects of life-cycle products at any given percentile. This is because, for example, the simulation where the fund balance equals \$539 000 for the single-strategy portfolio (the 5th percentile for that fund) is not the one where the fund balance equals \$570 000 for the defensive life-cycle product (its 5th percentile) or \$553 000 for the growth life-cycle product. The percentiles of the differences in outcomes is shown below for a few selected cases.

Source: PC estimates.

The effects on the overall benefits for members

As noted earlier, the value of retirement balances (rather than the income streams that they might otherwise generate) are of most relevance to members using all of their balance at retirement to buy another asset or extinguish a debt. However, the retirement system is intended to provide people with income for consumption and (to the extent they are intended) intergenerational transfers. This is best measured as the sum of the net present value of superannuation income streams, any welfare payments and bequests. For a single male on a moderate income (Case A), the qualitative case is not much different than for retirement balances, and indeed the overall forgone average benefits from a defensive life-cycle product is about \$95 000 or about 6.5 per cent less than both the single-strategy and growth life-cycle products (figure 6.6).⁶

⁶ As an indicator of the similarity of the results, the bootstrap estimate of the difference is only slightly higher at \$100 000.



Figure 6.6 The distribution of overall benefits under life-cycle versus single-strategy portfolios^a

Net present value of super income, welfare income and bequests

There are three components to the above result — the income stream from superannuation products excluding bequests, bequests given by a member to others, and welfare payments. In the two former cases, the pattern is much the same as for retirement balances and overall benefits. However, defensive life-cycle products entail a greater level of expected dependence on welfare (predominantly the Age Pension). On average, members of the defensive life-cycle product benefit from more than \$14 000 in additional welfare entitlements than the growth life-cycle product (figure 6.7). The implication of this is that not only do highly-defensive life-cycle products produce generally adverse outcomes for members, but they also simultaneously impose additional costs on the Australian Government (and taxpayers).⁷ The same applies to any superannuation product that fails to provide good returns.

^a Net present values are to the date of retirement, but in 2017 prices. *Source*: PC estimates.

⁷ In some instances, Age Pension claims can be higher for single-strategy and more growth life-cycle products. This occurs because such products are more exposed to large negative returns, and where these occur, can entail greater reliance on the Age Pension by the member. However, equally, there is a much greater likelihood that these products produce higher returns than defensive life-cycle products, which reduces eligibility. The latter effect dominates.



^a Welfare benefits include the Age Pension and the value of any relevant concession cards (the Pensioner Concession Card and the Commonwealth Seniors Health Care Card).

Source: PC calculations.

Measuring relative performance for given market scenarios

As noted by Minney (sub. DR131, pp. 4–5), there is an important distinction between the distribution of individual outcomes of different products (as shown in the charts above) and the distribution of the *differences* in outcomes between them for any *given* market outcome.⁸ This provides a measure of their comparative performance in a 'like for like' market comparison. The results show that while a growth life-cycle product has a 5 per cent chance of being worse in net benefit terms than the default single-strategy product (under Case A) by about \$200 000 or more, it has a 5 per cent chance of being better than the default by nearly a \$260 000 margin (figure 6.8). In contrast, the comparative outcomes for a defensive life-cycle product relative to a single-strategy product (and a growth life-cycle product) are extraordinarily poor, as shown by the lower of the two charts in figure 6.8 and by scatter plots in figure 6.9.

⁸ The way in which the outcomes are calculated is to use a given sequence of (say) 10 000 random draws of asset returns, calculate the difference in the outcomes for two products for each draw, and then estimate the averages and fractiles of the 10 000 differences.



Defensive life-cycle versus single strategy product

Median

75th

90th

95th

Average

Percentile

Figure 6.8 The comparative performance of two life-cycle products and a single-strategy product

Source: PC calculations.

-400

-500

-465

5th

10th

25th



Figure 6.9 **Defensive life-cycle products provide marginal benefits on** the downside and lose badly on the upside^a

^a Based on 10 000 simulations. 'Balance' refers to the retirement balance of a product, while 'Benefits' refers to the net present value of super income streams, welfare and the residual bequest of a product. Any given point represents the outcome for a common sequence of asset returns. The data show that the performance margin between single-strategy (or growth life-cycle) products and defensive life-cycle products is greater the higher is the value of the retirement balance or benefits. There is a much weaker relationship between the relative performance of growth life-cycle and single-strategy products, though life-cycle products still outperform single-strategy products when asset returns are high.

Source: PC calculations.

The evidence demonstrates the vast difference that product design makes to the outcomes of life-cycle products. The Productivity Commission's elevated outcomes test for funds (chapter 13) and, if implemented, ASIC's product design intervention powers (chapter 4) would curtail poor life-cycle products.

'Growth' usually beats 'defensive' for a diverse range of members

The above results generalise to many other life contexts (table 6.3). Generally, a defensive life-cycle product does not perform much better at insulating a person from downside risks than a more growth-oriented life-cycle product, but gives up large gains if asset returns are high.⁹

growth me-cycle products ^a						
	Average NPV all benefits	'Bad outcome' for all benefits	'Good outcome' for all benefits	Average welfare reliance	Average bequests	Average super income
	\$'000	\$'000	\$'000	\$'000	\$'000	\$'000
Defensive life-cycle product						
Case A (default case)	1 388	1 127	2 099	201	307	880
Case B (lower wages)	1 181	1 105	1 304	499	176	506
Case C (higher wages)	1 995	1 196	3 421	51	503	1 441
Case D (woman with 2 children)	1 157	1 086	1 230	610	141	406
Case E (part-time work when older)	1 371	1 125	2 063	217	298	856
Growth life-cycle product						
Case A (default case)	1 492	1 125	2 489	187	343	963
Case B (lower wages)	1 212	1 100	1 472	461	197	554
Case C (higher wages)	2 189	1 191	4 072	51	562	1 576
Case D (woman with 2 children)	1 172	1 077	1 284	572	158	443
Case E (part-time work when older)	1 473	1 123	2 446	201	334	938

Table 6.3Chalk and cheese — a comparison between defensive and
growth life-cycle products^a

^a The results are from separate Monte Carlo analyses for each product type, using the same methods as in figures 6.5 to 6.7. Bad and good outcome benefits are the net present value of combined super income, welfare benefits and bequests at the 5th and 95th percentiles respectively. As all of the cases involve homeowners, welfare benefits are isolated to the Age Pension and any relevant concession cards.

Source: PC calculations.

A defensive life-cycle product performs *relatively* better for someone who takes long periods out of the labour force and accumulates much of their income in their later working life (Case D — a woman bearing two children being the example cited). In this instance, the superannuation income from the defensive life-cycle product ($406\ 000$) is $37\ 000$ less than that from a growth life-cycle product ($443\ 000$). However, retirement welfare benefits for

⁹ Outcomes for single-strategy products are much the same as for the growth life-cycle product and are therefore not shown.

those on the defensive life-cycle product are higher at \$610 000 compared with \$572 000. The only reason for the small loss in overall net benefits for defensive versus growth life-cycle products is the lower level of bequests for the former (\$141 000 versus \$158 000). To the extent that bequests are not highly valued, then a defensive life-cycle product would be of greater value in this case.

Assessing the products in the current market

The substantial variations in impacts in the constructed examples above are replicated with all current MySuper life-cycle products (as at June 2018). Taking their target asset allocations by age as given, and assuming that members share the characteristics described for Case A, it is possible to estimate the expected impacts for each MySuper life-cycle product (figure 6.10). The results suggests that a significant number of current life-cycle products are unlikely to be meeting members' needs, with material differences in average outcomes between the best and worst performers.



^a Based on APRA data on the target levels of defensive assets, but excluding the QSuper products given their asset allocations vary by balances. The high average outcomes for the life-cycle products at the far right of the chart reflects their low exposure to cash and fixed income assets (the definition used for 'defensive' assets in this analysis). The expected balances of such funds may be below that shown to the extent that they hold other low-risk assets. **Source: PC estimates.**

6.4 The impact of investment options on rates of return

The Commission investigated the relationship between the number of investment options provided by a fund and its 10 year return rate using several approaches based on data from APRA:

- a continuous measure of option numbers (in log form)
- categorising option numbers into six categories with roughly equal numbers of accounts in each group. This can capture any major non-linearities in the effects of option numbers (with the categories being 1–10 options, 11–15 options, 16–25 options, 26–100 options, 101–320 options and 321 or more options).

The simplest approach took no controls for other factors that might affect 10 year returns. More complex approaches took account of the effects of fund type, the portfolio share in cash and fixed income assets (because this would be expected to lower returns), and the benefit to account number ratio (a measure of the average size of each parcel of managed funds per member). Notwithstanding the different approaches, the effects of options on return rates were similar, were statistically significant, and had large impacts on retirement balances (table 6.4).

Table 6.4	The impacts of option numbers on ten year rates of return					
Approacha	Impact on rate of return	Retirement balance	Impact on retirement balance	Change in option numbers modelled		
Арргоасн	Percentage points	\$'000	\$'000	Description		
(1)	-1.35	607	-226	10 to 700 options		
(2)	-0.72	693	-140	11–15 options to 321+ options		
(3)	-1.02	663	-170	11–15 options to 321+ options		
(4)	-1.06	637	-196	10 to 700 options		
(5)	0	833	0	Not applicable		

^a The variants are (1) ordinary least squares (OLS) of returns on six option number categories; (2) OLS of returns on log of options and controls for fund type, share in cash and fixed income, and the log of the benefit to account number ratio; (3) OLS on six option number categories, plus controls for retail fund status, the share of assets in cash and fixed income, and log of the benefit to account ratio; (4) OLS of returns on the log of option numbers; and (5) the result — as in the main cameo model used in this report — where returns are 5 per cent throughout the accumulation period. All coefficients were statistically significant. The cameo model described above and in chapter 1 was used to provide the impacts on retirement balances.

The impacts of the number of options on fees were estimated using a similar approach. Fees were represented as the ratio of all fees (less any charges for insurance) to each fund's net assets (to normalise for fund size). A shift from a modest number of options (11-15) to 321 or more increases the ratio of fees to net assets by between 0.5 and 0.7 percentage points (table 6.5).

	impacts of option numbers on ree rates			
Approach	Impact on fee rate	Change in option numbers modelled		
Арргоаст-	Percentage points	Description		
(1)	0.80	10 to 700 options		
(2)	0.51	11–15 options to 321+ options		
(3)	0.68	11–15 options to 321+ options		
(4)	0.69	10 to 700 options		

Impacts of option numbers on fee rates

^a The variants were: (1) OLS of fee rate on six option number categories; (2) OLS of fee rate on log of options and controls for retail fund type and the log of the benefit to account number ratio; (3) OLS on six option number categories, plus controls for retail fund status, and the log of the benefit to account ratio; (4) OLS of returns on the log of option numbers. All coefficients were statistically significant.

The key conclusion is that the number of options has impacts on fees and returns that materially reduce retirement balances and subsequent incomes.

6.5 Assessing satisfaction and trust

Table 6 5

Members' superannuation and financial literacy are often seen as important for good decision making (chapter 5). Such literacy can also affect the degree to which members are satisfied with the system and can trust their super fund, most likely because improved knowledge reduces uncertainty about the quality of the services provided by super funds.

To gain insight into how the various dimensions of literacy may affect members' perceptions about the performance of the system, three indices were constructed.

- KNOWLEDGE OF SUPER is an index of overall understanding of the system based on a series of questions about people's knowledge of superannuation and various aspects of their own super fund. The index is based on members' answers to Q1a,¹⁰ Q1b, Q3a, Q3e and Q3f of the Commission's members survey. For example, the questions covered whether employers were required to make super payments, whether superannuation was concessionally taxed and the age when members can access their balances. The index sums to a score anywhere from 0 to 17 for any given respondent (with 0 meaning no knowledge, and 17 meaning 'complete' knowledge). The index had good internal consistency as measured by Cronbach's alpha.
- LITERACY is an index of financial literacy, such as an understanding of compound interest rates (based on Q27 to Q29 of the survey). The index sums between 0 and 3 for any given respondent.
- UNDERSTAND STATEMENT is the extent to which a member can understand their statement (Q5b) (with 1 = fairly or very well, and 0 = not very well to cannot say).

¹⁰ The 5th sub-question in Q1a was excluded. It related to a question about insurance cover, and had poor consistency with measures of overall understanding of super.

All three measures were statistically related to the measures of satisfaction and trust (figures 4.1 and 4.2, respectively, in the main report), with a particularly strong relationship between these and the UNDERSTAND STATEMENT index. While correlation need not imply causation, it seems plausible that improved knowledge leads to better satisfaction and trust (and not the other way around).

The effects are material. For example:

- an OLS regression of satisfaction on the UNDERSTAND STATEMENT index provides an indication of the impact. The results showed that having some understanding of a member's superannuation statement increased satisfaction by about 1.6 points. Given that the average satisfaction level is 7 out of 10, this represents a significant increase. Much the same effect was apparent for a measure of trust, where the gain was about 1.5 points on a scale from 0 to 10, which again is a significant impact given that the average score for trust was 6.8 out of 10
- while more complex, an alternative, more rigorous approach is to undertake ordered logistic regression of measures of trust and confidence against the various indexes above. Unlike OLS, this approach takes account of the fact that satisfaction and trust measures are bounded and ordered count variables. There is no simple analogue to the impacts suggested by the OLS regression above, but an indicative result from an ordered regression is that the probability of getting a score of 10 out of 10 on satisfaction increases from 4 per cent (if there is a weak understanding) to 14 per cent (if there is a good understanding). Overall, the probability of getting a scale of 9 or 10 in the satisfaction measure is about 30 per cent if there is a good understanding and 10 per cent otherwise.

References

ABS (Australian Bureau of Statistics) 2017a, 2016 Census, Cat. no. 2071.0, Canberra.

- 2017b, Average Weekly Earnings, Australia, May 2017, Cat. no. 6302.0, Canberra.
- 2017c, Employee Earnings and Hours, Australia, May 2016, Cat. no. 6306.0, Canberra.
- 2017d, Life Tables, States, Territories and Australia, 2014-2016, Cat. no. 3302.0.55.001, Canberra.
- 2017e, Participation Job Search and Mobility Australia, February 2017, Cat. no. 6226.0, Canberra.
- 2018, Labour Force, Australia, Detailed Electronic Delivery, March 2018, Cat. no. 6291.0.55.001, Canberra.
- APRA (Australian Prudential Regulation Authority) 2018, *Quarterly MySuper Statistics, 30 June 2018*, 24 August, Sydney.
- Asher, A., Butt, A. and Kayande, U. 2015, 'Formulating appropriate utility functions and personal financial plans', presented at Actuaries Institute 2015 Actuaries Summit, Melbourne, 17-19 May, p. 32.

- ASIC (Australian Securities and Investments Commission) 2018, ASIC's Moneysmart Superannuation Calculator, www.moneysmart.gov.au (accessed 10 March 2018).
- ASX and Russell Investments 2018, 2018 Long term Investment Report, June.
- Barseghyan, L., Molinari, F., O'Donoghue, T. and Teitelbaum, J.C. 2018, 'Estimating risk preferences in the field', *Journal of Economic Literature*, vol. 56, no. 2, pp. 501–564.
- Bell, D., Liu, E. and Shao, A. 2017, *Member's Default Utility Function for Default Fund Design Version 1* (*MDUF v1''*), Working Paper, Sydney.
- Breusch, T. and Gray, E. 2004, 'New estimates of mothers' forgone earnings using HILDA data', *Australian Journal of Labour Economics*, vol. 7, no. 2, pp. 125–150.
- Cai, L. 2007, *Effects of Health on Wages of Australian Men*, Working Paper No. 2/07, Melbourne Institute of Applied Economic and Social Research, Melbourne University, Melbourne.
- Chant, W., Mohankumar, M. and Warren, G. 2014, *MySuper: A New Landscape for Default Superannuation Funds*, CIFR Paper no. 020/2014, Centre for International Finance and Regulation, Sydney.
- Forbes, M., Barker, A. and Turner, S. 2010, *The Effects of Education and Health on Wages and Productivity*, Productivity Commission Staff Working Paper, Canberra.
- Ganegoda, A. and Evans, J. 2015, *The Australian Retirement Lottery: A System Failure*, Sydney Business School Papers, University of Wollongong.
- Kontis, V., Bennett, J.E., Mathers, C.D., Li, G., Foreman, K. and Ezzati, M. 2017, 'Future life expectancy in 35 industrialised countries: projections with a Bayesian model ensemble', *The Lancet*, vol. 389, no. 10076, pp. 1323–1335.
- Politis, D.N. and Romano, J.P. 1994, 'The stationary bootstrap', *Journal of the American Statistical Association*, vol. 89, no. 428, pp. 1303–1313.
- Sinning, M. 2014, *How Much Is It Worth? New Estimates of Private Returns to University Education in Australia*, December, Final Report, University of Queensland, RWI and IZA.
- Treasury 2015, Intergenerational Report, Canberra.
- Vanguard Investments Australia 2017, The Power of Perspective: Vanguard 2017 Index Chart.
- Wei, H. 2010, *Measuring Economic Returns to Post-School Education in Australia*, Research Paper, Cat. no. 1351.0.55.032, Australian Bureau of Statistics, Canberra.
- Yu, P. 2004, *Return to Education for Australian Male Workers: An Estimate with HILDA*, Australian National University, Canberra.