5. HOW ACADEMIC RESEARCH CAN INFORM DEFAULT SUPERANNUATION FUND DESIGN AND INDIVIDUAL FINANCIAL DECISION-MAKING

Defined contribution superannuation plans require fund members to make several decisions requiring a high level of financial expertise and participation. Most members do not have the expertise to make such decisions; hence, the onus falls on fund providers to offer default products that make the “best” decision for their members. In this paper, we demonstrate mathematical tools that can assist in determining optimal decisions for members with various characteristics. We provide a specific example, in a simplified setting, showing that allowing for realistic elements like social security and tax has a material impact on optimal decisions. Finally, we discuss how such models might be used in the development of default options that better cater to the needs of members.

Introduction

The dominance of defined contribution superannuation plans in Australia (APRA 2017) means that individuals are largely responsible for making their own savings and investment decisions throughout their life. Some decisions are constrained, such as the Superannuation Guarantee (SG) contribution requirements and the minimum withdrawal requirements in the post-retirement phase. Other decisions are influenced by taxation and social security rules, such as the age pension, and concessional contribution and balance caps. Even allowing for this, significant decisions, particularly in terms of investment strategy, are required of individuals, who in many cases are not sufficiently financially literate to make appropriate decisions (Agnew et al. 2013). Given this gap between decisions required and the ability of individuals to make them, the importance of default arrangements becomes vital. Research suggests that, in the absence of appropriate qualifications or advice, people will tend to allow default arrangements to make decisions on their behalf. For example, this can be expressed in terms of choice of fund and/or investment (Butt et al. 2018) or in terms of withdrawals at the minimum level required by legislation (Snaddon et al. 2016).

Recent regulatory reform has focused on default arrangements, in particular in default fund arrangements in the accumulation phase — the MySuper reforms (Commonwealth of Australia 2012), and in product structure for risk management in the post-retirement phase — the Comprehensive Income Products for Retirement (CIPR) reforms (Australian Government 2016). For those who wish to make their own decisions, publicly available tools to assist with financial decision-making, such as superannuation calculators, tend to be rather basic in nature. Recent regulatory reforms in this space have also been minor, for example see ASIC (2014). Furthermore, superannuation calculators are mostly deterministic with respect to investment returns and therefore do not adequately inform individuals of the risks underlying the decisions they are making. The objective of this study is to compare financial decision-making structures in Australia with academic literature on optimal decision-making. There is a mountain of academic research in this area, although little evidence that it has had any significant impact on defaults and other means of making financial decisions, particularly when considering the interaction between these decisions and their associated taxation and social security systems. The treatment of the academic research will be broad and non-mathematical in nature, with sample references from the authors’ and broader academic research provided for those interested in exploring further.
For most Australians, superannuation and equity in the family home comprise their two largest asset holdings. However, for the purposes of funding retirement, utilisation of equity in the family home is still relatively small (De Silva et al., 2016). (For the remaining analysis in this paper we will assume equity in the family home is not used to fund consumption, although references to academic studies allowing for this are provided later in the paper.) Funding retirement is hence largely through the drawdown of superannuation savings and receipt of the means-tested age pension.

The vast majority of Australians currently drawdown superannuation through the use of an allocated pension (APRA, 2017), which combined with defined contribution arrangements in the accumulation phase, means individuals must make investment strategy decisions at all points of the savings cycle.

Although the CIPR reforms may impact this in future, there is still significant uncertainty in what the product design and regulatory environment will look like under these reforms; see for example Unisuper’s decision to “pause the development of (their) FlexChoice” CIPR in June 2017 (Unisuper 2017).

A number of MySuper products utilise basic lifecycle investment strategies (Chant et al., 2014), although these are largely limited to reductions in investment risk as an individual becomes closer to retirement age. Some exceptions exist, such as QSuper, whose MySuper product reduces risk both with age and also as superannuation balance increases.

**Optimal financial decision-making in academic literature**

The starting point for making an optimal decision is a financial objective. While this objective can be expressed in terms of asset accumulation, given the assumed purpose of saving is to fund future consumption it is therefore more coherent to express this in terms of consumption over the lifecycle. The objective may be expressed in a number of ways, such as the probability of achieving a consumption goal or expected shortfall compared to a consumption goal. However, coherency issues mean it is more appropriate and more common to express the objective to the utility framework (Butt and Khemka, 2015).

Utility measures the level of “satisfaction” an individual obtains from consumption and is expressed as a function of consumption. For an individual who is risk averse, the increase in utility from an $X$ increase in consumption is smaller than the loss in utility from an $X$ decrease in consumption. A commonly used utility function is an isoelastic function, which assumes an individual has constant relative risk aversion (CRRA). A key property of the CRRA utility function is that, without the presence of external labour income, individuals will utilise the same investment strategy regardless of the level of wealth being invested (Samuelson, 1969). Utility over the lifecycle is calculated by summing the utilities obtained from periodic consumption. An obvious implication of this is that an individual must balance utility from current consumption with utility from future consumption.

An individual makes optimal decisions when those decisions maximise their expected utility over the lifecycle. In this paper, the only decisions considered are consumption and asset allocation of the individual. The mathematical approach used to determine these optimal decisions is called dynamic programming (Rust, 1996). This approach breaks decisions into time points (typically annually) and states. A state is an individual factor that might impact decision-making. In this paper the only state considered is the superannuation balance of the individual. The model is solved recursively and stochastic assumptions are made about future utility and consumption over the decision point and another. In particular, it is necessary to set stochastic assumptions for the returns of the investment to be considered for investment.

Solving dynamic programming models can involve complicated calculus and significant computing power. In particular, introducing non-linear components such as the age pension means test, and increasing the number of decision points at a given time, affects the reliability of the optimisation. Furthermore, introducing additional state variables increases the computing time exponentially; known as the “curse of dimensionality” (Rust, 1996).

Examples of optimal decisions

In this section we present examples of optimal decisions from dynamic programming models with a variety of characteristics. The starting point is the authors’ previous work (Khemka and Butt, 2017), although some minor changes are made to assumptions, including allowing for the age pension eligibility age to be 67. An individual with the following characteristics is assumed:

- until age 67 earns a salary package of $85,000 in real terms and then retires immediately; and
- until age 67 contributes a minimum of 5 per cent or their salary package to superannuation and consumes the remainder; and
- from age 67 onwards withdraws from their superannuation (in allocated pension form) for consumption; and
- has mortality probability equivalent to the male rates in the Australian Life Tables 2010-12 (Australian Government Actuary, 2014); and
- has utility function with the following characteristics:
  - utility function is that of a CRRA with a risk aversion parameter of 5; and
  - experiences CRRA utility with a risk aversion parameter of 5; and
  - discounts future utility to allow for the probability of being alive but not for intertemporal consumption preferences (Yaari, 1987).

The individual makes decisions on each birthday on consumption and asset allocation for the coming year. Decisions are made based on current age and superannuation balance only. As per the initial setting of Khemka and Butt (2017), the choice of assets is between Australian equities and a risk-free asset only, using a real return of 4.4 per cent and allocated pension form. Utility returns are independent from year to year and distributed according to the daily, rolling actual returns on the S&P/ASX200 Accumulation Index from 1 July 1992 to 31 December 2017, deflated by average weekly earnings. The geometric mean real return on equities is 6.2 per cent per annum, with standard deviation of 14.4 per cent per annum. See Khemka and Butt (2017) for further information.

Results here are not surprising. As can be seen in Figure 1A, optimal equity allocation decreases as age and balance increases, until the cessation of work where the Samuelson (1969) rules apply. (An increase/decrease in the risk aversion parameter would lead to a decrease/increase in the post-retirement equity allocation although the remainder of the Figure 1A structure would remain.) This is consistent with the QSuper MySuper product structure. Figure 1B shows that, for pre-retirement, contributions increase as age increases and balance decreases, showing the need to sacrifice current spending if the superannuation balance is relatively small. Figure 1C shows that, for post-retirement, the withdrawal rate is a fixed proportion of the superannuation balance, which increases with age. This is consistent with the allocated pension minimum drawdown rules.

Comparisons between scenarios require reviewing both changes in scale and colour of the figures. Optimal allocation results in Figure 2A are much higher than those in Figure 1A, which can be attributed to the age pension acting as a risk-free ‘investment’ allowing additional investment risk to be taken with the superannuation balance. Contribution rates pre-retirement, in Figure 2B, are lower than those of Figure 1B, except where the minimum 5G is required. This is because the availability of the age pension necessitates a lower balance for the same level of retirement consumption. Withdrawal rates in Figure 2C are slightly higher than in Figure 1C, particularly at older ages, as the presence of the means-tested age pension makes it optimal to draw down the superannuation balance at a slightly faster rate in order to receive a higher age pension amount.
FIGURE 1A: SUPERANNUATION EQUITY ALLOCATION (BY AGE AND BALANCE) — WITH NO TAX AND SOCIAL SECURITY

Figures 1A–1C present the equity allocation and consumption decisions for ages 50–85.

FIGURE 1B: CONTRIBUTION RATE (BY AGE AND BALANCE) AS A PERCENTAGE OF SALARY — WITH NO TAX AND SOCIAL SECURITY

FIGURE 1C: WITHDRAWAL RATE (BY AGE AND BALANCE) AS A PERCENTAGE OF SUPERANNUATION BALANCE — WITH NO TAX AND SOCIAL SECURITY

Figures 2A and 2C also indicate a non-linearity in the impact of balance on the optimal equity allocation and withdrawal rate post-retirement. These impacts are easier to view when isolated to a specific age. We now present equity allocation and withdrawal rate percentages at age 67 in Figure 3.

The higher equity allocation and withdrawal rates in the presence of the age pension, as described above, can also be seen in Figure 3. What is most interesting is the distortive effect of the age pension on the optimal decisions across different balance levels. Looking first at equity allocation, where the balance is just above the maximum level at which the full age...
pension is received, individuals reduce equity allocation from 100 per cent to a minimum of 90 per cent. This is as a result of the upside gain of risky investment being reduced at these balance levels. If investment performance is good, the increase in balance offsets the reduction in age pension receipt. However, there is no corresponding increase in age pension receipt upon poor investment performance as the age pension cannot exceed the full age pension amount. Hence there is reduced incentive for equity investment at these balance levels. Where the balance is just below the level at which no age pension is received, individuals increase equity allocation back up to 100 per cent. Complementary to above, this is because the downside loss of risky investment has been reduced due to the increase in age pension receipt, without a reduction in upside gain as the age pension cannot decrease below zero. A similarly distortive effect can be observed on withdrawal rates. At balances where the means tests do not apply the withdrawal rate trends to a level of around 4.6 per cent of balance, which is the withdrawal rate without the age pension. However, this increases to a maximum of 9.6 per cent at the balance at which no age pension is received, due to the benefit of additional age pension received as balance decreases. Kinks are observed in the withdrawal rate at the maximum balance where the full age pension is received, as well as the switch point between the application of the income test and the asset test.

Throughout these results, we have assumed a risk aversion parameter of 5. However, this is an arbitrary choice. Academic literature demonstrates the varieties of, and difficulties in measuring, risk aversion across individuals (Dohmen et al., 2011). Figure 4 shows the impact of different risk aversion parameters on the results at age 67 of the tax and social security scenario. While the basic shape of the results is maintained for each risk aversion.
parameter in Figure 4, there are significant differences between the results, with lower risk aversion having up to 58 per cent higher equity allocation and up to 21 per cent higher withdrawals as a proportion of balance than the highest risk aversion. The only exception is this at very low balance levels, where for rho = 2 no initial increase in withdrawal rate is observed due to there being no reduction in equity allocation from the 100 per cent maximum at any balance level. This is offset by there being a much greater increase in withdrawal rate as balance increases while the means test applies.

Conclusions

The purpose of this paper is to introduce readers to the academic literature on optimal decision-making and compare this to financial decision-making structures in Australia. It can clearly be seen that the level of risk aversion held by an individual has a significant impact on, in particular, optimal equity allocations. Superannuation funds must consider the likely preferences of their default members in designing default options, and should also consider the implications of tax and social security arrangements in setting any structures that automatically change asset allocations with balance and other factors.

Furthermore, individuals may not have CRRA preferences and other utility approaches could be considered. For example, prospect theory (Kahneman and Tversky, 1979), sets a target level of consumption and assumes a kink in the utility curve at the target point, where losses in utility below the target are particularly severe. Utility can also be extended to allow for bequest motives, which is included in the Member’s Default Utility Function (MDUF) promoted by the Australian Institute of Superannuation Trustees (AIST, 2018).

More broadly, we pose the question of the possible design of ‘smart’ options in future. These might elicit risk preferences from individuals automatically or ‘pre’ individuals into optimal decisions across different stages of their lifecycle. This could include not just the impact of tax and social security (in particular the age pension) as described in this paper, but might also include other elements from the academic literature. Examples are decisions between multiple asset classes (Khemka and Butt, 2017), decisions on housing and home equity release (Andréasson and Shevchenko, 2017b), and the impact of health states and availability of long-term care products (Shao et al., 2017). We would expect this research to be of particular benefit in the design of CIPR structures to best meet the needs of individuals.

References


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