The 'Right' Level for the Superannuation Guarantee: A Straightforward Issue by No Means

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Synopsis

We deploy a stochastic life-cycle model to examine how differing levels of the superannuation guarantee (SG) impact on the welfare of individual Australians under existing superannuation, tax and pension eligibility rules. Our main focus is the effect of various assumptions on the optimal SG, emphasising the role of income and the retirement objectives of the individual. The analysis supports estimating the gains and losses from changing the SG for various individuals, and associated impacts on net government revenue. We find the optimal SG to vary substantially with income and objectives. While our baseline analysis indicates a SG of below the current level of 9.5%, higher estimates emerge if access to the Age Pension is excluded, and if the SG is used as a mechanism to self-insure against living to a very old age, being forced into early retirement, or incurring lower investment returns. We conclude that the case for raising the SG above 9.5% depends on the underlying assumptions, with the policy objectives that the SG is intended to achieve being critical.

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1. Introduction

Whether the superannuation guarantee (SG) should be increased from the compulsory rate of 9.5% is currently a topic of much debate (see for example: Daley and Coates, 2018; Mercer, 2019; Rice and Bonarius, 2019). There are two dimensions along which the discussion often falls short. First, is a tendency to focus on outcomes during retirement, and the question of what needs to be put aside to ensure an adequate lifestyle once retired. This overlooks the fact that saving through the SG can come at a cost to the individual, to the extent it reduces the amount available for pre-retirement consumption (see Evans and Razeed, 2019) or saving via other mechanisms. Second, analysis of how the SG impacts on the welfare of individuals (denoted fund 'members' here) could be improved in a number of respects. It typically focuses on median outcomes, or projected outcomes for selected fund members either across income levels or through cameos. Further, deterministic assumptions are often employed regarding asset returns, investment strategies and drawdown strategies are often employed. The landscape is more dynamic and complex than these simple formulations. Investment returns are uncertain, members can react to changes along the path, and (most importantly) members may differ along a large number of dimensions. Finally, existing analysis is quite hazy around how welfare should be defined and measured. The objective function for individual members remains an open issue, as does the policy objective of the SG itself.

We tackle these issues head-on through evaluating a range of SG levels using expected utility as a metric in the context of a stochastic life-cycle model that embeds the key rules under which the Australian superannuation system operates. Basing the analysis around such a model offers two main advantages. First, it condenses the temporal and investment risk trade-offs into a single measure. Saving via the SG entails shifting consumption from pre-retirement to post-retirement, while exposing the member to uncertainty related to investment markets. Utility functions allow a 'score' to be attached to all possible outcomes across each period and through time, which can be added up to deliver overall expected utility. If a particular SG leads to higher expected utility, then it implies that the member is better-off placing that money into superannuation after taking into consideration both the time and risk dimensions. The helps to address what is a complex problem that is hard to reduce to simple metrics such as shortfall measures (see Butt and Khemka, 2015). Second, we use utility functions to investigate how the optimal SG may vary with member objectives. Specifically, we examine the relation between desired post-retirement consumption and pre-retirement consumption, as well as a range of other assumptions. Our analysis uses reference dependent utility functions inspired by prospect theory, under which members target either a replacement rate or one of the ASFA retirement standards (ASFA, 2019) during the post-retirement phase.

Our model is designed to analyse the trade-off between pre-retirement and post-retirement consumption from the member's perspective. It assumes that the SG leads to lower take-home pay and hence reduces pre-retirement consumption, but then adds to post-retirement consumption which is exposed to random investment returns and uncertain time of death. The member maximises their expected utility of consumption over their lifetime, subject to existing Australian rules governing tax, superannuation and the Age Pension and related supplements. We initially conduct a baseline analysis that estimates the optimal SG across differing income levels and three objective functions. We then investigate the impact of altering various assumptions, including: the availability of the Age Pension; the assumption that the member saves to self-insure against the possibility of living to a very old age or retiring early; the cost of the SG being partly borne by the employer rather than the member; various investment and drawdown strategies; differing asset returns; and changes to risk tolerance. This allows us to identify what matters for determining the appropriate SG, and how the optimal SG varies across differing types of members depending on their income levels and objectives.

What Our Analysis Reveals

The main message is that there is no one-size-fits-all optimal SG, which in turn can vary substantially with assumptions. Our analysis generates a wide range of optimal SGs. This highlights that a single SG rate is a blunt instrument being applied against a background of significant member heterogeneity, along with a marked sensitivity to assumptions. The most influential variables include: assumed member objectives; income level; the availability of the Age Pension; whether the aim is for the member to self-insure against risks related to early retirement, longevity and/or investment returns; and whether the cost of SG is borne by the employer or comes out of lower take-home pay for the member. Other variables impacting on the optimal SG by up to a few percentage points include time discounting, and how the post-retirement consumption target and drawdown strategy are characterised. The most influential variables matter in the following way:

- ***Member objectives*** – We see the most relevant objectives as those where the member aims to save enough to support a post-retirement consumption target that sits below pre-retirement levels, subject to providing for a basic level of minimal income. We hence focus on ASFA modest at low incomes, and the replacement rate and ASFA comfortable objectives at medium-to-high incomes. Our baseline analysis generates an optimal SG that ranges from 3.5% to 9% under the replacement rate and ASFA comfortable, but only 2.5%-3% under ASFA modest. These results emerge because an SG below 9.5% makes sufficient headway towards the post-retirement targets once the impact of SG contributions on pre-retirement consumption and the presence of the Age Pension and supplements are taken into account. Further, an SG of 9.5% or above is indicated if ancillary objectives are included of becoming a self-funded retiree, or self-insuring against some combination of investment, longevity and early-retirement risk.

- ***Income*** – Income interacts with the Age Pension, which is more valuable for lower income members and thus becomes less influential as income increases. Income also matters more when the objective is to attain a fixed post-retirement consumption target as per the ASFA standards, under which it is optimal to just save enough to reach the target after accounting for the Age Pension. The net consequence is that the optimal SG under the ASFA standards is much higher for ASFA comfortable than ASFA modest and *declines* with income. For instance, our baseline optimal SGs fall from 9.0% to 4.5% under ASFA comfortable in moving from an income $60,000 up to $120,000. Under a replacement rate objective where the post-retirement consumption target scales up and down with pre-retirement income and hence consumption, the optimal SG *rise*s with income largely due to a decreasing contribution from the Age Pension. In this case, our baseline optimal SGs rise from 3.5% to 7.5% as income moves from $60,000 to $120,000.

- ***Assumed role of the Age Pension*** – The availability of the Age Pension and related supplements looms large in our results given that it provides a substantial head start towards securing any target as well as providing a hedge against investment losses. We find that estimated optimal SGs increase substantially if the Age Pension is excluded, exceeding 12% in the majority of cases. It hence matters whether the Age Pension is viewed as a perennial income source that is openly available to all, versus a safety net such that the implied aim of the SG is to support members in becoming self-funded retirees and hence avoiding relying on the Age Pension.

- ***Hedging against risks*** – Three key risks faced by members are investment risk, longevity risk and early retirement risk. To gauge the impact of self-insuring against these risks, we run the analysis under combinations of lower investment returns and the member saving enough to support consumption in case they happen to live to age 102 or retire early at age 62. The results indicate that an SG of 9.5%, if not 12%, might be supported if the SG is used for risk hedging. The case where the member retires at age 62 also proxies for career breaks, which have a similar effect in that the loss of income both reduces contributions and creates a need to fund consumption out of savings.

- ***Issue of 'who pays'*** – There is considerable debate over the extent to which the SG has been associated with lower take-home pay for the member, and the evidence and opinions seem mixed (see Evans and Razeed, 2019; Stanford, 2019). We address this issue by assuming that the SG comes entirely out of lower take-home pay for the member as a baseline, then conducting sensitivity analysis to gauge the impact where a portion of the SG is borne by the employer. This raises the optimal SG from the member's perspective, which is hardly surprising as they receive higher savings at diminished personal cost. The optimal SG is boosted by around 2.5% if the employer bears 50% of the cost, although impact varies with income and member objectives.

We generate estimates of the welfare loss from imposing a sub-optimal SG on members. A typical lifetime welfare (i.e. utility) loss from a sub-optimal SGs equals up to 2% of average income over the 5-years prior to retirement under the estimates we consider most relevant. This implies that the downside from setting the SG at a sub-optimal level is meaningful but not overly large. Under our baseline analysis, increasing the SG from 9.5% to 12% results in utility losses that are equivalent to reducing income by up to 1% for the majority of members.

We also calculate the net impact per member on the government budget associated with various SG levels. This analysis tallies the personal tax and Age Pension effects arising from our analysis over a member's lifetime. The modelling suggests that increasing the SG from 9.5% to 12% would result in a net increase in government revenue taken from individual members. Nevertheless, the estimated revenue changes are relatively modest, suggesting that the fiscal impacts might not be a major factor. However, we do not aggregate our estimates across members, and hence do not comment on the overall budget implications.

Considerations for Whether to Raise the SG

We put forward the following five considerations for policy makers to take into account in deciding whether the SG should be increased to 12% as planned:

(i) ***Specify the policy objectives that the SG is trying to achieve*** – This is the critical consideration in our view. Is the aim to facilitate maintenance of a standard of living post-retirement that is related to that experienced pre-retirement (e.g. replacement rate); or to deliver at least some basic level of post-retirement income (e.g. ASFA standards)? Should the superannuation system be directed at reducing reliance on the Age Pension? Should superannuation be the vehicle through which members self-insure against risks such as living to a very old age, involuntary early retirement or lower investment returns? And should the SG be set at a higher rate to cover for the possibility that members might not make optimal choices, e.g. invest too conservatively?

(ii) ***Decide how to trade-off gains and losses between members*** – The variable impact of any SG increase across members should be addressed, noting that it could be relatively detrimental for low income earners.

(iii) ***Asymmetry between setting the SG higher versus lower*** – The asymmetry relates to the fact that a member can do nothing if the SG is set too high, but can contribute more if it is set too low. Retaining a lower SG for flexibility might be balanced against the reluctance to contribute beyond the mandated minimum.

(iv) ***Where the burden falls of a higher SG*** – This issue includes whether the member or the employer pays, and the question of what broader economic consequences might arise if employers bear the cost.

(v) ***Impact on the government budget*** – Our estimates suggest the impacts are not large on a per-member basis; although we do not address the demographics of the member base and hence the total budget impact.

Assumptions Needed to Justify an SG of 9.5% and Above

Our baseline analysis generates an optimal SG of below 9.5% for the member objectives that we consider most relevant. The two main assumptions required to justify an SG of 9.5% and above include aiming to use the SG to replace the Age Pension, and the stance that superannuation should facilitate self-insurance against investment, longevity and early retirement risks. Two issues arise in taking the stance that a higher SG should be imposed as a self-insurance mechanism. First is whether superannuation is the appropriate hedging vehicle, relative to seeking other solutions based on social security or some form of member pooling. Second is that increasing the SG to insure against these risks would lead to over-saving if the risks do not come to fruition. The potential consequences are that pre-retirement consumption could be reduced unnecessarily, and an increased probability of members dying with substantial unused balances and hence not receiving full benefit from the savings.

The impact of other assumptions is more moderate, but some combination might justify an SG of 9.5% and above. Assumptions that increase our optimal SG estimates (in rough order of impact) include: assuming that the employer bears a portion of the cost associated with the SG; increasing the replacement rate target; lowering expected asset returns; and the member investing more conservatively, which also has the impact of lowering returns. In the case of the employer bearing part of the cost, note that our analysis views the SG from the member's perspective. It hence does not account for any associated macroeconomic effects on profits, employment, inflation, or overall consumption and savings. Assumptions that reduce our optimal SG estimates (in rough order) include imposing a time preference parameter (discount rate); decreasing the replacement rate; and assuming higher returns, perhaps through the member investing in an optimal asset mix entailing higher risky asset weights. We find that imposing the minimum drawdown rules generates mixed effects, but mainly reduces the optimal SG as constraining consumption increases the probability of that savings are not fully utilised before death. Changes to loss aversion only has small impacts under the reference dependent utility function for our set-up.

Our Own View

We see the case for increasing the SG to 12% as tenuous *unless* the stance is adopted that a primary aim is to use superannuation to replace the Age Pension where possible. We are wary over the use of the SG to facilitate self-insurance against risks, noting that this could lead to over-saving with its own issues and costs. Further, our analysis does not account for assets outside of superannuation that could significantly lower the required SG for some members. Our preference would be to see policy directed at supporting pooling solutions (as it has done recently with rule changes for annuities), while ensuring an appropriate social security safety net is in place.

2. Analysis Set-Up

Our analysis is primarily designed to evaluate the impact of different SG levels on utility generated from lifetime consumption at the individual member level. We vary the SG from 0% to 20% in increments of 0.5% under differing assumptions. This allows identification of the 'optimal' SG to the nearest 0.5% for each set of assumptions, and supports calculation of the change in member welfare from varying the SG from its current level of 9.5%. The impact on the government budget is also estimated at an individual level.

The Model

We model an individual member that consumes all their disposable income pre-retirement, after accounting for taxation and SG contributions. The member only saves via the SG, and does not directly optimise their pre-retirement consumption and saving decisions. Under this set-up, the SG acts to reduce pre-retirement consumption and hence utility prior to retirement, i.e. there is a pre-retirement cost borne by the member. The superannuation balance that arises from the SG then generates a utility benefit in terms of post-retirement consumption. The model effectively trades off the loss of utility from reduced consumption pre-retirement against the gain from additional consumption post-retirement, above that which is generated by the Age Pension and related supplements. Post-retirement consumption is uncertain for two reasons. First is exposure to investment risk over the life-cycle, captured in the analysis through running 10,000 simulations of asset returns. Second, the member does not know when they will die, and hence there is uncertainty over the extent to which they experience the full benefit of their savings. The aim is to discover how differing SG levels impact on the utility of consumption over the entire life-cycle, where the key trade-offs relate to consumption pre-retirement versus post-retirement, and exposure to the risk and returns associated with investing via a superannuation fund as well as mortality.

We are particularly interested in how the optimal SG varies with member objectives and income. How we address these two key variables is outlined in the next two sub-sections, followed by a discussion of the scope of the analysis. After undertaking a baseline analysis, we then conduct sensitivity testing around other assumptions to ascertain the extent to which they also matter. Specifically, we investigate how the results change with the utility parameters, time preference, asset returns levels, investment strategy, required drawdowns, desire to hedge against longevity risk, early retirement (also acts as a proxy for career breaks), the availability of the Age Pension, and the assumption that the SG directly reduces the amount available for pre-retirement consumption (i.e. the 'who pays' issue). We also run some scenarios involving combinations of assumption changes.

The main elements of the model appear in Figure 1, with items selected for sensitivity testing listed at the right. Most model elements are straightforward. One element that we do not directly address is home ownership, which has potentially important implications for the SG[1] and we plan to model in a follow-up study. Providing for the cost of housing should have limited consequences under the replacement rate analysis, which might be interpreted as modelling a situation where housing costs are a component of both pre-retirement and post-retirement consumption. For instance, a member who rents would be incurring rental costs throughout. The main complication occurs under the AFSA standards, which establish a fixed target level that is designed for a homeowner, while our analysis does not address how the member comes to be in possession of a home. In particular, ASFA modest sets a consumption target that may be far too low for non-homeowners who need to pay rent or equivalent. The ASFA modest results should thus be interpreted as relevant only for lower income earners who are fortunate enough not to pay rent. For members who need to pay rent, the ASFA comfortable results may provide a better reference, noting that AFSA comfortable exceeds ASFA modest by $15,787, and this difference appears to moderately exceed the additional costs associated with renting.[2] Another interpretation is that the ASFA standard analysis is relevant for a member who has access to a home or other lodgings at minimal cost, perhaps because they have been bequeathed a house or due to their family situation.

[1] A member who buys a home is effectively investing in an asset that generates a stream of income in terms of rental services. As such, home purchase should be modelled as a savings decision that may occur in parallel with savings via superannuation.

[2] According to the Australian Bureau of Statistics (ABS 4130.0, Housing Occupancy and Costs, 2017-18), average rent paid to private landlords was $399 per week or $20,748 per annum, with lone person households paying $316 per week or $16,432 per annum. However, non-homeowners may qualify rental assistance of up to $3,588 annually, while ASFA modest includes housing costs of $3,550 (excluding water charges) that are typically not incurred by renters. Thus, while AFSA modest of $27,814 appears far too low as a target for non-homeowners who need to pay rent, an ASFA comfortable target should be consistent with a living standard above that implied by ASFA modest after adjusting for rent and these offsetting items.

Figure 1: Main Modelling Assumptions and Inputs

Element	Baseline	Sensitivity Testing
Model structure	• Dynamic programming, solved numerically • Pre-retirement phase from age 25-66, post-retirement phase runs from age 67 until death • Income either consumed or invested in superannuation • Utility defined over consumption; no bequests • Modelling conducted in real terms; all real quantities implicitly assumed to inflate at a common rate	
Member	• Full-time worker, no career breaks • No assets outside the superannuation account • Mortality based 2015-17 Australian Life Tables for males, applied from age 67 with mortality improvement	• Aims to save enough for funds to last until age 102 • Retire at age 62; draw income from the super fund; access to Age Pension from age 67
Wage income	• Nine indicative gross income levels (pre-SG) ranging from $30,000 to $150,000 in $15,000 increments • Income age profile hump-shaped, following Freestone (2018) • Income tax rates for 2019-20 including Medicare levy	
Contributions	• SG range of 0% to 20%; 0.5% increments • Member contributes assumed SG; no additional contributions • Contribution taxes (allowing for caps) and LISTO applied	• 75%, 50% and 25% of SG borne by the employer
Investment	• Constant asset mix of 70% risky asset, 30% in risk-free asset • Risky asset real expected return of 5% compound, standard deviation of 17.4% (per global equities; Credit Suisse, 2019) • Risk-free real return of 1%; fixed • Fee of $70 plus 0.80% of balance (0.87% at $100,000) • Effective tax rates are imputed assuming mix of income, capital gains and franking; zero tax rate in retirement phase	• Risky asset return ±1.5% • Optimised asset mix, with no short selling or borrowing • Life-cycle fund with 90/10 asset mix until 25 years prior retirement, then trend to 40/60 mix at retirement and beyond
Social security	• Eligible for basic Age Pension, pension supplement and energy supplement in June 2019 (maximum value $24,063) • Asset and income means-tests applied	• Analysis is run excluding the Age Pension and supplements
Drawdown in Retirement	• Optimised, subject to minimum drawdown rules (i.e. member may opt to draw down more if beneficial) • Superannuation accessed upon retirement at age 67	• Super accessed at age 62 • Minimum drawdown only • Draws consumption target
Reference dependent utility function	• Functional form as per prospect theory value function • Reference level (i.e. target) pre-retirement consumption based on after-tax income at zero SG, so that SG is treated as 'loss' • Three reference levels for post-retirement consumption: -Replacement rate of 70% of average after-tax income during 5-years prior to retirement, assuming an SG of 0% -ASFA modest ($27,814) -ASFA comfortable ($43,601) • Parameters of Blake et al. (2013), including loss aversion weighting parameter of 4.5, curvature parameter on losses of 0.88, and curvature parameter on gains of 0.44 • Discount rate of 0% (time preference = 1.00)	• Higher loss aversion: weighting parameter of 5.5, curvature parameter on losses of 0.88, gain 0.22 • Lower loss aversion: weighting parameter of 3.5, curvature parameter on losses of 0.88, gain 0.66 • Discount rate of 2% (time preference = 0.98) • Replacement rates of 60% and 80%

Our expected asset returns are another element of the analysis that requires elaboration. Our baseline gross real asset returns of 5.0% compound on the risky asset and 1.0% on the risk-free asset align with those observed historically. While current returns on offer in the markets might be below historical levels, we are simulating over an entire lifetime where contributions are progressively invested over a pre-retirement phase that lasts 42 years, with the post-retirement phase extending up to another 43 years. Under these conditions, the historical compound real return is arguably the best guide for the gross returns that might be expected over the long haul, noting that the returns currently on offer are less relevant for contributions made over future years. Adjusting for our taxation and fee assumptions results in a net expected real compound returns of about 2.8% over the pre-retirement phase under our baseline 70/30 asset mix at balances of $100,000 and above.[3] This is more conservative than the median real return target of 3.5% for MySuper balanced funds at June 2019.[4] We conduct sensitivity testing on the return assumptions in Section 6, and find they make a moderate but relevant difference to the optimal SG.

Member Objectives and Utility Function

To capture different objectives, the model evaluates consumption outcomes using a reference dependent utility function that reflects the value function under prospect theory (Kahneman and Tversky, 1979; Tversky and Kahneman, 1992). The reference dependent utility function accommodates the notion that there exists some target level of consumption, and operates by applying a penalty to below-target consumption and a discount to above-target consumption. This penalty is largely driven by loss aversion, i.e. the desire to avoid outcomes below the target. See Warren (2019) for the functional form and detailed discussion of the properties of this utility function.[5]

The utility function is tailored to differing member objectives through applying three specifications for the post-retirement consumption target: a replacement rate, and two fixed consumption targets based around ASFA modest and ASFA comfortable respectively. These are coupled with a pre-retirement consumption target that equals post-tax income assuming an SG of zero. This set-up treats any SG during the pre-retirement phase as a shortfall relative to target, on the intuition that it reduces pre-retirement consumption relative to what would otherwise have occurred. Meanwhile, the SG contributes toward attaining the post-retirement consumption target. The reference dependent formulation hence involves a search for the SG level that balances the respective shortfalls versus target in the pre-retirement and post-retirement phases, noting that consumption occurring in the pre-retirement phase is deterministic while that in the post-retirement phase is uncertain due to random investment returns and mortality. The modelling effectively analyses two broad categories of objectives with respect to target consumption during the post-retirement phase, each with their own particular implications:

- ***Replacement rate target*** – A replacement rate implies a desire to maintain a standard of living related to that attained pre-retirement, albeit with relatively lower post-retirement consumption being acceptable. The baseline post-retirement target is set at 70% of post-tax income during the 5-years prior to retirement (see OECD, 2012), assuming an SG of zero. The set-up is equivalent to targeting the replacement of 70% of the consumption that would have occurred in the absence of the SG. This formulation effectively links the pre-retirement and post-retirement consumption targets, which scale up and down together.

- ***Fixed consumption target*** – Assuming a fixed target might be interpreted in two ways. First, there is a given level of post-retirement consumption that is deemed acceptable to the member. Second, the SG should be set from a policy perspective with a view to ensuring that members save enough to achieve a minimal level of post-retirement consumption. We examine both the ASFA modest and ASFA comfortable retirement standards for a single household at June 2019, which equal $27,814 and $43,601 respectively. This formulation will tend to indicate an optimal SG that suffices to achieve the post-retirement target, and no more. Further, because the post-retirement target is decoupled from pre-retirement, it becomes likely that the indicated optimal SG will decline with income as a lower savings rate becomes required to attain the target. This is exactly what we find.

[3] Net returns at lower balances are reduced by the fixed $70 account fee component.

[4] Based on data from the Australian Prudential Regulation Authority (APRA), see https://www.apra.gov.au/quarterly-superannuation-statistics

[5] We conducted analysis under power utility, which aligns with the objective of optimising lifetime utility of consumption. We do not report the results to avoid complicating the message. Power utility suffers from various shortcomings in the context of this study. It treats pre-retirement consumption and post-retirement consumption as equally valuable (at least where a zero discount rate is applied). This seems counterfactual to the extent that required consumption declines post-retirement, noting that pre-retirement consumption may be boosted by work-related expenses like travel, and the cost of raising a family. Further, many members may reduce post-retirement consumption because they become less active especially in their later years, with the availability of universal public healthcare helping to meet rising medical costs later in life. In addition, the optimal SG estimates were boosted under power utility through additional savings aimed at limiting the lower tail of outcomes during retirement. This resulted in optimal SGs that often sat at the maximum of 20%, and generated higher expected post-retirement consumption than observed pre-retirement. Saving to avoid poor outcomes thus dominated over consumption smoothing under the set-up, aided by various constraints not usually present in life-cycle models. (The reference dependent utility function did not suffer from this issue due to a lower curvature.)

Our baseline utility parameters are aligned with relatively high loss aversion, although sensitivity testing as reported in Section 6 reveals that the results are not very sensitive to parameter changes. We adopt the parameters of Blake et al. (2013), which include a curvature parameter on gains of 0.44, a curvature parameter on losses of 0.88, and a weighting (loss aversion) parameter on losses of 4.5. These place a heavy discount on above-target consumption, and a large penalty on below-target consumption. This generates a strong preference for avoiding consumption below target while giving limited credit for exceeding the target. The baseline analysis applies a zero discount rate, i.e. time preference parameter of 1.00. This assumption implies no intertemporal preference for earlier consumption over later consumption, i.e. both are considered equally valuable. Whether a discount rate should be applied in the context is an open question. It is plausible that a younger member might reasonably place lower value on post-retirement consumption. The issue also relates to the purpose of the SG. There is ample evidence that people can be myopic and may heavily discount the future.[6] This may prevent some from saving an adequate amount for retirement, even though it may be in their own interests. We investigate the potential impact of time discounting by running sensitivity testing including a discount rate of 2% pa, i.e. applying a time preference parameter of 0.98. This implies that consumption occurring (say) 30 years in the future generates only 55% of the utility to an equivalent consumption outcome today.

Income Levels

We run the analysis over nine income levels, which we denote income level one (L1) through to income level nine (L9). Our income range extends from $30,000 to $150,000 in $15,000 increments, which is taken to represent average pre-retirement income from age 25 to age 66 prior to personal income tax and the SG. We settled on this approach after finding none of the available income distribution statistics to be fully satisfactory. The main aim is to establish how the optimal SG varies with income, meaning that the exact income levels being analysed are *not critical* provided that they span a meaningful range. Our income range encompasses the effect of gender[7] and under-employment to the extent that women and part-time workers earn lower incomes, such that the results at the lower income levels may be interpreted as more relevant for these two groups. We discuss how our income range relates to available income distribution statistics at the end of this sub-section.

To generate an income profile over the pre-retirement phase, we take the nine average pre-retirement incomes as a reference point. The model of Freestone (2018) is then used to generate hump-shaped income profiles to match each average level. Under this model, income at age 25 is about 78% of the average. Income grows to peak at age 47 at 111% of the average, implying 1.6% real growth over this period. Income then tapers off to reach an average over the 5-years prior to retirement that is 10% below the average, and 19% below the peak. The real growth rate from age 25 to age 62-66 is 0.4%. Details of the income distribution appear in Figure 2.

Figure 2: Wage Income Distribution, Most Relevant Objectives and Related Income Targets

Income Level	**L1**	**L2**	**L3**	**L4**	**L5**	**L6**	**L7**	**L8**	**L9**
Base Income, Age 25	$23,278	$34,917	$46,557	$58,196	$69,835	$81,474	$93,113	$104,752	$116,392
Maximum, Age 47	$33,303	$49,954	$66,605	$83,257	$99,908	$116,559	$133,211	$149,862	$166,513
Pre-Retirement Average, Age 25–66	***$30,000***	***$45,000***	***$60,000***	***$75,000***	***$90,000***	***$105,000***	***$120,000***	***$135,000***	***$150,000***
Average 5-years Prior Retirement, Age 62–66	$27,028	$40,541	$54,055	$67,569	$81,083	$94,596	$108,110	$121,624	$135,138
Most relevant objectives*	AM	AM	AC RR	AC RR	AC RR	AC RR	AC RR	AC RR	AC RR
Related income targets	$27,814	$27,814	$43,601 $30,701	$43,601 $36,897	$43,601 $43,094	$43,601 $49,144	$43,601 $54,915	$43,601 $60,686	$43,601 $66,456

* AM is ASFA modest, AC is ASFA comfortable, RR is replacement rate

[6] Notable behavioural effects that give rise to a bias toward the present include myopic loss aversion (see Benartzi and Thaler, 1995) and hyperbolic discounting (see Laibson, 1997).

[7] Females differ to males in a propensity to earn lower incomes, a higher likelihood of career breaks and longer life expectancy. The main implication of the first two differences is lower lifetime income, and is thus covered by our income distribution. Our sensitivity tests involving early retirement also cover for career breaks to some extent.

Figure 2 also indicates the member objectives that we consider 'most relevant', and the related income targets. For income L1 and L2, we consider ASFA modest as most relevant. At these lower incomes, a replacement rate objective implies a living standard that is possibly below the poverty line, while ASFA comfortable implies a living standard above that enjoyed pre-retirement. For income L3 to L9, we view both ASFA comfortable and the replacement rate as competing candidates for plausible objectives, depending on whether the aim is to achieve a set standard of living, or to achieve income and consumption reflecting that enjoyed pre-retirement.

It is worth expanding on how our baseline 70% replacement rate relates to the pre-retirement income distribution. A 70% target based on average income over the 5-years prior to retirement equates to a replacement rate of 63% based on average pre-retirement income over the working phase from age 25 to age 66. However, we base our replacement rate target on after-tax income at a zero SG, which supports isolating the impact of the SG itself. This means that our quoted replacement rate is a higher percentage of disposable income in the presence of any SG. For instance, under an SG of 9.5%, our replacement rate target for income L5 equates to 76% of disposable income in the 5-years prior to retirement, and 69% of average pre-retirement income over age 55 to age 66.

To place our income distribution in context, we refer to Australian Bureau of Statistics (ABS) data on employee earnings[8] and household income[9] from 2017-2018. The lowest income L1 of $30,000 sits at around the 20th percentile for total earnings per employee of $29,120, but is well below the 10th percentile for earnings per full-time employee of $46,608. It is positioned in-between the 10th and 20th percentile for household income of $24,544 and $38,896 respectively. Our highest income L9 of $150,000 is above the 90th percentile for both total and full-time earnings per employee of $123,084 and $142,428 respectively, but sits about half-way between the 70th and 80th percentile for household income. The central income L5 of $90,000 is close to median household income, although it is nearer to the 60th percentile for full-time earnings and 75% percentile for total earnings per employee. It also happens to be close to ordinary-time adult average weekly earnings at May 2019 of $89,840.[10] We believe that the range we span is reasonable and meaningful, noting that those on incomes below $30,000 may be receiving support from the government or elsewhere that is not explicitly taken into account in our analysis. In addition, incomes above $150,000 comprise a minority of very wealthy people who should be able to cater for themselves, and might not be considered the prime concern for determining SG policy.

Scope of the Analysis

Implementation of the type of model applied in this study requires making judgements around which elements to include or leave out, and the degree of complexity to admit. Our aim is to incorporate all elements that might be crucial for setting the SG. Figure 3 summarises the key elements that are included in the model on the left, and notes some of the more notable elements that are excluded on the right. We consider the key elements captured by our modelling to be as follows:

- We analyse a single wage-earner that faces the trade-off between consuming their available income, or saving for retirement via their superannuation fund;
- We assume the member contributes to their superannuation fund only to the extent that the SG dictates;
- The superannuation (and retirement) fund invests in either a risky asset (equities) or a risk-free asset (cash);
- The member has access to the Age Pension plus related supplements, and is thus relying on both the Age Pension and drawdowns from their retirement fund to support consumption in retirement;
- We allow for the tax and other rules surrounding both personal income and superannuation, as well as the pension eligibility rules;
- We assume that the member holds a 70/30 balanced fund without attempting to optimise their asset mix;
- We assume that the member optimises their drawdown decisions;
- The member faces uncertainty over the post-retirement consumption that their savings will generate due to randomness in both investment returns and mortality.

[8] Based on ABS 6306.0- Employee Earnings and Hours, Australia.
[9] Based on ABS 6523.0 - Household Income and Wealth, Australia.
[10] Or $1,727.70 per week, per ABS 6302.0 - Average Weekly Earnings, Australia.

Figure 3: What We Include and Excluded from the Analysis

Included in the Model	Notable Exclusions From the Analysis
• Member either consumes their income, or saves a portion of it by investing via their superannuation fund • Wage income follows a pre-determined hump-shaped path during the pre-retirement phase • Taxation and other rules related to personal income and superannuation • Impact of uncertain mortality • Availability of the Age Pension plus supplements • Member contributes the SG only to their superannuation fund • Two assets: risky with stochastic real returns, risk-free with fixed real returns • Member invests in a 70/30 balanced fund (which our analysis reveals as sub-optimal) • Member optimises drawdowns, subject to meeting the minimum drawdown rules	• No assets outside of superannuation, including notably the potential to invest in a home • Income uncertainty (e.g. early retirement and career breaks) is not addressed under the baseline analysis, but is investigated under the sensitivity tests • Modelling performed in real terms without allowing for the possibility that average incomes, the Age Pension, consumption targets and asset returns may inflate at differing rates • Household effects are not considered, with modelling based around a single individual without any bequest motive • No other assets are available for investment, including annuities

The assumption that the member holds a 70/30 fund while optimising their drawdowns requires comment. It is an open issue whether the optimal SG should be estimated by assuming that the member behaves optimally, or in line with some commonly observed practice. Assuming that the member behaves optimally avoids confounding the SG findings with potentially sub-optimal choices, perhaps as a consequence of poor financial literacy, behavioural biases or shortcomings in the policy environment itself. On the other hand, members do not necessarily behave optimally with regard to either investment or drawdown decisions. Applying a 70/30 asset mix recognises that the optimal investment strategy is unlikely to be followed as it entails much higher risky asset weights than most members might be willing to accept. Our model generates risky asset weights that average between 75% and 85% across the life-cycle, depending on the member objective. By contrast, the optimal drawdown strategy that emerges is far more plausible, and entails drawing down the target in most circumstances (subject to the minimum drawdown rules). Against this background, our sensitivity testing gauges the impact of: optimised asset weights; a life-cycle investment strategy under which the risky asset weight transitions from 90% to 40% at retirement; and the member strictly following the minimum drawdown rules.

Five notable exclusions from the analysis are listed on the right of Figure 3. These are discussed below:

(a) ***Absence of other assets outside of superannuation*** – This is potentially an important omission: effectively we are modelling only pillar one and pillar two of the retirement incomes system. Including other assets in our model should ***lower*** the estimated optimal SG, potentially significantly. Other forms of savings can act as a direct substitute for saving via superannuation, and hence may impact on the SG required to support a desired level of post-retirement consumption. Housing is the asset that matters most in this context. Individuals who buy a family home enter into a form of semi-committed savings, and effectively buy an income stream in terms of the rental services that may extend through into retirement. Further, housing is advantaged to the extent that it is exempt from income and capital gain tax, and does not qualify for the assets test that determines Age Pension eligibility. For these reasons, housing might be viewed as a genuine alternative to superannuation; and the optimal SG for those with a family home might be expected to be considerably lower than for those without. An analysis of housing and its policy implications is a topic deserving of its own analysis, but is treated as beyond scope here.

(b) ***Uncertainty over pre-retirement income*** – Our baseline model assumes that pre-retirement income is known, although this issue is partly addressed during sensitivity testing. The most important source of uncertainty relates to the length of time spent in employment. Career breaks, periods of part-time work and early retirement all have the dual effect of lowering contributions into superannuation and creating the need to fund consumption when income dries up. Our sensitivity test is framed around early retirement, and indicates that a meaningfully ***higher*** SG is required when the length of time in employment is reduced by 5 years. Nevertheless, this issue is more complex than captured by the analysis in this study. In particular, it is ***not clear*** that a higher SG is the best way to deal with income uncertainty. First, if income is uncertain, or there is a possibility of career breaks, then it makes sense that some level of precautionary balances should be built to be readily accessible in times of need. These precautionary balances might be better held outside of superannuation,[11] thus providing one reason why the SG might be set at a lower level to provide more room for building precautionary savings elsewhere. The availability of social security (e.g. unemployment benefits) and capacity to borrow also needs to be taken into account. Further, the effect of career breaks on savings via superannuation might be mitigated by members contributing more when they can.[12] The other consideration is that neither career breaks nor early retirement are certain. It is debatable whether it is appropriate to set a higher SG for all members 'just in case' some may suffer a career break or retire early. The impact of income uncertainty on the optimal SG is a complicated issue that requires a more complex model to be addressed properly.

(c) ***Analysis in real terms, assuming that all amounts inflate at a common rate*** – The possibility that some quantities may inflate at different rates has been referred to as relating to the 'deflator' used, although we think this is better seen as a matter of whether to allow for differential *real* growth rates. One key issue is the relation between economy-wide real income growth, the post-retirement consumption target and the Age Pension. Also of relevance is the basis of the assumed asset returns, which we set with reference to historical CPI-adjusted returns. Our analysis might be viewed as consistent with a world where economy-wide incomes and hence the Age Pension do not grow in real terms, so that all variables inflate with prices (e.g. CPI). Note that we do allow for real income growth at an individual level under the model of Freestone (2018), equating to 1.6% between age 25 and age 47 and 0.4% between age 25 and the 5-years prior to retirement.

The effect of economy-wide real income growth on the optimal SG estimates is ***unclear***, and will depend on assumptions and various interactions. First, economy-wide real income growth would raise the dollar value of contributions above what we have assumed, thus increasing the balance at retirement available to support post-retirement consumption. Second, the impact on the post-retirement consumption target depends on how the target is formulated. Under the replacement rate objective, the target will rise in lock-step with any additional real growth in income. Calculations indicate that the percentage increase in a replacement rate target would be approximately twice that of the balance at retirement. However, the extent to which fixed consumption targets such as the ASFA standards increase with economy-wide real income growth is unclear: these targets might rise at a rate somewhere between wage and price inflation. Third, economy-wide real income growth would raise the level of Age Pension, given that it is linked to average weekly earnings. This opens up the possibility that the Age Pension might grow at a higher rate than the consumption required to retain a given standard of living during the post-retirement phase relative to what is implicit under our analysis, to the extent that living standards are linked to prices rather than wages. The net effect from these various influences is not straightforward.

(d) ***Household effects*** – We model a single-income household with male mortality with mortality improvements (i.e. allowing for increasing life expectancy). Modelling a household rather than an individual would add much complexity. It would require making allowance for the possibility of dual income streams and dual superannuation funds, applying Age Pension payments for couples, addressing dual longevity risk (the funds need to last to the second survivor), and making adjustments for shared living costs. These various elements are at least partly offsetting. We suspect modelling a household would make a ***marginal*** rather than substantial difference to the results. The fact that we do not allow for *bequests* is worth noting, as it implies zero value is attached to any residual left in the retirement account at death. The idea that the residual value is worthless will be counterintuitive for many members. Including a bequest motive in the analysis should tilt the results towards a ***higher*** optimal SG. On the other hand, it is debatable whether public policy should be set to accommodate bequests.

(e) ***Limited asset universe*** – We assume that the available assets comprise only a risky asset ('equities') and a risk-free asset ('cash'). Adding additional assets would allow more effective portfolios to be built, which might ***lower*** the SG required. This would be particularly the case where other assets might make a post-retirement consumption target easier to attain at lower risk. In particular, the availability of annuities might make a difference, to the extent that they deliver certainty of income and help to hedge longevity risk. Nevertheless, we expect that adding additional asset classes to the analysis would make only a ***modest*** difference.

[11] The hardship provisions, under which individuals can access their superannuation under extreme circumstances, go some way to mitigating this issue. However, they are a very poor substitute for having readily accessible savings to draw on.
[12] This option of contributing more at a later date is generally not available under early retirement.

3. Baseline Results – Optimal Superannuation Guarantee

We start by presenting our baseline estimates for the 'optimal' SG. The baseline sets the foundation for further analysis aimed at gauging how the SG varies with assumptions, which is the primary focus of this study. Figure 4 reports the matrix of optimal SG estimates by income and member objectives, based on running the model for SG levels from 0% to 20% in increments of 0.5%. The grey shading highlights results under the objectives we consider most relevant, which include ASFA modest at income L1 and L2, either the replacement rate or ASFA comfortable at L3 through to L9.

Figure 4: Optimal Superannuation Guarantee under the Baseline Analysis

	Income Level								
Member Objective	**L1**	**L2**	**L3**	**L4**	**L5**	**L6**	**L7**	**L8**	**L9**
70% Replacement Rate	0.0%	0.5%	3.5%	5.0%	6.0%	6.5%	7.5%	8.0%	8.5%
ASFA Comfortable	15.0%	12.0%	9.0%	7.0%	6.0%	5.0%	4.5%	4.0%	3.5%
ASFA Modest	3.0%	2.5%	2.0%	1.5%	1.0%	1.0%	1.0%	1.0%	1.0%

Two stark findings emerge. The first is the large variation in the optimal SG. There is no single SG that suits all. The second is that the optimal SG sits below the current level of 9.5% under the most relevant objectives as highlighted with grey shading, where the range is 2.5% to 9.0%. Indeed, an SG of 9.5% or above is indicated only under the ASFA comfortable target for L1 and L2, where the optimal SG is 15% and 12% respectively. Recall that ASFA comfortable sits above the level of pre-retirement consumption at incomes L1 and L2.

Estimation of optimal SGs of below 9.5% under the most relevant objectives will come as a surprise to many readers. Hence we now provide a detailed explanation of why our model generates these outputs, placing emphasis on the estimates for the most relevant objectives. Under the reference dependent utility function, the model directly addresses the question of how much a member needs to save in a bid to reach a post-retirement consumption target. Noting that sacrificing consumption pre-retirement is treated as a loss under our set-up, the model is in effect trying to locate the SG that balances the utility loss incurred pre-retirement, against the utility loss if the SG remains lower than required to achieve the post-retirement consumption target. Further, in most (but not all[13]) cases, the post-retirement consumption target is lower than the pre-retirement consumption target. Lower saving is also required where the Age Pension is doing much of the heavy lifting in terms of attaining the consumption target, as is the case for low income earners in particular.

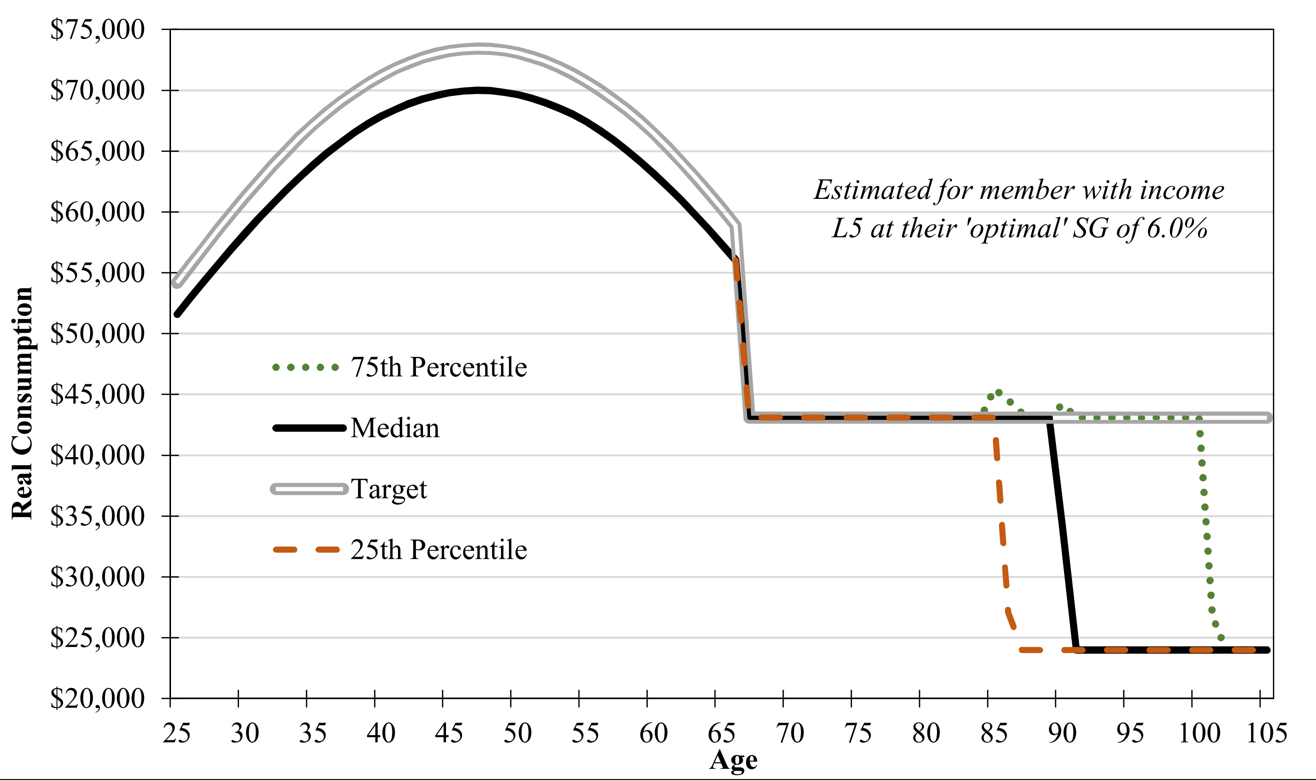
Life expectancy is another factor at play. Uncertain mortality has the effect under our model of placing a lower weight on consumption at older ages. For example, the probability of surviving to age 90 is 47%, meaning that consumption outcomes at age 90 might be considered as having a 47% weighting. The model is thus trading off certain reductions in pre-retirement consumption against increases in post-retirement consumption that are uncertain due to both fluctuations in asset returns and the chance that the consumption generated may not be experienced if the member does not survive. The model consequently references life expectancy (of age 89) in identifying the SG that optimises lifetime utility, and implicitly attaches a low weight on the possibility that the member might survive to a very old age.

Figure 5 provides intuition by plotting the consumption profile that emerges under a replacement rate target for income L5, applying the 'optimal' SG of 6.0%. Note that an SG of 6.0% is also optimal under the ASFA comfortable target at L5, hence this chart covers both objectives at this income level. The double grey line plots 'available' pre-retirement income and the post-retirement target, with the latter downwardly-dislocated. The model indicates that in most cases it is optimal to drawdown the target until the retirement account balance is exhausted, resulting in the member then moving onto the Age Pension. Drawdowns are subject to the minimum drawdown rules, which may require the member to withdraw more than the target where higher investment returns occur. (This explains the bumps in the 75th percentile line.) The utility-based model thus trades off the reduction in pre-retirement consumption against the risk of ending up on the pension later in life. The consumption profile appearing in Figure 5 indicates that exhaustion of the retirement account occurs at a median age of 91, with the

[13] ASFA modest exceeds pre-retirement post-tax income at L1, as does ASFA comfortable at L1 and L2.

25th percentile at age 87 and the 75th percentile at age 102. In essence, the model suggests that the utility loss from giving up 6% of pre-retirement consumption is equal to the utility benefit of consuming the post-retirement target well into the 80's with a 75% likelihood, with more than a 25% chance of sustaining the consumption target beyond age 100. The model implies it is worth taking these odds, with the downside related to ending up on the Age Pension later in life.

Figure 5: Consumption for Income Level 5 under Replacement Rate Target at the Optimal SG



The manner in which the optimal SG estimates vary with income also require explanation. Three factors are at play:

- *Age Pension* – As the Age Pension provides a capped level of income support during retirement, it is of greater value to lower income earners relative to higher income earners. It is hence more influential in limiting the need for a higher SG for those on lower incomes.

- *Tax effects* – The differential between the tax rate applied to personal income and superannuation vary with income in manner that makes contributing to superannuation less beneficial for those on lower relative to higher incomes. The Australian marginal personal income tax rates in 2019-20 are 19% for income between $18,201 and $37,000, then 32.5% for additional income up to $90,000, 37% for additional income up to $180,000, and 45% on any income above $180,000. Meanwhile, superannuation is taxed at 15% on contributions, 15% on income, and 10% on capital gains. Members on incomes below $37,000 – encapsulating L1 and L2 in part – notionally incur higher marginal tax rates on superannuation than regular income, although this is offset by the low income superannuation tax offset (LISTO) of up to $500 (which we incorporate in the modelling). Meanwhile, superannuation can act to lower effective tax rates for those in the higher tax brackets.

- *Nature of the post-retirement consumption target* – Where the post-retirement consumption target is fixed in level terms (i.e. the ASFA standards), a declining saving rate is required to attain that target as income increases. On the other hand, under a replacement rate the post-retirement consumption target is linked to pre-retirement income and hence consumption scales up with income. In this case, there is limited interaction between income and the optimal SG arising from the target itself.

The combination of the above effects leads to decline in the optimal SG with income under both ASFA comfortable and ASFA modest, where the dominant effect is that a lower portion of income needs to be saved to attain the fixed target as income increases. Under the replacement rate objective, the optimal SGs rise with income levels. Here the dominant influence is the tailing off in the value of the Age Pension relative to income, with tax effects playing a supporting role.

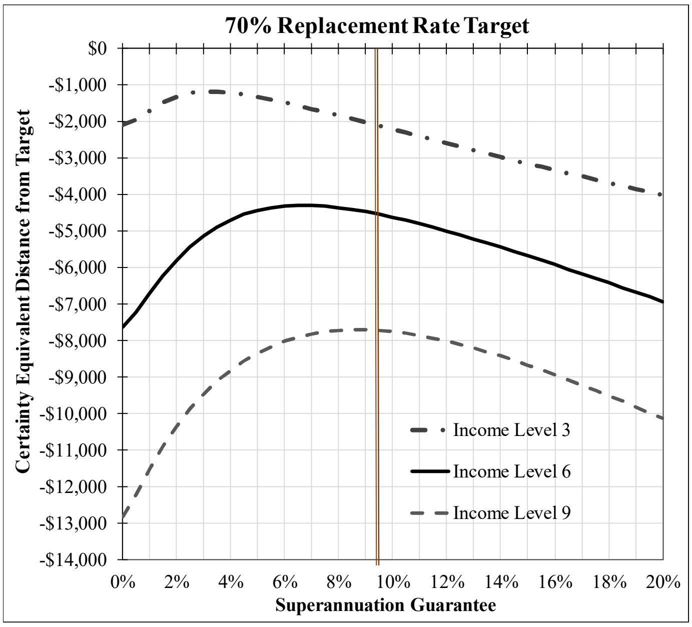
Putting it all together, under the ASFA comfortable target of $43,601, the optimal SG starts at 15.0% at L1 then progressively declines. Noting that AFSA comfortable sits above average pre-retirement income for income L1 and L2, the range of the relevant results under ASFA comfortable extend from 9.0% at L3 down to 3.5% at L9. Under ASFA modest, the maximum Age Pension plus supplements of $24,063 is just $3,751 short of the consumption target of $27,814. Hence a very low SG is required to secure the target. The optimal SG under ASFA modest is only 3.0% for L1 and 2.5% for L2 (the level we consider most relevant); then declines to only 1.0% at L5 and above. Under the replacement rate objective, the optimal SG increases over the most relevant range from 3.5% at L3 up to 8.5% at L9. It stands at 0% for income L1 and 0.5% for L2, as the Age Pension is above or near the target. These estimates highlight how purported member objective, income level and the existence of the Age Pension are key determinants of the optimal SG for any particular member.

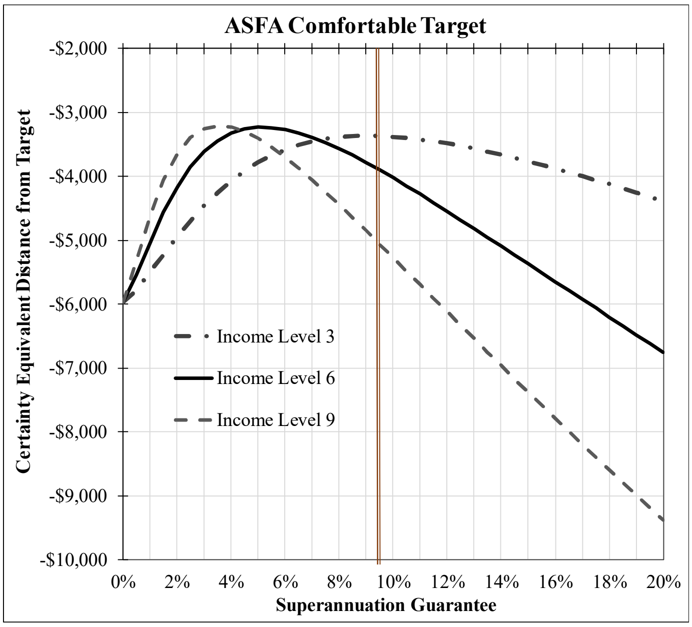
In summary, the relatively low SGs indicated by our model arise from a combination of requiring enough savings to achieve a post-retirement consumption target that is less than pre-retirement consumption, accounting for access to the Age Pension, and balancing the utility cost of a certain reduction in utility pre-retirement against an uncertain gain in utility post-retirement. We suspect that other commentators generate higher SGs in part because they examine the post-retirement phase in isolation, and do not characterise the SG in terms of a trade-off against pre-retirement living standards that involves uncertainty over the post-retirement pay-off due to unknown investment returns and mortality. Further, some commentators may be explicitly or implicitly giving insufficient credit to the Age Pension, which is a key factor in generating our results particularly for low income earners. We examine the impact of excluding the Age Pension, as well as altering other assumptions, under the sensitivity testing reported in Section 6.

4. How Member Welfare Changes with the Superannuation Guarantee

We now use our baseline estimates to gauge the individual welfare effects associated with differing SG rates. To make the analysis more tangible, we convert expected utility into certainty equivalents expressed in terms of lifetime consumption. This provides a utility-based metric where the units directly relate to yearly consumption levels, and hence can be interpreted in economic terms. Given the use of reference dependent utility functions, we calculate the constant deviation of consumption from the target across all ages that generates the same utility as estimated under the simulations. We denote this ‘certainty equivalent distance from target’. Figure 6 plots the respective certainty equivalents under the utility functions for income L3, L6 and L9, except for ASFA modest where we plot them for L1, L2 and L3. The vertical double-line representing the current SG of 9.5%. Figure 6 provides a visualisation of how expected utility varies with the SG across a range of incomes and member objectives. The utility functions all reveal a fairly distinct peak, sometimes with relatively steep slopes around the optimal level.

Figure 6: Certainty Equivalents Metrics at Three Income Levels





Notes on Certainty Equivalents Metric:

- *The series plotted represent levels of lifetime real consumption, expressed as a difference from target consumption.*
- *The highest points on each curve represent the optimal SGs as reported in Figure 4.*
- *Focus should be placed on how the certainty equivalents vary with the SG: the overall level of each series is of limited consequence.*
- *The slope of the curves around the optimal SG provide an indication of degree of the potential welfare losses from imposing a sub-optimal SG on a particular member.*

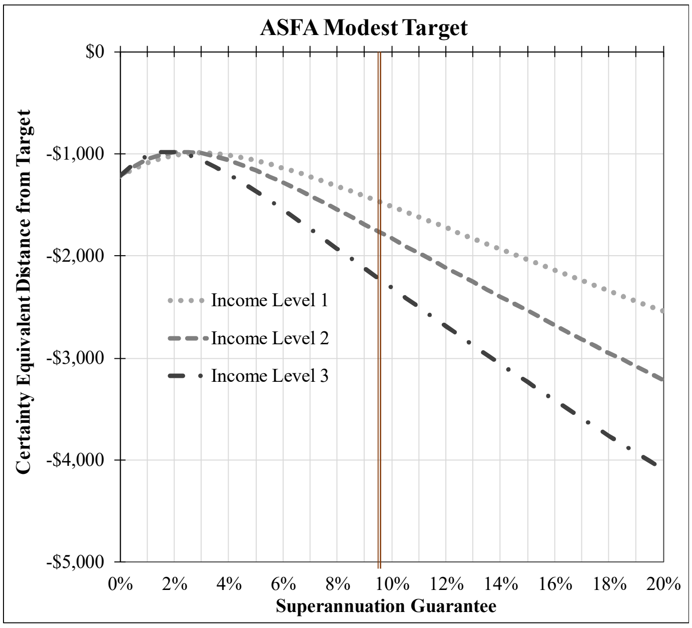


Figure 7 presents the difference in certainty equivalent estimates for an SG of 9.5% relative to the estimated optimal SG, and for an SG of 12% versus and an SG of 9.5%. Panel A reports (real) dollar differences; while Panel B expresses these differences as a percentage of income in the 5-years prior to retirement. Across the member objectives that we consider most relevant, the 9.5% SG is sub-optimal an imposes a cost up to the equivalent of about 2% of income. The losses sit above 1% of pre-retirement income for income L3 and L4 under the replacement rate, L8 and L9 under ASFA comfortable, and level L1 and L2 under ASFA modest. In all cases, the loss occurs because a 9.5% SG is too high. The estimates also indicate that increasing the SG from 9.5% to 12% would impose a loss in utility equivalent to a reduction of 0.2% to 1% in income under the most relevant objectives. Our welfare estimates depend on our model, and are valid only for the baseline assumptions. They flag the possibility that increasing the SG to 12% might harm more members than it helps. Nevertheless, the reduction in welfare is estimated to be relatively modest.

Figure 7: Certainty Equivalent Gains (Losses) at 9.5% and 12% Superannuation Guarantees

Difference in Certainty Equivalent Consumption or Distance from Target	Income Level								
	L1	L2	L3	L4	L5	L6	L7	L8	L9
PANEL A: Dollar Difference (Real)									
9.5% SG *less* Optimal SG									
Replacement Rate	-1,784	-1,401	-946	-645	-414	-239	-133	-62	-20
ASFA Comfortable	-258	-72	-3	-131	-375	-664	-1,018	-1,418	-1,844
ASFA Modest	-475	-779	-1,234	-1,741	-2,166	-2,580	-3,025	-3,492	-3,958
12% SG *less* 9.5% SG									
Replacement Rate	-296	-378	-475	-529	-526	-458	-400	-343	-290
ASFA Comfortable	200	72	-117	-322	-509	-643	-782	-922	-1,058
ASFA Modest	-259	-356	-473	-599	-719	-804	-906	-1,017	-1,132
PANEL B: % Income 5-Years Prior Retirement									
Average Income, 5-Years Prior Retirement	27,028	40,541	54,055	67,569	81,083	94,596	108,110	121,624	135,138
9.5% SG *less* Optimal SG									
Replacement Rate	-6.6%	-3.5%	-1.8%	-1.0%	-0.5%	-0.3%	-0.1%	-0.1%	0.0%
ASFA Comfortable	-1.0%	-0.2%	0.0%	-0.2%	-0.5%	-0.7%	-0.9%	-1.2%	-1.4%
ASFA Modest	-1.8%	-1.9%	-2.3%	-2.6%	-2.7%	-2.7%	-2.8%	-2.9%	-2.9%
12% SG *less* 9.5% SG									
Replacement Rate	-1.1%	-0.9%	-0.9%	-0.8%	-0.6%	-0.5%	-0.4%	-0.3%	-0.2%
ASFA Comfortable	0.7%	0.2%	-0.2%	-0.5%	-0.6%	-0.7%	-0.7%	-0.8%	-0.8%
ASFA Modest	-1.0%	-0.9%	-0.9%	-0.9%	-0.9%	-0.8%	-0.8%	-0.8%	-0.8%

5. Net Impact on the Government Budget

We calculate the total impact of different SG levels on the government budget at the individual member level by summing the effect on taxation and the Age Pension and supplements over the entire lifetime. The post-retirement inputs are weighted by probability of survival, thus generating an expected total impact allowing for uncertain life expectancy. Our calculations include the following inputs:

Inflows to the government:

- Income tax pre-retirement, including the Medicare levy
- Superannuation contributions tax
- Taxes on superannuation earnings pre-retirement

Outflows from the government:

- Low-income superannuation tax offset, up to $500 pa for individuals with income of $37,000 or less
- Age Pension and supplements
- Franking credits claimed within the retirement account

This is of course a partial analysis of the interactions between an individual and the government, ignoring other effects such as the impact on company tax and the GST. Hence the absolute numbers are less meaningful than how they vary with the SG. We also take no account of time discounting, and do not consider the mix of member cohorts in the economy that could lead to aggregate impacts that differ significantly from our indicative estimates. In particular, tax revenue is accrued pre-retirement while the impact on outlays via the Age Pension and other items is largely incurred post-retirement, meaning the net present value will exceed our estimates based on a simple sum over time from the government's perspective. These timing differences will also interact with population demographics in determining the aggregate budget impact.

Figure 8: Net Revenue to the Government – Tax Collected *less* Pension and Related Supplements

$'000 per Individual over their Lifetime (Constant 2019 Dollars)	Income Level								
	L1	L2	L3	L4	L5	L6	L7	L8	L9
PANEL A: Net Revenue Estimates									
Superannuation Guarantee of 0%	-416	-238	-21	196	420	660	905	1,150	1,396
Superannuation Guarantee of 9.5%									
Reference Dependent, Replacement Rate	-412	-220	31	337	580	825	1,074	1,324	1,571
Reference Dependent, ASFA Comfortable	-401	-199	58	320	579	845	1,113	1,378	1,638
Reference Dependent, ASFA Modest	-410	-219	22	267	511	768	1,029	1,290	1,548
Superannuation Guarantee of 12%									
Reference Dependent, Replacement Rate	-401	-202	60	381	627	866	1,111	1,355	1,598
Reference Dependent, ASFA Comfortable	-381	-168	100	367	625	885	1,145	1,402	1,654
Reference Dependent, ASFA Modest	-399	-200	48	298	545	798	1,056	1,314	1,568
PANEL B: Changes in Net Revenue									
Superannuation Guarantee 9.5% vs. 0%									
Reference Dependent, Replacement Rate	4	18	52	141	160	165	169	173	175
Reference Dependent, ASFA Comfortable	15	39	80	124	158	185	208	227	241
Reference Dependent, ASFA Modest	6	20	43	71	91	108	124	140	152
Superannuation Guarantee 12% vs. 9.5%									
Reference Dependent, Replacement Rate	11	18	29	44	46	42	37	32	27
Reference Dependent, ASFA Comfortable	20	31	42	47	46	40	33	25	17
Reference Dependent, ASFA Modest	12	19	26	31	33	30	27	24	19

By capturing the main revenue and outlay items that are affected by the SG we provide an indication of how altering the SG may impact on the flows between the government and individuals. Figure 8 reports the net revenue associated with an SG of 0%, 9.5% and 12% in Panel A, then presents the change in moving from an SG of 0% to 9.5% and from 9.5% to 12% in Panel B. Focusing on the change estimates appearing in Panel B, we find that the SG increases net government revenue across an individual's lifetime at all income levels, albeit by reducing what are net outlays at L1 and L2. Our results indicate that increasing the SG from 9.5% to 12% would boost net revenue in the range of $12,000 to $47,000 under the most relevant objectives. The numbers do not seem large bearing in mind that they are lifetime totals. The impact is less for those on high incomes. For example, the increase in net revenue taken by the government under the most relevant objectives stands between 12% and 34% of one year's income at L7 to L9, and between 42% and 70% for L1 through to L6.

6. Sensitivity and Scenario Testing

We test the sensitivity of the optimal SG estimates to a wide range of assumptions. This reveals which other assumptions are important, in addition to income level and member objectives as examined under the baseline analysis. The sensitivity analysis reveals that changing the following assumptions produces a meaningful change in the estimated optimal SG:

Higher SG indicated *(in rough order of significance)*

- Ignoring access to the Age Pension, implying a desire (or policy objective) for self-funding
- Early retirement at age 62, thus self-funding consumption until accessing the Age Pension at age 67
- Member saves so that the funds might last until age 102, i.e. self-insuring against longevity risk
- Employer bears a substantial portion of the cost of the SG, rather than the member
- Lower asset returns, via decreasing expected returns on the risky asset by -1.5%
- Lower exposure to risky assets, through a life-cycle strategy reaching 40% in risky assets at retirement
- Greater required drawdowns, e.g. higher replacement rate

Lower SG indicated *(in rough order of significance)*

- Adding a discount factor, consistent with a preference for current over future consumption
- Optimised asset mix, reflecting higher average risky asset weights
- Higher asset returns, via increasing expected returns on the risky asset by +1.5%
- Imposing the minimum drawdown rules (decreases the optimal SG in most cases, but not all)

We also run two groups of scenarios to evaluate combinations of changes, focusing on sets of assumptions that might provide justification for a higher SG. The first group captures the effect of using the SG as a hedging mechanism against investment risk in conjunction with either longevity or early retirement risk. The second group includes 'kitchen sink' scenarios that invoke combinations of: excluding the Age Pension; the employer bearing 50% of the cost of the SG; saving to maintain consumption at target through to age 102; retiring early at age 62; lower investment returns; and imposing the minimum drawdown rules.

Figure 9 presents an overview of the sensitivity and scenario analysis. It sets out changes made to the assumptions, and provides an indication of the directional impact on the optimal SG in the final column. The sensitivity and scenario analysis is arranged under five categories, which provides the structure below under which the results are reported and discussed.

Figure 9: Overview of the Sensitivity and Scenario Analysis

Sensitivity Test / Scenario	Input Assumptions		Indicative Impact on Optimal SG
	Baseline	Sensitivity Testing	
Utility Parameters			
Higher loss aversion	Slope 4.5, Curv(-) 0.88, Curv(+) 0.44	Slope 5.5, Curv(-) 0.88, Curv(+) 0.33	Very small, if any
Lower loss aversion	Slope 4.5, Curv(-) 0.88, Curv(+) 0.44	Slope 3.5, Curv(-) 0.88, Curv(+) 0.66	Very small, if any
Higher discount factor	0% p.a.	2% p.a.	Lower
Required Income Stream			
Higher replacement rate	70% of income age 62-66	80% of income age 62-66	Higher
Lower replacement rate	70% of income age 62-66	60% of income age 62-66	Lower
Minimum drawdown	Optimised, subject to minimum drawdown	Draw no more than the minimum drawdown	Mixed, but mainly lower
Draw the target	Optimised, subject to minimum drawdown	Draw the target (or min. drawdown) until retirement account exhausted	Modestly higher
Longevity risk self-insured	Expected mortality	Assume death at age 102	Much higher
Retire early	Retire at age 67	Retire age 62, draw income until access pension age 67	Very much higher
Investment Assumptions			
Higher risky asset return	5.0% compound	6.5% compound	Lower
Lower risky asset return	5.0% compound	3.5% compound	Higher, except for ASFA modest
Optimised asset mix	70% risky / 30% risk-free	Dynamically optimised	Lower
Life-cycle strategy	70% risky / 30% risk-free	90% risky to age 42, trends to 40% risky at retirement	Higher
Policy Environment			
Age Pension	Age Pension available	Fully self-funded	Very much higher
Who bears the cost	Member	Employer bears 25/50/75%	Higher
Scenarios			
Self-insuring against combinations of two risks	See above	• 3.5% risky asset return *plus* death at age 102 • 3.5% risky asset return *plus* retire at age 62	Meaningfully higher: SG of 9.5% or 12% is justified across a much broader range of income levels and member objectives
Combinations of changes: • Fully self-funded • Employer pays 50% • 3.5% risky asset return • Death at age 102 • Minimum drawdown	See above	Four combinations	Very much higher optimal SG, often exceeding 12%

Utility Parameters

Figure 10 reports the optimal SG estimates at differing utility parameters. The matrix of revised optimal SG estimates across income and member objectives appears at the top, with changes from the baseline estimates appearing below with '..' indicating no change. Grey shading highlights the objectives that we consider to be most relevant at each income level. Changing loss aversion has only small effects. This stems from our set-up. The reference dependent analysis primarily balances utility losses pre-retirement versus post-retirement, while the modelling produces a tendency for the member to draw the target until the funds run out (see Figure 5). Outcomes that indicate above-target consumption only occur in a modest proportion of the simulations (if required by the minimum drawdown rules). When this occurs, the gain is heavily discounted by the curvature parameter applied. This effectively means that the optimal SG remains dominated by outcomes in the realm of losses. Hence only minor changes occur in response to the varying the reference dependent utility parameters, with at most a ±0.5% change in the optimal SG occurring in some instances.[14]

Figure 10: Sensitivity to Utility Parameters

	Income Level								
Objective	**L1**	**L2**	**L3**	**L4**	**L5**	**L6**	**L7**	**L8**	**L9**
REVISED OPTIMAL SG									
Higher loss aversion									
70% Replacement Rate	0.0%	0.5%	3.5%	4.5%	6.0%	6.5%	7.5%	8.0%	8.5%
ASFA Comfortable	15.0%	12.0%	9.0%	7.0%	6.0%	5.0%	4.5%	4.0%	3.5%
ASFA Modest	3.0%	2.5%	2.0%	1.5%	1.0%	1.0%	1.0%	1.0%	1.0%
Lower loss aversion									
70% Replacement Rate	0.0%	0.5%	3.0%	5.0%	6.0%	7.0%	7.5%	8.5%	9.0%
ASFA Comfortable	15.0%	12.0%	9.5%	7.5%	6.0%	5.5%	4.5%	4.0%	3.5%
ASFA Modest	3.0%	2.5%	2.0%	1.5%	1.5%	1.0%	1.0%	1.0%	1.0%
Higher discount rate									
70% Replacement Rate	0.0%	0.0%	2.0%	3.0%	3.5%	3.5%	4.0%	4.0%	4.0%
ASFA Comfortable	9.0%	6.5%	5.0%	4.0%	3.5%	3.0%	2.5%	2.5%	2.0%
ASFA Modest	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
CHANGE vs. BASELINE									
Higher risk or loss aversion									
70% Replacement Rate	..	..	..	-0.5%	..	..	..	..	..
ASFA Comfortable	..	..	..	..	..	..	..	..	..
ASFA Modest	..	..	..	..	..	..	..	..	..
Lower risk or loss aversion									
70% Replacement Rate	..	..	-0.5%	..	..	0.5%	..	0.5%	0.5%
ASFA Comfortable	..	..	0.5%	0.5%	..	0.5%	..	..	..
ASFA Modest	..	..	..	..	0.5%	..	..	..	..
Higher discount rate									
70% Replacement Rate	..	-0.5%	-1.5%	-2.0%	-2.5%	-3.0%	-3.5%	-4.0%	-4.5%
ASFA Comfortable	-6.0%	-5.5%	-4.0%	-3.0%	-2.5%	-2.0%	-2.0%	-1.5%	-1.5%
ASFA Modest	-3.0%	-2.5%	-2.0%	-1.5%	-1.0%	-1.0%	-1.0%	-1.0%	-1.0%

[14] We also tested the parameters of Tversky and Kahneman (1992), which include a weighting parameter on losses of 2.25 and a curvature parameter of 0.88 on both gains and losses. These parameters often deliver an optimal SG of 20% and above. Investigation reveals that this stems from the combined effect of only a small discount being applied to above-target consumption, and the fact that compounding returns over long horizons can generate considerable wealth accumulation. The consequence is that utility then becomes maximised through investing to access post-retirement consumption that is well above-target, i.e. the member becomes willing to take on risk in pursuit of higher post-retirement consumption in order to boost lifetime utility of consumption. These results seem at odds with both observed behaviour and the purported purpose of the SG, and hence we do not report them. They also suggest that the Tversky and Kahneman (1992) parameters may be unsuitable for addressing multi-period investment problems where returns compound over time.

Imposing a discount rate of 2% (time preference parameter of 0.98) makes more of a difference, reducing the optimal SG by between -1.5% and -4.5% across the most relevant objectives as shaded in grey. At income L5 for example, a 2% discount rate reduces the optimal SG by -2.5% under the replacement rate and ASFA comfortable targets. This provides a guide to the effect of our baseline assumption that the member has no preference in favour of current consumption over future consumption. Further, this sensitivity test applies a consistent discount rate as typically specified under rational models. It is possible that behavioural effects such as hyperbolic discounting (see Laibson, 1997) might heighten the preference for the present over the future even further.

Required Income Stream

We undertake five sensitivity tests designed to evaluate changes to the income stream that the member requires. Results are reported in Figure 11.

- **Differing replacement rates** – We test both 80% and 60% replacement rates, versus the baseline assumption of 70%. This changes the optimal SG by a magnitude of between 1.5% and 3.0% across the relevant income range spanning income L3 and above. Increasing the replacement rate to 80% generates an optimal SG above 9.5% only at income L7 and above, but still falls short of indicating an SG of 12%. The higher 80% replacement rate also indicates what might occur if the 70% replacement rate was based on average pre-retirement income from age 25 to 66, which would be equivalent to applying a replacement rate of about 77% relative to average income in the 5-years prior to retirement.

- **Applying the minimum drawdown rules** – Assuming that the member draws income from their retirement account in line with minimum drawdown rules generates changes in the optimal SG that are mixed in sign, but with a decrease occurring in the majority of instances. The mixed results reflect interactions between constraining post-retirement consumption in cases where the minimum drawdown rate is not binding, and the manner in which pre-retirement and post-retirement consumption are traded off under the utility function. The main reason for the decreases in optimal SG is that the minimum drawdown rules constrain consumption to below the target, making it less attractive to sacrifice (certain) pre-retirement consumption in order to gain an increase post-retirement consumption that occurs mainly later in life, and hence are down-weighted by mortality. In essence, our model is indicating that there is little point in forcing members to save more if they are unlikely to make use of those savings (given the probability of dying before they drawdown fully on their retirement account). Also contributing to the results is a relatively flat utility curve flat under this sensitivity test, meaning that small changes can produce sizeable shifts in the optimal SG.

- **Drawing down the target** – This sensitivity test assumes in all instances that the member draws the maximum of any consumption target or the minimum drawdown rate in. Some small increases in the optimal SG result, typically of 0.5%. This reflects the fact that the optimal drawdown strategy under the reference dependent objectives is to draw the target in most instances anyway (see Figure 5), except under limited circumstances such as where high investment returns make it optimal to further increase drawdowns.

- **Self-insuring to age 102** – The baseline analysis assumes that the member takes into consideration their mortality rate in accordance with the 2015-17 Australian Life Tables. This implies that the member optimises with an eye on their life expectancy, with outcomes later in retirement having lesser influence because the probability of survival decreases with age. This set-up might be interpreted as underweighting any desire to hedge against longevity risk, i.e. the need to save enough to ensure that the funds last 'just in case' of survival to a very old age. To test the impact of a desire to self-insure against longevity risk, we run the analysis assuming that the member is certain to live to age 102. According to the 2015-17 Australian Life Tables, the probability of survival to age 102 is 3.6%. Thus, we consider this a conservative test to the extent that few members might want to self-insure against such a low probability event, while many could be satisfied with the Age Pension coupled if they happen to reach a very old age. Modelling as if the member expects to live to age 102 generates mixed but generally meaningful increases in the optimal SG, ranging from +1.0% to +6.0% across the most relevant objectives. Impacts of +3% or greater are observed under the replacement rate objective at income L6 and above, and under the ASFA comfortable objective at income L4 and below. This takes the optimal SG to 9.5% or greater for these estimates. The average increase in the optimal SG versus the baseline is +2.9% across the most relevant objectives as shaded in grey.

Figure 11: Sensitivity to Assumptions Regarding the Required Income Stream

	Income Level								
Objective	**L1**	**L2**	**L3**	**L4**	**L5**	**L6**	**L7**	**L8**	**L9**
REVISED OPTIMAL SG									
Differing replacement rates									
80% Replacement Rate	0.0%	2.5%	5.0%	6.5%	8.0%	9.0%	10.0%	10.5%	11.5%
60% Replacement Rate	0.0%	0.0%	1.0%	3.0%	4.0%	5.0%	5.5%	6.0%	6.5%
Minimum drawdown rules									
70% Replacement Rate	0.0%	0.5%	3.5%	4.5%	4.5%	4.0%	4.0%	10.0%	11.5%
ASFA Comfortable	11.0%	8.5%	6.5%	5.0%	4.5%	3.5%	3.5%	3.0%	2.5%
ASFA Modest	3.5%	2.5%	2.0%	1.5%	1.5%	1.0%	1.0%	1.0%	1.0%
Drawing down the target									
70% Replacement Rate	0.0%	0.5%	3.0%	5.0%	6.0%	7.0%	7.5%	8.5%	9.0%
ASFA Comfortable	15.5%	12.5%	9.5%	7.5%	6.0%	5.5%	4.5%	4.0%	3.5%
ASFA Modest	3.0%	2.5%	2.0%	1.5%	1.5%	1.0%	1.0%	1.0%	1.0%
Self-insure to age 102									
70% Replacement Rate	0.0%	0.5%	4.5%	6.5%	8.5%	10.5%	12.0%	13.5%	14.5%
ASFA Comfortable	20.0%	18.0%	13.5%	10.5%	8.5%	7.5%	6.5%	6.0%	5.0%
ASFA Modest	5.0%	3.5%	3.0%	2.0%	2.0%	1.5%	1.5%	1.5%	1.0%
Retire early at age 62									
70% Replacement Rate	4.0%	4.5%	8.5%	9.5%	10.5%	12.0%	13.0%	13.5%	14.0%
ASFA Comfortable	20.0%	20.0%	17.0%	13.5%	11.0%	9.5%	8.0%	7.0%	6.5%
ASFA Modest	10.5%	8.0%	6.0%	5.0%	4.0%	3.5%	3.0%	2.5%	2.5%
CHANGE vs. BASELINE									
Differing replacement rates									
80% replacement rate	..	2.0%	1.5%	1.5%	2.0%	2.5%	2.5%	2.5%	3.0%
60% replacement rate	..	-0.5%	-2.5%	-2.0%	-2.0%	-1.5%	-2.0%	-2.0%	-2.0%
Minimum drawdown rules									
70% Replacement Rate	..	..	..	-0.5%	-1.5%	-2.5%	-3.5%	2.0%	3.0%
ASFA Comfortable	-4.0%	-3.5%	-2.5%	-2.0%	-1.5%	-1.5%	-1.0%	-1.0%	-1.0%
ASFA Modest	0.5%	..	..	..	0.5%	..	..	..	..
Drawing down the target									
70% Replacement Rate	..	..	-0.5%	..	..	0.5%	..	0.5%	0.5%
ASFA Comfortable	0.5%	0.5%	0.5%	0.5%	..	0.5%	..	..	..
ASFA Modest	..	..	..	..	0.5%	..	..	..	..
Self-insure to age 102									
70% Replacement Rate	..	..	1.0%	1.5%	2.5%	4.0%	4.5%	5.5%	6.0%
ASFA Comfortable	5.0%	6.0%	4.5%	3.5%	2.5%	2.5%	2.0%	2.0%	1.5%
ASFA Modest	2.0%	1.0%	1.0%	0.5%	1.0%	0.5%	0.5%	0.5%	..
Retire early at age 62									
70% Replacement Rate	4.0%	4.0%	5.0%	4.5%	4.5%	5.5%	5.5%	5.5%	5.5%
ASFA Comfortable	5.0%	8.0%	8.0%	6.5%	5.0%	4.5%	3.5%	3.0%	3.0%
ASFA Modest	7.5%	5.5%	4.0%	3.5%	3.0%	2.5%	2.0%	1.5%	1.5%

- **Early retirement at age 62** – This sensitivity test investigates the circumstance where the member spends five years less than the full term earning income and hence contributing, and supports consumption over that period entirely by drawing down on their superannuation balance. Assuming retirement 5-years earlier at age 62 has a significant impact on the optimal SG estimates, increasing them by between 3.0% and 8.0% across the most relevant objective range as shaded in grey. Under the replacement rate objective, all increases sit in the range of +4% to +5.5%. Increases of +7.5% and +5.5% are observed for ASFA modest at L1 and L2, noting that low income earners are now required to save in order to support consumption over 5-years with no access to the Age Pension. The increase under ASFA comfortable is +8.0% at L3, declining to +3.0% at L9. The average increase in the optimal SG versus the baseline is +5.2% across the most relevant objective range; and the majority of optimal SG estimates now sit above 9.5%. An SG of to 12% is indicated at income L6 and above under the replacement rate objective, and at L4 and below under AFSA comfortable.

The early retirement sensitivity test is important as it covers for a range of situations where income is impaired, thus leading to lower contributions to the superannuation fund coupled with a likely need to fund consumption out of savings (or borrowings). In addition to early retirement, career breaks and periods of part-time employment can also leave a member in a comparable position. We contend that basing our sensitivity test around retiring 5-years early while fully-funding consumption from the superannuation account amounts to a very conservative evaluation of these situations. First, the assumption that income falls to zero and the member then draws down on their savings to maintain a targeted level of consumption is an extreme assumption. It is possible that many members who incur a loss of wage income may receive support from other sources, including social security such as unemployment benefits or carer's payments, paid maternity leave, redundancy payments, and so on. This might particularly be the case for lower income earners, where we do not model all the support payments that they may have available. Many members could also have latitude to reduce consumption below the assumed target during the time they are not earning income. Second, our modelling assumes that superannuation is the only source of savings. In practice, many people will have access to other forms of savings on which they might draw. Third, those suffering career breaks may have the ability to top-up superannuation contributions at a later date. We thus believe that our early retirement analysis might be seen as establishing a reasonable upper limit on the potential impact on the optimal SG of the risk of failing to remain in full-time employment over the full working term.

A related point is we understand that lower income earners are more likely to retire early, but also have lower life expectancy. Thus, while lower income earners may be more exposed to early retirement risk, they may also be less exposed to longevity risk. Under these circumstances, the risk of under-saving in case of early retirement may be partly offset by a lesser need for saving to allow for the possibility of living to an old age.

Investment Assumptions

The sensitivity analysis around the investment assumptions takes two directions, with the results appearing in Figure 12. The first is varying the expected risky asset expected returns by ±1.5% relative to the baseline of 5.0% compound. This translates to a reduction in total portfolio returns of a bit over ±1% under the constant mix of 70% in the risky asset and 30% in the risk-free asset assumed in the baseline analysis. Increasing the risky asset returns to 6.5% decreases the optimal SG by up to -1.5% across the range of most relevant objectives. Conversely, lowering the real risky asset return 3.5% increases the optimal SG by a comparable amount.

The second direction applies alternative investment strategies. Imposing an optimised asset mix has the effect of increasing risky asset exposure and hence portfolio returns, which reduces the optimal SG. The optimisation generates an optimal glide path that is u-shaped and centred around the point of retirement, where the median risky asset weight at L5 is 54% under the replacement rate, 59% under ASFA comfortable and 88% under ASFA modest. The average risky asset weights over the life-cycle are relatively high, averaging between 75% and 85% across the three objectives. The optimal SG decreases by up to -2.0% across the most relevant objective range (average decrease of -1.3% versus the baseline). We also apply a life-cycle strategy entailing a 90% weight in the risky asset until 25-years prior to retirement (i.e. age 42), then linearly decreasing to reach a risky asset weight of 40% at retirement (i.e. age 67) and beyond. This has the effect of reducing risky asset exposure to an average of 58% over the life-cycle (lower still on an asset-weight basis), which reduces portfolio returns. This produces an increase in the optimal SG of up to 1.0% across the most relevant objective range (average increase of +0.5%).

The investment sensitivity results reflect the need for higher savings to attain a given post-retirement consumption target when investment returns are lower. They also highlight the potential impact of two aspects. First is the increase in SG that might be needed to cater for the risk that investment returns are lower going forward than experienced historically. As a rough rule of thumb, the SG might be set about 1% higher if superannuation fund returns are expected to be 1% lower. Second is the effect of catering for the possibility that members might choose sub-optimal investment strategies, perhaps due to behavioural biases. The difference in the optimal SG between the life-cycle and optimal investment strategy is up to +3% across the most relevant range (averaging about +2%). The life-cycle strategy might be taken as a guide to the conservative investment strategies followed by some members, to the extent that it de-risks as retirement approaches and maintains a relatively conservative asset mix throughout retirement. Our model suggests that it is optimal for members to maintain an asset mix that can generate higher returns over the long run, and limit the degree of de-risking going into retirement. The 70/30 asset mix used in the baseline analysis sits is the middle ground. The issue that arises for setting the SG is whether policy should accommodate sub-optimal investment behaviour by members, versus being based on a more optimal asset mix, perhaps coupled with other measures to encourage better investment decisions.

Figure 12: Sensitivity to the Investment-Related Assumptions

Objective	Income Level								
	L1	L2	L3	L4	L5	L6	L7	L8	L9
REVISED OPTIMAL SG									
Higher risky asset return									
70% Replacement Rate	0.0%	0.5%	2.5%	4.0%	5.0%	5.5%	6.0%	7.0%	7.5%
ASFA Comfortable	12.5%	10.0%	7.5%	6.0%	5.0%	4.5%	3.5%	3.5%	3.0%
ASFA Modest	3.0%	2.0%	1.5%	1.5%	1.0%	1.0%	1.0%	1.0%	0.5%
Lower risky asset return									
70% Replacement Rate	0.0%	0.0%	3.5%	5.5%	6.5%	7.5%	8.5%	9.0%	9.5%
ASFA Comfortable	17.0%	14.0%	10.5%	8.0%	7.0%	6.0%	5.0%	4.5%	4.0%
ASFA Modest	2.0%	1.5%	1.5%	1.0%	1.0%	1.0%	0.5%	0.5%	0.5%
Optimised asset mix									
70% Replacement Rate	0.0%	0.5%	3.5%	3.5%	4.5%	5.0%	5.5%	6.0%	6.5%
ASFA Comfortable	11.5%	9.0%	7.0%	5.5%	4.5%	4.0%	3.5%	3.0%	3.0%
ASFA Modest	2.5%	2.0%	1.5%	1.0%	1.0%	1.0%	1.0%	0.5%	0.5%
Life-cycle: 90/10 to 40/60									
70% Replacement Rate	0.0%	0.0%	3.5%	5.5%	6.5%	7.5%	8.0%	9.0%	9.5%
ASFA Comfortable	17.0%	13.5%	10.0%	8.0%	6.5%	5.5%	5.0%	4.5%	4.0%
ASFA Modest	2.5%	2.0%	1.5%	1.0%	1.0%	1.0%	1.0%	1.0%	0.5%
CHANGE vs. BASELINE									
Higher risky asset return									
70% Replacement Rate	..	..	-1.0%	-1.0%	-1.0%	-1.0%	-1.5%	-1.0%	-1.0%
ASFA Comfortable	-2.5%	-2.0%	-1.5%	-1.0%	-1.0%	-0.5%	-1.0%	-0.5%	-0.5%
ASFA Modest	..	-0.5%	-0.5%	..	..	..	..	..	-0.5%
Lower risky asset return									
70% Replacement Rate	..	-0.5%	..	0.5%	0.5%	1.0%	1.0%	1.0%	1.0%
ASFA Comfortable	2.0%	2.0%	1.5%	1.0%	1.0%	1.0%	0.5%	0.5%	0.5%
ASFA Modest	-1.0%	-1.0%	-0.5%	-0.5%	..	..	-0.5%	-0.5%	-0.5%
Optimised asset mix									
70% Replacement Rate	..	..	..	-1.5%	-1.5%	-1.5%	-2.0%	-2.0%	-2.0%
ASFA Comfortable	-3.5%	-3.0%	-2.0%	-1.5%	-1.5%	-1.0%	-1.0%	-1.0%	-0.5%
ASFA Modest	-0.5%	-0.5%	-0.5%	-0.5%	..	..	..	-0.5%	-0.5%
Life-cycle: 90/10 to 40/60									
70% Replacement Rate	..	-0.5%	..	0.5%	0.5%	1.0%	0.5%	1.0%	1.0%
ASFA Comfortable	2.0%	1.5%	1.0%	1.0%	0.5%	0.5%	0.5%	0.5%	0.5%
ASFA Modest	-0.5%	-0.5%	-0.5%	-0.5%	..	..	..	..	-0.5%

Policy Environment

The sensitivity testing presented so far assumes access to the Age Pension, and that the member bears the full cost of the SG which directly lowers their take-home pay below what it otherwise would have been. Testing the sensitivity to these assumptions reveals both to be important, with the Age Pension being critical. We use the heading 'policy environment' for lack of a better term, noting that these two aspects relate to whether the policy objective might be to ensure more people become self-funded retirees, as well as how any increase in the SG is structured. It is also plausible that some members might aspire to becoming self-funding retirees, and hence prefer not to take the Age Pension into account in deciding how much to place in their superannuation fund. Another interpretation of the analysis excluding the Age Pension is that it reveals the total amount of savings required to maximise utility under each member objective.

Figure 13 reports estimates of the optimal SG where the value of the Age Pension and related supplements are set to zero. The impact is particularly large, with the optimal SG increasing between 5.0% and 17.0%, with an average of +8.7% across the most relevant objectives. The optimal SG sits at 9.5% across all estimates with the exception of ASFA comfortable at income L9; and above 12% except for ASFA comfortable at income L7 to L9. This confirms the importance of the Age Pension in the generation of the baseline estimates, which indicate optimal SGs in the 2.5% to 9% range. It highlights the significant value of the Age Pension to Australian retirees.

Figure 13: Sensitivity to Removing the Age Pension

	Income Level								
Objective	**L1**	**L2**	**L3**	**L4**	**L5**	**L6**	**L7**	**L8**	**L9**
REVISED OPTIMAL SG									
70% Replacement Rate	14.0%	16.0%	15.0%	14.5%	14.0%	14.0%	14.0%	13.5%	13.5%
ASFA Comfortable	20.0%	20.0%	20.0%	17.5%	14.0%	12.5%	10.5%	9.5%	8.5%
ASFA Modest	20.0%	18.0%	13.5%	10.5%	9.0%	7.5%	6.5%	6.0%	5.0%
CHANGE vs. BASELINE									
70% Replacement Rate	14.0%	15.5%	11.5%	9.5%	8.0%	7.5%	6.5%	5.5%	5.0%
ASFA Comfortable	5.0%	8.0%	11.0%	10.5%	8.0%	7.5%	6.0%	5.5%	5.0%
ASFA Modest	17.0%	15.5%	11.5%	9.0%	8.0%	6.5%	5.5%	5.0%	4.0%

Figure 14 reports the optimal SG when it is assumed that a portion of the cost is borne by employers (implying increased labour costs to business), with the remainder paid for by the member by reducing the income available for consumption. We compile estimates under the assumption that the employer bears 25%, 50% and 75% of the cost, noting that 100% would indicate an SG as high as possible from the member's perspective. Unsurprisingly, the optimal SG increases with the proportion of cost borne by the employer. The magnitude of the change also varies with both income and member objective. Under the 50% assumption for instance, the increase in optimal SG sits in the +1% to +4.5% range under the most relevant objectives as shaded in grey, averaging +2.5% versus the baseline. This is sufficient to lift the optimal SG above the current level of 9.5% at L6 and above under the replacement rate objective, and at L4 and below under ASFA comfortable. These results are hardly surprising, as the member receives higher savings at diminished personal cost. Our model does not account for any associated macroeconomic effects on profits, employment, inflation, or overall consumption and savings that might impose a burden through other channels. This complicates interpreting the estimates, to the extent it is possible that some of the cost initially borne employers might be passed back to members via higher prices or reduced employment.

Figure 14: Sensitivity to Portion of Cost Borne by Employer

	Income Level								
Objective	**L1**	**L2**	**L3**	**L4**	**L5**	**L6**	**L7**	**L8**	**L9**
REVISED OPTIMAL SG									
Employer contributes 25%									
70% Replacement Rate	0.0%	0.5%	3.5%	5.5%	7.0%	8.0%	9.0%	10.0%	10.5%
ASFA Comfortable	18.0%	14.5%	10.5%	8.5%	7.0%	6.0%	5.5%	4.5%	4.0%
ASFA Modest	4.0%	3.0%	2.0%	2.0%	1.5%	1.5%	1.0%	1.0%	1.0%
Employer contributes 50%									
70% Replacement Rate	0.0%	0.5%	4.5%	6.5%	8.0%	10.0%	11.0%	12.0%	13.0%
ASFA Comfortable	20.0%	17.5%	13.0%	10.0%	8.5%	7.0%	6.5%	5.5%	5.0%
ASFA Modest	5.0%	4.0%	3.0%	2.5%	2.0%	1.5%	1.5%	1.5%	1.0%
Employer contributes 75%									
70% Replacement Rate	0.0%	0.5%	5.5%	8.5%	11.0%	13.5%	15.0%	16.5%	17.5%
ASFA Comfortable	20.0%	20.0%	17.5%	13.5%	11.0%	9.5%	8.5%	7.5%	6.5%
ASFA Modest	7.5%	5.5%	4.0%	3.5%	3.0%	2.5%	2.0%	2.0%	1.5%
CHANGE vs. BASELINE									
Employer contributes 25%									
70% Replacement Rate	..	..	..	0.5%	1.0%	1.5%	1.5%	2.0%	2.0%
ASFA Comfortable	3.0%	2.5%	1.5%	1.5%	1.0%	1.0%	1.0%	0.5%	0.5%
ASFA Modest	1.0%	0.5%	..	0.5%	0.5%	0.5%	..	..	..
Employer contributes 50%									
70% Replacement Rate	..	..	1.0%	1.5%	2.0%	3.5%	3.5%	4.0%	4.5%
ASFA Comfortable	5.0%	5.5%	4.0%	3.0%	2.5%	2.0%	2.0%	1.5%	1.5%
ASFA Modest	2.0%	1.5%	1.0%	1.0%	1.0%	0.5%	0.5%	0.5%	..
Employer contributes 75%									
70% Replacement Rate	..	..	2.0%	3.5%	5.0%	7.0%	7.5%	8.5%	9.0%
ASFA Comfortable	5.0%	8.0%	8.5%	6.5%	5.0%	4.5%	4.0%	3.5%	3.0%
ASFA Modest	4.5%	3.0%	2.0%	2.0%	2.0%	1.5%	1.0%	1.0%	0.5%

Scenarios

The sensitivity testing investigates the impact of changing one assumption at a time. We now adjust combinations of assumptions. The first set of scenarios assumes that the SG is used to hedge against a combination of risky asset returns being -1.5% lower coupled with either longevity risk, as represented by assuming death at age 102, *or* early retirement (and other income-related risk) by assuming retirement at age 62. We do not include hedging against longevity and early retirement at the same time as this would amount to an element of 'doubling-up', noting that lower income earners are more likely to both retire and die earlier. Figure 15 reveals that using the SG to hedge against investment risk plus one other risk boosts the majority of estimates to above 9.5% across the most relevant range, and might provide support for increasing the SG to 12%. This indicates that an SG level in the 9.5%-12% range could be justified if members were expected to self-insure against at least two of these three key risks.

Figure 15: Hedging Scenarios

	Income Level								
Objective	**L1**	**L2**	**L3**	**L4**	**L5**	**L6**	**L7**	**L8**	**L9**
REVISED OPTIMAL SG									
Lower returns + death age 102									
70% Replacement Rate	0.0%	0.5%	5.5%	8.0%	10.0%	12.5%	14.5%	16.0%	17.5%
ASFA Comfortable	20.0%	20.0%	16.5%	12.5%	10.5%	9.0%	8.0%	7.0%	6.5%
ASFA Modest	5.5%	4.5%	3.5%	2.5%	2.0%	2.0%	1.5%	1.5%	1.5%
Lower returns + retire age 62									
70% Replacement Rate	4.0%	5.0%	10.0%	11.0%	12.5%	14.0%	15.0%	15.5%	16.5%
ASFA Comfortable	20.0%	20.0%	20.0%	15.5%	12.5%	11.0%	9.5%	8.5%	7.5%
ASFA Modest	11.0%	8.5%	6.5%	5.0%	4.5%	3.5%	3.5%	3.0%	2.5%
CHANGE vs. BASELINE									
Lower returns + death age 102									
70% Replacement Rate	..	..	2.0%	3.0%	4.0%	6.0%	7.0%	8.0%	9.0%
ASFA Comfortable	5.0%	8.0%	7.5%	5.5%	4.5%	4.0%	3.5%	3.0%	3.0%
ASFA Modest	2.5%	2.0%	1.5%	1.0%	1.0%	1.0%	0.5%	0.5%	0.5%
Lower returns + retire age 62									
70% Replacement Rate	4.0%	4.5%	6.5%	6.0%	6.5%	7.5%	7.5%	7.5%	8.0%
ASFA Comfortable	5.0%	8.0%	11.0%	8.5%	6.5%	6.0%	5.0%	4.5%	4.0%
ASFA Modest	8.0%	6.0%	4.5%	3.5%	3.5%	2.5%	2.5%	2.0%	1.5%

The second set of 'kitchen sink' scenarios alters combinations of the following assumptions, with the results reported in Figure 16:

- Excluding the Age Pension and related supplements (denoted 'Pension' in Figure 16)
- Employers bear 50% of the cost of the SG (denoted 'cost')
- Self-insuring against living longevity risk to age 102 (denoted 'age 102')
- Self-insuring against early retirement at age 62 (denoted 'age 62')
- Lowering real returns on the risky asset by 1.5% to 3.5% compound (denoted 'return')
- Drawdowns at the minimum drawdown rate (denoted 'min')

Unsurprisingly, the optimal SG estimates turn out to be substantially higher, sometimes hitting the imposed maximum of 20%. We consider these to be an aggressive set of assumptions that deliver optimal SG estimates which seem questionably high. The point of this exercise is to demonstrate that an increase in the SG might be justified if it were designed to cover for a range of additional considerations that were not incorporated in our baseline case. This provides a segue into the next section, which discusses the issue faced by policy makers of 'what is in, and what is out' in deciding whether to go through with plans to increase the SG to 12%.

Figure 16: Kitchen Sink Scenarios

	Income Level								
Objective	**L1**	**L2**	**L3**	**L4**	**L5**	**L6**	**L7**	**L8**	**L9**
REVISED OPTIMAL SG									
Pension/age 102/return/min									
70% Replacement Rate	20.0%	20.0%	20.0%	20.0%	20.0%	20.0%	20.0%	20.0%	20.0%
ASFA Comfortable	20.0%	20.0%	20.0%	20.0%	20.0%	20.0%	19.5%	17.0%	15.0%
ASFA Modest	20.0%	20.0%	20.0%	19.5%	15.5%	13.5%	11.5%	10.5%	9.0%
Pension/age 62/return/min									
70% Replacement Rate	20.0%	20.0%	20.0%	20.0%	20.0%	20.0%	20.0%	20.0%	20.0%
ASFA Comfortable	20.0%	20.0%	20.0%	20.0%	20.0%	20.0%	20.0%	17.5%	15.5%
ASFA Modest	20.0%	20.0%	20.0%	19.5%	16.0%	14.0%	12.0%	10.5%	9.5%
Cost/age 102/return/min									
70% Replacement Rate	0.0%	1.0%	7.5%	10.5%	17.5%	20.0%	20.0%	20.0%	20.0%
ASFA Comfortable	20.0%	20.0%	20.0%	20.0%	18.5%	16.0%	14.0%	12.5%	11.0%
ASFA Modest	7.5%	5.5%	4.0%	3.5%	3.0%	2.5%	2.0%	2.0%	1.5%
Cost/age 62/return/min									
70% Replacement Rate	0.1%	1.0%	11.0%	15.5%	20.0%	20.0%	20.0%	20.0%	20.0%
ASFA Comfortable	20.0%	20.0%	20.0%	20.0%	20.0%	20.0%	18.5%	16.0%	14.5%
ASFA Modest	11.0%	8.5%	6.5%	5.0%	4.5%	4.0%	3.5%	3.0%	2.5%
CHANGE vs. BASELINE									
Pension/age 102/return/min									
70% Replacement Rate	20.0%	19.5%	16.5%	15.0%	14.0%	13.5%	12.5%	12.0%	11.5%
ASFA Comfortable	5.0%	8.0%	11.0%	13.0%	14.0%	15.0%	15.0%	13.0%	11.5%
ASFA Modest	17.0%	17.5%	18.0%	18.0%	14.5%	12.5%	10.5%	9.5%	8.0%
Pension/age 62/return/min									
70% Replacement Rate	20.0%	19.5%	16.5%	15.0%	14.0%	13.5%	12.5%	12.0%	11.5%
ASFA Comfortable	5.0%	8.0%	11.0%	13.0%	14.0%	15.0%	15.5%	13.5%	12.0%
ASFA Modest	17.0%	17.5%	18.0%	18.0%	15.0%	13.0%	11.0%	9.5%	8.5%
Cost/age 102/return/min									
70% Replacement Rate	..	0.5%	4.0%	5.5%	11.5%	13.5%	12.5%	12.0%	11.5%
ASFA Comfortable	5.0%	8.0%	11.0%	13.0%	12.5%	11.0%	9.5%	8.5%	7.5%
ASFA Modest	4.5%	3.0%	2.0%	2.0%	2.0%	1.5%	1.0%	1.0%	0.5%
Cost/age 62/return/min									
70% Replacement Rate	0.1%	0.5%	7.5%	10.5%	14.0%	13.5%	12.5%	12.0%	11.5%
ASFA Comfortable	5.0%	8.0%	11.0%	13.0%	14.0%	15.0%	14.0%	12.0%	11.0%
ASFA Modest	8.0%	6.0%	4.5%	3.5%	3.5%	3.0%	2.5%	2.0%	1.5%

7. Deciding on the SG Rate

Whether the SG should be increased to 12% as planned is currently a matter of considerable debate. Our analysis indicates that the issue arises against a background where the impact of the SG on members may vary substantially depending on member objectives and income levels, and where the appropriate level of the SG also depends on the underlying assumptions. ***Our primary recommendation is that the policy objective of the SG needs to be more clearly specified. How the interests of various members are to be traded-off is also pivotal, given that the impact of the SG is not evenly felt.*** Other considerations such as the broader effects on employers, the economy and the government budget might be also addressed. But arguably these are not as important as establishing clear policy objectives and deciding how to deal with disparate welfare effects. We suggest the following five considerations be addressed in making any decision on whether to increase the SG:

(i) **Define the policy objective that the SG is trying to achieve** – This is a fundamental issue with various angles:

- *What is the superannuation system trying to facilitate?* Two key choices are either (a) catering for post-retirement living standards at a level related to that enjoyed pre-retirement, implying a replacement rate target, or (b) ensuring a basic living standard during retirement, implying a fixed target such as the ASFA standards. There is also a case for considering some combination of the two, emphasising a basic living standard for lower income earners and some degree of maintenance of living standards for those on higher incomes. Under this approach, our baseline estimates point toward an SG in the 6%-9% range by applying an ASFA comfortable objective between L3 and L5 and a replacement rate objective at L5 and above; but an SG below 3% under ASFA modest at L1 and L2. While insufficient to justify the current SG of 9.5% let alone an increase to 12%, our sensitivity analysis indicates that an increase in the SG to 12% does receive support if the policy objectives are broadened beyond that implicit in our baseline analysis.

- *Is the policy objective to reduce reliance on the Age Pension?* The case for a higher SG would be considerably strengthened if the aim was to suppor as many members as possible to become self-funded retirees, with the Age Pension viewed as a safety net that is used only if really needed. In this case, our estimates that ignore the availability of the Age Pension come into play from a policy perspective. Under these estimates, an SG above 12% receives strong support.
- *Is facilitating self-insurance against risks one of the aims?* Another issue is whether the SG should be set to ensure that individuals save enough to generate adequate retirement income 'just in case' they happen to: (a) suffer poor investment returns, (b) live to a very old age, and/or (c) are forced into involuntary early retirement. The alternative is that other solutions are sought to deal with these three risks, such as through social security or various pooling solutions. Our analysis suggests that desire to self-insure against longevity risk or early retirement risk are the key elements, with each potentially increasing the optimal SG in the order of 3% to 5% under the member objectives that we consider to be most relevant. Hedging against the risk of lower investment returns than experienced historically might boost the required SG by a further 1% or so. However, the benefit of hedging needs to be weighed against the possibility that members may end up over-saving if the risks of concern do not come to fruition. Over-saving incurs costs related to unnecessarily decreasing pre-retirement consumption and the possibility of dying with substantial un-used balances.
- *Should SG policy accommodate sub-optimal choices by members?* Many members do not make optimal decisions with regard to either investments or drawdowns, at least by comparison with the optimal strategies that emerge under our model. They appear to invest too conservatively given the long-term purpose of superannuation, and often fail to drawdown enough. Our analysis suggests that setting policy on the assumption that members will invest too conservatively indicates that that the SG might be set about 2% higher than if they were assumed to invest more optimally. On the other hand, accommodating the possibility that many members may fail to draw down enough due to following the minimum drawdown rules hints at shaving the SG at the margin, lest it result in some members saving more than they will use and hence dying with substantial unused balances.

(ii) **Decide how to trade off welfare gains and losses across various member types** – Given that a ubiquitous optimal SG level does not exist, the issue of how to trade-off the interests of differing members should be addressed. Possible approaches include maximising aggregate welfare, minimising losses, or focusing on the equity considerations between low and high income earners. There is an argument that any compulsory system should try to benefit the largest number of Australians while prioritising low income earners over the rich, to the extent that the rich are more capable of looking after themselves. For instance, high income earners may be more inclined to make additional contributions when required. If emphasis is placed on the lowest income earners, the case for a higher SG becomes tenuous at least in the presence of the Age Pension, to the extent that our analysis reveals that the SG may already be too high for members at income L1 and L2 under an ASFA modest target.[15]

(iii) **Asymmetry between setting the SG higher versus lower** – If the SG is set too high, there is nothing a member can do to lower their contributions. If the SG is set too low, a member at least has the option to contribute more. This would suggest erring on the side of a lower SG; or perhaps building in more flexibility into the system that allows the SG to be tailored to member circumstances. On the other hand, the reluctance of members to contribute beyond the mandated minimum due to behavioural influences is also relevant,

[15] The situation may change for low income earners who need to pay rent, in which case ASFA modest is likely to be too low. See discussion in Section 2, in particular footnote 2.

raising the question as to what extent it is appropriate for the government to adopt a paternalistic stance when setting policy.

(iv) **Where the burden falls, and how this impacts on the broader economy** – The impact of a higher SG will depend in part on how it is implemented, in particular who pays for any increase. If the member pays, then our analysis as reported in this paper is relevant in its own right. However, there may also be broader macroeconomic effects to take into account. If an increase in the SG effectively comes out of profits with no offsetting reduction in wages, then this might impact on economic activity and employment. Alternatively, the cost of the SG may be passed through into prices, leading to higher inflation that unwinds the effective benefit to members by reducing their spending power. Another issue is the broader impact of a higher SG stemming from lowering consumption and raising savings, including whether members might respond by substituting superannuation for other forms of saving.

(v) **Impact on the government budget** – Our indicative estimates of the net revenue effects per individual member suggest that a higher SG might be associated with a net increase in government revenue from a majority of members over their lifetimes. Also of interest is that this revenue increase would impact more on lower income earners. However, the numbers are modest, suggesting that the effects may not be overly significant. How the revenue and outlay impacts associated with a higher SG interact with the various member cohorts and the demographics of an aging population might also be considered, as well as other impact such as on corporate taxation and GST receipts.

The above considerations and the evidence from our analysis suggests that justifying an increase in the SG to 12% requires adopting a particular stance on the policy objectives that the SG is aiming to achieve. The two key objectives in this regard would be treating the policy aim as replacing the Age Pension (or supporting members to become self-funded retirees), and/or using the SG as a mechanism for members to self-insure against some combination of investment, longevity and early-retirement risk. Changes in other assumptions will also make a difference at the margin, but seem unlikely to tip the balance towards increasing the SG in isolation.

8. Conclusion

This study applies a stochastic life-cycle model to estimate the optimal SG for members across nine different income levels and three member objectives. We gauge the sensitivity of our results to changes in a wide range of assumptions, and estimate the impact of various SG levels on member welfare and the government budget at an individual-level. Our main contribution is to identify the factors that matter for determining the appropriate level of the SG. In doing so, we highlight that the appropriate level can differ substantially across members; and with the stance taken on what the SG is trying to achieve, and the particular assumptions underpinning the modelling. We trust that our analysis will inform what has already been an intense policy debate, which is set to continue under the current Retirement Income Review. To this effect, we suggest five considerations to take into account in deciding whether the SG should be increased from 9.5% to 12% as proposed. Our results suggest that an increase in the SG might be justified if the policy objective involves either replacing the Age Pension, or requiring members to self-insure against various risks. We caution that setting the SG so that members self-insure gives rise might result in over-saving if the risks do not come to fruition, with its own potential issues and costs. We raise the point that there may be other solutions for insuring against risks related to social security and pooling, rather than relying on the SG.

We understand that some of our findings are at odds with a strong belief in some quarters that increasing the SG is essential to ensure adequacy during retirement. We believe the difference stems from the fact that our analysis: (a) takes into account the impact of the SG on pre-retirement consumption; (b) treats the Age Pension as an income stream that will continue to be available to all, rather than as a safety net that should only be accessed when needed; (c) does not assume an aim of saving enough to self-insure against the risk of either low investment returns, living to a very old age or early retirement; and, (d) is based on the assumption that the SG will be paid for by the member out of their take-home pay. We strongly suspect that many of those arguing for a higher SG are implicitly taking a different position on some, if not all, of these key assumptions.

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