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Retirees' Longevity Risk

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Abstract

The retirement income market is set to grow rapidly in coming years as the baby boomers retire. Account-based pension products (e.g. allocated pensions) currently command the lion's share of the retail retirement income market.

There are many drivers of a retiree's financial decisions in retirement and the advice/planning process will inevitably consider a wide range of issues. This paper seeks to isolate, for particular analysis, certain key financial-related risks faced by Australian retirees and their bearing on a retiree's decisions regarding the choice between allocated pensions and lifetime annuities at retirement.

This paper illustrates an alternative framework for assessing and enunciating these key financial risks at and during retirement.

The paper highlights the implications of this framework for the advice/planning process and considers the importance of this framework for the design and promotion of guaranteed (investment and longevity) benefits on allocated pensions. The paper also highlights the importance of this framework in relation to an AFS licensee's management of the risks associated with the advice process.

Key words: *retirement income, longevity, risk metrics, product solutions/strategy, advice process*

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Executive Summary

There are many drivers of a retiree's financial decisions at and during retirement and the advice/planning process will inevitably consider a wide range of issues.

This paper illustrates an alternative framework for assessing and enunciating key financial risks associated with a retiree's choice between allocated pension and lifetime annuity products at and during retirement.

The paper highlights the implications of this framework for the advice/planning process and considers the importance of this framework for the design and promotion of guaranteed (investment and longevity) benefits on allocated pensions. The paper also highlights the importance of this framework in relation to an AFS licensee's management of the risks associated with the advice process.

For a lifetime annuity provider, the primary source of longevity risk relates to parameter uncertainty. By pooling annuitants, the random, statistical variation in the timing of an annuitant's death is a less significant risk for a provider (as long as a provider's mortality assumptions are robust and their pool of annuitants is large enough).

By contrast, a retiree who opts for an allocated pension in retirement is, in effect, self-insuring longevity risk. The retiree who holds an allocated pension is also exposed to parameter uncertainty, which is not unimportant for that retiree. However, a more substantial longevity risk for an individual "self-insured" allocated pension retiree is the random, statistical uncertainty associated with the binary risk of survival or death from one year to the next.

This paper starts by considering the nature of a self-insured allocated pension retiree's longevity risk using a stochastic simulation of an allocated pension fund balance. It also provides an example which highlights the complexity of the interplay between an allocated pension and the current age pension in relation to a retiree's longevity risk. The paper then outlines some probabilistic techniques for enunciating the extent of longevity risk being assumed by an allocated pension retiree.

These elements are then combined to provide a simple yet comprehensive basis for conveying the interplay of investment and longevity risks associated with an allocated pension for use in the advice/planning process and in designing investment/longevity guarantees on allocated pensions.

This analysis highlights the importance, when considering allocated pension investment strategy, of assessing investment risk by reference to a retiree's attitude to the dispersion of fund depletion outcomes around a mean/median depletion outcome, rather than the more traditional measures of investment risk tolerance (such as the volatility of year-on-year returns).

The paper then looks in more detail at whether the decision to purchase an allocated pension at retirement, instead of a lifetime annuity, is rational from an economic perspective. To facilitate this, the paper introduces the concept of a survivor risk premium (which is akin to an equity risk premium). The paper explains why the survivor risk premium ("SRP") represents a key benchmark for assessing an allocated pension relative to a lifetime annuity.

The SRP analysis confirms that whether the decision to purchase or retain an allocated pension is rational (from an economic perspective) depends on:

- the likelihood of the investment return from an allocated pension exceeding the SRP; and
- the retiree's risk tolerance/aversion.

The SRP increases with age and, thus, the older the retiree, the harder it becomes for the investment return from an allocated pension to exceed the SRP.

A key finding of the paper is that investment risk for allocated pension retirees should also be judged in terms of the dispersion of investment return outcomes **relative to the SRP**, rather than simply in terms of more traditional measures of investment risk (e.g. volatility of returns about an expected return, or 1 in X years with a negative investment return).

While the SRP analysis suggests that the decision not to purchase a lifetime annuity might be a quite rational decision for many 60 year olds, it also suggests that retirees should think seriously about locking into a lifetime annuity as they advance through retirement.

The more risk averse the retiree (judged in terms of dispersion of investment return outcomes relative to the SRP), the more the scales tilt in favour of a lifetime annuity and the earlier in retirement this occurs. Similarly, the higher the weighting to defensive

assets within the allocated pension or the larger the fees/margins on an allocated pension compared to a lifetime annuity, the more the scales tilt in favour of a lifetime annuity.

Where access to lump sums remains important for a retiree, the SRP analysis highlights the opportunity cost of that flexibility and the extent to which that opportunity cost increases during retirement.

The forms of analysis presented in the paper have an important contribution to make in better informing the decisions made by retirees at and during retirement, while supporting a valuable continuing role for an adviser during retirement and at the same time providing for better management by AFS licensees of the risks associated with the retirement income advice process.

As the Australian market adds new, innovative forms of investment/longevity guarantees to allocated pension products, providers and advisers will need to understand (and be able to convey to retirees) whether a guarantee benefit which reduces the tail of adverse outcomes is suitable to recommend when judged in terms of the adverse impact of the guarantee fee on the median/expected outcome and on the likelihood of beating the SRP benchmark. This should be a key risk management concern for AFS licensees, in order to reduce risk in the retirement income advice process.

The SRP analysis presented in this paper also has a critical role to play for providers in the design of investment/longevity guarantees within an allocated pension, for example in assessing:

- whether the cost of the guarantee will materially reduce the likelihood that the after-fee outcomes from the product will outperform the SRP benchmark and/or will provide only a low likelihood of bettering the outcomes from alternative advice; and
- the potential size of the market for investment/longevity guarantees within an allocated pension in light of the present policy regarding the aged pension (including its effective rate of indexation) and in light of the implications of the SRP analysis for a "reasonable basis of advice".

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1. Introduction

The retirement income market is set to grow rapidly in coming years as the baby boomers retire. Retirees appear to regard the guarantees provided by non-account based lifetime annuity products as being of limited attraction at the price and conditions offered by insurers. Account-based pension products (e.g. allocated pensions) currently command the lion's share of the retirement income market.

This dominance is likely to be reinforced by the new minimum pension regulations introduced in early 2007, coupled with changes which remove the asset means test advantage for complying income streams.

There are many drivers of a retiree's financial decisions in retirement and the advice/planning process will inevitably consider a wide range of issues. This paper seeks to isolate, for particular analysis, certain key financial-related risks faced by Australian retirees and their bearing on a retiree's decisions regarding the choice between allocated pensions and lifetime annuities at retirement.

The focus of this paper is on the financial risks faced by those Australian retirees who derive a substantial portion of their retirement income from assets which have been accumulated in a defined contribution (or lump sum benefit) environment. Defined benefit retirement income streams payable by defined benefit super funds introduce a different set of considerations and a different balance of risks between provider and consumer than those considered in this paper.

This papers aims to strike a balance between more complex actuarial analysis and concepts which are kept sufficiently practicable for use by non-actuaries. As such, the paper deliberately glosses over a number of the finer points of actuarial theory.

The paper seeks to provide a framework for understanding key financial risks inherent in retirement planning. To facilitate presentation of the various concepts considered, the paper adopts a number of modelling simplifications, which are described in the paper. In practice, some of these simplifications would likely need some refinement before the methodologies set out in this paper are adopted in advice and product development processes. Accordingly, this paper is intended as a catalyst for discussion within the actuarial profession of the concepts/ideas set out herein and should not be relied upon as a basis for specific decisions.

2. Focus of the Paper

The primary objectives of this paper are to:

- recap on the nature of an Australian retiree's longevity risk exposure;
- analyse certain risk measures for enunciating that longevity risk exposure;
- explore the implications of this analysis for the retirement income advice process;
- consider the implication of this analysis for retirement income product solutions;
- consider a range of strategic issues for distributors and product providers in the retirement income market.

Retirees face myriad financial and non-financial risks in retirement, including:

- the risk of retiring too early;
- the risk of living too long in retirement and exhausting one's assets;
- the risk of dying too soon in retirement and not enjoying the fruits of one's labours;
- the risk and cost of ill-health in retirement;
- the risks associated with investing in risky assets (e.g. uncertain future returns, volatility of returns);
- the risks associated with investing in supposedly risk-free assets (e.g. uncertain future interest rates or yields, inflation risk);
- managing the mismatch of being asset rich (own home) but income poor;
- retirees' observed price inflation differing from general price inflation; and
- taxation risk, inheritance considerations and uncertain/lumpy cashflow needs.

This paper deliberately seeks to focus on a sub-set of these risks. This paper also deliberately adopts a number of simplifying assumptions to reduce the number of parameters at play and to simplify presentation of the specific concepts introduced by the paper.

3. The Nature of an Australian Retirees' Longevity Risk

Plan for Life statistics as at June 2007 show allocated pension and allocated annuities accounting for 86% of total retail retirement income funds under management. The balance comprises immediate annuities, of which only a portion will constitute lifetime annuities.

Accordingly, a substantial proportion of Australian retirees (outside of defined benefit income streams) self-insure their longevity risk, namely those investing in allocated pensions and allocated annuities (and term-certain annuities).

In addition, the age pension (currently) provides a means-tested underpin in the form of an inflation-linked lifetime annuity. Thus, to the extent that a retiree's account balance reduces over time, the State in effect partially underwrites the retiree's self-insurance risk.

The probability that at least one half of a married couple both aged 60 will still be alive by age 80 or age 90 is higher than the public might generally appreciate. Assuming Australian population mortality (ALT00-02) and ignoring future mortality improvements, the probabilities are 89% and 47% respectively. Assuming a lighter mortality basis to reflect the better-than-average demographic profile of mass affluent retirees, and incorporating some allowance for mortality improvements, the probabilities increase to 96% and 75% respectively.

By opting for an allocated pension in retirement, a retiree is assuming a number of facets of longevity risk, including:

a) parameter uncertainty today (uncertainty over a retiree's current mortality rates);

b) parameter uncertainty tomorrow (uncertainty over the pace of future mortality improvements); and

c) random, statistical uncertainty commensurate with the Binomial distribution i.e. in each year of retirement, a retiree experiences a binary outcome - they either die or survive that year.

For an individual holder of an allocated pension, we would suggest that (c) is a substantial risk from a self-insured's perspective. Parameter uncertainty is not unimportant for a self-insured allocated pension retiree, for example, where the retiree

has used a measure of life expectancy as a benchmark for determining the level of income to be drawn down from an allocated pension. However, from the individual self-insured retiree's perspective, survival/death from one year to the next is binary. The uncertainty associated with this binary risk is substantial for the individual retiree.

This contrasts with a provider of lifetime annuities or defined benefit pensions, for whom (a) and, in particular, (b) are significant risks. In contrast, (c) ought to be relatively unimportant for a provider of lifetime annuities/pensions as long as each portfolio of annuitants is large enough to reduce the standard deviation of claims to a sufficient extent i.e. to provide sufficient spread/diversification of risks. The reason for reinsurers' historical wariness of longevity risk is due to parameter uncertainty, not random statistical uncertainty.

Considerable research effort is being expended on longevity risk and its pricing in certain overseas markets. Key drivers of this research are the longevity risk exposures of defined benefit pension funds and lifetime annuity providers, where the aggregate risk exposures under (a) and (b) are very large in some markets. Much of this research is focused on assessing, managing and pricing the aforementioned parameter risks and, in particular, finding capital market solutions for transferring and/or hedging longevity parameter risk.

Some of this research may also aid smaller portfolio providers with their management of (c) above to the extent that more efficiently priced risk transfer might provide greater scope to reduce exposure to random claims fluctuations in smaller portfolios.

However, this research does little or nothing (directly) to alleviate arguably the primary longevity risk exposure of an Australian self-insured retiree, namely the binary risk of death and the associated statistical uncertainty for an individual retiree.

4. "How Long Will My Allocated Pension Last?"

This is a question of critical importance for a retiree and is likely to be a key focus of the retirement planning process.

Planning tools which provide deterministic projections of future asset values and forecast levels of retirement income provide very little, if any, insight into the risks associated with opting for a particular product mix and/or investment strategy.

Such deterministic projections focus mainly on the forecast expected return rather than the risk being borne in pursuit of that return.

Deterministic projections which include "sensitivity results" using alternative assumptions provide an indication of the potential consequences of alternative investment return outcomes. However, these provide no insight into the likelihood of outcomes and, hence, do very little to capture the risks being assumed by a retiree.

By "risk", we do not mean simply the more traditional risk measures associated with a chosen investment portfolio (e.g. volatility of returns or 1 in X years with a negative investment return). This paper sets out an alternative view of risk which encapsulates the volatility of investment returns but which is not defined by it.

A typical planning process might devote considerable effort to, among other things, profiling the risk tolerance of the retiree for the purpose of recommending an investment strategy. This process will seek to ensure that the chosen investment strategy is reasonably aligned with the retiree's investment risk tolerance.

A key theme of this paper is whether this approach to enunciating risk is sufficient for the decisions faced by retirees regarding how to invest their allocated pension.

We start by considering the impact of investment risk in isolation, ignoring mortality. Consider the following example:

- Male, just retired, age 60.
- First year total income of $35,000 from a combination of allocated pension drawdown and part age pension. Income assumed to be payable annually in advance. This income level corresponds approximately with the level estimated by

the Westpac/ASFA Retirement Standard publication (for the September 2007 quarter) as providing a comfortable lifestyle in retirement for single person.

- Asset mix assumed to be 50% growth and 50% defensive assets.
- Total income indexing at CPI per annum.
- Age pension indexing at CPI+2%, as a proxy for future wage inflation. (As the single age pension payment rate is currently at the minimum level of 25% of the Male Total Average Weekly Earnings (MTAWE) figure, the single age pension is in effect being indexed each year in line with a measure of wage inflation, rather than CPI.)
- Allocated pension starting account balance $360,000. This has been estimated as the starting balance required for the allocated pension to be depleted at close to the assumed life expectancy, allowing for the retirement income basis described above. It should be noted that this starting account balance is substantially higher than the current average account balance implied by APRA's Annual Superannuation Bulletin for new, retail-sector retirees.

Domestic equities were adopted as the proxy for growth assets, while defensive assets were divided equally between fixed interest and cash. We performed 2,000 simulations of CPI, asset classes and Government bond yields using Global CAP:Link, Towers Perrin's proprietary econometric model for generating scenarios of future economic conditions (GDP, inflation, interest rates) and associated asset class returns.

The total income level and age pension were simulated using the stochastic CPI projections provided by CAP:Link. The account balance was simulated using the stochastic asset class returns projected by CAP:Link. The allocated pension drawdown was determined each year by deducting the projected age pension entitlement from the projected total income target amount, subject to the minimum pension levels stipulated by the minimum pension regulations.

The results of these simulations are set out in Appendix B.

- Chart B.1 provides an illustration of the probability of fund depletion by projection year.

- Chart B.2 provides an illustration of the projected account balance by year of projection. This shows a 5% probability of fund depletion before age 81, 25% before age 84, 50% before age 88 and 75% before age 93. In this case, using an adjusted Australian population mortality with an allowance for mortality improvements (see Appendix A for further details), the life expectancy of a male age 60 was 87.

- Chart B.3 provides an illustration of the projected total income from the allocated pension and part age pension on a nominal basis. We also considered projected total income on a real basis (using CPI as the deflator) but this did not add much to the focus of this paper.

- Chart B.4 provides an illustration of the projected age pension entitlement.

- Chart B.5 provides an illustration of the projected income drawdown from the allocated pension. It should be noted that the simulation number applicable to a percentile in Chart B.4 will not correspond to the simulation applicable to the equivalent percentile in Chart B.5 since a simulation producing a higher account balance will imply a lower age pension entitlement and a higher drawdown from the allocated pension to meet the projected total income target.

In Appendix B, we have also repeated these results using alternative indexation assumptions (Charts B.6 to B.15). The first sensitivity indexes total income and age pension at CPI plus 2% per annum. The second sensitivity indexes both at CPI.

Comparing these projections reveals an interesting consequence of the current age pension inflation basis. Specifically, if the target total income is assumed to increase at CPI and the age pension is assumed to increase at CPI plus 2%, the illustrated retiree's income does not decline significantly on account of the allocated pension being depleted. In addition, the median year of fund depletion is materially later and the "tail" of fund depletion outcomes is more extended than if the age pension and total income are indexed at the same rate.

In this particular example, the retiree whose living standards keep pace with price inflation rather than wage inflation might be considered to bear substantially lower longevity risk provided that the age pension continues to be indexed at wage inflation in the future. Clearly, the actual outcome would depend on the extent to which wage

inflation exceeds CPI in the future. In this particular example, the longevity risk has been replaced by a political risk that the basis of indexation of the age pension will change in future.

Taken together, these charts provide one form of probabilistic presentation of a retiree's longevity risk. We acknowledge that none of the above is particular rocket-science for actuaries armed with a suitable asset model, Excel and a PC. However, the choice of asset model will obviously influence the results; assumption setting for projections of this nature is not trivial; and interactions with age pension means-testing requires some care.

On the basis of the foregoing, it seems reasonable to ask the following:

- Have probabilistic assessments of this nature played a sufficient role in the retirement advice/planning process to date?
- Should an assessment of a retiree's risk tolerance include an assessment of the dispersion of fund depletion outcomes around the mean/median, in addition to a more traditional investment risk-tolerance focus of volatility, X out of Y years producing a negative return and the like?

We believe there are a number of compelling reasons for probabilistic assessments of this nature, including the following:

- The risk preferences of a retiree may cause him/her to attach greater weight to worse-than-average fund depletion outcomes than better-than-average fund depletion outcomes.
- Product innovation in the form of investment guarantees will change the dispersion of fund depletion outcomes, for which the retiree will pay a guarantee fee. A deterministic projection of outcomes will not convey this trade-off effectively and, hence, may not provide effective support for the product promotion or advice process.

There is an obvious communication challenge in presenting probabilistic information to the consumer. In addition, such probabilistic assessments could be considered to be unduly complex in instances of low account balances where the dispersion of fund depletion outcomes might be relatively small (measured in terms of years of age) for a

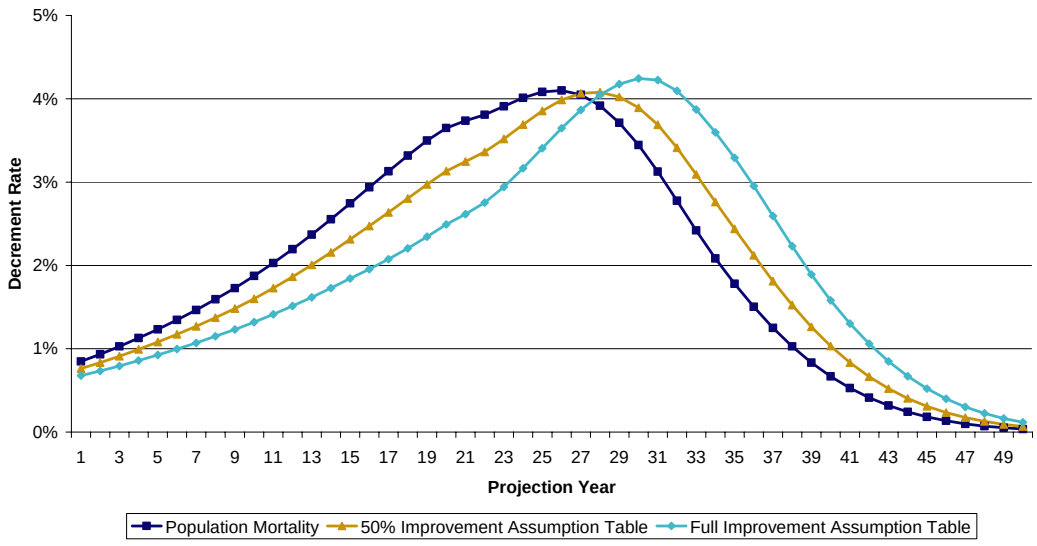
meaningful level of retirement income which requires relatively high rates of drawdown from a relatively low account balance.

However, we believe that probabilistic information has an important place in the advice/planning process and in the following section we suggest a way of presenting the information clearly and comprehensibly.

5. Assessing Retirees' Self-Insured Longevity Risk

Chart 1 below illustrates the probability distribution for the future mortality of a male aged 60 using 100% ALT 00-02 with and without an assumption for mortality improvements. The chart shows distributions using two alternative mortality improvement bases for the purposes of illustration. The "full improvement" basis corresponds with the improvement basis outlined in Appendix A. The probabilities associated with each chart sum to 1, since they represent the probability that a male aged 60 today will die at each future year of age.

Chart 1. Mortality Distribution
Age 60 Male



Clearly, the effect of mortality improvements is substantial. However, we would expect that any long term assessment of longevity risk in an advice/planning context would make allowance for the effects of mortality improvements.

As noted earlier, the consequences of random statistical uncertainty associated with the overall probability distribution would seem to be a much more significant risk for an individual self-insured retiree than parameter uncertainty (i.e. the risk of misestimating the mean of the probability distribution) provided that the assumed mortality basis has made allowance for mortality improvements in the first place.

This raises a question as to whether a focus on life expectancy in the advice/planning process should be accompanied by a greater consideration of this random statistical uncertainty.

For the average retiree, illustrating probability distributions as in the previous section might be regarded as a step too far. However, by adopting a relatively simplified risk measure we believe that it is possible to provide a reasonable representation of the statistical uncertainty in a form which might facilitate understanding.

We define LV_x^n to be the age at the n^{th} percentile of the mortality probability distribution for a life currently aged x. Thus, a male age 60 has a 75% likelihood of dying before LV_{60}^{75}.

A potential standardised risk measure might be $[LV_x^n – (x + e_x)]/ (x + e_x)$, where e_x is the life expectancy for a life currently aged x. This would have the benefit of providing a relatively simple, standardised measure of dispersion around the mean. However, even this might be considered too complex for the average retiree.

An alternative might be to adopt $LV_x^n – (x + e_x)$ as a longevity risk measure, to provide a compromise between a standardised measure and simplicity of communication. This would still present outcomes relative to life expectancy rather than as absolute ages.

However, for the purposes of this paper, we have adopted LV_x^n as an even simpler alternative.

Table 1 below illustrates our adopted risk measure for males of various ages, assuming mortality rates in line with ALT00-02 with an assumption for mortality improvements.

TABLE 1

Percentile Risk Measures, 100% ALT00-02, with mortality improvements

Age Now	LV_x^5	LV_x^{25}	LV_x^{50}	LV_x^{75}	LV_x^{95}
60	66	78	86	92	100
70	72	80	87	92	100
80	81	84	89	93	101

We suggest that a combination of the risk measures set out above and projections of the form set out in section 4 provide a powerful illustration of the longevity risk associated with an allocated pension. Table 2 provides an illustration of how these might be combined for the purposes of presentation to a retiree.

TABLE 2

Using ALT00-02, with mortality improvements

Male currently aged 60		**Likelihood that allocated pension will be depleted by this age**	
		50% weighting to growth assets	*30% weighting to growth assets*
1 in 20 chance of dying before age	66	0% chance of fund being depleted before this age	0% chance of fund being depleted before this age
1 in 4 chance of dying before age	78	1% chance of fund being depleted before this age	0.5% chance of fund being depleted before this age
1 in 2 chance of dying before age	86	36% chance of fund being depleted before this age	46% chance of fund being depleted before this age
3 in 4 chance of dying before age	92	68% chance of fund being depleted before this age	80% chance of fund being depleted before this age
19 in 20 chance of dying before age	100	85% chance of fund being depleted before this age	93% chance of fund being depleted before this age

Additional lines might be preferred. For example, a typical retiree might expect to see a 1 in 5 or 1 in 10 chance presented also.

Clearly, it would also be feasible to present this information graphically in the form of a 3-dimensional surface plot or contour map. However, we believe that a simple tabular illustration of the form shown in Table 2 conveys a substantial amount of information about the character of an allocated pensioner's self-insured longevity risk, while keeping the volume of information relatively manageable.

There is a school of thought that some retirees may struggle to understand percentages. However, we would contend that the real value of the information in Table 2 is to facilitate a more advanced advice/planning process and hence add value to an adviser's role. Also, one could present the information in a more colloquial form (1 in X chance) rather than as probabilities.

The information in Table 2, when coupled with illustrations of the form set out in section 4, has a range of powerful uses in the advice/planning process, including:

- enabling an adviser to better communicate the nature and extent of longevity risk being taken on by a retiree who opts for an allocated pension;
- more sophisticated tailoring of investment mix in light of a more comprehensive enunciation of risk (i.e. the risk of surviving to various ages and the risk of the allocated pension being depleted by that age);
- more robust comparison of the risk/return characteristics of an allocated pension versus a lifetime annuity; and
- presenting the effects of investment guarantees on risk and the range of outcomes, thereby facilitating an assessment of the costs and benefits of those guarantees by reference to their effect on the illustrations set out in Table 2.

Further to the last bullet point above, we believe this information has a considerable role to play in the development and pricing of investment guarantees, by providing an assessment of the likely impact of an investment guarantee (both the guarantee benefit and guarantee fee) on the distribution of projected outcomes for the retiree. We return to this topic later in the paper.

6. How Rational is the Decision not to Purchase a Lifetime Annuity at Retirement?

There are many factors that will influence a retiree's investment decisions at retirement; some rational, some emotional and some perhaps on account of misapprehensions.

A key misapprehension is the perception that if a retiree purchases a lifetime annuity and dies in a year's time, the insurance company will make a large windfall profit at the expense of the retiree.

Other reasons why a retiree may choose not to buy a lifetime annuity will include control, security, investment flexibility, income flexibility, perception of value for money, risk profile and exposure to growth assets.

In this section of the paper, we assess the decision not to purchase a life annuity by examining a sub-set of key economic considerations. We note that other factors may have a significant bearing on a retiree's decision to invest in an allocated pension instead of a lifetime annuity. Thus, our comments/findings in this paper should be read in that context.

6.1. No Free Lunch

In basic actuarial training, we all learned that with a lifetime annuity the income paid to those surviving beyond the life expectancy is funded by those dying before the life expectancy.

Retirees are commonly considered to dislike this insurance feature of lifetime annuities, to the extent that it puts them at risk of forgoing a lifetime of superannuation savings upon premature death.

Providing a meaningful death benefit for deaths before the life expectancy would clearly incur a cost that would have to be funded either through a lower annuity income or a higher annuity purchase price – there is no free lunch available.

From a theoretical risk-adjusted pricing perspective (and assuming equivalence of product fees/margins) a lifetime annuity and allocated pension might be regarded as being of equal tangible value, provided that the mortality basis underlying the lifetime annuity's pricing is reflective of the retiree's mortality/longevity risk and provided also that one adopts a "market-consistent" approach to the pricing of risk. In this case, the

better expected return (however one chooses to measure this) from an allocated pension arises on account of the customer choosing to assume risk, notably investment risk and longevity risk, and the market-consistent cost of that risk exactly offsets the additional expected return (in theory). Put another way, the risk of dying early after having purchased a lifetime annuity (and hence receiving a poor return) is compensated for by the enhanced return that arises from a lifetime annuitant living too long.

Where an allocated pension has higher product fees/margins than a lifetime annuity, a lifetime annuity might therefore be regarded as having a greater risk-adjusted tangible value, again provided that the mortality basis underlying the lifetime annuity's pricing is reflective of the retiree's mortality/longevity risk and provided also that one adopts a "market-consistent" approach to the pricing of risk. Thus, in these circumstances, the lifetime annuity might superficially be considered the rational choice for a retiree on the basis of a theoretical risk-adjusted economic assessment of tangible value.

However, the real world is inevitably more complicated than this, as manifested by the following:

- A retiree who is in poorer health than that implied by the pricing of a lifetime annuity should attach greater weight to the risk of dying earlier in retirement than the risk of living too long and hence the scales would tilt in favour of an allocated pension (all other things being equal).
- The conservatism adopted by a provider in pricing the longevity protection offered by a lifetime annuity may also exacerbate the tilt in favour of an allocated pension for a retiree of average health (howsoever determined).
- While appropriate from a provider's perspective, a typical retiree may not be inclined to factor market-consistent techniques into his/her assessment of the choice at retirement!
- A retiree may also ascribe value to a host of other factors beyond those having measurable, tangible value (e.g. control, flexibility etc). Hence, as noted earlier, a retiree's decision is not purely about an economic assessment of tangible value.

6.2. Survivor Risk Premium

For the purposes of this paper, we have defined a term which we refer to as the Survivor Risk Premium ("SRP"). The SRP is a measure of the annual economic cost of electing not to invest in a lifetime annuity.

Initially, we will adopt a simplified definition for SRP, namely the extra cost of purchasing a lifetime annuity of $1 per annum in one year's time (one year of age older) compared to the value in one year's time of a lifetime annuity of $1 per annum that is purchased today assuming survival over the year.

An approximation for the SRP is $q_x/(1-q_x)$ – see Appendix D for the proof.

Later in this paper, we will adopt a more complex SRP definition but it is helpful to adopt a simplified definition in the first instance.

Throughout this SRP analysis, we have adopted a more conservative (i.e. lighter) mortality basis which adopts a percentage (less than 100%, and increasing with age) of Australian population mortality and includes mortality improvement assumptions. The mortality basis adopted is outlined in Appendix A.

This basis is not necessarily intended to represent a pricing basis for lifetime annuities. Rather, it is intended as a proxy representation of mortality characteristics for the retiree demographic that retires with a reasonable level of accumulated retirement savings. In broad terms, we would expect this demographic to exhibit lighter mortality rates than the population as a whole (on socio-economic grounds) but heavier mortality than might typically be assumed in the pricing of lifetime annuities (since lifetime annuitants in today's market are likely to be a highly "select" group).

As noted later, for the purposes of this paper and to aid presentation of the concepts introduced, we have elected to simplify matters somewhat by adopting the same mortality basis for all aspects of the SRP estimation. This is obviously a simplifying assumption. A potential refinement would be to adopt different mortality bases for the assumed experience of the retiree and the pricing of the lifetime annuity.

The SRP is a measure of the implicit financial benefit that flows to the surviving annuitants on account of the death of some annuitants in the prior year i.e. as the

residual value of the annuity on death is implicitly shared among the surviving annuitants.

Consider a retiree who elects to invest in an allocated pension for one year, survives the year and then purchases a lifetime annuity. By waiting a year to purchase the annuity, the retiree misses out on the aforementioned benefit. Thus, all other things being equal, the retiree needs to achieve a better net (of fees/expense margins) investment return on their fund over the year than the return implied in the pricing of the lifetime annuity, in order to be able to purchase the annuity at the end of the year. The additional investment return required is the SRP.

Throughout this SRP analysis, for simplicity, we have assumed that the mortality basis underlying the annuity pricing remains unchanged over time. In practice, however, a retiree who defers a purchase of a lifetime annuity incurs an additional risk of the mortality basis being strengthened over time and the cost of the annuity increasing accordingly.

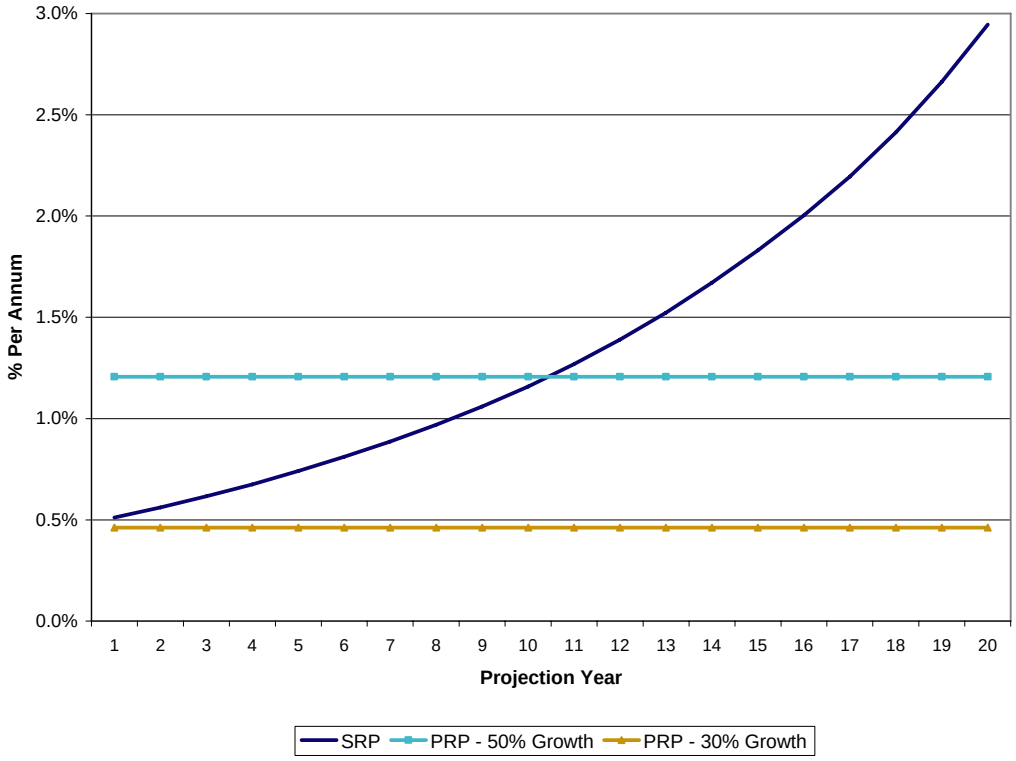
6.3. Simplified Assessment of SRP

The total fees incurred on a retail allocated pension are likely to exceed those implicit in the pricing of a lifetime annuity. On the other hand, an allocated pension will typically have some weighting to growth assets which would be expected to outperform the "risk-free" asset return usually assumed in the pricing of a lifetime annuity. However, this expected excess return comes with the risk/cost of greater volatility of returns.

Thus, judged purely from an economic perspective, a retiree electing to invest in an allocated pension rather than a lifetime annuity is betting that the investment return achieved by the allocated pension less the extra fees incurred in the allocated pension exceed the SRP from one year to the next.

Chart 2 below shows the simplified SRP for a male aged 60 for each future year of age, together with a deterministic presentation of the additional investment return (after additional fees) expected from an allocated pension assuming weightings of 30% and 50% to growth assets (and assuming the investment risk premiums set out in Appendix A) .

Chart 2. Portfolio risk premium (PRP) vs Simplified Survivor risk premium (SRP)



On the basis of the assumptions adopted, this chart suggests that the decision not to purchase a lifetime annuity might be a quite rational decision for many 60 year olds, since the allocated pension is expected to perform sufficiently in the early years to meet the SRP. However, as the retiree ages, the SRP increases considerably which suggests that there is a point at which continuing with an allocated pension may not be rational from the perspective purely of this economic comparison.

Another issue that this chart highlights is the importance of a retiree's risk tolerance to the decisions he/she faces at and during retirement. The cross-over point in the chart above is the age beyond which the allocated pension is not expected to keep pace with the escalating cost of the SRP. Assuming a 50% weighting to growth assets, this cross-over occurs at age 70 in the above simplified illustration. For a more risk averse investor who attaches more weight to below-median outcomes than to above-median outcomes, the cross-over point would be at a younger age. Also, if we assume a 30% weighting to growth assets, this illustration has no cross-over point.

These issues would seem to be of relevance to an advice/planning process at and during retirement, where that advice/planning process is required to satisfy a "reasonable basis of advice" test.

The above is an admittedly simplified assessment. In the remainder of this section 6, we refine the basis of assessment.

6.4. Refining the Assessment of SRP

6.4.1. Compounding the Effects of the SRP

The SRP defined above assumes that the slate is wiped clean each year in making a comparison between the performance of the allocated pension and the cost of a lifetime annuity. In other words, the compounding effect of the SRP in year 1 is ignored when defining the SRP hurdle in year 2. An alternative approach would be to allow for this compounding effect.

We have done so by rolling forward the lifetime annuity and the allocated pension allowing for the same level of income to be drawn from the allocated pension as is paid from the annuity. At the end of each year, the lifetime annuity is revalued on the basis of its remaining income payments.

To ensure a like-for-like comparison, the allocated pension is accumulated using the same discount/earning rate assumption and same expense/fee margin as were implied in valuing/pricing the annuity.

At the outset, the value of the annuity was equal to the balance of the allocated pension. At the end of each year, the then value of the remaining annuity is compared to the rolled-forward value of the allocated pension. The difference between these values (i.e. the accumulated shortfall) as a percentage of the allocated pension fund balance is the cumulative, compounded SRP. The SRP for each year can then be distilled.

In this case, the SRP derived is a measure of the additional net investment return required from the allocated pension in the current year in order to break even at year t compared to year 0 or, in other words, in order to have the necessary funds required to be able to purchase the same annuity at the end of each year of retirement as the retiree could have purchased at the point of retirement.

6.4.2. Relaxing the Implicit Assumption of Survival

The SRP defined above assumed that the retiree survives the year, since the SRP implicitly compares the outcomes from each product for a retiree who is alive at the end of each year. Strictly, the SRP should also factor in the outcomes from each product if the retiree dies.

There are a number of ways in which this survival factor might be addressed. One way of addressing it is to examine the difference in outcomes in the event of death in the year and to then attach weights to the death and survival outcomes under each product. One might be tempted to use the probabilities of death and survival as the weights for each outcome. This approach implicitly assumes a particular utility function or risk preference for the retiree.

For the purposes of this paper, we have taken a different approach. Rather than trying to settle a view on a retiree's risk preferences, we have adopted a framework which seeks to provide a reasonable like-for-like comparison of the products.

The basis we have chosen here for refining the SRP deliberately glosses over a number of elements of life contingencies. We have sought to adopt a reasonably pragmatic approach that might be intuitively more obvious to a person who has not had actuarial training. Other practitioners may prefer alternative bases.

Our framework assumes a hypothetical lifetime annuity (with guarantee period) which pays an income per annum for a term certain plus a lifetime income thereafter:

- The assumed term is the life expectancy of the retiree at retirement.
- The assumed income level is the dollar amount of income per annum which has a discounted net present value equal to the starting balance of the allocated pension at retirement. We have elected to allow for annual CPI indexation of the income level.

The income level implied by the above is not intended to represent the actual income that will be drawn by the retiree from their allocated pension. The purpose is to determine the level of income which might be considered to "neutralise" the retiree's negative perception of forfeiting their savings to the insurer if they die during the early years of a lifetime annuity. In doing so, we are seeking to postulate a form of lifetime annuity that might be considered to provide financial equivalence between the choices

available at retirement (i.e. an allocated pension or a lifetime annuity), notwithstanding any other compelling reasons a retiree may have for favouring an allocated pension over a lifetime annuity than simply an equivalent measure of financial outcomes.

For the purposes of this paper, we have assumed that risk neutral mortality rates are equivalent to best estimate mortality rates in the mind of the retiree, although this point could be debated.

Using this derived annuity, we have then rolled-forward the lifetime annuity and the allocated pension allowing for the same level of income to be drawn from the allocated pension as is paid from the annuity. At the end of each year, the lifetime annuity is revalued for the balance of the original guarantee period and lifetime thereafter.

We have then applied the same methodology as in section 6.4.1 above to determine the SRP for each year.

6.4.3. Resetting the Guarantee Period

The hypothetical lifetime annuity described above adopted a fixed guarantee period equal to the life expectancy at retirement. An alternative approach would be to reset the guarantee period each year to the then life expectancy for the purposes of assessing the SRP.

One rationale for adopting this approach might be to dovetail with an advice process that reassessed, from year to year (during retirement), the merits of a retiree locking in a lifetime annuity based on the position of the retiree's allocated pension at that review point.

At a review point, whether the retiree can still purchase the same lifetime income as he/she could have purchased at retirement might be considered largely irrelevant to the decision the retiree faces at the review point itself - namely whether, having survived to the review point, the retiree should continue with the allocated pension or lock-in a lifetime annuity at the review point. Factors relevant to this decision include the life expectancy and balance of the allocated pension at the review point, not what these were at the original date of retirement, nor how the retiree might have fared in the past had a different choice been made at retirement.

Thus, the SRP might be assessed by reference to a re-stated lifetime annuity which has a new guarantee period equal to the life expectancy at the review point and which solves for the level of income that can be purchased by the balance of the allocated pension at the review point.

We consider that there is intuitive appeal to assessing SRP by resetting the guarantee period. In particular, it would seem more aligned with, and would better support, the advice process by providing a basis for continual, prospective review of a retiree's allocated pension throughout retirement. That review would focus on the risk/return trade-off between locking into a lifetime annuity at advancing age or continuing with the allocated pension, with risk in this context being considered in the more comprehensive form enunciated in this paper (rather than in the narrower form of investment volatility).

For the purposes of this paper, however, we have confined our focus to a consideration of SRP as defined section 6.4.2.

6.4.4. Stochastic Investment Returns

The simplified analysis in section 6.3 focused on the expected returns from the allocated pension and ignored the investment volatility associated with the exposure to growth assets.

A stochastic presentation would better illustrate the risk of the allocated pension not outperforming the SRP. Assuming the retiree is risk averse, a stochastic presentation would provide a more comprehensive picture of the risk assumed by the retiree in opting for an allocated pension in preference to a lifetime annuity.

6.4.5. Results of Analysis

Having derived alternative forms of SRP in section 6.4 (than the simpler form illustrated in section 6.3), we have then performed a full stochastic simulation of the allocated pension using the same asset model and asset class simulations as those used in section 4. This provides a comparison of SRP by year of retirement against quartiles of investment portfolio risk premium (expressed as compound per annum portfolio returns in excess of the compound "risk-free" rate, after adjusting for the difference in fees). The results are presented in Charts 3 and 4 below.

Chart 3. Portfolio risk premium (PRP) vs Survivor risk premium (SRP) - with indexation
Investment Mix - 50% Growth

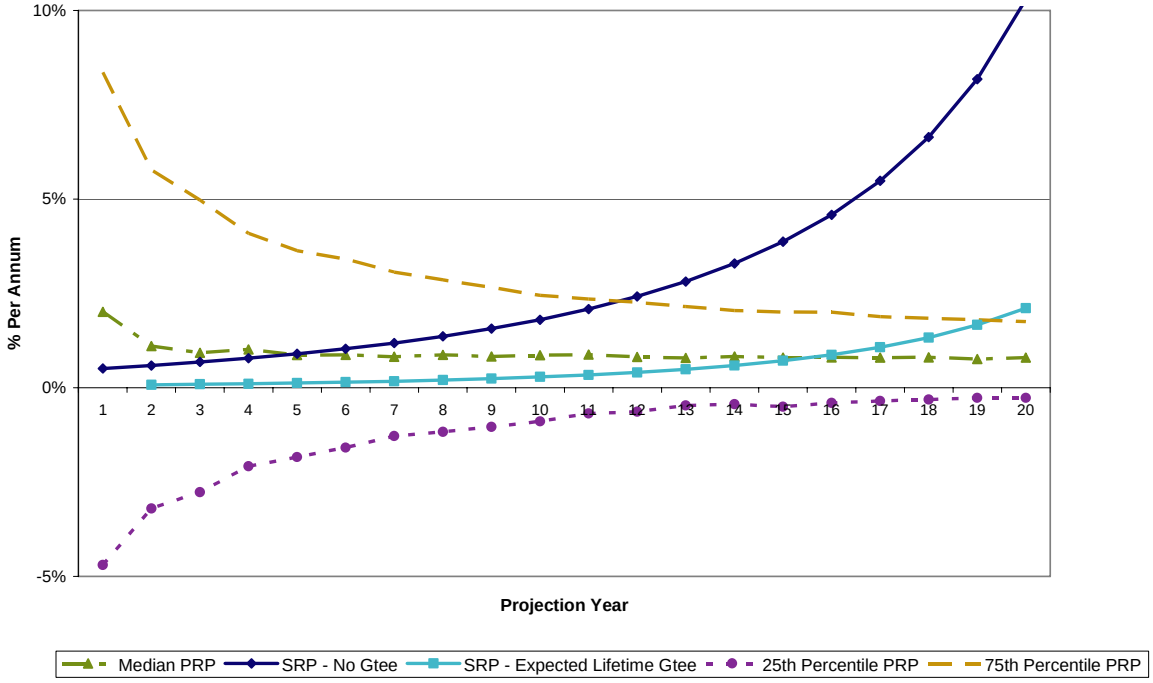
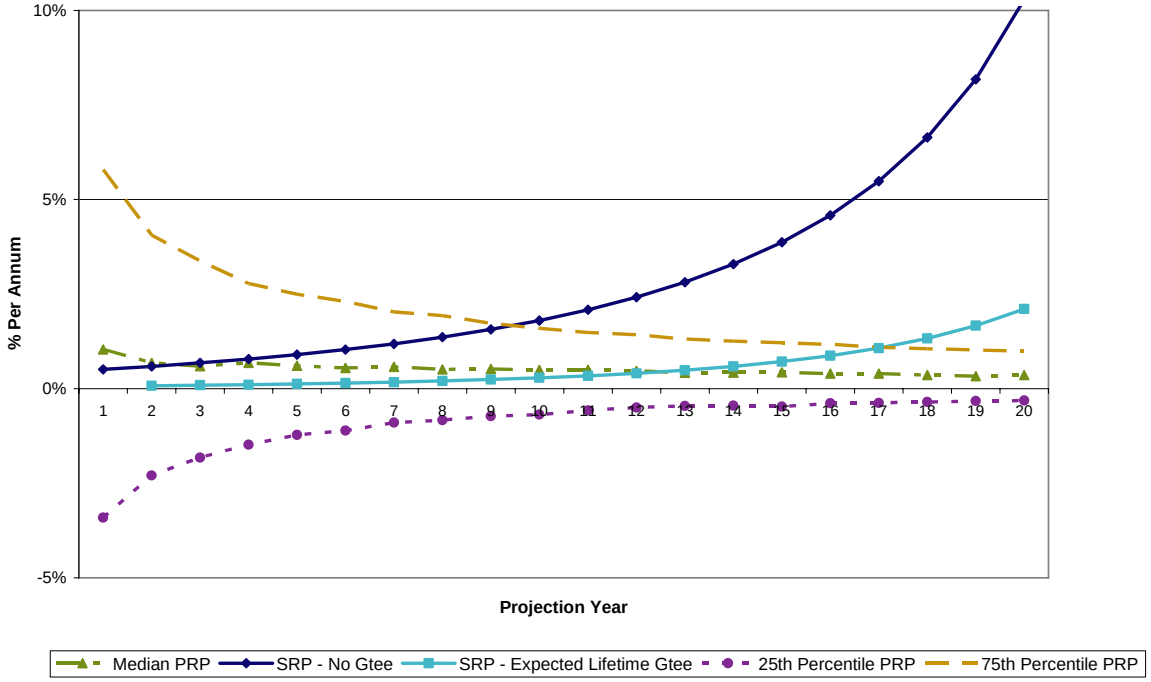


Chart 4. Portfolio risk premium (PRP) vs Survivor risk premium (SRP) - with indexation
Investment Mix - 30% Growth



The charts above illustrate that the more refined definition of SRP (as set out in section 6.4.2) not surprisingly has a material bearing on the results of our analysis and on the implications for new retirees. On the basis of the assumptions adopted, and focusing on the SRP determined using a guarantee period (per section 6.4.2), these charts suggest as follows:

- The decision not to purchase a lifetime annuity might be a quite rational decision for many 60 year olds in view of the distribution of PRP outcomes relative to the SRP.
- The retiree in our example should think seriously about locking into a lifetime annuity as he/she advances through his/her mid 70s, on account of the SRP increasing relative to the percentiles of investment return. The timing of this decision would also be impacted by any difference between a retiree's own health and the assumed health of a lifetime annuitant implied by the annuity pricing basis – as noted earlier, we have ignored this difference as a simplifying assumption for this paper.
- The more risk averse the retiree, the more the scales tilt in favour of a lifetime annuity and the earlier in retirement this occurs. By risk averse, we do not mean the risk profile arrived at using traditional risk profilers. Here we are referring to risk tolerance judged by reference to the dispersion of the investment return outcomes **relative to the SRP**. In other words, once the SRP concept has been introduced, a retiree's risk tolerance might include an expression in terms of "I am comfortable with a 1 in 2 chance of underperforming the [SRP]" or "I am comfortable with a 1 in 4 chance of underperforming the [SRP]".
- The higher the weighting to defensive assets within the allocated pension, the more the scales tilt in favour of a lifetime annuity.
- The larger the fees/margins on an allocated pension compared to a lifetime annuity, the more the scales tilt in favour of a lifetime annuity.
- For very risk averse investors, an allocated pension may not be suitable at all, at least not as judged by reference to the SRP risk/return trade-off.
- Where access to lump sums remains important for a retiree, the above analysis highlights the extent to which the opportunity cost of that lump-sum flexibility increases during retirement.

7. Implications for the Advice Process

We would suggest that information in the form of the above analyses have a significant contribution to make to the advice/planning process, and to better satisfying a "reasonable basis of advice" test.

In particular, information of the form shown in sections 4, 5 and 6.4.5 of this paper, taken together, provides:

- a more robust basis for communicating the trade-off between an allocated pension and a lifetime annuity;
- a more meaningful expression of the nature and extent of investment and longevity risk/uncertainty associated with an allocated pension;
- a basis for weighing up that investment risk against a more relevant return threshold/benchmark (namely the SRP);
- a basis for identifying when the case in favour of a lifetime annuity becomes more compelling (rather than dealing with lifetime annuities in a more curtailed manner within the advice/planning process);
- a basis for better ensuring that a retiree who opts for, or chooses to retain, an allocated pension for other reasons (flexibility etc), despite an analysis of the above form suggesting a stronger case for a lifetime annuity, has been sufficiently informed of the nature and extent of the risks associated with their proposed course of action;
- support for a valuable continuing role for an adviser during retirement; and
- better protection for the AFS licensee against claims of inappropriate advice and/or a failure to keep that advice up-to-date through retirement.

This information also has a considerable role to play in the development and pricing of retirement income products, which we return to in section 8 below.

One objection might be that the assumption setting process is too difficult and too subjective to warrant attempting the forms of analysis presented in this paper. Another objection might be that providing projections/illustrations of future outcomes is inherently risky for the provider. However, we take a different view:

- Deterministic projections might create a risk exposure for the provider by potentially creating an impression of a particular outcome against which an unsophisticated retiree might judge the provider in later years. However, a stochastic analysis, by its nature, avoids this risk by providing a probabilistic illustration of a range of outcomes.

- The analysis obviously requires the use of assumptions and methodologies that are reasonable. However, while choosing assumptions is not a trivial exercise, it is not impossible.

- By better informing retirees of risk trade-offs, the analysis offers AFS licensees a valuable addition to their internal tool-kit for managing licensee risk in the advice process.

- The analysis suggests that it may not be sufficient for the advice process to consider traditional measures of investment risk (e.g. volatility around expected returns) without considering the risk of underperforming the SRP benchmark and the spread of outcomes around the SRP.

- Lastly, we submit that these forms of analysis would add considerable value to an adviser's proposition to the customer and thereby strengthen the adviser's role as a provider of continuing, value-adding advice during retirement.

The advice/planning process should provide sufficient information for the retiree to make a suitably informed choice at and during retirement. In our view, this merits better enunciation of survivorship risk, probabilistic illustrations of overall outcomes and a probabilistic assessment of the risk of investment returns underperforming an SRP benchmark (or similar).

By contrast, an advice/planning process for retirees which is qualitative or deterministic in nature, and which is focused simply on investment returns and traditional measures of investment volatility, may pose considerable risks for AFS licensees, particularly as a retiree progresses through retirement.

We have observed some attempts to convey investment uncertainty for particular investment options by illustrating "tail" outcomes arising from stochastic investment projections over, say, a 5 or 10 year period. However, where we have observed these, the investment uncertainty has not been expressed relative to an SRP benchmark (or

similar), and has been presented in an abstract form without a probabilistic projection of fund depletion for an allocated pension.

As the Australian market adds new, innovative forms of investment guarantees to allocated pension products, the aforementioned enhancements to the advice process are likely to become increasingly important, in order to ensure:

- that the retiree is properly informed in relation to the costs and benefits of the investment guarantee compared to alternative choices; and
- appropriate risk management on the part of the AFS licensee, in relation to advice risk.

For example, providers and advisers will need to understand (and be able to convey to retirees) whether an investment guarantee which reduces the tail of adverse outcomes, but at the expense of lowering the median/expected outcome, is suitable to recommend when judged in terms of:

- its probable negative impact on the likelihood of beating the SRP benchmark;
- the "risk-free" alternative of a lifetime annuity; and/or
- alternative advice strategies involving combinations of non-guaranteed allocated pensions and lifetime annuities (and potentially other forms of annuity innovation).

A key potential risk for AFS licensees will be in recommending an allocated pension with an investment/longevity guarantee in circumstances:

- where the cost of the guarantee rider is such that the after-fee outcomes arising from the product materially reduce the likelihood of beating the SRP benchmark; and/or
- where the guarantee provides only a low likelihood of bettering the outcomes from alternative advice strategies; and
- where these points have not been assessed or communicated effectively in the advice/planning process.

8. Retirement Income Products

8.1. Product Strategy/Design Issues

There are a variety of differing retirement income products on offer overseas which provide differing mixes of investment risk sharing and longevity risk sharing between the provider and the customer. This is illustrated in the matrix below.

Investment Risk	**Non-Guaranteed**	Inv-linked Lifetime Annuity GMWB	Annuitised Fund	Inv-linked Allocated Pension
	Pooled	Par Lifetime Annuity	Par Lifetime Annuity Annuitised Fund	Par Allocated Pension
	Underwritten/ Guaranteed	Trad Lifetime Annuity GMIB/GMWB	Annuitised Fund	Non-par, capital guaranteed AP GMAB/GMWB
		Underwritten	**Pooled**	**Self-Insured**
	Longevity Risk			

Key:

GMIB – Variable annuity guaranteed minimum income benefits for life

GMWB – Variable annuity guaranteed minimum withdrawal benefits

GMAB – Variable annuity guaranteed minimum accumulation benefits

Annuitised Fund – A form of annuity where survivors share explicitly in the mortality "profits" arising from deaths. A deceased's fund is divided among the survivors in a transparent way in the form of a "credit" or "top up" to each survivor's fund e.g. for an investment-linked product design, this would take the form of adding extra units to each survivors' unit balance at the end of the year. Longevity risk is effectively pooled among all policyholders with little (if any) longevity guarantee being underwritten by the provider.

Not all of these products are currently present in the Australian marketplace. The two principal products in the Australian market occupy the top right and bottom left of the matrix.

The Asteron Longevity Income Stream product is a version of an annuitised fund, also incorporating a deferment feature. We understand that, in Australia, participating lifetime annuities have been offered as a minor, niche product in the past but we are not aware of any being actively marketed today. Also, we are not aware of any providers

offering a pure form of investment-linked annuity in Australia. The old (pre September 2007) complying income stream means testing rules were arguably an impediment to investment-linked and participating lifetime annuities.

A key product strategy question for retirement income stream product providers will be whether there is a sufficient proposition for retirees in Australia for products positioned in parts of the above matrix other than the top right and bottom left.

- What mix of investment risk and longevity risk is optimal?
- What complexity of product design is marketable?
- Is there a market for pooled longevity risk and where is that market e.g. is it equally rational for new retirees to shun "annuitised fund" products in the earlier years of retirement?
- Is there a market for pooled investment risk or have participating products had their day?
- What form of investment/longevity guarantee can be offered in an allocated pension setting which provides an appropriate mix of guarantee benefit and guarantee fee **and** which provides a "reasonable basis of advice":
  - Will the cost of the guarantee rider be such that the after-fee outcomes arising from the product materially reduce the likelihood of beating the SRP benchmark and/or provide only a low likelihood of bettering the outcomes from alternative advice?
  - How will an adviser be able to judge this trade-off in the absence of the sorts of techniques discussed in this paper, what risk does this pose for the AFS licensee, and what implications does this have for providers' choice of tools used to promote new retirement income guarantees?
  - Is the current level of allocated pension fees an impediment to adding substantive guarantee riders?
  - Is it sub-optimal for such guarantees to be purchased in the early years of retirement?

  - Do alternative strategies involving combinations of non-guaranteed allocated pensions and lifetime annuities (and potentially other forms of annuity innovation) offer more optimal product solutions for retirees and advisers than guarantee riders added to an allocated pension?

- How large is the target market for investment/longevity guarantee riders within an allocated pension in light of:

  - the present policy regarding the aged pension (including its effective rate of indexation) and the value of the full aged pension for a homeowner;

  - large account balances arguably being inherently less exposed to the risks covered by the guarantee;

  - small account balances probably being depleted well before life expectancy in any event; and

  - analysis of the form presented in this paper which, when applied to such guarantees, will have a bearing on the "reasonable basis of advice" test?

- What product or combination of products best supports an ongoing role for the adviser during retirement?

The analysis in this paper suggests that a decision not to purchase a lifetime annuity might be a quite rational decision for many 60 year olds, given the terms at which lifetime annuities are offered and given the alternative of an allocated pension. And this is before factoring in other, less tangible drivers of a new retiree's decision in favour of an allocated pension, which are also compelling for many retirees.

By contrast, providers are wary of the parameter uncertainty associated with longevity risk and may not feel that they are being appropriately rewarded for this risk at current prices, and certainly not at more generous pricing.

Thus, the current "clearing price" for lifetime annuities sold to retirees results in low demand and that low demand further exacerbates matters by giving rise to greater selection effects which in turn further increases the price of the lifetime annuity.

A key strategic consideration is whether this disconnect at retirement lessens during retirement. If so, a further strategic consideration is whether there are ways of

approaching the design/promotion of, and advice process for, allocated pensions (with or without guarantees) and lifetime annuities which together would provide a more optimal outcome for retirees during retirement while reducing risk for AFS licensees in the advice process.

8.2. An Aside on Overseas Markets

Other papers recently presented at the 2007 Convention provided an overview of retirement income products in other markets. Thus, this paper has not sought to cover this same ground.

However, we would caution against drawing inferences about the level of sales of certain products in other markets without a clear understanding of the tax, social security and regulatory framework applicable to those markets.

For example, in the UK market, lifetime annuities accounted for approximately 75% of individual retirement income new (retail) business sales in 2006. By contrast, the equivalent of allocated pensions accounted for only 21% of sales in the UK market but these are steadily gaining in popularity.

Historically, a substantial driver of the dominance of lifetime annuities has been taxation legislation, which included a compulsory requirement for new retirees to use a substantial portion of their pension pot at retirement to purchase a lifetime annuity. This compulsory purchase requirement has been relaxed somewhat in the last 10-15 years but its legacy, and the regulatory requirement to provide "best advice", retain a significant influence on the composition of the UK market.

The compulsory purchase requirement stifled the emergence of allocated pension equivalents, which only began to appear in the mid 1990s. Generally, allocated pensions have been regarded as unsuitable for lower fund balances. However, views over the minimum suitable balance vary greatly. The fee structure for allocated pensions seems to have contributed, in part, to the continuing dominance of lifetime annuities.

Compulsory lifetime annuity purchase can now be deferred beyond nominated retirement age, in favour of purchasing an allocated pension. However, retirees are generally still required to convert to a lifetime annuity by age 75 (with some limited alternatives).

The dominance of lifetime annuities has spawned considerable innovation in the lifetime annuity market. The most notable innovation has been the emergence of enhanced annuities (also known as impaired life or substandard annuities until the marketing department took charge of writing the brochures!). These annuities are effectively cherry-picking good (i.e. unhealthy) annuity risks.

Other developments have included the emergence of with-profits annuities, investment-linked annuities and annuitised funds. As noted earlier, Asteron's ALIS product is an example of an annuitised fund which also incorporates a deferment feature.

With-profits and investment-linked annuities have been available in the UK for many years (since before the introduction of allocated pensions). Annuitised funds have been a more recent entrant earlier this decade. However, the combined market share of these product variants is very small indeed. Thus, despite the potential technical merits of these innovations, to date, none has been a sustained success. With-profits annuities experienced some sales success but a major provider was the Equitable - the product has suffered from poor press in recent times and new business market share is now small. Thus, the UK retirement income market (outside of defined benefit schemes) remains dominated by lifetime annuities and to a lesser extent allocated pensions.

Variable annuities are another key innovation, originating in the US, now with a significant presence in Japan and developing a foothold in Europe and other parts of Asia.

Our colleagues have advised us that lifetime annuities hold a relatively small market share compared to other retirement income products in the US and Japan. Also, although pure longevity insurance is offered by some providers in the US, in the form of deferred lifetime annuities which can vest at more advanced age, sales of these products are very limited at present and we understand are often only available to the group market.

APPENDIX A

Assumptions

The results presented in this paper are based on projections that require various assumptions for mortality experience, product parameters and economic parameters/assumptions. This appendix provides a summary of key assumptions.

Mortality

The base tables for mortality were the Australian Life Tables 2000-02. The base table was adjusted to reflect lighter expected mortality rates for allocated pensioners. We elected to adopt 75% of table at age 60 grading to 95% of table at age 100+. We also included an allowance for mortality improvements using a "cohort" basis of improvement.

Product Design

The major allocated pension product design assumptions are:

- Pension Income drawn 100% from Cash, annually in advance;
- Portfolio rebalanced once per year on pension anniversary date;
- Indexation
  - Assumed to occur annually in arrears on pension anniversary date;
  - Base assumption is indexation equal to 100% of the prior year's increase in CPI.
- Fees deducted annually from year end account balance as follows;

— Cash	1.50% of account balance per annum
— Australian Fixed Interest	1.50% of account balance per annum
— Australian Equities	2.00% of account balance per annum

For a 25/25/50 cash/fixed interest/equity asset mix, this implies an allocated pension fee of 1.75% per annum.

The lifetime annuity is assumed to be priced at an implicit 0.85% per annum gross fee/margin.

Economic Parameters/Assumptions

Stochastic scenarios were produced using Towers Perrin's Capital Market Scenario Generator, Global CAP:Link.

CAP:Link was used to produce stochastic simulations of price inflation and relevant asset class returns (cash, Australian fixed interest and Australian equities), using CAP:Link's standard assumption set and correlation factors.

The simulations were based on an initial 10-year Australian government bond yield of 6.05% as at 31 March 2008. The asset class simulations implied the following long-run average risk premiums relative to the simulated government bond yield:

- equity risk premium: a little over +4% per annum;
- fixed interest risk premium: a little under +1% per annum;
- cash risk "premium": approximately -1% per annum.

Our projections also required the following initial information regarding the Age Pension:

- Single Payment Rate (fortnightly) $547
- Single Payment Means-Test Pension Base $166,750

APPENDIX B

Projections

Chart B.1 Fund Depletion Histogram

Annual Income Target = $35,000 (Income indexed at CPI, Age Pension indexed at CPI plus 2%), 50% Growth

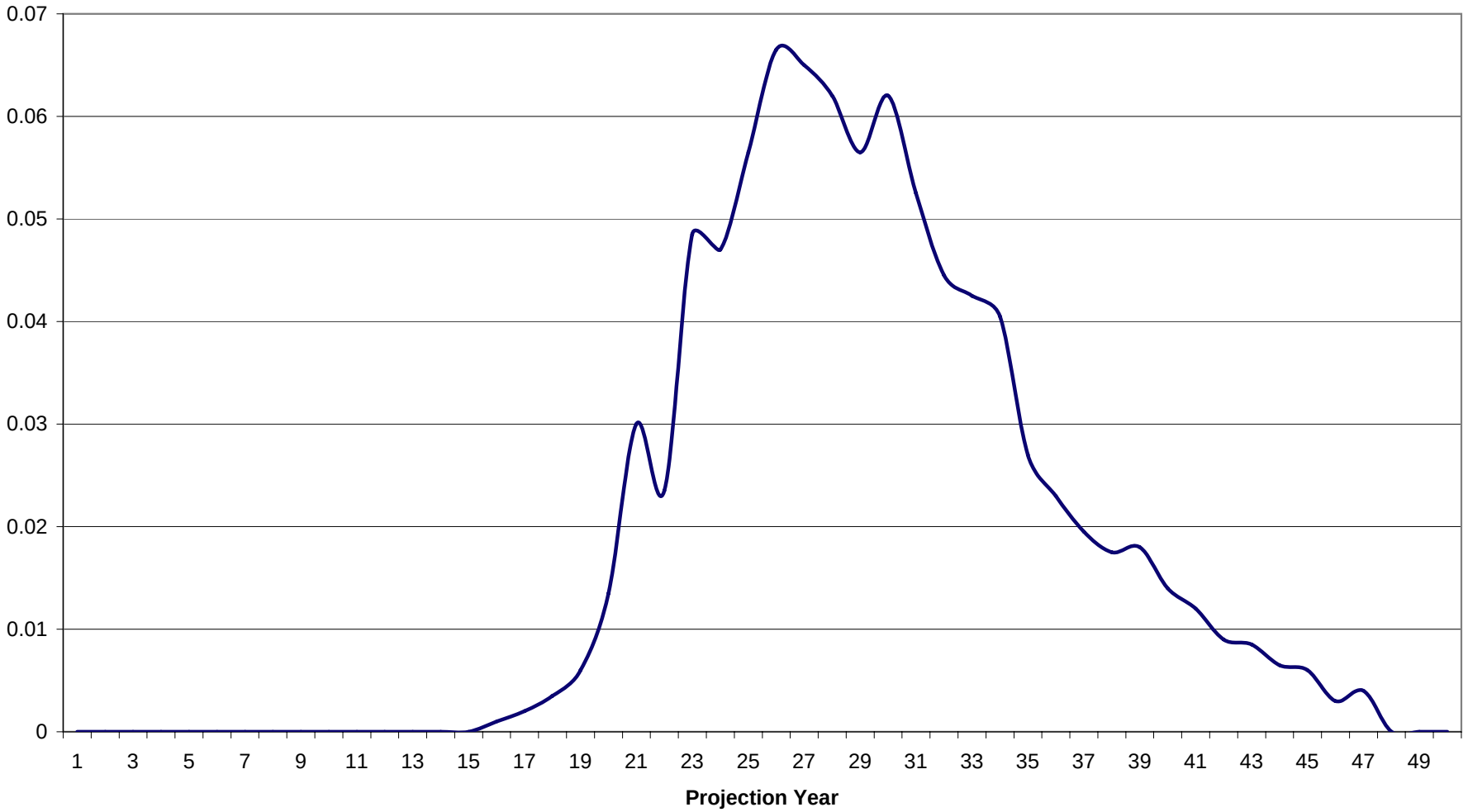


Chart B.2 Projected Account Based Pension Fund Balance

Annual Income Target = $35,000 (Income indexed at CPI, Age Pension indexed at CPI plus 2%), 50% Growth

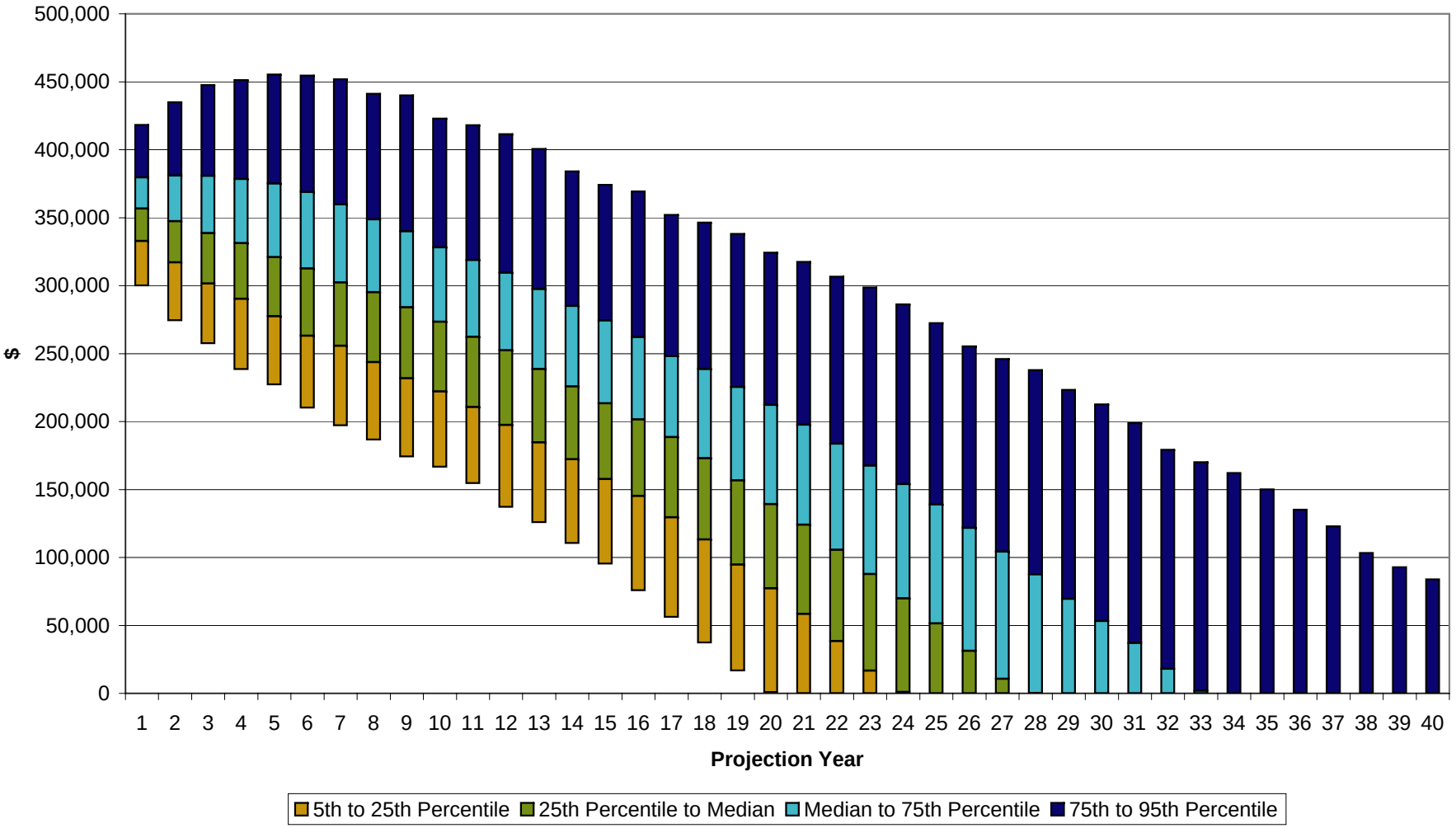


Chart B.3 Projected Total Income

Annual Income Target = $35,000 (Income indexed at CPI, Age Pension indexed at CPI plus 2%), 50% Growth

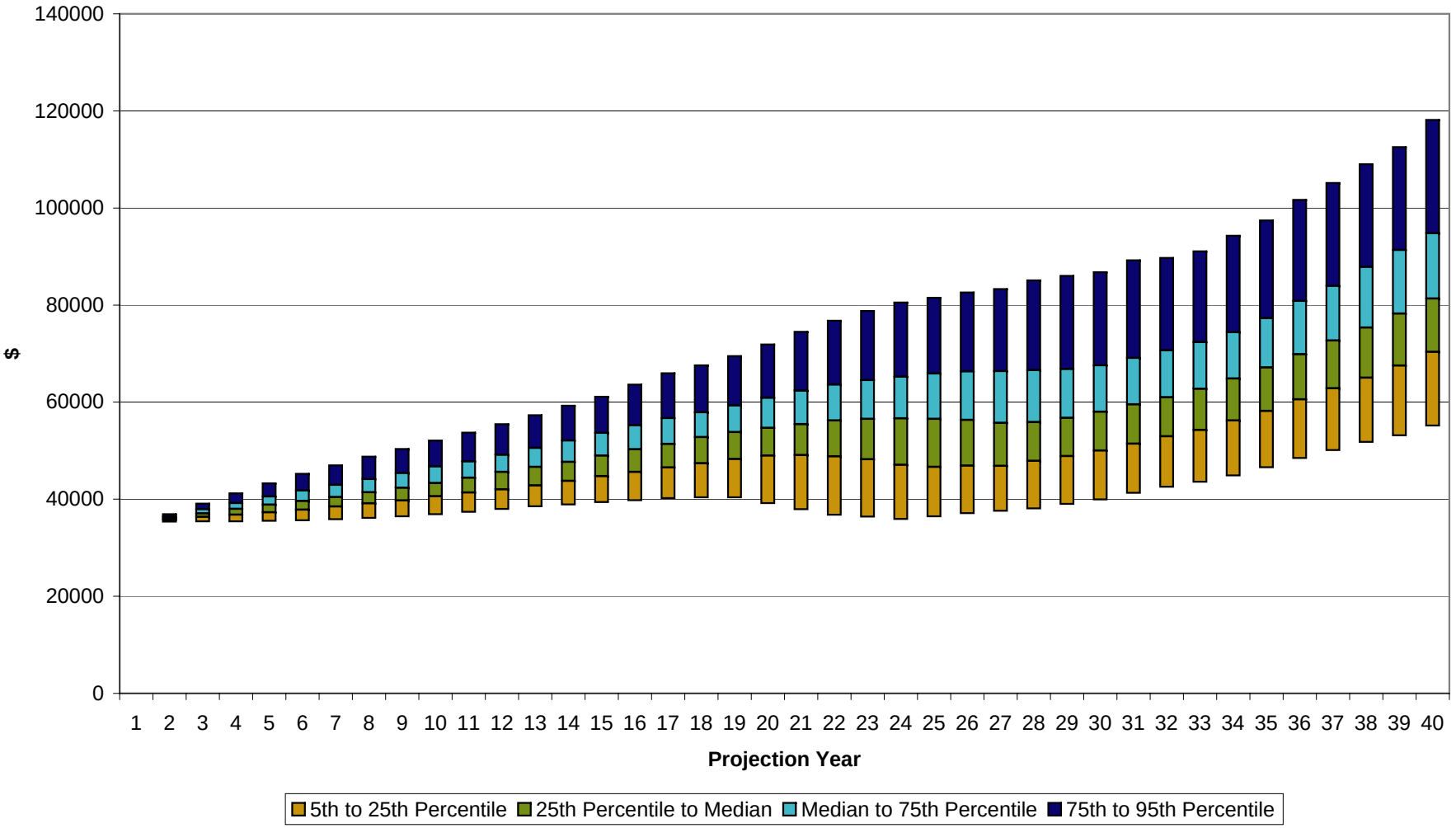


Chart B.4 Projected Age Pension

Annual Income Target = $35,000 (Income indexed at CPI, Age Pension indexed at CPI plus 2%), 50% Growth

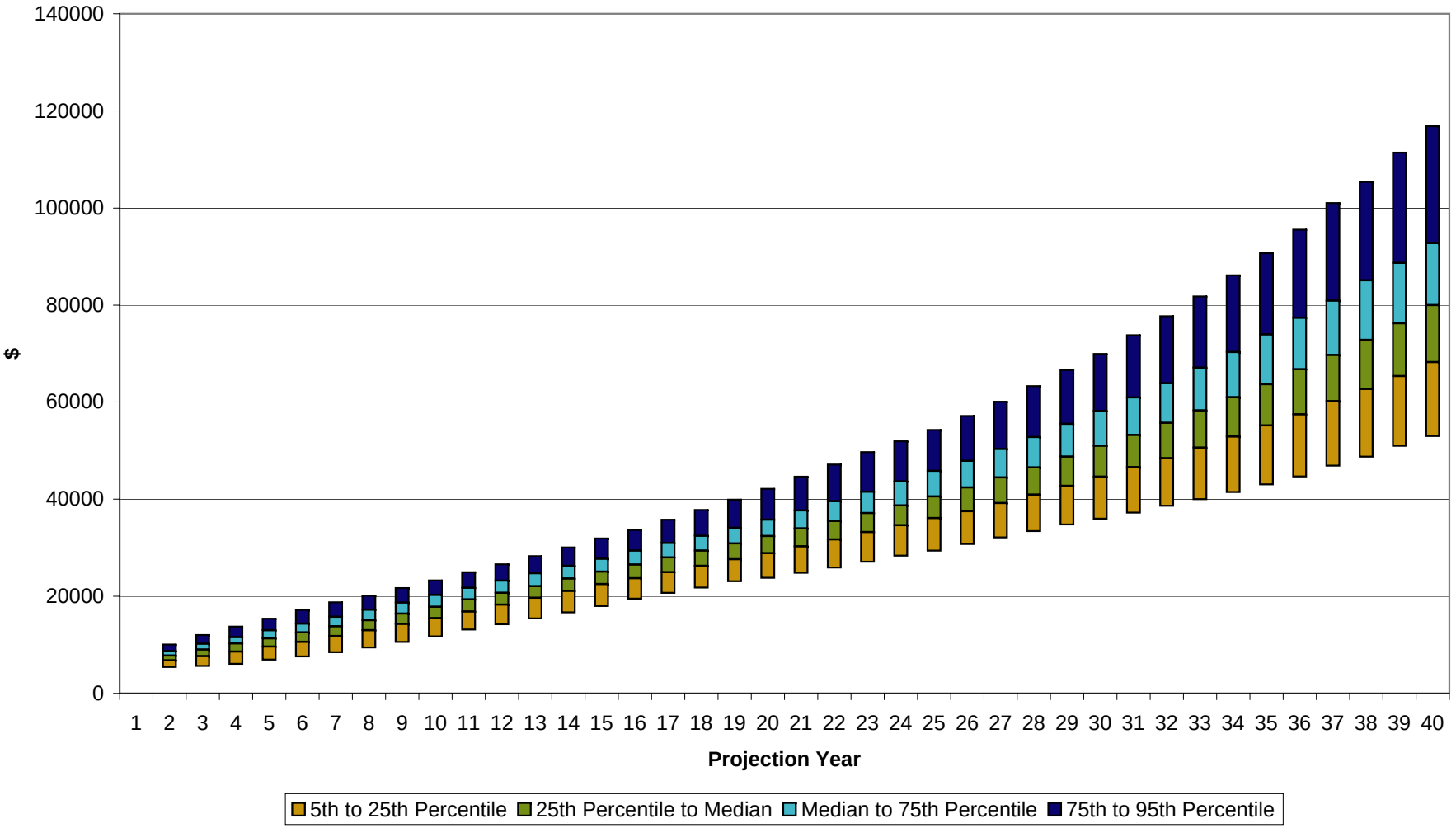


Chart B.5 Projected Account Based Pension Income

Annual Income Target = $35,000 (Income indexed at CPI, Age Pension indexed at CPI plus 2%), 50% Growth

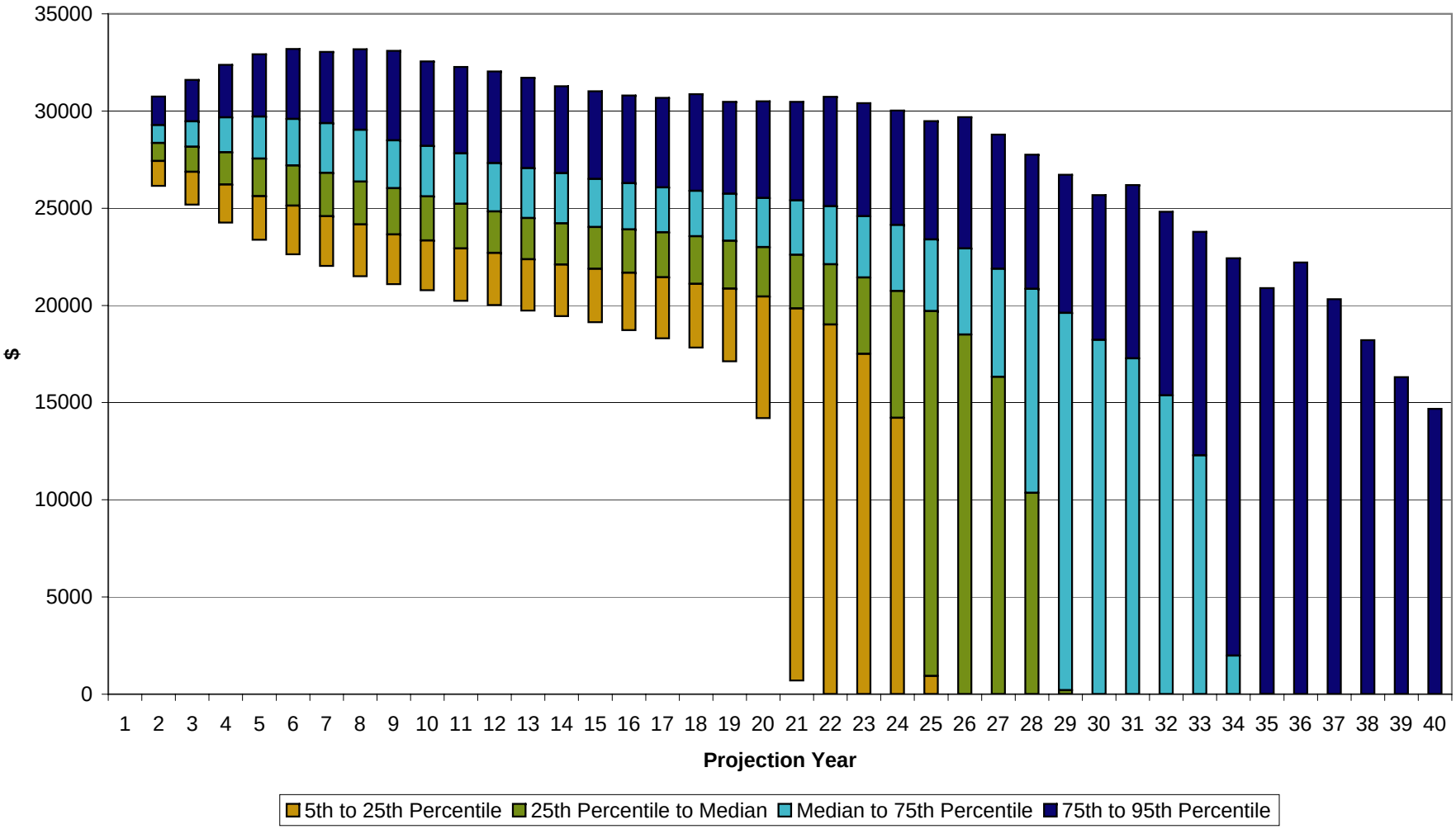


Chart B.6 Fund Depletion Histogram

Annual Income Target = $35,000 (Income and Age Pension indexed at CPI plus 2%), 50% Growth

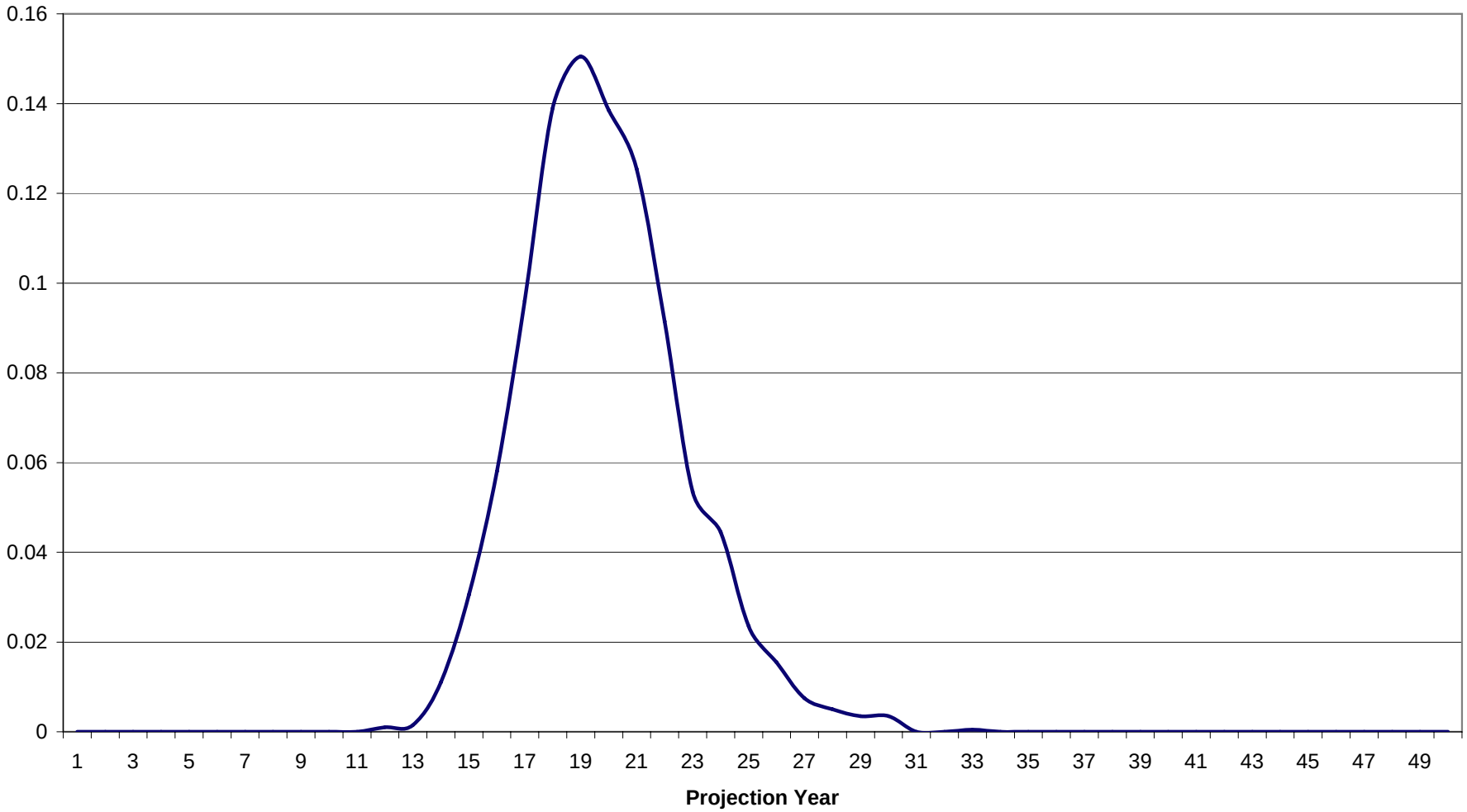


Chart B.7 Projected Account Based Pension Fund Balance

Annual Income Target = $35,000 (Income and Age Pension indexed at CPI plus 2%), 50% Growth

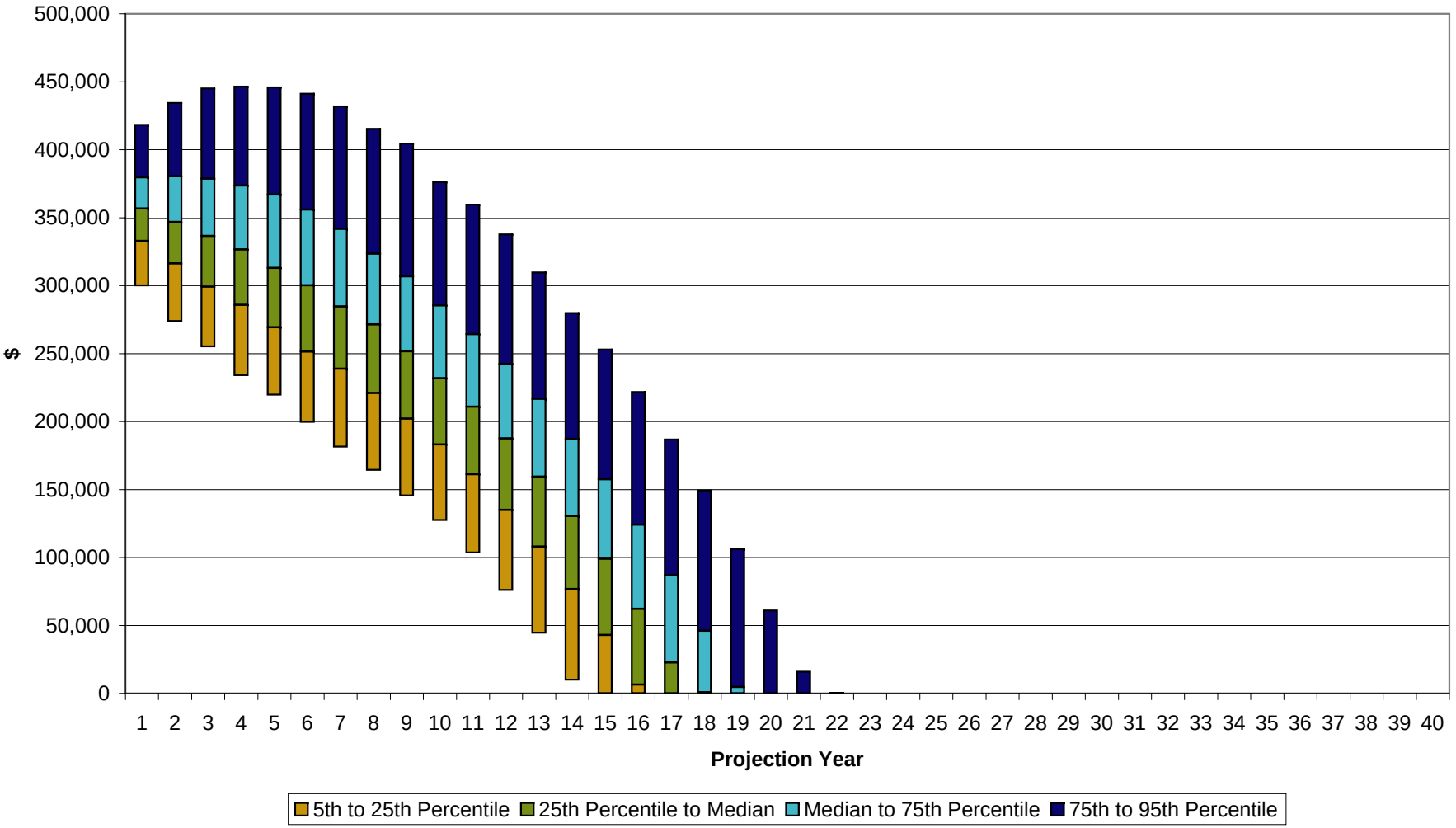


Chart B.8 Projected Total Income

Annual Income Target = $35,000 (Income and Age Pension indexed at CPI plus 2%), 50% Growth

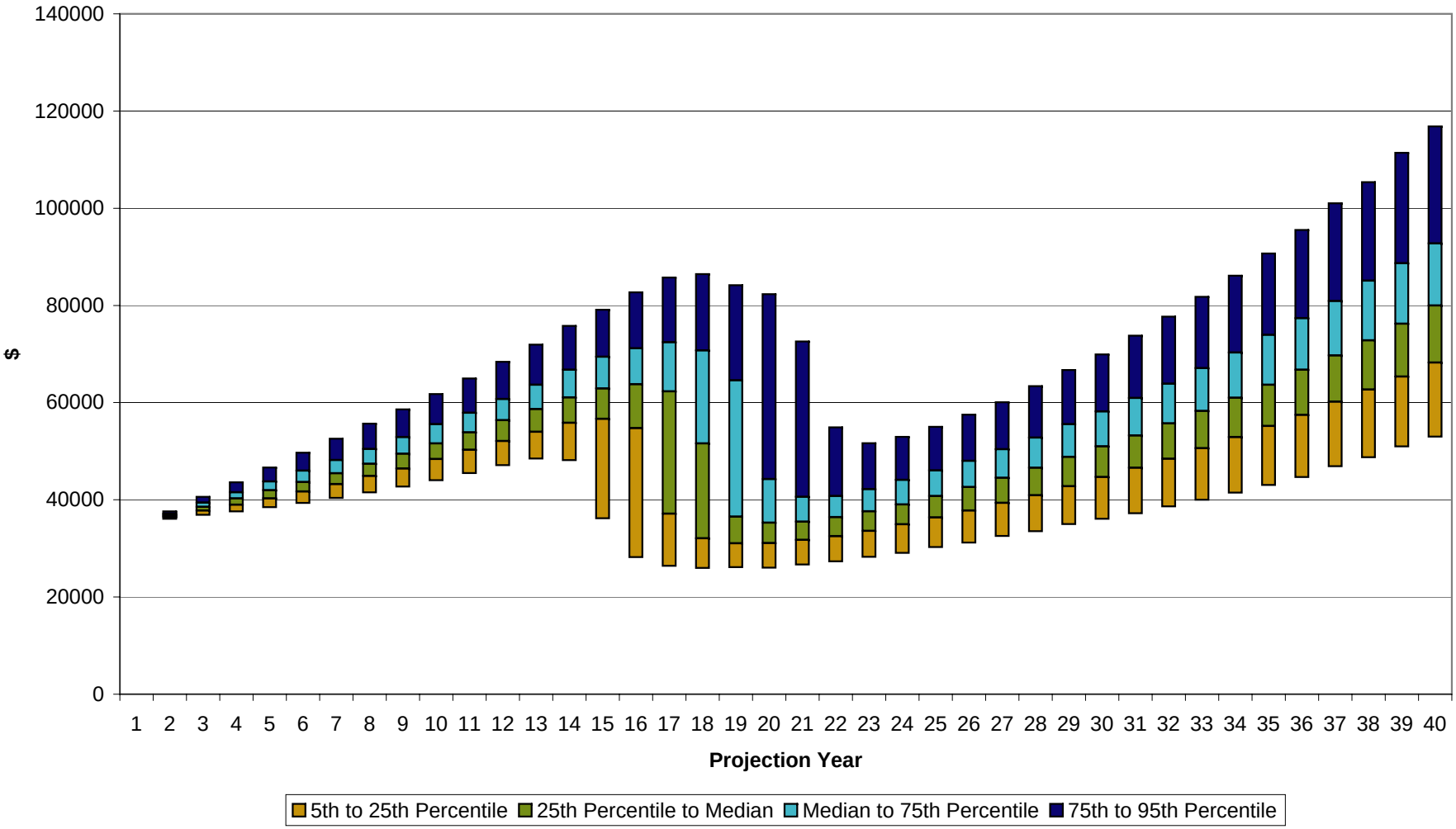


Chart B.9 Projected Age Pension

Annual Income Target = $35,000 (Income and Age Pension indexed at CPI plus 2%), 50% Growth

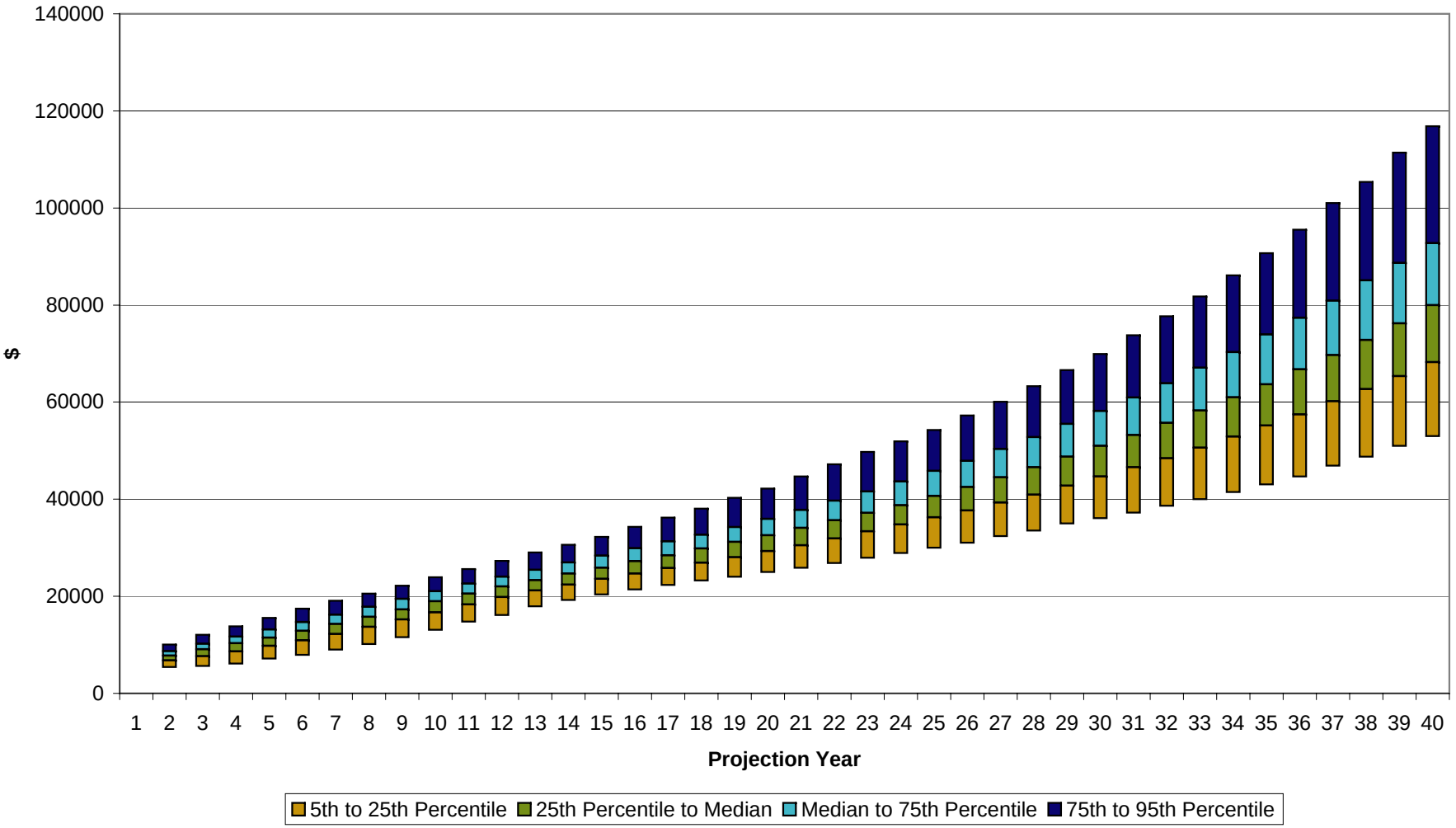


Chart B.10 Projected Account Based Pension Income

Annual Income Target = $35,000 (Income and Age Pension indexed at CPI plus 2%), 50% Growth

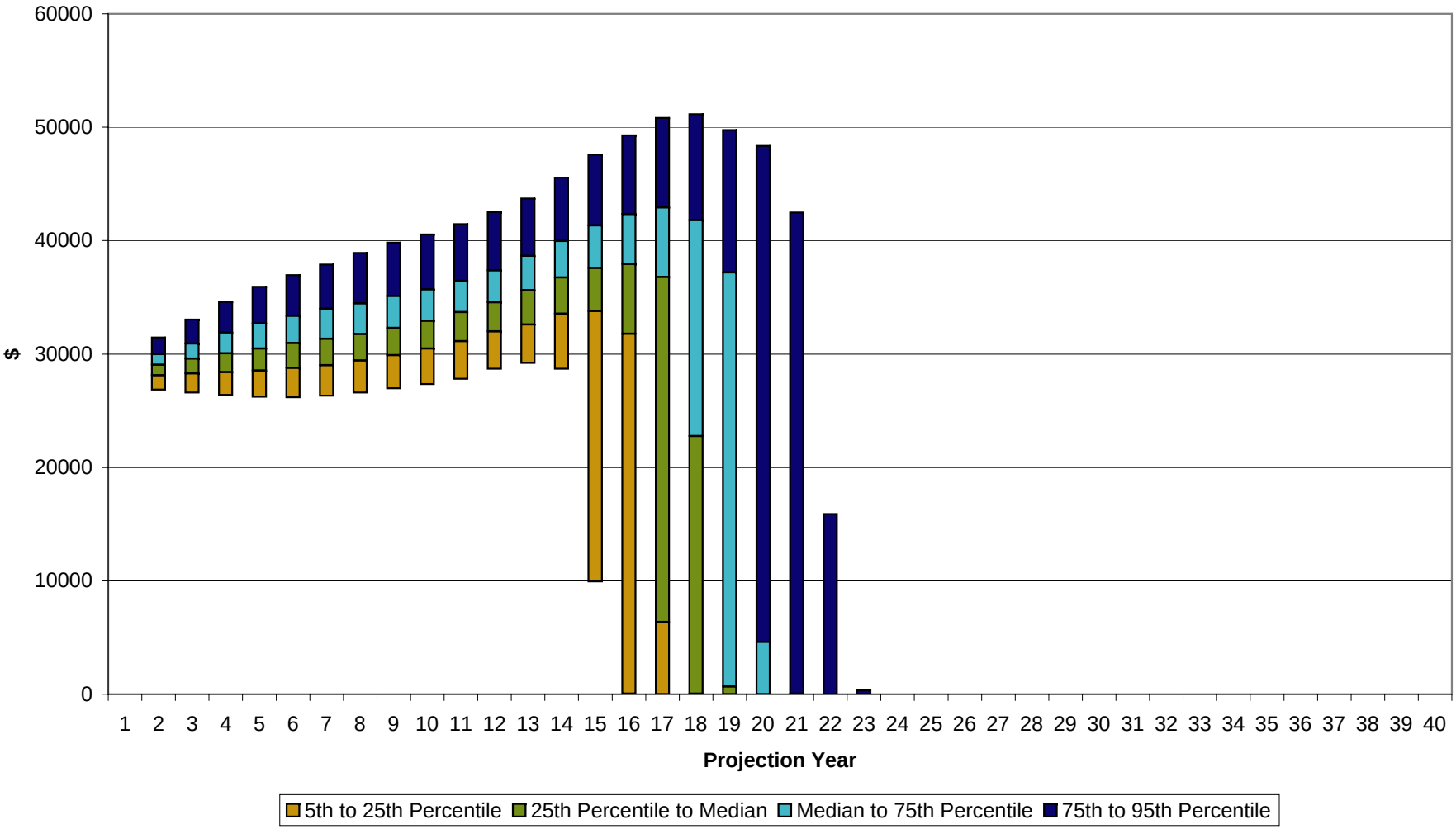


Chart B.11 Fund Depletion Histogram

Annual Income Target = $35,000 (indexed at CPI), 50% Growth

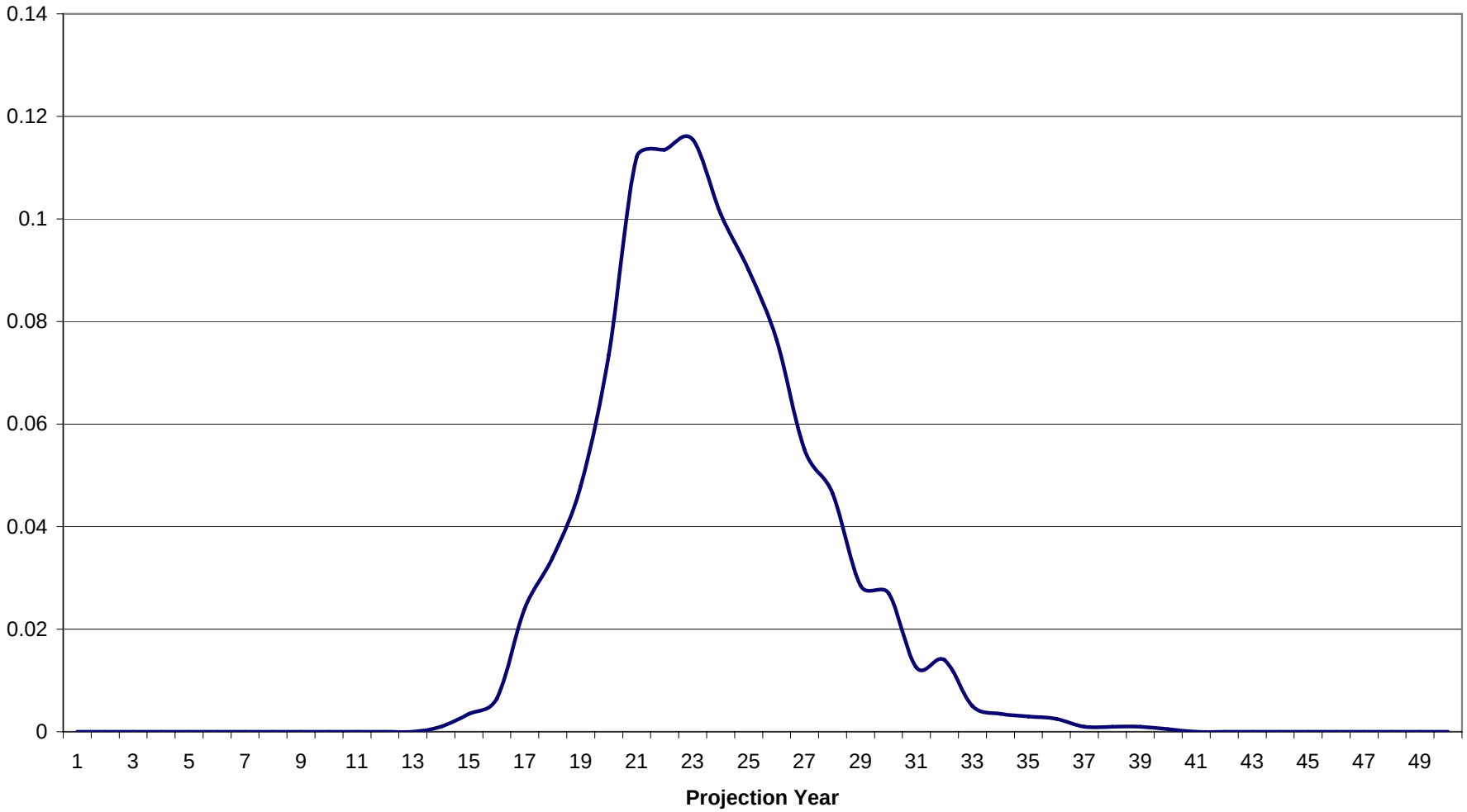


Chart B.12 Projected Account Based Pension Fund Balance
Annual Income Target = $35,000 (indexed at CPI), 50% Growth

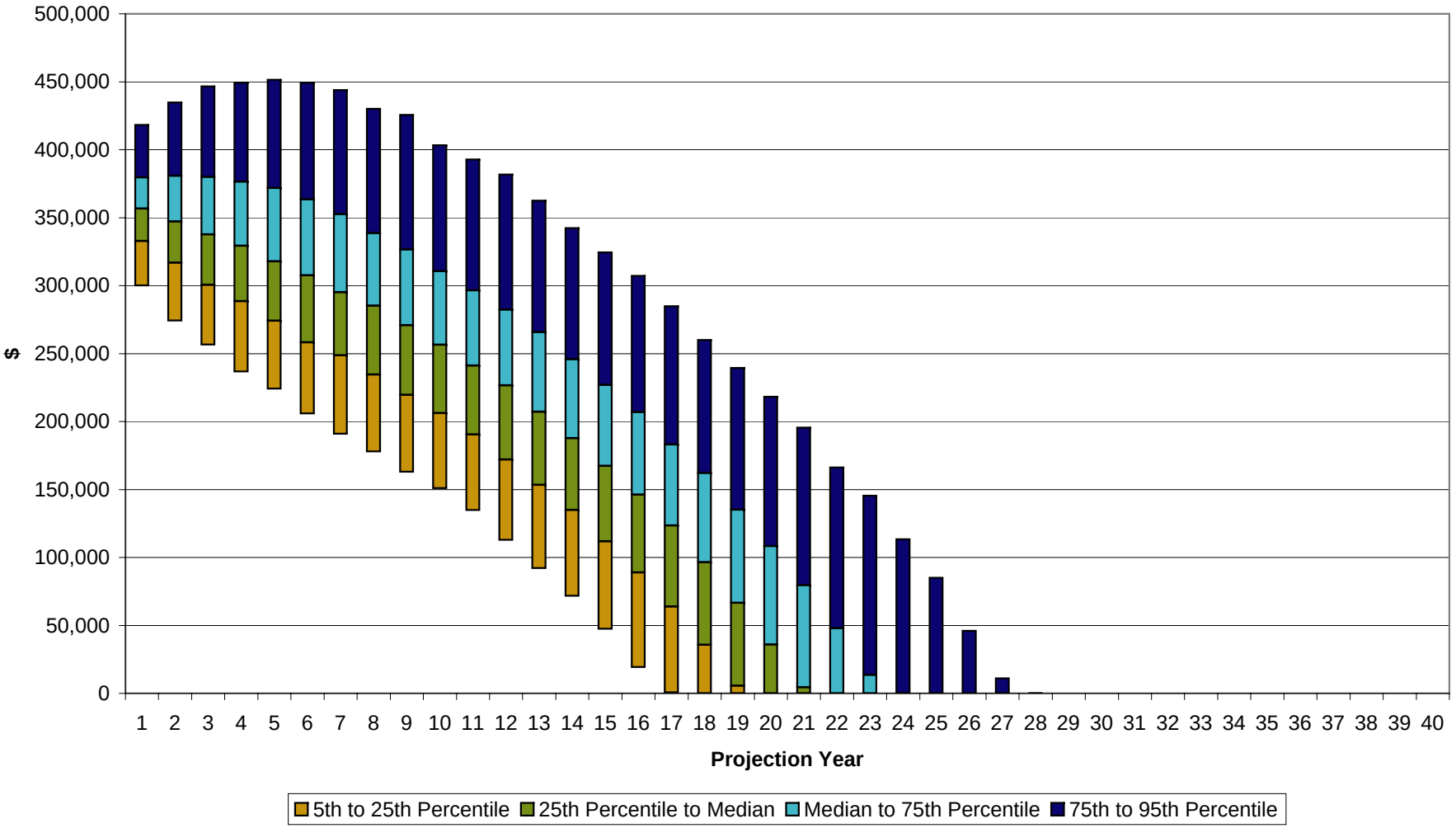


Chart B.13 Projected Total Income

Annual Income Target = $35,000 (indexed at CPI), 50% Growth

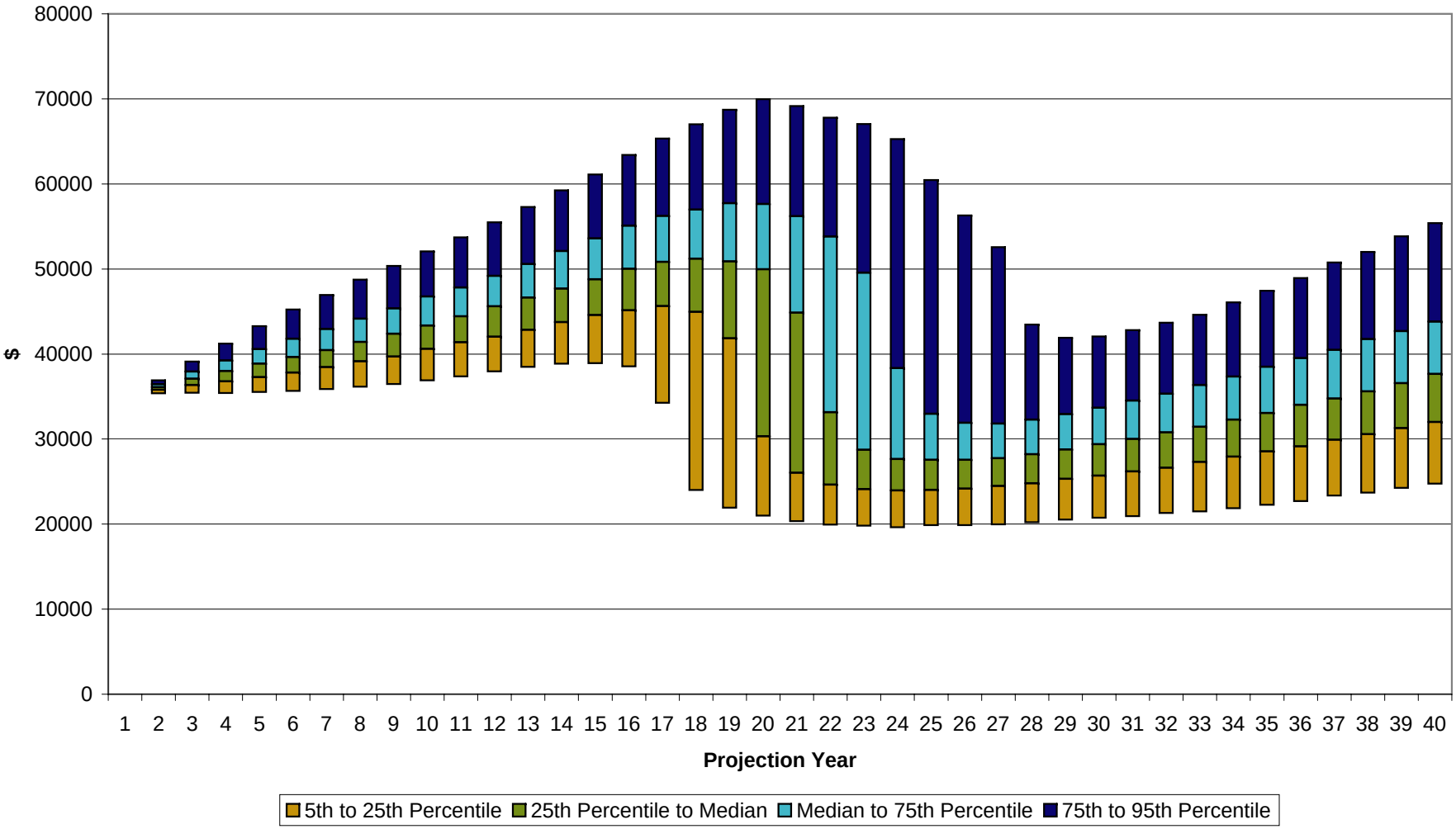


Chart B.14 Projected Age Pension

Annual Income Target = $35,000 (indexed at CPI), 50% Growth

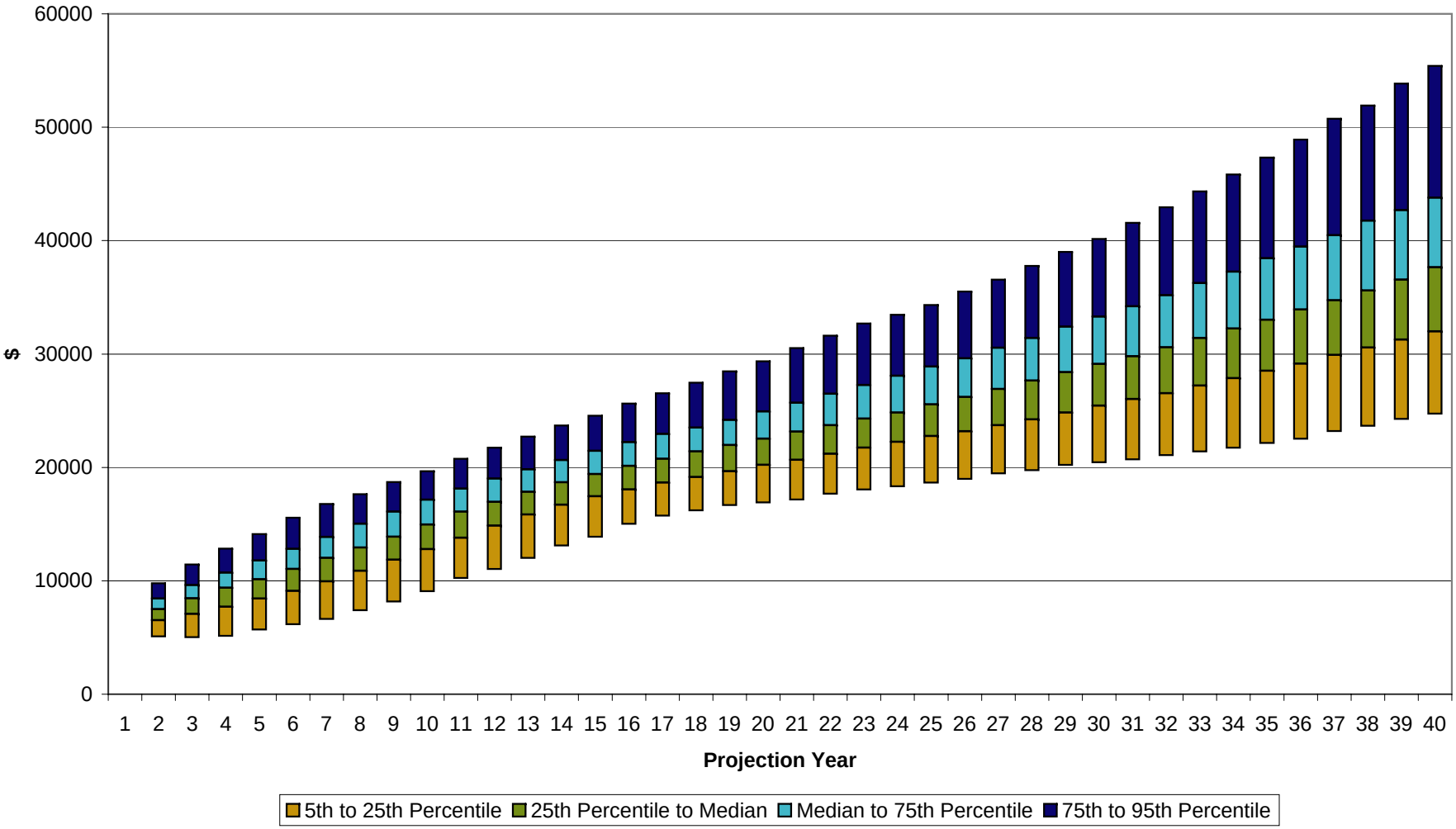
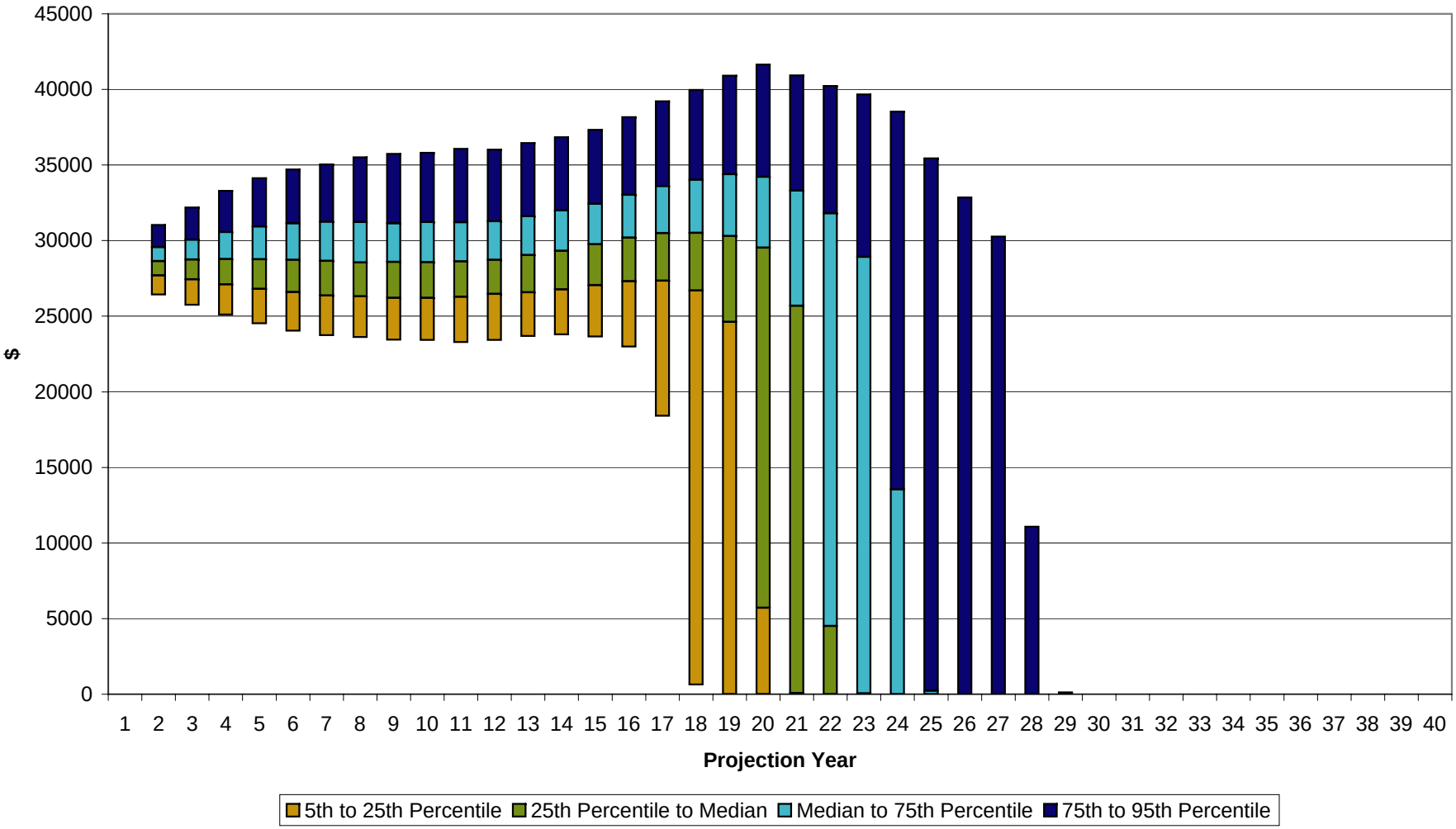


Chart B.15 Projected Account Based Pension Income

Annual Income Target = $35,000 (indexed at CPI), 50% Growth



APPENDIX C

Simplifying Assumptions/Factors

The results presented in this paper are based on a number of simplifying assumptions. In practice, a number of other factors related to mortality, pricing and performance will come into play and affect how the SRP emerges over time.

For the purposes of projecting the age pension and allocated pension in section 4, we made the following simplifying assumptions:

- Income was assumed to be payable annually in advance.
- The age pension single payment rate is assumed to be indexed once per year.
- The asset means test thresholds are assumed to be indexed by CPI.
- The allocated pension fund balance is assumed to be subject only to the assets test. We have ignored the income test and we have also assumed that the retiree holds no other assets other than the super fund balance and a principal residence.

Key simplifying assumptions underlying the calculation of the SRP were as follows:

- No allowance has been made for the interaction of the age pension when assessing the SRP.
- The mortality of the individual retiree is assumed to be consistent with the mortality basis assumed in the pricing of the lifetime annuity.
- No allowance has been made for changes in the annuity pricing basis over time.
- No allowance has been made for the term structure of interest rates.
- The like-for-like calculations for the roll-forward of the lifetime annuity and allocated pension in section 6.4.1 have adopted a deterministic basis rather than a stochastic basis.
- We have assumed that the mortality rate for an individual is known with certainty from year to year. In practice, this parameter uncertainty would be a further source of risk.

APPENDIX D

Survivor Risk Premium

Our calculations of the simplified Survivor Risk Premium in section 6.3 are based on a lifetime annuity due making annual payments.

The formula for the present value of this lifetime annuity for a life aged *x* at t = 0 is as follows:

$$\ddot{a}_x = 1 + p_x v + {}_2p_x v^2 + {}_3p_x v^3 + {}_4p_x v^4 \ldots\ldots.$$

where

$$v = 1 / (1 + i)$$

At time t = 1, if the annuitant is still alive, the present value of the lifetime annuity is as follows:

$$\ddot{a}_{x+1} = 1 + p_{x+1} v + {}_2p_{x+1} v^2 + {}_3p_{x+1} v^3 + {}_4p_{x+1} v^4 \ldots\ldots$$

$$= [1/p_x \,].\, (p_x + p_x . p_{x+1} v + p_x . {}_2p_{x+1} v^2 + p_x . {}_3p_{x+1} v^3 \ldots\ldots)$$

which, since ${}_{t+1}p_x = p_x \,.\, {}_tp_{x+1}$, becomes

$$\ddot{a}_{x+1} = [1/p_x \,].\, (p_x + {}_2p_x v + {}_3p_x v^2 + {}_4p_x v^3 \ldots\ldots..)$$

rearranging gives

$$p_x \ddot{a}_{x+1} = (p_x + {}_2p_x v + {}_3p_x v^2 + {}_4p_x v^3 \ldots\ldots..) \qquad (1)$$

To calculate the value of the SRP, we equate the present value of the lifetime annuity at t = 1 to the rolled forward allocated pension.

At t = 0 the value of the allocated pension fund, F_0, is equal to the present value of the lifetime annuity at that date. That is,

$$F_0 = \ddot{a}_x$$

Since we're assuming that the allocated pension fund is earning interest at the rate anticipated in the annuity pricing basis, at t = 1, the fund has paid $1 of income and has earned interest of i%.

So we have

$$F_1 = (\ddot{a}_x - 1) \cdot (1 + i)$$

Substituting in the formula for $\ddot{a}_x$ gives

$$F_1 = (1 + p_x v + {}_2p_x v^2 + {}_3p_x v^3 + {}_4p_x v^4 \ldots\ldots - 1) \cdot (1 + i)$$

which simplifies to

$$F_1 = (p_x + {}_2p_x v + {}_3p_x v^2 + {}_4p_x v^3 \ldots\ldots)$$

We can see that the right hand side is the same as the right hand side of equation (1). So we have,

$$\ddot{a}_{x+1} = (1/p_x) \cdot F_1 \qquad (2)$$

The SRP at t = 1 is the difference between the present value of the lifetime annuity and the allocated pension fund at that date. That is

$$SRP = (\ddot{a}_{x+1} - F_1) / F_1$$

Using (2) we have

$$SRP = ((1/p_x) \cdot F_1 - F_1) / F_1$$

which simplifies to

$$SRP = (1 - p_x) / p_x \text{ or equivalently } SRP = q_x / (1 - q_x)$$