Institute of Actuaries of Australia

A Review of Design and Hedging Strategies for Modern Australian Investment Guarantee Products

Prepared by Patrick Brennan, John Nicholls and Zac Roberts

20 September 2007

Presented to the Institute of Actuaries of Australia
Biennial Convention 23-26 September 2007
Christchurch, New Zealand

The Institute of Actuaries of Australia
Level 7 Challis House 4 Martin Place
Sydney NSW Australia 2000
Telephone: +61 2 9233 3466 Facsimile: +61 2 9233 3446
Email: actuaries@actuaries.asn.au Website: www.actuaries.asn.au

Table of Contents

1. INTRODUCTION

1.1 Key Words

Investment Guarantee, Hedge, ALM, Stochastic, Risk-Neutral, Market-Consistent, Superannuation, Retirement

1.2 Purpose

We discuss the potential demand for investment guarantees in Australia and describe products that are likely to meet that demand. We examine the cost and effectiveness of alternative risk management approaches (e.g. hedging) from the product manufacturer's perspective and the cost / benefit implications for investors.

1.3 Synopsis

While investment guarantees are not common in Australia, legislative and demographic changes, combined with the attractiveness of modern investment guarantee products, may stimulate demand. We view this as an opportunity for product manufacturers to meet a growing market need and earn additional margins on a risk-adjusted basis by offering investment guarantees and using sophisticated techniques to manage the associated investment risk.

This paper examines:

- the potential demand for products with investment guarantees in Australia and how factors such as changes to superannuation and taxation legislation, the ageing of the population and the emergence of attractive, flexible products with simple investment guarantees may influence the evolution of this demand;

- a range of product designs that could be used to satisfy the demand for investment guarantees;

- the theoretical market-consistent cost of providing investment guarantees;

- the attraction for an investor of purchasing a product with an investment guarantee; and

- alternative strategies for managing the investment risk associated with these products.

1.4 Summary of Conclusions

The Australian investment guarantee market is under-developed compared to other major financial markets, where investors can purchase open entry investment products that invest in growth assets and yet have an investment guarantee.

Legislative and demographic factors will drive an increase in the number of individuals with significant assets making investment decisions regarding their retirement. Further demographic factors will cause an increase in longevity and the associated health cost risks of older age, which could mean that a conservative investment strategy may not generate sufficient returns to fund the desired lifestyle of a large number of these retirees. However, the limited ability of most retirees to earn additional income means that a portfolio comprising a large proportion of "risky" growth assets may not be a suitable investment for an average retiree. This should stimulate demand for financial products that provide investment guarantees over growth assets.

Improvements in financial hedging and modelling techniques should enable financial services providers to manage the associated investment risk well enough to take advantage of this demand by introducing flexible, open entry products with simple investment guarantees. This has already occurred in some of the major markets overseas.

Based on the analysis performed, we conclude that an accumulation product that provides a guaranteed interest rate of 0% over a 5 year period could have a theoretical guarantee cost in the range of 0.5% to 0.7% pa. A draw-down product that provides a guaranteed interest rate of 3% over a 15 year period could have a theoretical guarantee cost in the same range. A higher guaranteed interest rate is achievable for the draw-down product due to the longer duration of the guarantee.

A product with a lower guaranteed interest rate that resets regularly over the investment period could be used to more efficiently protect against large market down-turns, while "locking-in" excess returns over shorter periods. For example, a 15 year draw-down product with a guaranteed interest rate of 0% that “locks-in” excess returns on an annual basis could have a theoretical guarantee cost in the same range.

The analysis also highlighted the attractiveness of simple investment guarantees for individuals wishing to protect their assets from large market down-turns without eliminating their upside exposure to growth asset classes. For an investor with an asset mix comprising 75% equities and 25% bonds, introducing an investment guarantee can result in a greater expected return and more protection from market down-turns than switching to a more conservative asset mix, such as 50% equities and 50% bonds.

While a range of strategies can be used to manage the investment risk associated with providing investment guarantees, many of the larger international providers use dynamic financial hedging. A cost / benefit analysis of a number of dynamic hedging strategies highlights the importance of selecting an appropriate hedging approach.

The keys to success for investment guarantee manufacturers are to design an investment guarantee that is affordable and attractive to investors, creates a manageable investment risk and is profitable to the guarantee manufacturer. Given the relatively small size of many players in the Australian wealth management industry, it may be more efficient for the Australian market to develop specialist investment guarantee manufacturers, with retailers able to offer these guarantees as additional features on their existing investment platforms. This would help guarantee manufacturers achieve adequate scale, while still giving retailers the ability to package the guarantees as their own.

2. AUSTRALIAN ENVIRONMENT

The Australian super system is the envy of the world, but any back-slapping should be tempered by the realisation that the fate of most people's retirement savings is now increasingly linked to world stockmarkets…. Despite the system's grandiloquent title of Superannuation Guarantee, most members don't have any guarantee on their payouts if markets turn nasty – and after they retire most will still rely on market-based investment accounts to pay their funded pensions. (AFR Opinion Editor, 2007)

Super assets now are slightly larger than the national GDP figure and also exceed the total market value of the Australian stockmarket…. Gary Weaven (chairman of Industry Funds Management) has forecast further spectacular market growth, predicting that total assets will quadruple from $1 trillion now to $4 trillion in just 13 years. (Dunstan, 2007)

If you work in the financial services industry these quotes should have grabbed your attention.

2.1 Demand for Investment Guarantees in Australia

Over the next few decades there will be an unprecedented number of Australians approaching retirement with a significant amount of assets in their superannuation accounts. Much of this wealth is currently invested in growth oriented asset classes, but these asset classes are subject to the risk of losses due to market falls. The limited ability of most retirees to earn additional income means that a portfolio comprising a large proportion of "risky" growth assets may not be a suitable investment for an average retiree.

While retirees are therefore normally associated with more risk-averse investment strategies, current individuals approaching retirement have become accustomed to higher "market-linked" returns. Thus, investment products that offer participation in market gains, while providing downside protection, may be very attractive to these individuals. In particular, the following factors may stimulate investor demand for products with investment guarantees over growth assets.

Legislative factors

An increasing proportion of individuals are determining their own superannuation investment decisions.

- The total money in defined benefit funds has decreased from 22% of total superannuation assets in June 1995 to 9% in June 2006 (APRA, 2007).

- Over this period the total dollar amount in defined benefit funds has increased by 60%, but this has been offset by the fact that the total dollar amount in accumulation funds and hybrid funds has more than quadrupled (APRA, 2007).

Superannuation legislation and taxation changes will drive an increase in superannuation assets, for both pre-retirees and post-retirees.

- The average account size for industry, public sector and retail fund members has increased by 43% over the five years to 30 June 2006 (APRA, 2007). Given that the superannuation guarantee (compulsory superannuation) only commenced in 1992 and only reached a contribution rate of 9% of income in 2002 (APRA, 2007), it will take until approximately 2030 before new retirees will have been contributing to their super at today's levels for most of their working life. This means that we can expect the average account size to keep increasing over the coming few decades.

- The recently introduced increased additional post-tax contribution limits, and the once off $1m opportunity in 2007, will contribute to further growth in superannuation assets. In fact, one fund manager received additional superannuation contributions of $700m ($1m from each of 700 clients) in the period from March 1 to April 30 this year (Swift, 2007).

- The removal of tax on superannuation investment income and withdrawals from age 60 is likely to encourage more individuals to retain their assets in the superannuation environment after their retirement.

Demographic factors

The ageing of the baby boomers means that new retirees with substantial superannuation assets will become a larger sector of the investment market.

- The proportion of the Australian population aged 65 or above increased from 11.4% to 13.4% in the 15 years from 1991 to 2006. This has been projected to increase to 18.7% by 2021, and to 23.4% by 2036 (Productivity Commission, 2005).

Increasing life expectancy will mean that future retirees will need to live off their superannuation assets for longer, while the associated health cost risks of older age will increase the retirement assets required.

- Life expectancy for 65 year old males and females increased by approximately 2 years in the 10 years from 1995 to 2005 (Australian Bureau of Statistics, 2005). This trend is not showing any sign of reversing.

- Technological advancements in health care mean that the cost of sustaining individuals in their old age is likely to continue to rise.

Attractiveness of modern investment guarantee products

Investment guarantee products that combine participation in growth assets with protection against market downturns in a flexible product design are likely to be quite attractive to today's investors.

- The analysis presented in this paper shows that for an individual with an asset mix of 75% equities and 25% bonds, maintaining their existing asset mix and incorporating a cleverly designed investment guarantee can result in a more favourable risk and return situation than switching to a more conservative asset mix.

- A 2007 Tillinghast survey (Tillinghast, 2007) sent to major industry, public sector and corporate superannuation funds in Australia indicated that 75% of respondents believe that investment options which invest in growth assets and yet have a capital guarantee or capital protection have a role to play in a member's superannuation investment strategy.

- This same survey indicates that less than 10% of respondents believe that it is unlikely that the superannuation industry will develop this type of guaranteed investment option for retirees within the next five years.

2.2 Investment Guarantees Available in Australia and Overseas

Legislative and demographic factors will drive an increase in the number of pre and post retirees and their level of superannuation assets. Changing life expectancy and health care costs could mean that a conservative investment strategy may not generate sufficient returns to fund the desired lifestyle of a large number of these retirees. However, a portfolio comprising a large proportion of “risky” growth assets may not be a suitable investment for an average retiree, who may have limited ability to earn additional income to make up for decreases in asset values. Combined, these factors should stimulate demand for investment guarantees over growth assets.

Given this background, it is worth examining the Australian investment guarantee market.

The investment guarantee market in Australia is currently dominated by conservative capital guaranteed funds and complicated “limited entry” capital guaranteed investments.

A number of superannuation funds and fund managers offer a capital guaranteed fund as an investment option. Many of these funds are invested in conservative assets, resulting in little investment risk for the fund manager, and limited upside potential for the investor.

Some fund managers and investment banks offer investments with upside participation in investment markets, combined with capital protection. Many of these investments offer little flexibility as they are generally open for a limited time, offer limited or no investment choice and have a single fixed maturity date, with the initial capital guaranteed at the maturity date only. Further, these products can often be difficult to understand, with the investment guarantee provider possessing the ability to adjust the asset mix in response to market conditions.

Thus, the majority of Australian capital guarantee products either have very limited upside potential, or are so sophisticated that their target market is likely to be a mixture of investment savvy individuals who will perhaps leverage into the products, and wealthy individuals who want to invest a portion of their wealth in an exotic investment.

When you compare the suite of products available in Australia to those in the US, Japan and more recently also in Europe, there is a glaring omission from the Australian market – products that give investors a choice of funds and provide simple investment guarantees over those funds. Table 2.1 summarises some of the features of these products.

TABLE 2.1

Typical Variable Annuity Guarantees in the US (Roberts, 2006)

Benefit	**Nature of Guarantee**	**Typical Terms**	**Typical Annual Charge**
GMDB (Death)	Lump sum on death, related to premiums paid	Either a premium roll-up (premiums accumulated at a specified annual rate) or a ratchet (initially set equal to the single premium then reviewed periodically and increased to the fund value, but never decreased). Typically to age 80.	15 – 35 bp
GMAB (Accumulation)	Lump sum at end of specified period	Generally a premium roll-up till maturity, though a ratchet is also possible.	25 - 75 bp
GMWB (Withdrawal)	Guaranteed drawdown via partial withdrawals	Return of premium via annual withdrawals equal to a specified percentage of the single premium. Guaranteed drawdown period is typically 14 years, but can be lifetime for older ages.	40 – 60 bp
GMIB (Income)	Guaranteed income at annuitisation	Guaranteed base for annuitisation (premium roll-up) combined with guaranteed purchase rate for annuity.	50 – 75 bp

As an example, there has been considerable recent interest in the US in “GMIB for life” products. These products generally consist of an accumulation phase and a draw-down phase. The underlying assets are maintained in a unit-linked environment, with the policyholder able to switch between investment funds (within limits). At the conclusion of the accumulation phase (often at retirement), a typical design gives the policyholder the ability to choose between:

- withdrawing the account balance as a lump sum;
- using the account balance to purchase a retirement product (e.g. term or lifetime annuity) at prevailing market rates; or
- electing to receive lifetime annuity payments based on a guaranteed interest rate, which is set at the start of the accumulation phase. Under this option, the policyholder's investments throughout the accumulation phase are rolled up at the guaranteed interest rate to calculate the base for annuitisation, with the lifetime annuity payments calculated using this same guaranteed interest rate.

Thus, under this product the policyholder is able to maintain exposure to growth assets while being assured of the minimum interest rate that will be earned over both the accumulation and draw-down phases of the product. This is the type of product that is missing from the Australian market – a product that would be suitable for the average individual to invest the majority of their retirement savings, their superannuation.

So why are products that give investors a choice of funds and provide simple investment guarantees over those funds not popular in Australia?

One factor may be the Australian wealth management industry's low appetite for the associated investment risk. This is partly due to the negative experience of many wealth managers who offered investment account products without adequately managing the associated investment risk.

Another factor may be the ownership structure of the Australian wealth management industry. Much of the product innovation undertaken by insurers overseas was driven by the desire for insurers to attract funds under management from mutual funds. However, as many of the players in the Australian wealth management industry conduct insurance and funds management businesses, there is less pressure for insurers to compete with fund managers in this space.

A further factor may be that the Australian insurance industry has developed in a manner that sees individuals buy separate insurance and savings products. In the major overseas markets where insurers provide products with simple investment guarantees, the guarantees were first introduced as guaranteed minimum death benefits within savings products. These guarantees then spread to cover living benefits such as guaranteed minimum accumulation, withdrawal and income benefits, so that investors now have a range of options that cover guarantees during both the accumulation and draw-down phases of their investment life-cycle.

2.3 Future Supply of Investment Guarantees in Australia

Despite their current unavailability, there are a number of factors that suggest that it may only be a matter of time before products with simple investment guarantees are available in Australia.

- Increasing investor demand, as outlined in Table 2.1.

- Improvements in financial hedging and modelling techniques, that may lead financial services providers to believe that they can manage the associated investment risk well enough to introduce products with simple investment guarantees. This has already occurred in some of the major markets overseas.

- The ability of multi-nationals to adapt successful product designs across countries. Several multi-nationals have already adapted US products to European markets, and there is no fundamental reason the same could not occur in Australia.

- The increasing sophistication of the superannuation industry. The average superannuation fund size for industry, public sector and retail funds has tripled to $1.9 billion over the five years to 30 June 2006 (APRA, 2007). This has been driven by an 87% increase in total assets, combined with consolidation among the superannuation funds. The increasing size of the average superannuation fund means that more funds will become large enough to consider more complicated products, such as products with investment guarantees over growth assets. This could lead to more intense competition amongst financial services providers, and alternative product designs may become a differentiating feature for product providers and superannuation funds to attract and retain investors.

The following quotes illustrate the sentiment amongst some industry participants regarding the inevitability of the introduction of simple investment guarantees.

…super funds will eventually embrace protected products as a way to "lock in" gains (Bailey, 2006)

"When the baby boomers start to understand that they will live a long time, there will be a clamour for products that can sustain a high living standard, but have some kind of guarantee as well. My observation is that most people don't know a lot about investments, so they want security more than anything else", Monaghan (Intech) says. The post-retirement products currently on the market will not be acceptable to most baby boomers, he believes. Baby boomers want the high returns which market-linked allocated pensions currently offer, but will not want to bear their downside risk, or the risk the may outlive them. (Bailey, 2006)

3. SIMPLE ACCUMULATION PHASE INVESTMENT GUARANTEES

This section introduces several simple investment guarantee designs and calculates the theoretical cost of each of these designs under a set of simplified economic conditions. For one of these designs we then analyse the cost and benefit of the investment guarantee by comparing the performance of an investment strategy with a high proportion of growth assets and an investment guarantee, to the performance of investment strategies with the same and lower proportions of growth assets and no investment guarantee. This analysis is undertaken using both 2,000 simulated economic scenarios and 50 actual economic scenarios.

The analysis suggests that a product that provides a guaranteed interest rate of 0% over a 5 year period could have a theoretical guarantee cost in the range of 0.5% to 0.7% pa. A product with a lower guaranteed interest rate that resets regularly over the 5 year period could be used to more efficiently protect against large market down-turns, while “locking-in” excess returns over shorter periods.

The analysis highlights the attractiveness of simple investment guarantees for individuals wishing to protect their assets from large market down-turns without eliminating their upside exposure to growth asset classes. For an investor with an asset mix comprising 75% equities and 25% bonds, introducing an investment guarantee can result in a greater expected return and more protection from market down-turns than switching to a more conservative asset mix, such as 50% equities and 50% bonds.

3.1 Guarantee Design Terminology

The investment guarantee designs in this paper are specified using three parameters; the Guarantee Term, the Guaranteed Interest Rate, and the Guarantee Reset Frequency.

The Guarantee Term

Each guarantee design covers a specific investment time horizon. The investment guarantee arises from the fact that at the end of the guarantee term, the investor is entitled to the greater of their actual account and their notional account. Individuals withdrawing for any reason before the end of the guarantee term are entitled to their actual account at that date.

The Actual Account

The actual account is managed in much the same way as a unit-linked account. The account balance is credited for contributions and interest based on the (post-tax) performance of the underlying assets. It is debited for withdrawals, fees and charges, including a management fee and a charge to cover the investment guarantee.

The Notional Account

The notional account is simply the opening account plus contributions less withdrawals, accumulated at a pre-determined *"Guaranteed Interest Rate"*. Since no fees or charges are deducted from the notional account, this guaranteed interest rate can be considered a guaranteed net rate of return.

In addition, the notional account may be reset at fixed intervals to be the greater of the actual account and the notional account immediately before the reset. This effectively locks in accumulated returns in excess of the guaranteed interest rate. The frequency with which the notional account is reset is referred to as the *"Guarantee Reset Frequency"*.

3.2 Sample Guarantee Designs

Accumulation phase investment guarantees may be suitable for investors approaching retirement who wish to remain exposed to the upside potential of growth asset classes, but want to protect their assets from a downturn in the market prices of these asset classes. This type of guarantee provides an alternative to reducing risk by moving assets into conservative asset classes as one approaches retirement.

Individuals approaching retirement who plan to leave their superannuation assets in the superannuation environment post-retirement (as is encouraged by the new superannuation tax legislation) can expect to have these assets invested for approximately 30 years. With such a long investment horizon it could be argued that switching to conservative asset classes may not be an optimal investment strategy. Indeed, in Tillinghast's recent superannuation survey (Tillinghast, 2007) two-thirds of respondents thought that switching to a more conservative asset mix in the years leading up to retirement was not a sound investment strategy.

To investigate alternative investment strategies we examined six guarantee designs that could be sold to an individual approaching retirement, through their superannuation fund. The individual is assumed to have an account balance of $100,000, and to make annual contributions of $6,000 ($500 at the start of each month). All six guarantee designs incorporate a guarantee term of 5 years, but have guarantee characteristics that differ as described in the table below.

TABLE 3.1

Defining the Six Accumulation Phase Investment Guarantees

Guarantee Term	5 years	5 years	5 years	5 years	5 years	5 years
Guaranteed Interest Rate	- 3%	- 3%	0%	0%	+ 3%	+ 3%
Guarantee Reset Frequency	No reset	1 year	No reset	1 year	No reset	1 year

The figures that follow use a single economic scenario to illustrate the performance of the six guarantee designs, by showing the evolution of the actual account and the notional account over the guarantee term. Note that for simplicity these illustrations assume no charge for the investment guarantee. Thus, the evolution of the actual account is identical for all six investment guarantee designs.

For a given guaranteed interest rate, the notional accounts increase at the same rate between guarantee reset dates. This increase is driven by the regular contributions and the guaranteed interest rate.

For the designs with no guarantee reset, the guaranteed amount at the end of the five years is independent of the actual investment earnings over the five years. This style of guarantee brings additional security as the exact size of the guarantee is known at the start of the guarantee term.

However, this security comes at the expense of potential upside. Under the one year guarantee reset frequency, the annual reset of the notional account means that the guaranteed amount is responsive to investment earnings. While the exact size of the guarantee cannot be known at the start of the guarantee term, it is certain that the guarantee will be at least as large as the guarantee under the design with the same guaranteed interest rate and no guarantee reset (ignoring the second order impacts of different guarantee charges).

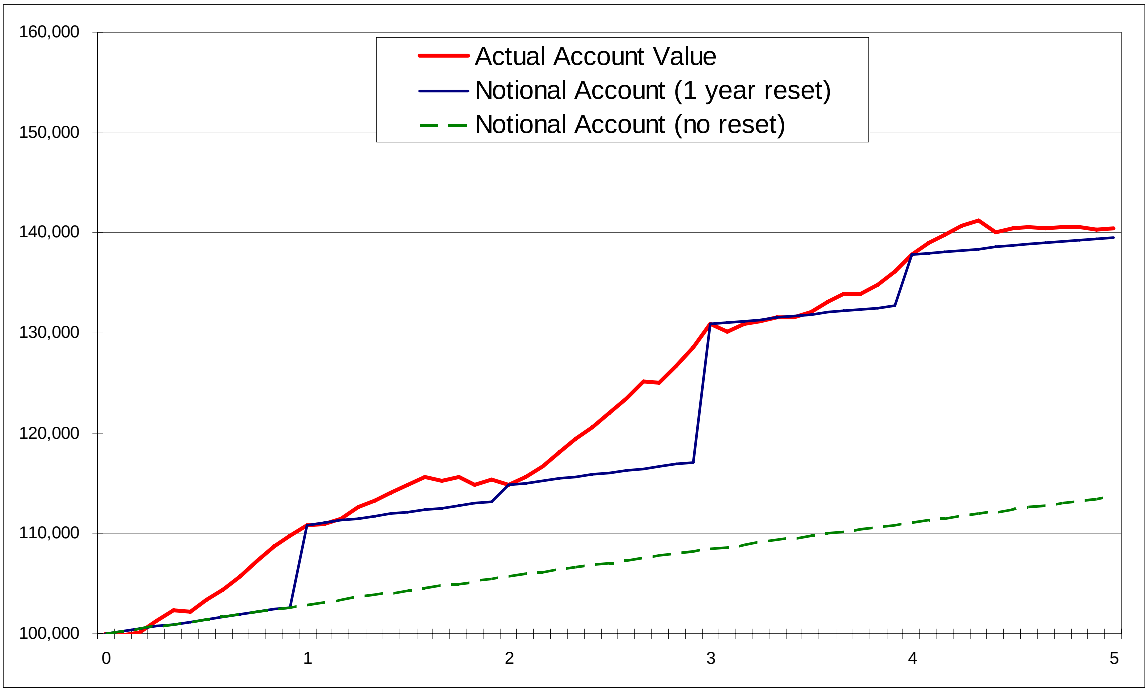
FIGURE 3.1

Guarantee Term = 5 years

Guaranteed Interest Rate = -3%

Guarantee Reset Frequency = 1 year and no reset

	Account Value at end of Guarantee Term	Guarantee Payout
Actual Account	140,454	
Notional Account 1 year guarantee reset frequency	139,579	0
Notional Account No guarantee reset	113,665	0



For the guarantee designs with a -3% guaranteed interest rate, in this illustrative scenario the investor receives no guarantee payment under either guarantee design. Despite the low guaranteed interest rate of -3%, the guarantee design with a one year guarantee reset frequency provides a reasonably strong guarantee, with the notional account increasing to the level of the actual account every year. Under this design the investor could only lose a significant amount of money if the account value was subject to consecutive years of negative returns.

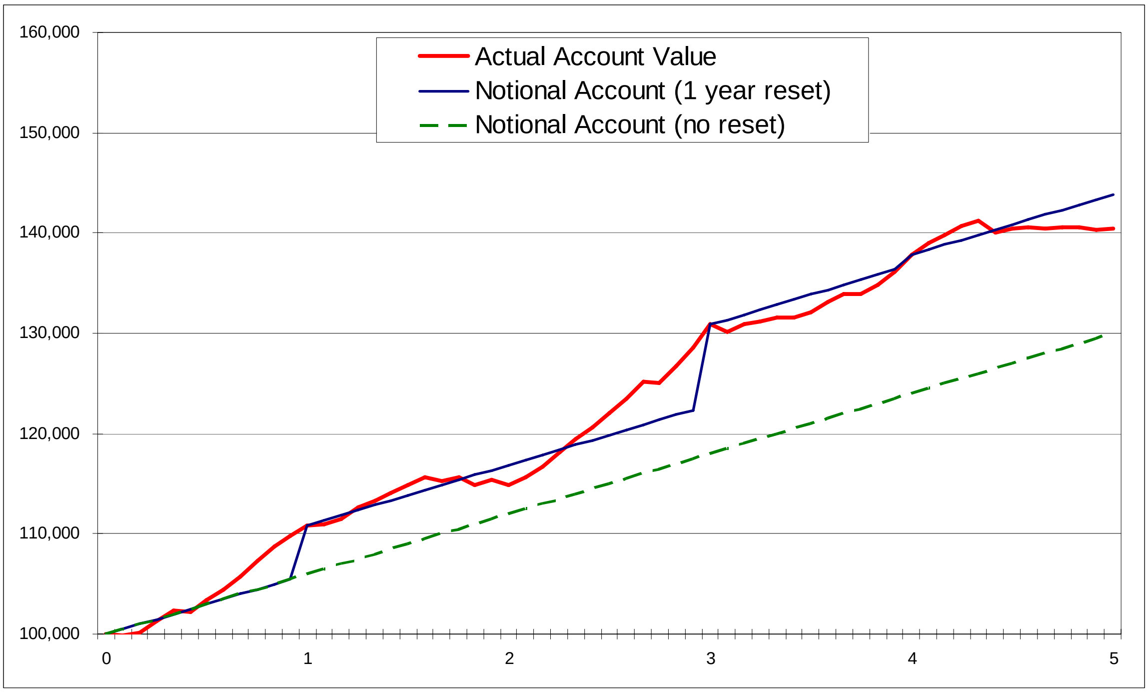
FIGURE 3.2

Guarantee Term = 5 years

Guaranteed Interest Rate = 0%

Guarantee Reset Frequency = 1 year and no reset

	Account Value at end of Guarantee Term	Guarantee Payout
Actual Account	140,454	
Notional Account 1 year guarantee reset frequency	143,812	3,358
Notional Account No guarantee reset	130,000	0



For the guarantee designs with a 0% guaranteed interest rate, in this illustrative scenario the investor receives a guarantee payment of $3,358 under the guarantee design with a one year guarantee reset frequency. This payment is driven by the fact that the return in the final year is negative. Note that the return in the second year is also negative, which causes there to be no increase in the notional account on the second reset date. The design with no guarantee reset is equivalent to a guarantee of 100% of the initial account balance plus all contributions.

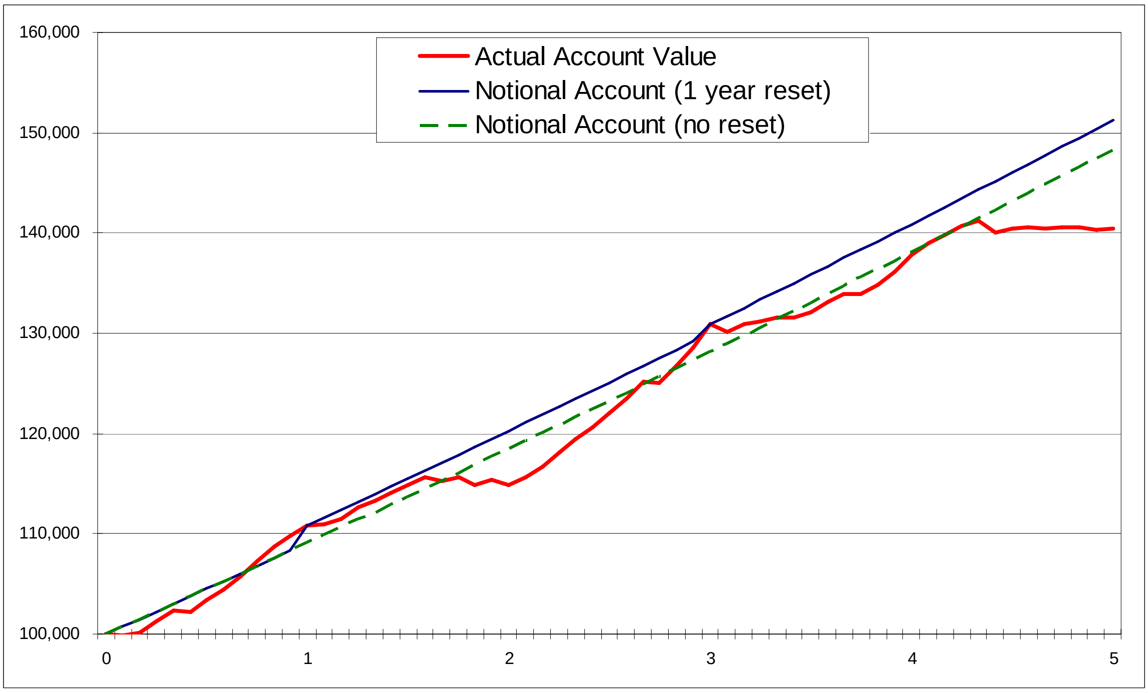
FIGURE 3.3

Guarantee Term = 5 years

Guaranteed Interest Rate = +3%

Guarantee Reset Frequency = 1 year and no reset

	Account Value at end of Guarantee Term	Guarantee Payout
Actual Account	140,454	
Notional Account 1 year guarantee reset frequency	151,208	10,754
Notional Account No guarantee reset	148,298	7,844



For the guarantee designs with a +3% guaranteed interest rate, in this illustrative scenario the investor receives a guarantee payment under both guarantee designs. The guarantee payment is greater under the design with the one year guarantee reset frequency because the actual account was greater than the notional account on two reset dates, causing the notional account to reset to the level of the actual account.

3.3 Theoretical Cost of the Investment Guarantee

For each of the guarantee designs explained above, the theoretical cost of the investment guarantee has been calculated using the following process:

- project the account balance under stochastic market-consistent economic scenarios;
- for each economic scenario, calculate the present value of the guarantee amount paid at the end of the guarantee period;
- calculate the average of these present values over the entire set of stochastic scenarios; and
- calculate an annual guarantee charge, expressed as a percentage of the account balance, so that over the entire set of stochastic scenarios the average of the present value of the guarantee charges deducted from the account balance is equal to the average of the present value of the guarantee amount paid (from the previous step). This is the guarantee charge required to cover the theoretical market-consistent cost of the guarantee. It should be noted that the calculation of the guarantee charge is an iterative process due to the fact that the deduction of the charge causes a change in the account balance, and potentially second order changes in the guarantee amount paid and the dollar amount of the guarantee charge.

The calculations assume that 75% of the account balance is invested in Australian equities, with the remaining 25% invested in Australian government bonds. More information regarding the projections is given in Appendix A.

Appendix B provides an explanation of the process used to create the stochastic market-consistent scenarios. The following assumptions have been used in these scenarios:

- Swap Rates: 8% for all durations;
- Swaption Volatility: 15% for all durations; and
- Equity Volatility Parameter: 20% for all durations.

The lower interest rates prevailing in the current environment would result in higher guarantee costs compared to those generated by the 8% assumption. This would be offset to the extent that recent market implied volatility, being lower than the levels assumed, would generate lower guarantee costs. Thus, these assumptions result in theoretical guarantee costs that should be similar to those that would be calculated using recent market conditions (though this would not be the case under more volatile market conditions, such as August 2007).

The table below presents the theoretical cost of the investment guarantees, expressed as an annual percentage of the account balance. Appendix A provides the key assumptions in the calculations behind this information. It should be noted that the calculations assume that a charge equal to the theoretical cost of the investment guarantee is deducted from the account balance every month.

TABLE 3.2

Theoretical Cost of the Accumulation Phase Investment Guarantees

Guaranteed Interest Rate	Guarantee Reset Frequency	Cost of the Investment Guarantee (% of account balance)
- 3%	No reset	0.16%
- 3%	1 year	0.85%
0%	No reset	0.58%
0%	1 year	1.74%
+ 3%	No reset	1.92%
+ 3%	1 year	3.95%

These results show that:

- as expected, the cost increases substantially as the guaranteed interest rate increases;
- incorporating an annual reset adds a considerable cost to the guarantee; and
- incorporating the annual reset is relatively more expensive (compared to the guarantee with no reset) for designs with a low guaranteed interest rate.

While the process described above is a common process used to calculate the cost of investment guarantees, it does suffer from several limitations. One limitation is that the calculation of the guarantee cost does not include an allowance for the guarantee manufacturer's profit margin. In several markets investment guarantees are added to savings products to attract customers to the savings product, with the guarantee provided "at cost" so that the guarantee manufacturer can reap the rewards of the underlying administration and/or investment management fees on the base savings product. Thus, it may not be unreasonable to include limited or no allowance for a profit margin in the cost of the guarantee.

Another limitation is that the theoretical cost of the guarantee does not allow for the actual cost to the guarantee manufacturer of managing the investment risk associated with the investment guarantee. This limitation is potentially more problematic, as the cost associated with a hedging strategy designed to mitigate the investment risk can vary substantially from the theoretical cost of the investment guarantee. This issue is discussed in section 5 of this paper.

3.4 Benefits to an Investor

In this section, we examine the product design that guarantees that the average rate of investment income on the individual's account balance will be at least 0% pa over the entire guarantee term with no guarantee reset. For this analysis we assumed that the charge for this guarantee is 0.7% pa of the account balance. We projected the maturity benefit received by an investor over 2,000 real world stochastic scenarios. These scenarios were based on the same underlying parameters as the market-consistent economic scenarios, with an equity risk premium of 4%. Appendix C provides more information regarding these scenarios.

An alternative to investing aggressively and paying for an investment guarantee is to invest more conservatively, with no guarantee. To explore this alternative we compared the distribution of the maturity benefit for the following four investment strategies:

- Strategy 1: An asset mix of 75% equities and 25% bonds, with no guarantee and no guarantee charge.

- Strategy 2: An asset mix of 75% equities and 25% bonds, with a guarantee and a guarantee charge.

- Strategy 3: An asset mix of 50% equities and 50% bonds, with no guarantee and no guarantee charge.

- Strategy 4: An asset mix of 25% equities and 75% bonds, with no guarantee and no guarantee charge.

The benefit of the guarantee can be seen in Figure 3.4, which plots the probability distribution functions of the maturity benefit over the 2,000 stochastic scenarios for these four investment strategies, and provides summary information from these distributions.

FIGURE 3.4

Probability Distribution Function of the Maturity Benefit

Investment Strategy	**Average maturity benefit**	**Average annual return**	**Percentage of scenarios with total negative returns**
1. 75% equities, 25% bonds, no guarantee	183,647	8.00%	10.6%
2. 75% equities, 25% bonds, with guarantee	179,831	7.50%	0%
3. 50% equities, 50% bonds, no guarantee	179,501	7.46%	4.2%
4. 25% equities, 75% bonds, no guarantee	175,358	6.91%	0.3%

Considering only the investment strategies with 75% equities, incorporating the guarantee decreases the average maturity benefit by $3,816, from $183,647 to $179,831. This causes a 0.5% decrease in the average annual rate of return, from 8.0% to 7.5%. This decrease is less than the 0.7% guarantee charge because incorporating the guarantee truncates the left tail of the distribution, improving the worst outcomes. This decrease in the expected maturity benefit can be viewed as the cost of the guarantee to the investor.

Again considering only the investment strategies with 75% equities, the strategy with no guarantee resulted in a negative return in 11% of scenarios. The elimination of these negative returns can be viewed as the benefit of the guarantee.

Thus, it could be argued that the guarantee would be suitable for investors willing to give up approximately 0.5% pa of expected earnings, in return for the removal of the 11% chance that the total returns over the five year period will be negative.

The investment strategy with 50% equities and no guarantee results in very similar average returns to the investment strategy with 75% equities and a guarantee. However, under the 50% equity strategy total returns are negative under 4% of scenarios. Thus compared to maintaining an aggressive asset mix and incorporating a guarantee, moving to a more conservative asset mix will result in a similar expected return, but there is still a 4% chance that the total returns over the five year period will be negative.

Switching to an investment strategy of 25% equities decreases the probability of negative returns over the five year period to 0.3%. However, the average annual rate of return decreases to 6.9%, which is 0.6% less than under the strategy with 75% equities and a guarantee. This lower average return is largely driven by the removal of the chance of significant earnings in strong equity markets caused by the decrease in the equity allocation from 75% to 25%.

These results are dependent on the choice of the real world stochastic scenario generator. The generator assumed a flat yield curve of 8%. Using a yield curve more in line with the current, lower, yield curve would, all other things being equal, improve the performance of the strategy with a guarantee relative to the two more conservative strategies. However, the generator assumed above-market volatility. Using lower volatility would, all other things being equal, detract from the attractiveness of the guarantee.

To remove this dependence on the scenario generator we also examined the benefit of the guarantee to an investor by back-testing the guarantee over 50 sets of actual five-year investment returns. The five-year investment returns we used were the five years until the end of June 1957, the five years until the end of June 1958, etc, up to the five years until the end of June 2006. Thus, they did not constitute 50 independent sets of returns.

In this back-testing we used the same four investment strategies, the same annual guarantee charge of 0.7% pa of the account balance, and the same annual investment management charges. The figure below plots the probability distribution functions of the maturity benefit over the 50 actual scenarios for these four investment strategies, and provides summary information from these distributions.

FIGURE 3.5

Back-testing investment strategies over 50 five-year periods

Investment Strategy	Average maturity benefit	Average annual return	Percentage of periods with total negative returns
1. 75% equities, 25% bonds, no guarantee	185,577	8.25%	6%
2. 75% equities, 25% bonds, with guarantee	180,628	7.61%	0%
3. 50% equities, 50% bonds, no guarantee	179,680	7.48%	4%
4. 25% equities, 75% bonds, no guarantee	174,625	6.81%	0%

This analysis suggests the following:

- With 75% equities, the cost of incorporating an investment guarantee is a reduction in the average annual return of 0.64% pa. The benefit of incorporating an investment guarantee is the fact that the investor would receive a guarantee payment in 6% of the 50 sets of returns examined.

- Compared to the strategy with 75% equities and the incorporation of an investment guarantee, adopting a more conservative asset mix of only 50% equities (with no guarantee) causes a decrease in the average annual return of 0.12% pa. Further, the total return is still negative in 4% of the 50 sets of returns examined. This suggests that, compared to adopting a more conservative investment strategy with no guarantee, retaining a more aggressive investment strategy and incorporating a guarantee would have been a superior investment strategy from both a risk and return perspective.

- While an even more conservative strategy of only 25% equities does eliminate all the periods with total negative returns, this comes at the expense of a decrease in the average annual return of 0.8% pa compared to the strategy with 75% equities and the incorporation of an investment guarantee.

This analysis suggests that under the investment management fees and guarantee charge assumed, on average, rather than switching to a more conservative asset mix, investors over the past 50 years wishing to remove the risk of negative returns would have been better off maintaining an aggressive asset mix and incorporating an investment guarantee.

4. SIMPLE DRAW-DOWN PHASE INVESTMENT GUARANTEES

This section introduces several simple investment guarantee designs and calculates the theoretical cost of each of these designs under a set of simplified economic conditions. For one of these designs we then analyse the cost and benefit of the investment guarantee by comparing the performance of an investment strategy with a high proportion of growth assets and an investment guarantee, to the performance of investment strategies with the same and lower proportions of growth assets and no investment guarantee. This analysis is undertaken using 2,000 simulated economic scenarios.

The analysis suggests that a product that provides a guaranteed interest rate of 3% over a 15 year period could have a theoretical guarantee cost in the range of 0.5% to 0.7% pa. Compared to the 5 year accumulation products examined in the previous section, a higher guaranteed interest rate is achievable within the same cost range due to the longer duration of the guarantee.

As with the accumulation products, a product with a lower guaranteed interest rate that resets regularly over the 15 year period could be used to more efficiently protect against large market down-turns, while "locking-in" excess returns over shorter periods. For example, a product with a guaranteed interest rate of 0% that "locks-in" excess returns on an annual basis could have a theoretical guarantee cost in the same range.

The analysis of the attractiveness to an investor was not as clear cut as it was for the accumulation product. The expected return under an investment strategy comprising 75% equities and 25% bonds with an investment guarantee was less than the expected return under an investment strategy comprising 50% equities and 50% bonds with no investment guarantee. However, by maintaining 75% in equities the strategy with the investment guarantee outperformed the strategy with 50% equities in the strong growth scenarios, offering greater participation in market gains. Another advantage of the incorporation of an investment guarantee was the removal of the possibility of the assets being exhausted and the draw-downs ceasing before the end of the 15 year period.

4.1 Guarantee Design Terminology

The terminology used is the same as that described for the accumulation phase investment guarantees, in Section 3.1.

4.2 Sample Guarantee Designs

Draw-down phase investment guarantees may be suitable for retirees who wish to remain exposed to the upside potential of growth asset classes, but want to protect their assets from a downturn in the market prices of these asset classes. Given that most retirees have limited ability to earn additional income, it could be more important for them to protect their assets against a downturn in market prices than it is for individuals approaching retirement, who could potentially delay retirement by a few years to recover savings lost due to a market downturn.

New retirees who leave their assets in the superannuation environment can expect to have these assets invested for several decades. With such a long investment horizon it may be argued that reducing investment risk by switching to conservative asset classes may not be an optimal investment strategy.

To investigate alternative investment strategies, we examined six guarantee designs that could be sold to an individual with an account balance at retirement of $180,000. All six guarantee designs incorporate a guarantee term of 15 years. The investor is guaranteed to receive a draw-down of $12,000 every year in the guarantee term. The draw-downs are spread evenly over the year, and occur at the end of each month. Note that the investor continues to receive these guaranteed draw-downs even if the actual account balance is zero. The final component of the guarantee is that at the end of the guarantee term, the investor receives the maximum of the actual account and the notional account. Hence, unlike an annuity, there is a potential upside from the product.

The six guarantee designs differ only in their guaranteed interest rate and guarantee reset frequency, as described in the table below.

TABLE 4.1

Defining the Draw-Down Phase Investment Guarantees

Guarantee Term	15 years	15 years	15 years	15 years	15 years	15 years
Guaranteed Interest Rate	0%	0%	0%	+ 3%	+ 3%	+ 3%
Guarantee Reset Frequency	No reset	5 years	1 year	No reset	5 years	1 year

Finally, it should be noted that to meet the minimum legislated requirements for draw-downs, in reality the annual draw-downs may be greater than the guaranteed amount. Our annual drawdown of $12,000 is high enough to ensure that the age based minimum would have an immaterial impact on our results. For simplicity, we have thus ignored this legislative constraint.

The figures that follow use a single economic scenario to illustrate the performance of the six guarantee designs, by showing the evolution of the actual account and the notional account over the guarantee term. Note that for simplicity these illustrations assume no charge for the investment guarantee. Thus, the evolution of the actual account is identical for all six investment guarantee designs.

For a given guaranteed interest rate, the notional accounts decrease at the same rate between guarantee reset dates for all guarantee designs. This increase is driven by the regular draw-downs and the guaranteed interest rate.

Under the guarantee design with a 0% guaranteed interest rate and no guarantee reset, the guarantee equates to a return of the initial account balance of $180,000 over the 15 years, in monthly payments of $1,000.

However, under the other two guarantee designs with a 0% guaranteed interest rate, the reset of the notional account means that the guarantee is responsive to investment returns. Thus, the guarantee could include a lump sum payment at the conclusion of the 15 year term.

All the guarantee designs with a 3% guaranteed interest rate will include a guaranteed lump sum payment at the conclusion of the 15 year term.

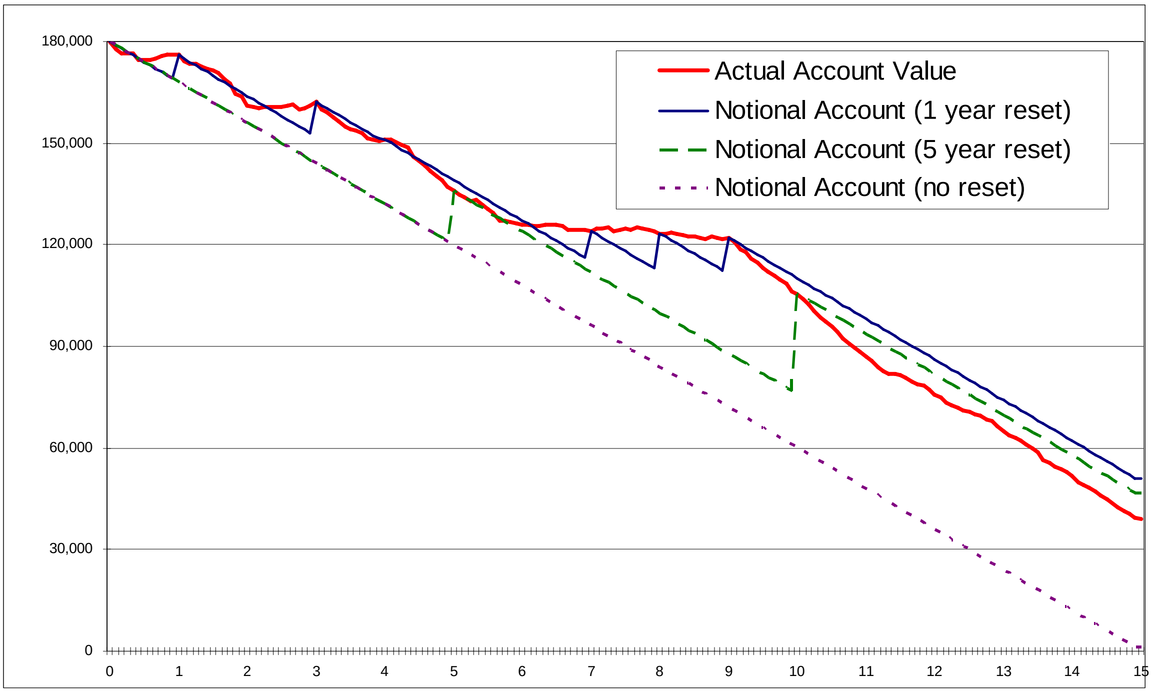
FIGURE 4.1

Guarantee Term = 15 years

Guaranteed Interest Rate = 0%

Guarantee Reset Frequency = 1 year, 5 years and no reset

	Account Value at end of Guarantee Term	Guarantee Payout
Actual Account	38,091	
Notional Account 1 year guarantee reset frequency	50,110	12,019
Notional Account 5 year guarantee reset frequency	45,627	7,536
Notional Account No guarantee reset	0	0



For the guarantee designs with a 0% guaranteed interest rate, in this illustrative scenario the investor receives a guarantee payment under the two guarantee designs that incorporate a guarantee reset. The guarantee payment is greater under the design with the one year guarantee reset frequency. This is due to the fact that the returns were negative in year 10.

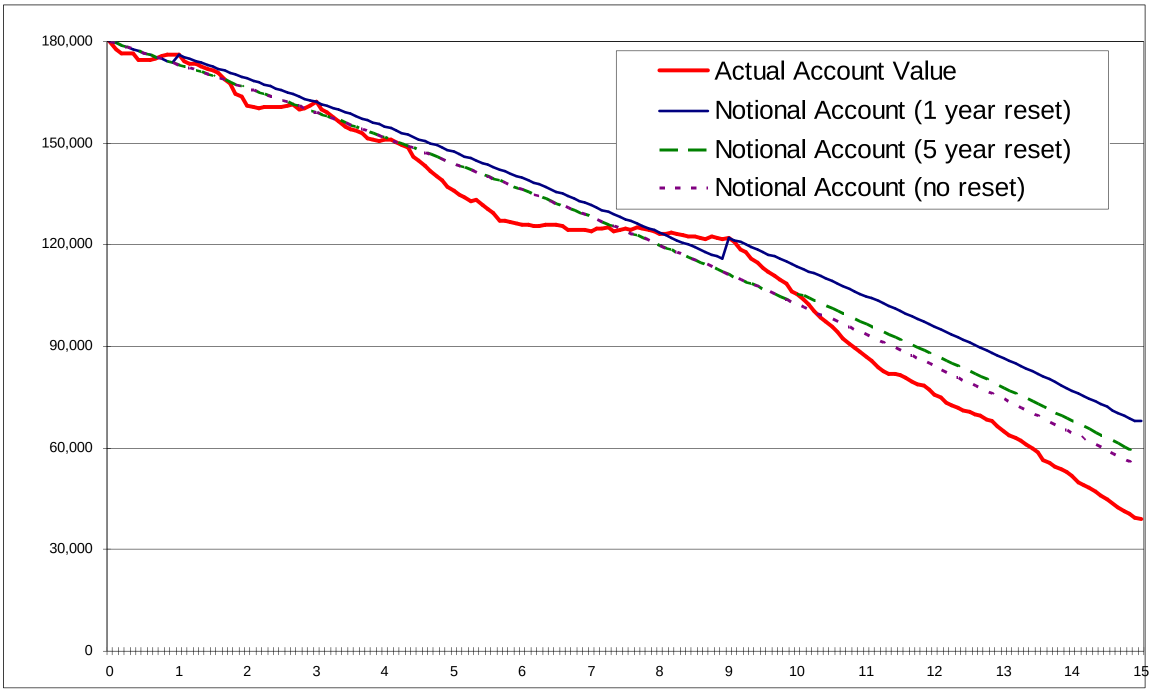
FIGURE 4.2

Guarantee Term = 15 years

Guaranteed Interest Rate = 3%

Guarantee Reset Frequency = 1 year, 5 years and no reset

	Account Value at end of Guarantee Term	Guarantee Payout
Actual Account	38,091	
Notional Account 1 year guarantee reset frequency	67,123	29,032
Notional Account 5 year guarantee reset frequency	57,870	19,779
Notional Account No guarantee reset	54,195	16,104



For the guarantee designs with a +3% guaranteed interest rate, in this illustrative scenario the investor receives a guarantee payment under all three guarantee designs. The size of the guarantee payment increases as the guarantee is reset more frequently.

4.3 Theoretical Cost of the Investment Guarantee

For the sample guarantee designs explained above, the theoretical cost of the investment guarantee has been calculated using the process and assumptions outlined in Section 3.3.

The table below presents the theoretical cost of the investment guarantees, expressed as an annual percentage of the account balance. Appendix A provides the key assumptions in the calculations behind these results. It should be noted that the calculations assume that a charge equal to the theoretical cost of the investment guarantee is deducted from the account balance every month.

TABLE 4.2

Theoretical Cost of the Draw-Down Phase Investment Guarantees

Guaranteed Interest Rate	Guarantee Reset Frequency	Cost of the Investment Guarantee (% of account balance)
0%	No reset	0.10%
0%	5 years	0.31%
0%	1 year	0.62%
+ 3%	No reset	0.57%
+ 3%	5 years	1.07%
+ 3%	1 year	1.72%

As with the accumulation guarantee designs, the guarantee cost increases as the guaranteed interest rate increases and as the guarantee resets more frequently. The lower guarantee costs compared to the accumulation designs are due to the fact that the draw-down guarantee is over a longer period, giving the account balance more chance of recovering from short-term down-turns in the equity market.

4.4 Benefits to an Investor

In this section we examine the product design with a guaranteed interest rate of 3% and no guarantee reset. For this analysis we assumed that the charge for this guarantee is 0.7% pa of the account balance. We projected the total benefit received by an investor over 2,000 real world stochastic scenarios. Appendix C provides more information regarding these scenarios.

An alternative to investing aggressively and paying for an investment guarantee is to invest more conservatively, with no guarantee. To explore this alternative we compared the distribution of the total benefit, being the sum of the regular draw-downs and the maturity benefit, for the following four investment strategies:

- Strategy 1: An asset mix of 75% equities and 25% bonds, with no guarantee and no guarantee charge.

- Strategy 2: An asset mix of 75% equities and 25% bonds, with a guarantee and a guarantee charge.

- Strategy 3: An asset mix of 50% equities and 50% bonds, with no guarantee and no guarantee charge.

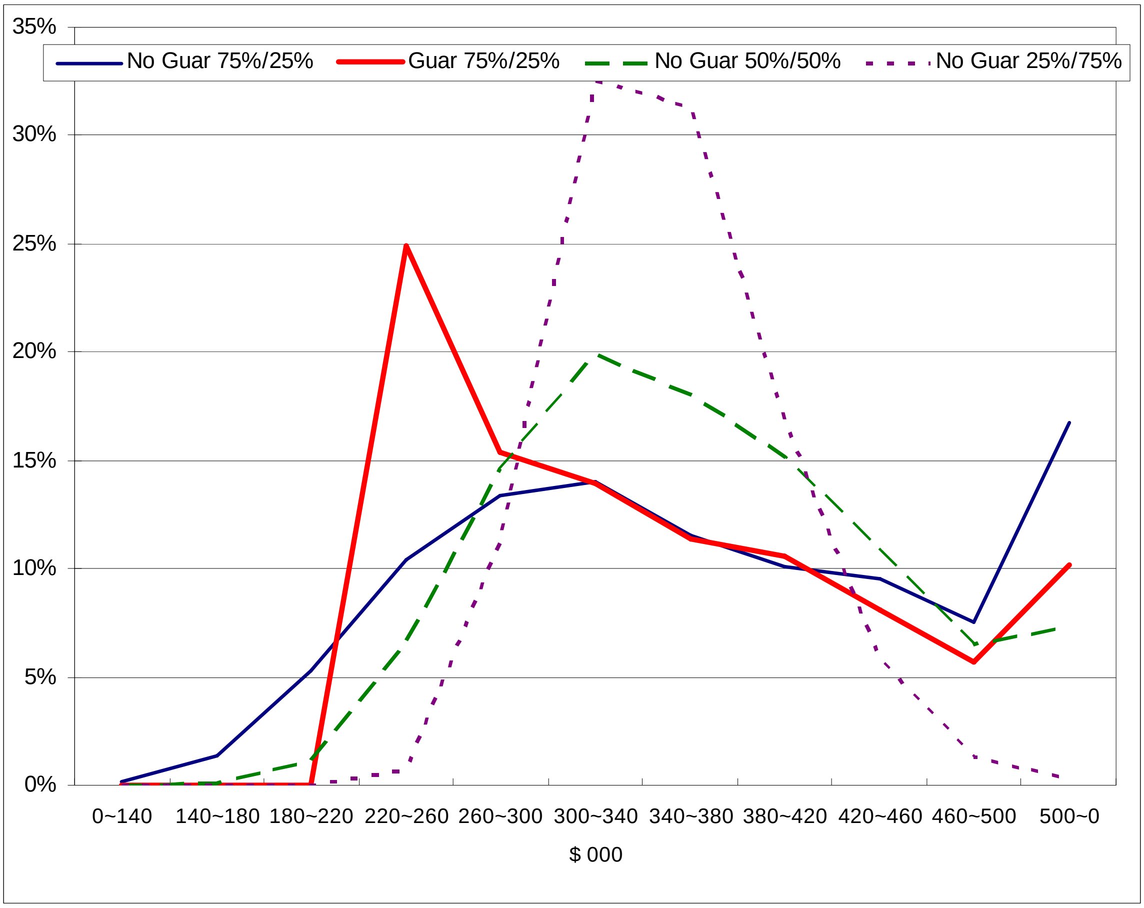
- Strategy 4: An asset mix of 25% equities and 75% bonds, with no guarantee and no guarantee charge.

The benefit of the guarantee can be seen in Figure 4.3, which plots the probability distribution function of the total benefit, being the sum of the regular draw-downs and the maturity benefit, over the 2,000 stochastic scenarios for these four investment strategies, and provides summary information from these distributions.

FIGURE 4.3

Probability Distribution Function of the Total Benefit

Investment Strategy	Average total benefit	Average top 10% level total benefit	Percentage of scenarios with total returns < 3% pa
1. 75% equities, 25% bonds, no guarantee	382,193	665,459	10.3%
2. 75% equities, 25% bonds, with guarantee	353,816	600,973	0%
3. 50% equities, 50% bonds, no guarantee	367,709	539,086	2.5%
4. 25% equities, 75% bonds, no guarantee	350,591	438,833	0.1%



Under the investment strategy with 75% equities, incorporating the guarantee removes the 10% chance that the total return over the 15 year period will be less than 3%.

However, the case for the incorporation of a guarantee is not as strong as it was for the accumulation product. The average total benefit with 75% equities and a guarantee is less than the average total benefit with 50% equities and no guarantee. Also, the investment strategy with 50% equities only has a 2.5% chance that the total return over the 15 year period will be less than 3%.

This is offset by the fact that maintaining 75% equities and incorporating a guarantee retains much greater upside potential, and performs considerably better than the investment strategy with 50% equities in the top 10% of scenarios.

Another advantage of the guarantee is that it ensures that, regardless of the investment performance, the monthly draw-downs will be received for the entire duration of the product, and a minimum lump sum of approximately $54,000 will be received at the conclusion of the 15 year period. This could be a major consideration for an individual using this product to fund their retirement.

Under the investment strategy with 75% equities and no guarantee, the account balance is exhausted before the end of the 15 year period in 1.5% of the scenarios examined. In the worst of these scenarios the individual would not have received any draw-down payments for the last 4 years and 9 months of the 15 year period.

While the case is not as bad for the investment strategy with 50% equities and no guarantee, the account balance is still exhausted before the end of the 15 year period in 0.1% of the scenarios examined. In the worst of these scenarios the individual would not have received any draw-down payments for the last 1 year and 9 months of the 15 year period.

5. INVESTMENT RISK MANAGEMENT STRATEGIES

This section explores the investment risk management strategies available to investment guarantee manufacturers and discusses the operation of a dynamic hedging process. A cost / benefit analysis of a number of dynamic hedging strategies then highlights the importance of selecting an appropriate hedging approach.

5.1 Strategies Available

There are several approaches available to investment guarantee providers to manage the investment risk associated with investment guarantees. A comprehensive investment risk management strategy may involve a combination of several of these approaches.

- Stay Naked: Generally not recommended for companies that wish to participate in this market in the long term as a sudden downturn may cause large losses.

- Purchase Static Protection: Investment banks can tailor protection to the particular needs of an investment guarantee provider. However, the protection would need to be monitored regularly and adjusted if the investment risk of the investment guarantee provider differs substantially from the protection purchased, for example, due to lapse experience differing from expected or unanticipated fund switches.

- Internal Dynamic Hedging: This is when the product provider itself hedges the risk by buying traded financial instruments on the futures and options markets. The most sophisticated dynamic financial hedging strategies involve daily monitoring of the hedge position against pre-defined risk limits.

- Outsource the Hedging: An alternative to developing an internal financial hedging process is to outsource the hedging process to a specialist, such as an investment bank or a consulting company. However, while this approach transfers the hedging process, any basis risk (and operational risk) would remain with the investment guarantee provider. The capital relief provided may therefore be limited and APRA guidelines on outsourcing would need to be followed.

- Outsource the Guarantee Provision: An alternative to outsourcing the financial hedging process is to use an investment bank to provide the investment guarantee. However, investment banks without an insurance license may have difficulty providing investment guarantees that are triggered by specific mortality or longevity events.

- Reinsure: Reinsurance may be a viable way of transferring any unwanted risk. If exploring this option, an investment guarantee provider should compare its costs and benefits to alternative methods of risk transfer, including a consideration of credit worthiness.

- Hold Capital: The need to hold capital may arise under any approach to cover any residual risk or risk that cannot be hedged.

The trend among the major players in the investment guarantee markets overseas is to implement internal dynamic hedging strategies, combined with holding economic capital against residual risk and any shortcomings in the operation of the dynamic hedging process under extreme scenarios.

The leading edge providers of investment guarantees perform the dynamic hedging process outlined below on a daily basis, similar to the approach used by trading banks to monitor and adjust their market risk positions.

1. Collect information regarding the investment guarantees and the position of each investor's guarantee.

2. Document assumptions regarding the behaviour of investors (e.g. withdrawal and fund switching behaviour) under a range of circumstances.

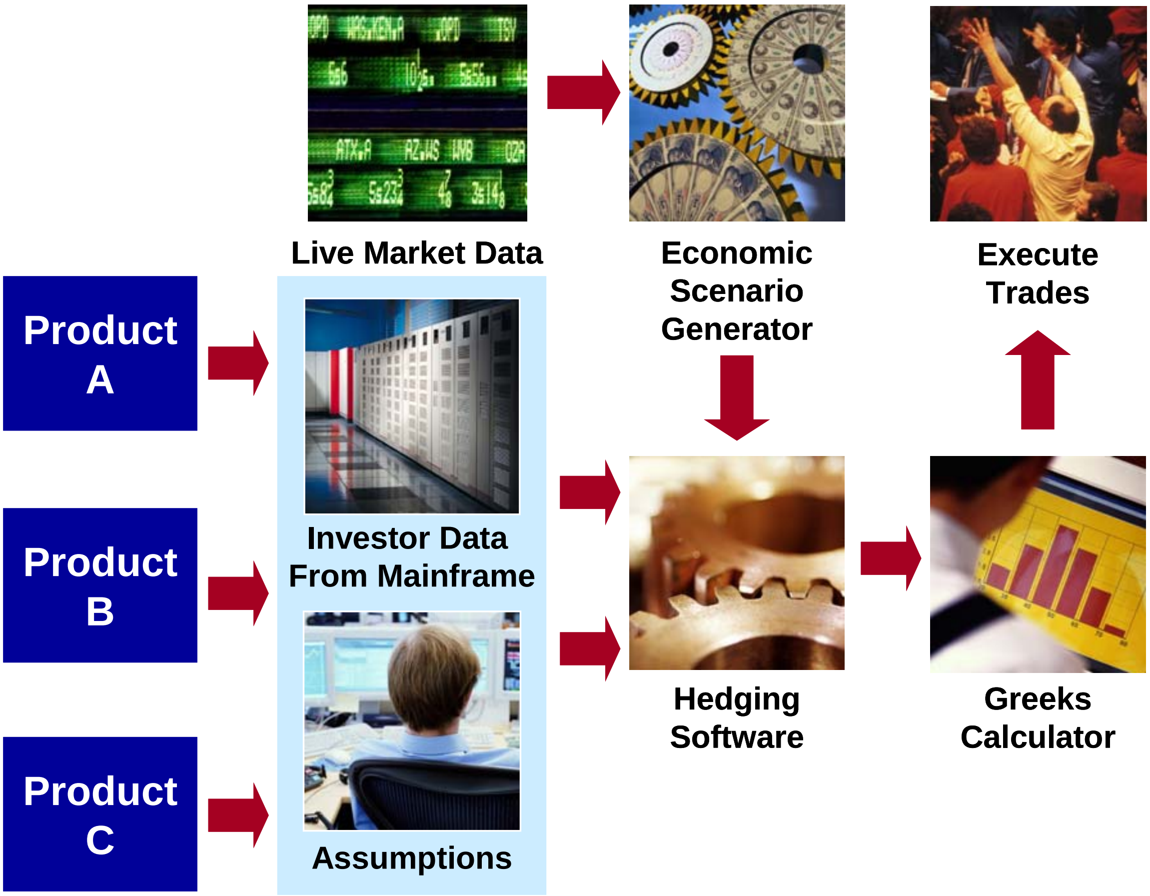
3. Feed market data into an economic scenario generator to create a set of stochastic market-consistent economic scenarios, and scenarios for shocks in the major economic variables that drive the size of the guarantee payout (e.g. underlying asset prices, interest rates).

4. Combine the above three pieces of information in hedging software to project the investment guarantee payout due to each investor under each of the stochastic scenarios.

5. Aggregate this information across investors and scenarios to calculate the exposure of the investment guarantee provider to the major economic variables that drive the size of the guarantee payout. This information is often referred to as "the Greeks".

6. Compare the investment guarantee manufacturer's Greek exposures, net of the Greek positions from their hedge portfolio, against the risk limits that have been established for this business, and execute trades in specific hedging instruments to counter Greek exposures that are excessive.

Figure 5.1: Dynamic Hedging Process



5.2 Sample Dynamic Hedging Strategies

When choosing to implement a dynamic hedging strategy, a company has to answer several key questions.

What should they hedge?

More financial products and valuation models allow companies to separate the investment risk associated with an investment guarantee into the risk associated with movements in underlying key variables. A company needs to decide which key variables they will hedge.

How should they hedge it?

The financial markets include a myriad of structured products, each with differing degrees of price sensitivity to movements in underlying key variables. Once a company has chosen which variables to hedge, they must then choose the financial instruments they will use to construct the hedge.

At what level should they set their risk limits?

The theory behind dynamic hedging involves continuous rebalancing of the hedge position. However, rebalancing involves transactions, which incur transaction costs. A company must compare the transaction costs with the benefits of more frequent rebalancing of the hedge position, and determine how often they will rebalance their hedge position. Rather than choosing a duration-based rebalancing frequency, a more common approach is to set risk limits, which define the extent to which the hedge is allowed to become “unbalanced” before it is rebalanced.

The table below summarises the hedging strategies considered in this paper, while Appendix D gives more information regarding these strategies.

TABLE 5.1

Dynamic Hedging Strategies

Hedge Strategy	**What is being hedged?**	**How is it being hedged?**
Delta	The sensitivity of the investment risk to changes in the price of Australian equities.	Equity futures
Delta and Gamma	Above, plus the sensitivity of the investment risk to changes in delta.	Equity futures and options

An investment guarantee provider may wish to explore hedging further variables, such as interest rates or rho, which can be hedged using interest rate swaps, and rho convexity, which can be hedged using interest rate caps and floors.

5.3 Cost and Benefit of Sample Dynamic Hedging Strategies

The analysis of the cost and benefit to the guarantee provider is not a trivial exercise as the choice of hedging strategy needs to be considered. In particular, different hedging strategies will incur different transaction costs and provide different levels of protection against the investment risk taken on by the guarantee provider.

To illustrate the impact of different dynamic hedging strategies we analysed the performance of the dynamic hedging strategies outlined above for the accumulation phase guarantee design with a guarantee term of 5 years, a guaranteed interest rate of 0% and no guarantee reset. For comparison, the result of performing no hedging was also examined. For this analysis we assumed a guarantee charge of 0.7% pa of the account balance, and other assumptions as per Section 3.

We projected the performance of each hedging strategy under 100 real world stochastic scenarios by calculating the monthly profit impact of the provision of the guarantee and the implementation of the hedging strategy. The scenarios used were a sub-set of the real world stochastic scenarios used in the analysis of the cost and benefit to the investor. The profit we calculated included the impact of changes in the market value of the investment guarantee and the hedge instruments.

Profit = + Fee revenue equal to the charge for the investment guarantee
+ Net payoffs from the hedge instruments held
+ Net increase in the market value of the hedge instruments held
+ Net interest on cash reserves held
– Payments made to the policyholder in respect of the investment guarantee
– Transaction costs associated with the hedge instruments held
– Net increase in the market value of the investment guarantee liability

For each hedging strategy:

- the cost of the hedging strategy can be interpreted as the difference between the average profit for that hedging strategy and the average profit with no hedging; while

- the benefit of the hedging strategy can be interpreted as the extent to which the hedging strategy decreases the profit variability compared to the unhedged strategy.

For the hedging strategies examined, the three figures below present the following information for each month of the projection:

- the average profit;

- the standard deviation of the profit; and

- the profit at the upper and lower first percentile.

Figure 5.2: Projection of the Monthly Hedging Profit ($) – No Hedging

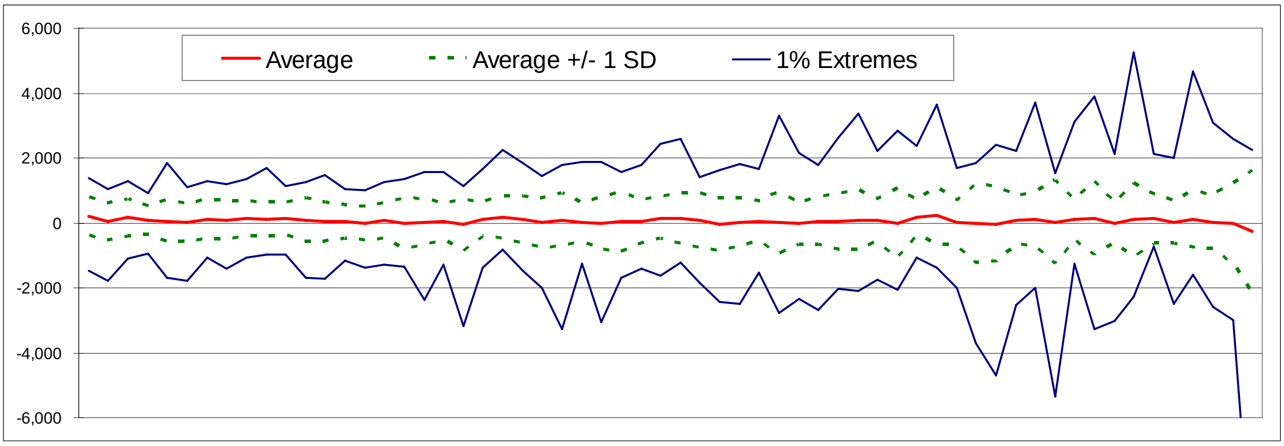


Figure 5.3: Projection of the Monthly Hedging Profit ($) – Delta Hedging

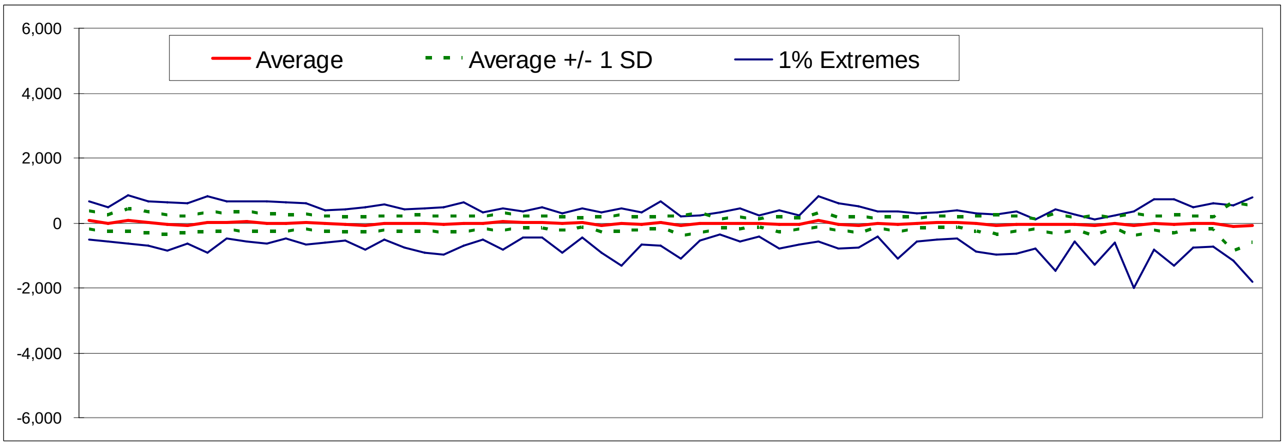
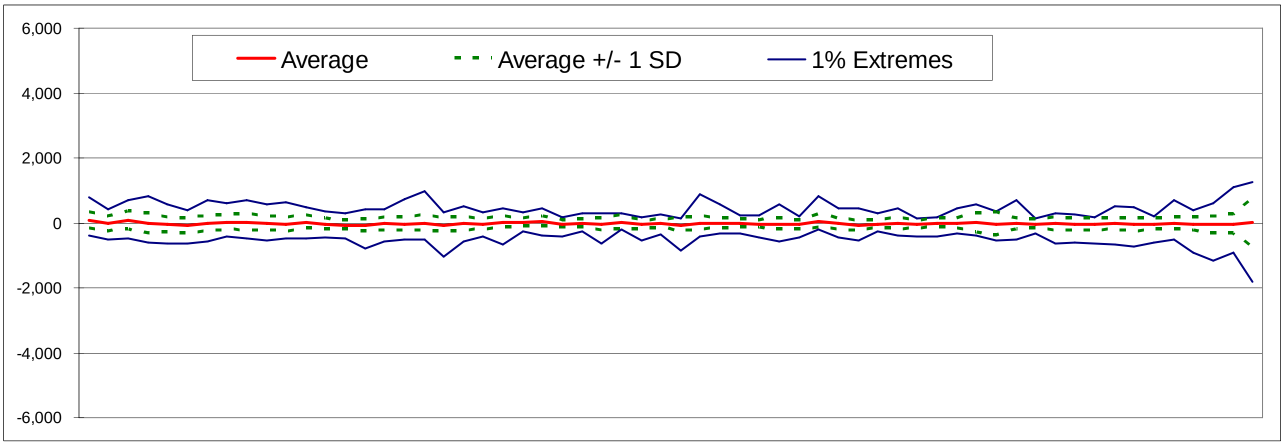


Figure 5.4: Projection of the Monthly Hedging Profit ($) – Delta & Gamma Hedging



These figures show that as the hedging strategy becomes more complex, the variance around the expected value also becomes more constrained.

To assist in the comparison of the hedging strategies, Table 5.2 presents summary information from this analysis. Note that while only 100 scenarios were analysed, each scenario consists of 60 months, resulting in a total of 6,000 monthly profit values.

TABLE 5.2

Comparison of the Hedging Strategies ($)

Monthly Profit	No Hedge	Delta Hedge	Delta and Gamma Hedge
Average	56	- 22	- 24
Standard Deviation	622	220	176
Upper 1% Level	2,278	610	596
Upper 5% Level	1,025	299	255
Lower 5% Level	- 906	- 401	- 314
Lower 1% Level	- 2,369	- 865	- 632

The analysis did not consider the costs associated with holding capital to cover residual risks. The level of capital required would depend on the risk appetite and internal capital requirements of the investment guarantee provider, along with regulatory requirements. Given that the capital requirement should increase with the degree of uncertainty, the unhedged strategy should have a much greater capital requirement, and thus a much greater cost of capital, than the hedged strategies. Including an allowance for the costs associated with holding capital to cover residual risks would thus decrease the attractiveness of the unhedged strategy.

Nevertheless, the following information can be drawn from this analysis.

- With no hedging in place the profit is extremely volatile.

- Incorporating delta hedging significantly reduces the monthly profit volatility. Over all months the average difference between the upper and lower first percentile profit reduces by 70%.

- Incorporating delta and gamma hedging further reduces the monthly profit volatility. Compared to delta hedging, over all months the average difference between the upper and lower first percentile profit reduces by 18%. This is driven by a 30% increase in the lower first percentile, with little change in the upper first percentile.

- While the expected profit impact of the guarantee without hedging is positive, the impact becomes negative once hedging is introduced. This suggests that the annual guarantee charge of 0.7% is insufficient to cover the cost of the investment guarantee and the associated hedging strategies examined.

6. INVESTMENT GUARANTEE MANUFACTURER KEYS TO SUCCESS

The keys to success for investment guarantee manufacturers are to design an investment guarantee that:

- is affordable and attractive to investors;
- creates a manageable investment risk; and
- is profitable to the guarantee manufacturer.

We now examine each of these factors.

6.1 Affordable and Attractive to Investors

The analysis presented in this paper shows that the cost of an investment guarantee varies substantially with the guarantee design. Rather than designing a guarantee and associated hedging strategy and then performing a pricing exercise, a better approach may be to identify the price the market is willing to pay for an investment guarantee, and then design a guarantee and associated hedging strategy that can be provided within this price.

Guarantee manufacturers can also explore methods of limiting the cost of the guarantee, such as restricting the asset mix available to customers, limiting the upside participation in earnings given to customers and designing the product so that other features contribute to a smaller guarantee cost.

To sell properly priced investment guarantees, the product provider needs to demonstrate to customers that they are receiving value for the guarantee charge. Creating products with flexibility helps in achieving this goal. Customers may be more willing to pay the market rate for an investment guarantee if they can choose a guarantee design that meets their specific requirements.

The concept of an actual account and a notional account used to describe the investment guarantees in this paper provides a framework that allows considerable product flexibility within a single guarantee design structure, by changing the guarantee term, guaranteed interest rate and guarantee reset frequency. However, there are further details that need to be considered, such as the method used to adjust the notional account to allow for future contributions or draw-downs. The analysis in this paper adjusts the notional account by the dollar amount of the contribution or draw-down. An alternative approach is to adjust the notional account by the percentage movement that the contribution or draw-down causes in the actual account. This type of detail needs to be considered by potential guarantee providers as it could influence customer behaviour and, ultimately, the cost of the guarantee.

Further examples of flexibility that could be added to a draw-down product include offering CPI indexation to the annual draw-down amount, or combining the investment guarantee with a guarantee or pooling of the longevity risk faced by the retiree, perhaps by providing guaranteed draw-down benefits for life.

The product design process will also need to consider relevant legislation, such as the minimum annual withdrawal amounts under the new superannuation legislation.

The asset mix covered by the guarantee will also need to be defined. It is common for investment guarantee products offered overseas to limit the exposure to equities to a specified maximum. This could be done by providing a guarantee over a balanced fund, which already has a maximum allowable equity exposure. An alternative to imposing a single limit would be to create a number of guarantee charges, with the charge increasing as the proportion of the total assets invested in equities breaches pre-defined levels. There is also the possibility of varying the guarantee fee with the investor’s age, especially for draw-down guarantees where mortality may start to become significant. However, in overseas markets the standard practice is to avoid this degree of complication by pricing for the average expected or target age (though this can introduce anti-selection risk).

Another consideration is the investment guarantee period. Other things being equal, a longer guarantee term will incur a lower guarantee cost, which could increase the attractiveness of the guarantee.

Finally, the product design process should consider investor behaviour, such as:

- the potential for investors to exit a product if the guarantee is out-of-the-money, only to re-enter with a higher guaranteed amount;

- investors switching between asset classes and changing the risk profile of the guarantee based on the position of the guarantee and the duration until the next guarantee reset; and

- investors making irregular or lumpy contributions or draw-downs. The size of the contributions or draw-downs can have an impact on the guarantee cost. Further, investors with a long guarantee term who make significant contributions near the end of the guarantee term could be receiving a substantial discount in the charge of the guarantee in respect of those contributions. To avoid this possibility a guarantee manufacturer may want to consider placing restrictions on the size and/or timing of future contributions.

6.2 Creates a Manageable Investment Risk

Apart from being attractive to investors, the guarantee needs to create an investment risk that can be managed. As explained in Section 5.1, a best practice dynamic hedging system involves daily monitoring of the net Greek exposure against pre-defined risk limits, via nightly valuations of the hedge portfolio and the position of the investment guarantees. Such a system requires substantial establishment and running costs, which may make it too expensive unless these costs can be spread over a significant amount of funds under guarantee. A guarantee manufacturer is therefore likely to need the scale to be able to implement appropriate systems and processes, and to perform the product development and investment management tasks at a competitive cost to the investor.

Further, if stochastic projections are used to calculate the net Greek position on a daily basis, projection model run times could become an issue. This can be assisted through the use of sophisticated sampling techniques to reduce the number of stochastic scenarios required to calculate the net Greek position. An alternative is to replace the liability projection with a hypothetical matching portfolio of traded assets, and use the price of these assets (which can be calculated from closed-form solutions without the need to use stochastic projections) to calculate the net Greek position.

Whatever the technique chosen, the guarantee manufacturer needs to be comfortable that the calculations adequately reflect the characteristics of the underlying asset classes. This could introduce further complications, such as whether to allow for non-continuous price jumps in the modelling of the asset price process. Further modelling sophistication will be required to extend the modelling of the investment guarantee and associated hedging strategy to cover asset classes not considered in this paper, such as international investments, property, infrastructure, hedge funds, currency and other alternative asset classes.

6.3 Profitable to the Investment Guarantee Manufacturer

Once a guarantee manufacturer has produced a product that they believe will be attractive to investors and creates an investment risk that they can manage, the manufacturer still needs to ensure that the product will be profitable.

The analysis presented in this paper illustrated the difference that can exist between the theoretical cost of an investment guarantee and the cost of implementing a specific hedging strategy. Further, the gap could be larger than identified in this paper as this paper assumed that the hedge position is rebalanced once per month. In reality, more frequent rebalancing may occur, which could incur higher transaction costs. The costs of holding capital to cover residual risks could also vary substantially with the approach used to manage the investment risk associated with the provision of an investment guarantee. It is therefore important to ensure that the expected cost of the selected investment risk management strategy is fully priced into the charge for the investment guarantee.

A further problem faced by manufacturers of investment guarantees is that the cost of implementing the selected hedging strategy may change as market conditions fluctuate. It may therefore be a good idea for the product design to incorporate the ability for the guarantee manufacturer to alter the charge for the guarantee within a prescribed range, similar to the manner in which many fund managers are able to alter their administration fees.

Other costs that need to be allowed for in the charge for the investment guarantee include the costs associated with the establishment and running of the systems required to support the hedging process, any distribution costs, and the product manufacturer’s profit margin.

Most of the major investment guarantee providers in overseas markets use internal dynamic hedging processes to manage the associated investment risk. There is also a tendency for guarantee providers to reduce the charge for investment guarantees by providing them "at cost", with limited or no allowance for profit margins. This is done because the investment guarantees are often viewed as a product enhancement designed to attract investors to their funds, so that the guarantee manufacturer can achieve higher funds under management, and thus higher fund administration profits.

However, the importance of economies of scale in the ability to provide investment guarantees at a cost that is attractive to investors means that it may not be feasible for many financial services providers in Australia to design and hedge their own investment guarantees. Rather than leaving this market to the larger players, an alternative scenario could involve a limited number of specialised investment guarantee manufacturers supplying guarantees to financial services providers and superannuation funds. The financial services providers and superannuation funds could then offer these guarantees as additional features on their existing investment platforms, with the cost of the guarantee related to the underlying assets.

The investment guarantee manufacturers would not be limited to the established players in the wealth management market, and could include reinsurers or investment banks. This scenario would help the guarantee manufacturer achieve adequate scale, while still giving financial services providers and superannuation funds the ability to package the guarantees as their own. However, the investment guarantee manufacturer would need to include an allowance for profit in the charge for the investment guarantee, as the benefits of any increased funds under management would flow to the financial services providers or superannuation funds, not the guarantee manufacturer.

The costs associated with providing capital to support the investment risk also need to be considered. Capital requirements to support the investment risk could arise from several sources. Firstly, the guarantee manufacturer will need to hold sufficient "economic capital" to be comfortable that it is able to absorb the residual risk associated with the selected hedging strategy under most extreme scenarios. The analysis presented in Section 5.3 showed that a risk of loss in the tails of the distribution remained for all of the hedging strategies examined. In addition, capital may be needed to cover the operational risk associated with dynamic hedging strategies.

Another determinant of the amount of capital required to support the investment risk will be legislative requirements. Key determinants of the level of required capital will be the corporate structure of the issuer and the nature of the guarantees themselves.

From a legislative required capital viewpoint, it would be optimal for the guarantees to be written within an investment management or superannuation vehicle that is exempt from the capital requirements applicable to life insurance companies and banks. In this case there would be a fixed minimum capital requirement for the issuing vehicle but no capital requirement varying in relation to the volume of guarantee business written. Any guarantee business captured within a life insurance or banking framework would be subject to capital requirements that are responsive to the volume of business written.

The nature of an investment performance guarantee may be such that the guarantee itself could be classified as life insurance. GMDBs (death) could be classified as life insurance on the basis that the excess benefit would only be payable in case of death. Depending on their structure, GMIBs (income) and GMWBs (withdrawal) may have features similar to life time or long-term annuity business. As such, they could also be considered for classification as life insurance business. The precise classification and treatment of the investment performance guarantees will depend upon the specific situation of any potential issuer.

An additional consideration for guarantees attached to the investment-linked business of life insurance companies is that the Life Insurance Act 1995 and Actuarial Standard 5 limit the cost of guarantees to 5% of the underlying policy liabilities in the relevant statutory fund. In order to ensure that this limit is not breached at any time, companies would need to maintain the cost of the guarantees well below the limit in the normal course of business.

APPENDIX A – PROJECTION ASSUMPTIONS

The financial results presented in this paper are based on projections that require assumptions for product design, experience, economic scenarios (both real world and market-consistent) and hedging strategies. This appendix gives information regarding the assumptions for product design and experience. Information regarding the assumptions for economic scenarios and hedging strategies is given in the remaining appendices.

The major product design and experience assumptions are:

- The two underlying investment funds available are an Australian equity fund (returns equal to the ASX 200 index, with dividends reinvested) and an Australian fixed interest fund (10-year rolling Australian government bonds, with coupons reinvested).

- The monthly investment earnings are subject to a taxation rate of 15% pa. This is deducted immediately after the monthly return is credited to the individual's account balance. For simplicity we apply a tax benefit of 15% pa to investment losses, and have ignored any taxation timing issues and the preferential tax treatment associated with capital gains.

- The external fund management fee is deducted from the underlying asset class return each month before the post-tax return is credited to the individual's account balance. The external fund management fee is 1.5% pa for the Australian equity fund and 0.5% pa for the Australian fixed interest fund.

- An administration fee of 0.5% pa is deducted from the individual's account balance at the end of each month, after the deduction of the external fund management fee.

- The charge related to the investment guarantee is deducted from the individual's account balance at the end of each month, after the deduction of the administration fee.

- Fees and charges are expressed net of any tax relief available to the investor.

- The individual's account balance is rebalanced at the end of each month (immediately after the deduction of the administration fee) so that the proportion of the account balance invested in each of the underlying investment funds does not change.

- We have not modelled any underlying expenses for the investment guarantee manufacturer. This is because we are only calculating financial information for the investment guarantee and are not considering the overall profitability of the guarantee manufacturer.

- We have ignored all decrements. It should be noted that mortality should be considered in the pricing of draw-down products, as different mortality at the higher ages could have an impact on the charge required to cover the investment guarantee. The extent to which this will have an impact will depend on the design of the benefit paid on death.

APPENDIX B – MARKET-CONSISTENT SCENARIOS

Introduction

The analysis presented in this paper uses market-consistent economic scenarios for two purposes; to illustrate the theoretical cost of investment guarantees and for the evaluation of dynamic hedging strategies.

In illustrating the theoretical cost of the investment guarantees a single set of market-consistent economic scenarios was utilised. The scenarios were calibrated to the following illustrative conditions:

- Swap Rates: 8% for all durations;
- Swaption Volatility: 15% for all durations; and
- Equity Volatility Parameter: 20% for all durations.

Nested stochastic calculations were performed to analyse the dynamic hedging strategies. In this case, at each node along a set of real world projections a set of market-consistent economic scenarios is generated, with the market-consistent scenarios calibrated to the economic conditions of the node in question. The market-consistent economic scenarios are then used to determine, at each node along the real world scenarios, the sensitivity of the investment risk to changes in equity prices (delta) and to changes in delta.

Appendix C provides more information regarding the real world scenarios, while Appendix D provides more information regarding the dynamic hedging assumptions.

The model used for the derivation of the market-consistent economic scenarios is described in this appendix.

Model Formulation

The projections undertaken have been performed using a series of investment scenarios generated using Tillinghast's market-consistent asset model.

Each scenario produced by the model consists of projections of a number of variables for each future year. The variables projected forward for each year t (where t is measured from a base of zero for each node along a real world scenario) include:

- the value of a share index at time t;
- the discount function at time t; and
- the price of an n-year zero coupon bond at time t (used to model fixed interest returns, to derive coupon bearing bond prices and to derive gross redemption yields).

The projection model is defined by a set of parameters, which have been chosen so that the model's results are consistent with the selected yield curve and equity market assumptions. The calibration process is described below.

The model projects the yield curve, equities and discount functions over periods of up to 50 years from a specified calibration date.

Model Calibration

The interest rate calibration process occurs in two steps. First a zero-coupon yield curve is derived from the swap rates at the valuation date. This is used to ensure that the model is calibrated to the specified interest rates at the valuation date. That is, the model will reproduce the prices of swaps at the valuation date.

Second, the interest rate parameters are chosen such that, given the discount function, the model optimally replicates the specified swaption volatilities.

The correlation of equity returns with short-term interest rates is assumed to be 0% for illustration purposes. The equity dividend yield has also been set to 0%, as we are only interested in total returns. The equity process volatility parameter was set to 20%.

APPENDIX C – REAL WORLD SCENARIOS

The real world scenarios utilised in our analysis were produced using the Towers Perrin Capital Market Scenario Generator, Global CAP:Link. Global CAP:Link is designed to help institutional investors in "decision-making under uncertainty". The underlying philosophy is that financial markets are subject to variability, much of which is unforecastable, but which still exhibits elements of pattern and shape.

The future state of financial markets cannot be accurately forecast over longer time horizons. To adequately reflect the variability that financial markets are subject to, Global CAP:Link simulates a range of realistic, possible outcomes. These scenarios can then be used to estimate the risk faced by institutional investors. For every scenario, Global CAP:Link simulates an internally consistent set of economic variables and the resulting asset class returns, for up to eight currencies simultaneously:

- Full yield curve
- Economic activity (GDP)
- Price inflation
- Wage inflation
- Corporate yield curves
- Exchange rates
- Stock returns
- Bond returns
- Real estate

The analysis undertaken in this paper only required the yield curve and stock return information for Australia. Global CAP:Link utilises an interest rate model based upon the Brennan-Schwartz two-factor method and equity growth and yield models based upon work with Professor J. Mulvey (Mulvey and Thorlacius, 1998).

Inputs to Global CAP:Link include initial conditions, normative assumptions, calibration parameters and economic data, including interest rates, GDP, inflation, earnings yield, dividend yield and equity risk premium by country.

The real world scenarios utilised in our analysis are based on an initial flat yield curve of 8% for all durations. This was also adopted as the normative assumption. The implication of these assumptions is that the real world economic scenarios target a flat yield curve of 8% at all points in time. The scenarios target equity returns of 12% and equity volatility of 20%. We note that these assumptions are consistent with those used to generate the market-consistent economic scenarios used to illustrate the theoretical cost of the investment guarantees.

APPENDIX D – HEDGING ASSUMPTIONS

The table below, from Section 5.2, outlines the dynamic hedging strategies examined in this paper.

TABLE D.1

Dynamic Hedging Strategies

Hedge Strategy	**What is being hedged?**	**How is it being hedged?**
Delta	The sensitivity of the investment risk to changes in the price of Australian equities.	Equity futures
Delta and Gamma	Above, plus the sensitivity of the investment risk to changes in delta.	Equity futures and options

For each hedging strategy the hedge position was rebalanced once per month throughout the projection period. The hedge position was rebalanced regardless of the net Greek position. In reality, to help control transaction costs each Greek position would be monitored against an acceptable exposure limit, and only rebalanced if the net Greek exposure is excessive.

The net Greek exposure is equal to the asset Greek exposure less the liability Greek exposure, where:

- the liability Greek exposure is determined by the sensitivity of the investment risk associated with the investment guarantee to the relevant underlying economic variable (equity prices and delta); and

- the asset Greek exposure is determined as:
  - Delta: the sensitivity of the equity options and equity futures held to changes in the price of Australian equities; and
  - Gamma: the sensitivity of the equity options held to changes in delta.

The analysis of the cost and effectiveness of the hedging strategies outlined above includes the transaction costs associated with each hedging strategy. For equity futures we have assumed transaction costs that are in line with commissions, fees and the interest foregone on the initial margin call. For equity options we have assumed transaction costs for a purchase and a sale to be equal to half of a typical bid-offer spread, as illustrated in the table below.

TABLE D.2

Transaction Costs for Hedge Instruments

Hedge Instrument	Bid-Offer Spread	Transaction Cost
1-month future on the ASX 200	n/a	0.4 bps
1-year at-the-money put option over the ASX 200	40 bps	20 bps

Note that to avoid option settlement and to salvage some option value prior to expiry, all options with one month till expiry are sold as part of the monthly rebalancing of the hedge position.

REFERENCES

AFR Opinion Editor 5 January 2007, *Super reality check overdue,* Australian Financial Review

APRA 2007, *June 2006 Annual Superannuation Bulletin*, APRA

Australian Bureau of Statistics 2005, *TABLE 3.9 DEATHS, LIFE EXPECTANCY, Australia, 1995–2005,* in ABS cat. no. 33020 2005 Deaths, Australia

Bailey, Michael 2006, *Trading Up: investment banks court the wholesale funds management business*, Investment & Technology

Dunstan, Barrie 27 March 2007, *A 2020 vision for super amounts to $4 trillion*, Australian Financial Review

Mulvey J. M. and Thorlacius A. 1998, *The Towers Perrin Global Capital Market Scenario Generation System*, in World Wide Asset and Liability Modeling (W. T. Ziemba and J. M. Mulvey, eds.), Cambridge University Press

Swift, Brendan 22 May 2007, *700 Cough up $1m Super each*, Australian Financial Review

Productivity Commission 2005, *Economic Implications of an Ageing Australia*, Research Report, Canberra

Roberts, Zac 2006, *Investment Guarantees – Is it time to Consider Defensive Investment Products?,* Towers Perrin Update December 2006

Tillinghast 2007, *2007 Australian Superannuation Survey Results, Investment Guarantees in Superannuation*, Towers Perrin