

## **Who's afraid of the big bad bear?**

Or, why investing in equities for retirement is not scary and why investing without equities is scary.

Ronald Bewley, Nick Ingram, Veronica Livera and Sheridan Thompson  
*CommSec\**

July 7, 2003

Invited Paper for Colloquium on  
Retirement Provision in Scary Markets

### **PRELIMINARY DRAFT - PLEASE DO NOT QUOTE**

The third Millennium bear market has caused financial worries to many, especially those about to retire and those exposed to equities in retirement. The natural reaction is for investors to avoid or down-weight equities in their portfolios, at least until this bear market becomes a distant memory.

Recent negative returns have depleted savings for anyone in equities. Of these investors, those drawing on an allocated pension, without sufficient cash reserves to weather the bear market, have been hit the hardest.

While some alarmists are prophesying the-end-of-the-world-as-we-know-it, there are good reasons for believing that a return to normalcy will come. In such a world, good planning, with the aid of a sensible quantitative asset allocation model provides risks and returns that outstrip those who chose to avoid equities.

The current market is put into perspective using a statistical analysis of equity returns and asset allocations. The potential of the future market is defended.

The need for a dynamic asset allocation over an investor's life cycle is discussed. Emphasis is placed on the distinction between investing while working and investing during retirement. The importance of an adequate allocation in cash and other low risk liquid assets is stressed.

Our prescription for investing in equities is evaluated in a simulation experiment. We do this in the context of the expected duration of future bear markets.

\* This paper does not necessarily reflect the views of CommSec nor the Commonwealth Bank of Australia.

## 1.0 Introduction

Few would deny that the turmoil experienced in the political and financial arenas in recent times have changed people's perceptions of the world. Examples of these unusual events include the stock market collapse of 1987, the worldwide problem of terrorism, the Asian crisis and the financial collapse of several global conglomerates, to name just a few.

The impact of these events on investment performance is a cause of much concern to all investors. The financial press is saturated with opinions on the current state of investment markets. Some proclaim the arrival of the bear market to end all others. Others advocate that the time for investment is ripe, claiming that markets have nowhere to go but up. These alternative views have certainly increased the confusion and scepticism of investors regarding equity markets – particularly of those investors who recall more stable times from the past.

While the impact of these events on the performance of investments is a matter of concern for all investors, it is particularly so for those in or facing retirement. These days we are actively encouraged to provide for our own retirement, with government social security offering only the bare minimum. Thus, the impact of these turbulent times on our financial security in retirement is a matter of grave concern. Whereas those who have many years to go before retirement have the opportunity to recuperate from any unexpected losses in their investments, retired individuals may not.

The fear that equity markets are altogether too volatile, particularly in recent times, for retirement investments have led some retirees and their advisers to steer clear of equities as much as possible. Retirees have come to rely on conservative lifetime annuities and other seemingly low-risk investments such as property. However, these low-risk investments, while offering a stable stream of income, may not provide retirees with enough funds for the lifestyles they desire.

Retirees may find themselves altering their expenditure patterns significantly in fear of running out of funds, thus failing to take the fullest advantage of their lifetime savings. Or, they may continue with the lifestyle they are accustomed to and gradually erode their investment capital without further re-investment. On the other hand, those retirees with investments that are too heavily weighted towards risky markets face the possibility of crystallising losses from their investment funds.

To those who have worked hard in their careers for many decades, anticipating a comfortable lifestyle in retirement, the thought of not having sufficient funds in their twilight years is a daunting thought. In addition to the usual investment risk of not meeting investment goals, retirees face the additional burden of longevity risk, or outliving their funds. Usually, emphasis is placed on the former type of risk, with little thought given to the possibility that the pool of funds and stream of income received will not sustain the increasingly higher life expectancies we can enjoy.

In this paper, we attempt to address the challenge of mitigating the two main types of risk facing retirees: investment risk and longevity risk. In our paper, these risk management issues are translated to striking the right balance between risky and non-risky investments in retirement. Investment asset allocation during retirement has the particular challenge of ensuring that retirees are not put into an over-aggressive investment position with excessive investment risk, leaving retirees vulnerable to equity market fluctuations. The other part of the retiree investment challenge not often considered by conventional retirement plans is the danger of an asset allocation that is overweight towards fixed-interest and other low-return investments. Such a strategy may fail to realise the potential of the retiree's funds to provide the income for their desired lifestyle.

In the context of the particular circumstances and issues of investments during retirement, we address three pertinent questions. Is the world more volatile now than before? Secondly, are equities really all that risky? Thirdly, how do the answers to these questions impact on the right mix between risky and riskless investments in retirement?

Our first task, in Section 2, is to separate fact from fiction when it comes to the question of whether we live in a more volatile investment world now than before. In answering this question, we perform an objective statistical analysis of the data. The results clearly depend on the period being analysed. Our longer-term view refutes the popular belief that all equity markets have undergone an upward shift in volatility.

Importantly, our analysis shows that, while broad markets are not now more volatile, component stocks or industries are. This change in the balance of volatility means that effective diversification strategies are now even more necessary for investors than before.

The common perception when comparing equity markets with perceived lower-risk investments such as fixed interest or property is that equity markets suffer long and sustained periods of loss before recovery not shared by other investments. We provide a number of representations of the past experience in various asset classes that give a different view of asset market behaviour. For example, surprisingly, some property markets have experienced longer periods of sustained loss than Australian equities, debunking the myth of their infallibility.

We also assert, in Section 3, that the same arguments of diversification that are applicable to investments during the working period of an individual's life also apply to the retirement period. If retiree investors are prepared to invest for a reasonably long period of time, our portfolio analysis suggests that excluding equities will be to the considerable detriment of many retiree investors. Equities offer significant diversification benefits because of the low correlation between the asset classes.

In Section 4 we estimate that the rewards offered by equity investments are significant enough to overcome the higher risk accompanying them. Our multi-period asset allocation analysis shows that equities should be included in retirement investments, especially in the beginning phases of retirement, unless the retiree has only small savings to commence this strategy. Equity investments should be balanced with adequate fixed interest and cash investments that offer a secure and stable income stream and diversification of risk. We demonstrate these effects using a number of hypothetical retirement scenarios. We conclude in Section 5.

## **2.0 Is the World More Scary?**

Casual inspection of equity market returns might suggest that they are more volatile now than in the past. Experience has shown that asset markets experience temporary periods of higher volatility surrounding an adverse event. However, these short-term clusters often subside with time, and volatility returns to its normal level. The challenge is to identify those equity market reactions that are strong enough to signal a significant permanent change from the short-run clusters that occur, and modify an investment strategy accordingly.

We consider a number of issues in regard to this question. The first is have the unusual and unprecedented events of the past decades, such as the Asian crisis or the threats of terrorism caused a permanent increase in equity markets' volatility? We then investigate Australian equity market volatility in more detail by decomposing it into the overall market, industry-specific and firm specific volatility. We then compare our findings on the Australian market with the findings of the Campbell, Lettau, Malkiel and Xu (2002) study on the U.S. market.

Finally in this section we ask how bad can a bad experience in equity investments really be? And how does such a negative experience in equities compare with that in other investments?

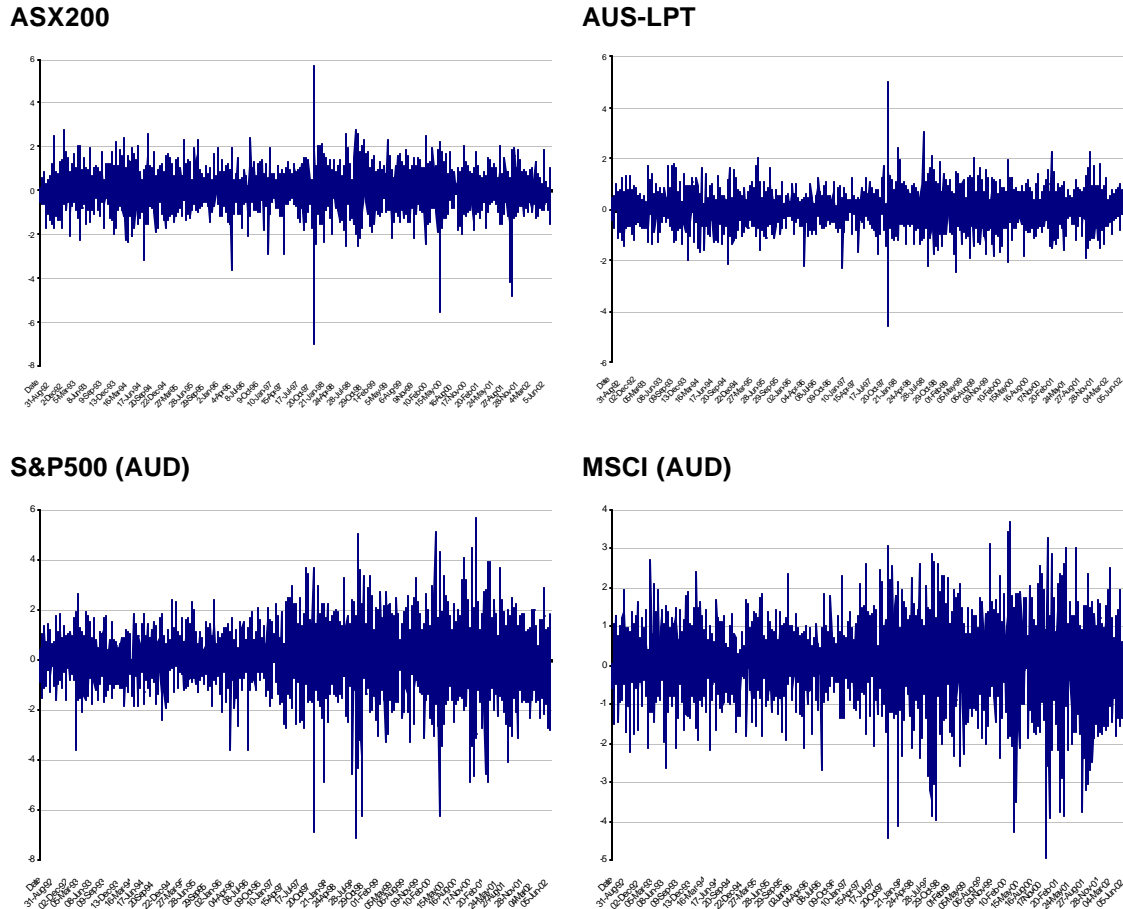
### **2.1 Are Equities More Volatile?**

In analysing whether or not asset returns have become more volatile with recent events, we consider, by way of example, Australian equities (ASX200), and Listed Property Trusts (LPTs) and international equities. International equities are represented by the S&P500 for the USA and the Morgan Stanley international index (MSCI) for global equities. Both international indexes are expressed in Australian Dollars. Monthly returns of the four assets are shown for the last ten years in Figure 1.

This figure confirms a number of stylised facts about the asset class series. Month-to-month returns appear to fluctuate randomly around some average value making short-term prediction futile. However, there is a limited degree of predictability in the volatility of these series. Returns appear to experience short-term bursts of abnormally high or low volatility in certain periods followed by a return to more average volatility levels.

The two international equity series appear to have higher (long-run) volatility since 1997, coinciding with the post-Asian crisis period. It is unclear from a visual inspection whether Australian equities and Listed Property Trusts show a one-off increase in long-run volatility.

**Figure 1: Returns Data**



The CommSec test for detecting structural breaks in long-run volatility has the advantage of not having to impose a particular hypothesised break point. Instead, every possible data point is considered. Where the test statistic at a particular point breaches its critical value, it is highlighted as the point at which a possible permanent change occurs.

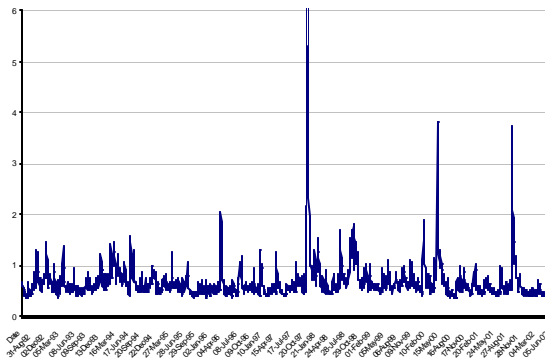
Each of the series shown in Figure 1 was tested for structural breaks. In results not shown, structural breaks in long-run volatility were found in both of the international equity market volatilities. To ensure that the detected change in volatility was not a result of a volatility-break in exchange rates, we subjected the AUD/USD exchange rate series and the international indexes expressed in US dollars to the same volatility break test. Structural breaks were detected in all three series.

The Listed Property Trust series also showed evidence of a small but significant change in volatility since the Asian crisis period. However, the Australian equity market appears to have been immune to the effects of the Asian crisis. No significant break was detected for the ASX200, even though the LPT index is a component of it. This conundrum is explored more fully in the next section.

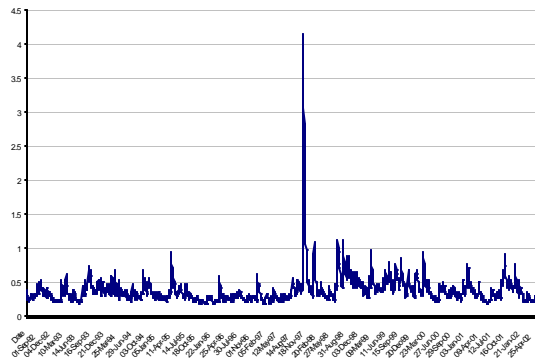
We estimate the monthly volatility of each of the series using the CommSec method that is based on a GARCH process. It allows factors and the possibility of structural breaks. Our estimates are given in Figure 2. The short-run clusters around a permanent long-run break are clear for all but the ASX200. The absence of a break in the ASX200 is striking.

**Figure 2: Estimated Volatility**

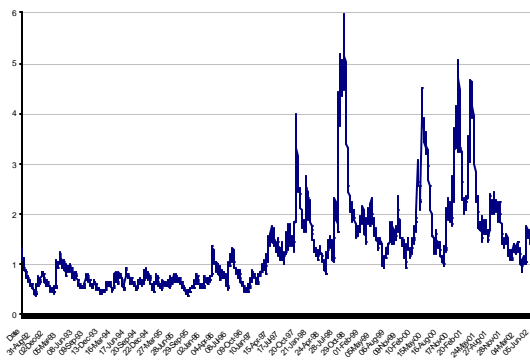
**ASX200**



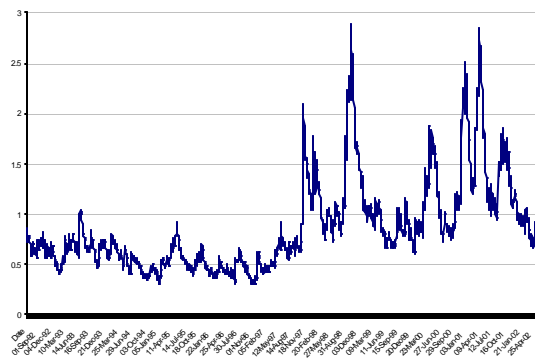
**AUS-LPT**



**S&P500 (AUD)**



**MSCI (AUD)**



The fact that the short-run clusters are of limited duration means that risk to the investor only depends upon the long-run level of volatility providing the investors anticipates holding the assets for more than a few months. The puzzling resilience of Australian equities to a structural break in volatility is now examined in a much longer term and detailed analysis.

## 2.2 A Decomposition of Risk

Having found no evidence of a significant permanent change in volatility in Australian equities as a whole, but some evidence of a break in a component, LPTs, we examine this equity volatility question more thoroughly.

Total equity volatility can be expressed as the sum of the parts attributable to the overall market, the representative industry and the representative firm following Campbell et al. In this way, we are better able to analyse any changes in volatility that may have occurred in the component parts that happen to cancel out in the aggregation to Australian equities as a whole. This cancellation effect may occur because of changes in the correlation structure of these components.

Campbell et al devised a theoretical method for defining component measures of market, industry and firm risk that sum to the excess-return volatility of a typical firm. Their method defines a firm's total excess-return (excess returns relative to a risk-free measure) volatility as the variance of the component daily returns, that is, the market, industry and firm-specific parts. They use the daily data within each month to estimate monthly volatility.

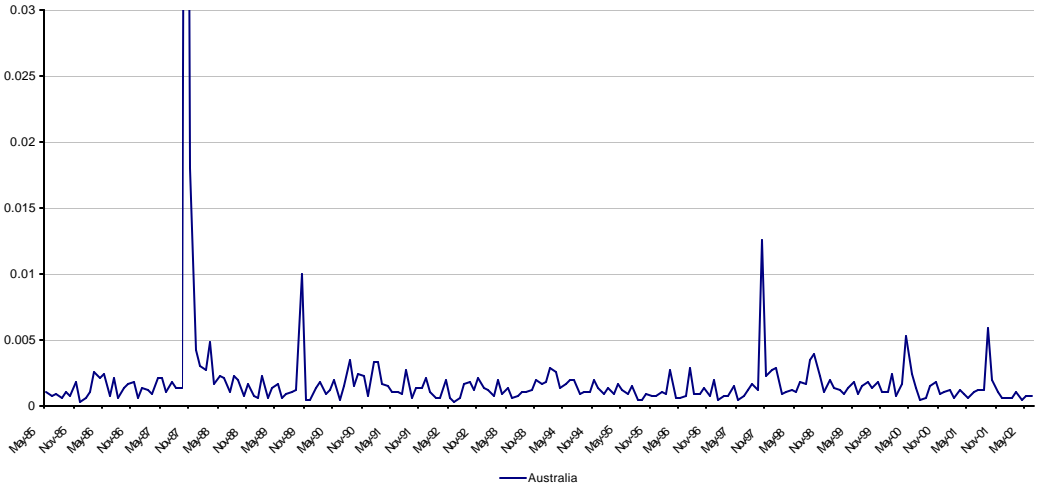
In Campbell et al's study of the U.S. equities market, they concluded that the volatility of individual stocks in the USA has been trending upwards, but the market and industry components were stable. Their data period, however, ended in 1997 before the Asian crisis took effect. Our Australian equities study starts in 1985 because there is no comparable data prior to that year. However, at the other end of the sample,

we have almost five more years of data than Campbell et al. This extension to the sample is particularly important because the Asian crisis occurred in the last few months of the Campbell et al sample.

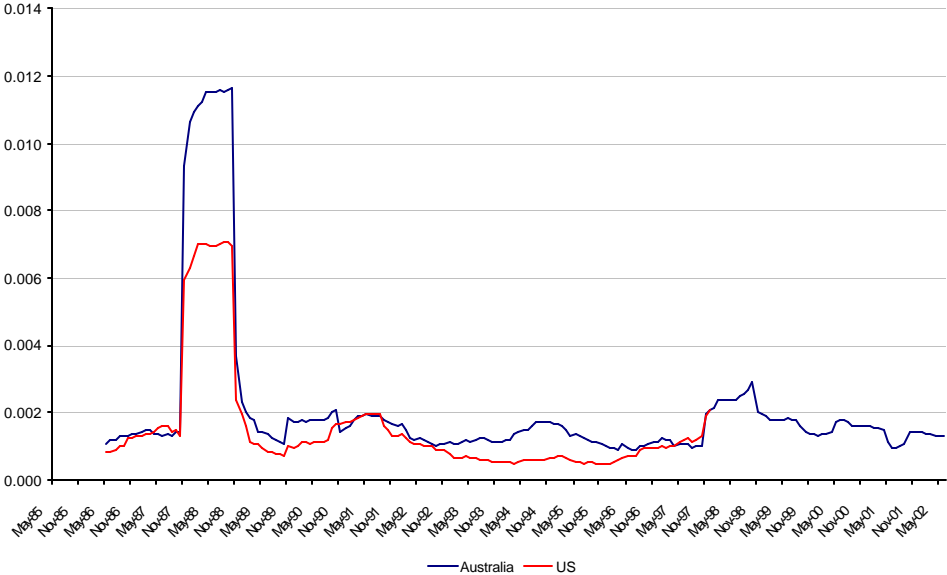
The raw monthly market volatility component is shown in Figure 3. This is similar, but not identical, to that which would have been obtained by analysing the ASX 200. The main difference is because to the Campbell et al methodology uses fixed weights within each month.

The October 1987 peak is off the scale, at a value 0.073, but this volatility cluster subsides to normal behaviour within six months. The October 1989 shock dissipated within a month. The October 1997 Asian crisis shock dissipated from market-level risk within four months. Thus, our analysis shows that the shocks that impacted the Australian market in recent years, while causing temporary increases in volatility, were not persistent enough to create any permanent increase in riskiness. We do not find evidence of an upward trend in overall market volatility.

**Figure 3: Market-Level Component of Volatility**



**Figure 4: Moving Average of Market-Level Volatility**

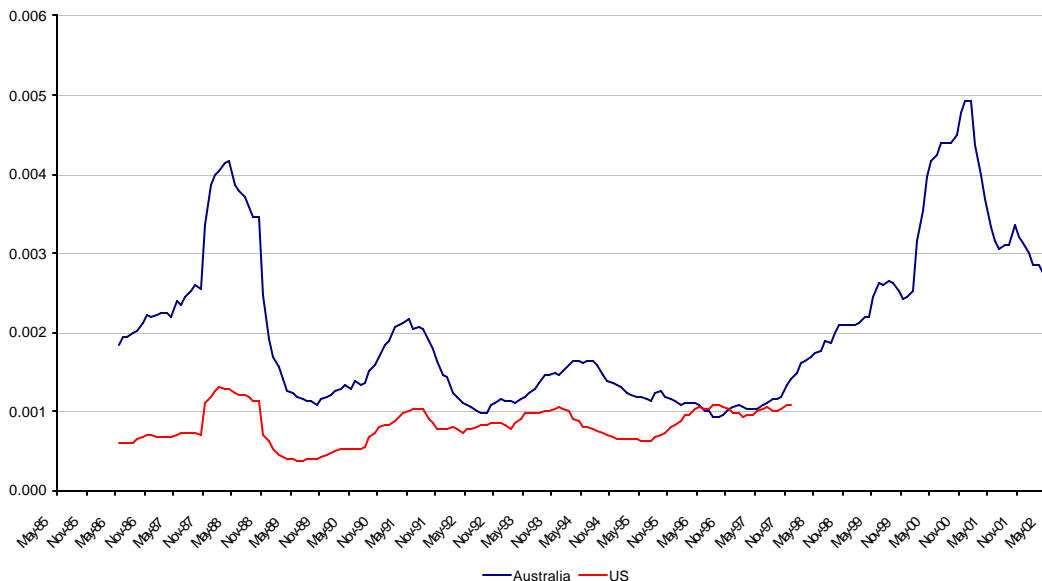


The absence of a trend in the Australian market volatility can best be seen in the 12-month (lagged) moving average shown in Figure 4. The Asian crisis appears to have lasted longer in this representation, partly because of the length of the moving average and partly because of the subsequent volatility spikes.

Nevertheless, there is a distinct return to the levels of the mid-1990s. The correspondence between Campbell et al's estimates for the US and ours is striking.

The raw industry-level volatility component is the weighted average of industry-level risks across industries. We see from Figure 5 that the post-1997 volatility clusters (not shown) significantly contribute to a large and permanent change in the lagged twelve-month moving average of the industry specific effects.

**Figure 5: Moving Average of Industry-Level Volatility**



Comparable US data from Campbell et al are also shown in Figure 5. Interestingly, the estimates from the two countries are similar in 1996 and 1997. There is a slight difference in the trend prior to that time and there is much less risk around 1987 in the US than in Australia. Without comparable data for the US post-1997, it is difficult to draw strong conclusions about the similarities or differences between industry level risks in the two countries. However, we do conclude that industry-level risk in Australia has been trending upwards in recent years. Unlike Campbell et al, we did not detect any trend in the firm-specific volatility (not shown).

These structural changes within different industries have important implications for diversification strategies within equities. With the exception of a few industries, the relative volatilities between industries (not shown) do not appear to be distinctly different when we consider the entire sample period. However, post the Asian crisis, relative volatility between industries has changed. This suggests greater inter-industry diversification benefits since 1997 than previously.

### 2.3 How Bad is Bad?

The preceding quantitative analysis on the changes in equity risk gives little indication of what the actual experience of weathering the peaks and troughs of equity investments may feel like. As another measure of the relative riskiness of asset classes, we ask the question, how long is a bad run? A bad run is measured as the length of time required for an asset to recoup losses after accounting for inflation. This measure gives us an idea of how long retirees might be expected to weather losses if they include equities among their investment strategy compared to other asset classes.

We assess these probabilities in two ways. In the first we scrutinise the last nineteen years of quarterly data to count each and every run of loss. The probability of each asset class having experienced a losing sequence historically is computed by considering every possible quarterly start date of investment over the past 19 years. We computed the probability of an asset class experiencing a run of losses, in terms of the amount of time required in quarters for the asset class to recoup its loss to a level equal to, or higher than, its starting value. In the second, we use simulation methods to predict future losing runs. These

probabilities of loss are based on the assumption that asset returns from quarter to quarter are independently and identically normally distributed.

Figure 6 shows the cumulative probability of each asset experiencing particular lengths of losing periods over the last 19 years of monthly historical data. We have chosen a number of asset-classes representative of a variety of investment markets. They are Australian and international fixed interest, Australian and international equities, direct property and listed property trusts. Since residential property is considered by many investors to be a safe and highly profitable investment, we have included Sydney residential property (inclusive of rents) as an asset class. All data are in real terms.

**Figure 6: Probability of Losing Sequences**

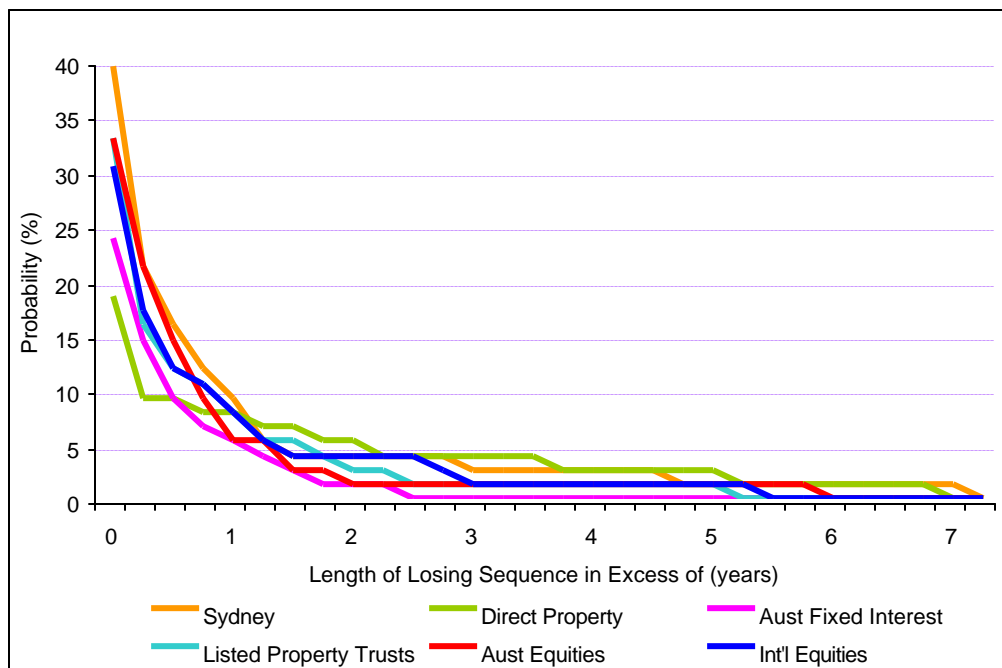


Figure 6 may be interpreted as follows. Consider the case of Australian equities as an example. Based on historical data, we find that Australian equities had a 33% probability of breaking even or making a profit in the first quarter after an investment. That is, Australian equity investments made in any quarter over the past 19 years returned a profit at the end of the investment period 67% of the time. Australian equities experienced losses for one year or more before regaining losses 5% of the time. The probability of Australian equity investments taking four years or more to break even or make a profit is much lower at 3%.

Unsurprisingly, the figure shows that there is a much lower probability of sustaining a long period of losses than facing losses for one or two quarters. Even those investments made at the worst times rebound within a maximum of eight years over the last 19 years. The asset classes with the lowest probabilities of experiencing losses for one year indicate the best investments for very short-term investors.

Figure 6 also reveals an interesting comparison of the relative performance of the asset classes. Sydney residential property had the lowest probability of making a profit at the end of the investment period at 60% of the time followed by Australian equities at 67% of the time. Direct property had the highest probability of making a profit at the end of the investment period at 82% of the time.

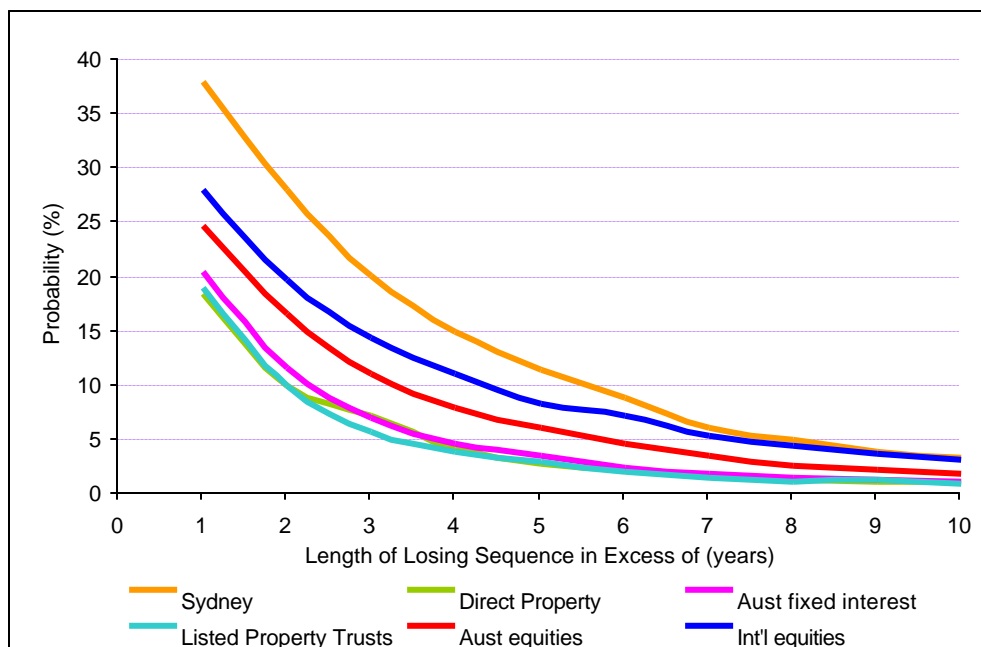
Despite the preference for residential investments among many investors, particularly retirees, our calculations show that the Sydney market experienced a downturn for seven years following the 1989 first quarter peak before rebounding. Similarly, despite having the highest probability of a profitable investment in one quarter, some direct property investments experienced losses for seven years before rebounding. In contrast, the longest period over which Australian equities experienced a loss before regaining the initial investment value was six years. The longest losing sequence for international equities was 5.5 years.



We now repeat the preceding analysis, which was on historical data, to project the likelihood of prolonged losses in the future through simulations. Under the assumptions of our model, returns are assumed to be identically and independently normally distributed, allowing for unexpected exogenous shocks that are not part of the underlying process. In our analysis of historical performance, we included the impact of the quarter of the 1987 stock market crash in our estimates of average returns but not variances. We do not believe that the crash is likely to be repeated within a 19 year period.

Our simulation results are reported in Figure 7. They show that the probability of having to bear losses in equities is much lower for prolonged periods than it is for shorter periods such as one or two years. Sydney residential property has a much higher probability of suffering losses over the short term than Australian equities. We estimate a 35% chance of Sydney property sustaining a loss for one year or more, compared to less than 25% for Australian equities. While we estimate that there is a 5% chance of sustaining a loss in Australian equities for seven years or more, this is very similar to the probability for residential property. The estimated probabilities of losing sequences approach zero asymptotically.

**Figure 7: Projected Probability of Losing Sequences**



Our results based on historical data and simulations suggest a result that is contrary to the traditional retirement strategies that under-weight equities due to their perceived higher risk. In terms of the length of time the investment has to be held for until it yields a profit, we find that equities in fact fare better than residential investments.

Over the past 19 years, the longest run of losses in Australian equity investments was six years, compared to seven for property investments. Both historically, and based on simulated projections, we find that international equities are slightly riskier than Australian equities. They generally require longer holding periods than Australian equities in times of bear markets. Overall, our analysis on probabilities of loss advocates that, if held for a sufficient period generally exceeding five years, equities can offer retiree investors significant benefits without undertaking excessive risk.

### 3.0 Is There Life Without Equities?

Retiree investors should and do approach equity and all other risky investments with caution. Experience shows us that equity markets have higher risk than many other asset classes. Our analysis of the actual experiences in investments in the past 19 years have shown that, at the very worst periods in equity

market cycles, investors would have had to wait six years before recouping their money. However, other investments, such as some investment property, are equally risky.

A retirement strategy with low investment risk, based solely on cash and fixed interest investments, has the benefit of giving investors a steady income stream with little or no uncertainty. But such an investment strategy can be costly, even in, or especially in, retirement. At a time when investors require the maximum benefit from their investments, the compensatory benefit of including equities as part of a diversified strategy can far outweigh the cost.

We first consider the investment choices available to an investor who chooses to exclude equities completely, in the form of Australian shares, LPTs or International shares. Figure 8 shows the estimated portfolio efficient frontier obtained by combining Australian fixed interest, direct property and Sydney residential property only ('Without equities') based on the risk return characteristics of the representative asset classes over the last 20 years. In this first case, we assume that the retiree investor does not wish to invest in any international assets or domestic equities.

We see that Australian equities and Sydney residential property have very similar risk/return characteristics, providing the highest return for a given amount of risk. The impact of the significant downturn in international equities in recent months on the estimated returns is apparent.

The estimated frontier is the outer envelope of all possible combinations of the three assets. For each level of risk, the portfolio estimated to yield the highest return are those on the upper outer layer of portfolios. The frontier is bound from above and below by the highest and lowest risk/return asset classes, which are Sydney residential property and direct property, respectively.

The green line in Figure 8 gives the estimated efficient frontier including Australian equities, 'with Australian equities', (but not international assets). The green and blue lines are not very distant from each other because Australian equities and Sydney residential property are very similar in risk and return. However, including Australian equities in a diversified portfolio offers significant benefits to investors both in terms of risk and return.

The gains from including Australian equities are most apparent for less-conservative investors. Consider an investor who is willing to accept 12% annual volatility on their investments. The return on a portfolio excluding Australian equities is approximately 9.5% per annum. Then consider an investor who includes Australian equities in his/her portfolio. By moving to a portfolio on the green frontier that includes Australian equities, the investor can get an equivalent amount of return for more than 2% less risk. For a conservative investor who is only willing to bear 6% volatility, including Australian equities offers less risk for an equivalent return.

The benefits of diversification become very apparent when we compare the portfolio outcomes including and excluding Australian equities. Even though it is the asset class with the highest risk, we see that even for the most conservative investor, including Australian equities offers significant diversification benefits in terms of lower risk. The ability to reduce risk for a desired level of return is an advantage offered by Australian equities that is highly desirable to retiree investors, who would wish to bear as little risk as possible.

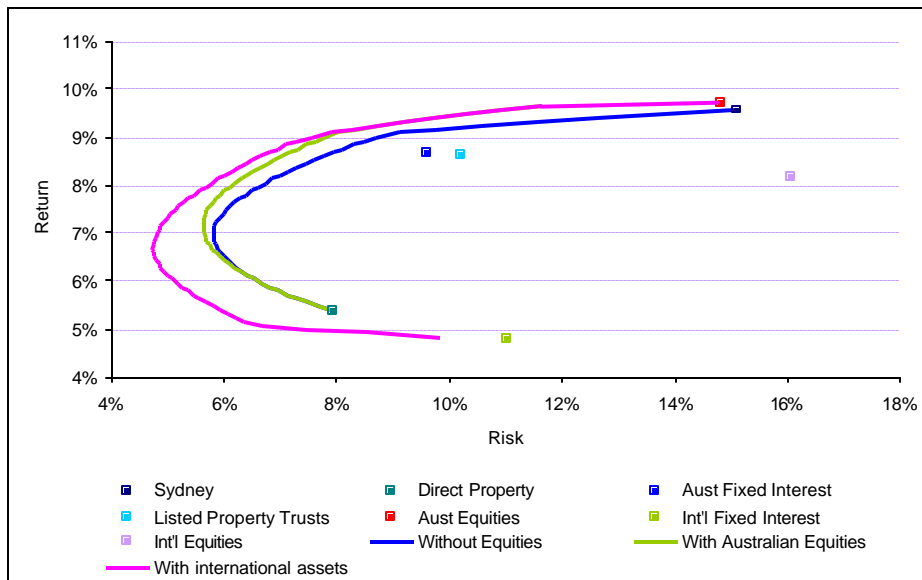
International equity investments have been a cause for much concern over the past three years, having sustained significant losses in the last three years. Even though they have staged a small recovery in the past month, many investors are giving international equities a very wide berth. However, the low correlations between asset classes mean that even international investments can be beneficial to investors when combined with other asset classes.

Compare the green estimated frontier in Figure 8, which includes Australian equities but excludes international assets, with the purple line, which also includes international equities. Here, we see that both the green and purple estimated frontiers are bound at the right by Australian equities, which is the highest risk/return asset. For the less-conservative investor, including international equities offers no additional benefit.

The result of our analysis is that including international equities benefits the most conservative investors the most, despite its status as an inferior asset class when considered individually. Although international assets have a lower level of return and higher risk, the fact that it has low correlations with the other asset

classes means that it offers significant diversification benefits to conservative investors. For an investor who is only willing to bear 6% volatility, including international equities offers an equivalent return but for much lower risk level of 5% per annum.

**Figure 8: Estimated Efficient Frontiers**



#### 4.0 Why Are Retirees Different from Other Investors?

History shows that the financial industry has tended to have its actions dictated by the perceived shifts in equity markets. When market sentiment favours equities, the industry has been known to increase the allocation to equities and down-weight equities when performance has been poor.

Certainly, the boom period in equities during the 1990s was accompanied by increasing allocations to equities in balanced funds for investors both in and nearing retirement in Australia. This problem is not one that is unique to Australia. For example, the same pattern was followed by the financial industry in UK in the early 1970s.

Arising from these changing trends in asset allocations, the financial press has been splattered with cautionary tales about recent retirees being placed in dire circumstances because of their equity allocations. There have been numerous occasions when the industry has come under criticism for 'chasing returns' and taking advantage of favourable short-term experiences to push clients into more aggressive risk profiles. However, investors are also culpable by demanding higher returns to meet their growing need for self-funded retirement into increasingly longer life expectancies.

The recent industry lobbying of the government for the introduction of growth-based allocated pensions is another symptom of succumbing to short-term market fluctuations, coupled with the increasing demands of retiree investors. Whilst a useful addition to the range of products available, these products present a potentially dangerous zone if all retirement funds are placed into one such fund without adequate liquid assets.

Adverse world events may have led investors to be more wary of equity markets now than in the past. However, we have argued that equity risk has not in fact increased and that equity allocations should be retained as part of a diversified strategy. Comparing investment choices with and without equities, we have found considerable evidence in favour of including equities. Both Australian and international equities provide increased returns as well as significant diversification benefits.

Even though equities have not changed significantly in nature, it cannot be denied that the needs of investors, particularly retiree investors, have undergone significant changes. The role of self-funded

investments in retirement has undergone a paradigm shift in recent decades. We are increasingly forced to make sufficient provisions for our retirement or face the prospect of relying on the diminishing benevolence of the social security system.

We are also living longer now than before. If a typical person attains a tertiary education until the age of 23, then works until the age of 60, that leaves a working life of approximately 37 years. This typical scenario presents the challenging possibility of having a retirement period longer than a person's working period. An individual would have to accumulate sufficient funds and invest prudently enough to fund a longer spell in retirement than their working life.

Life expectancy is often cited as the age to which retirees need their resources to last. However, there is a close to 50% chance of outliving the actuarially determined life expectancy. We suspect that this is too high a longevity risk for most. Instead, resources must last until some later date at which longevity risk is more acceptable, say only a 20% chance of outliving resources. We call this the 'required' period.

The increasing reliance on self-funded retirement coupled with the increasing periods over which such funding is required set retirees apart from other investors. Another factor distinguishing retiree investors is the tax environment they face. For example, tax can be largely avoided with allocated pensions, which gives a strong incentive to retirees to rely on such products. For our analysis we choose to ignore the many complexities of the Australian superannuation taxation system. We comment in passing that the prospect of further government-led change to the taxation system be scarier to retirees than the riskiness of equity markets.

Given the particular requirements of retiree investors to balance investment risk and longevity risk two popular investment vehicles for retirees are lifetime annuities and allocated pensions. Lifetime annuities invested in conservative assets offer a relatively low return, but are guaranteed by the life company to continue for life (that is, there is no risk of outliving funds). On the other hand, allocated pensions offer more equity-orientated assets, but retirees face investment risks.

Too low an equity allocation means that returns may not be sufficient to allow the portfolio to last the required period. There is thus a strong case for equities especially in the first years of retirement when the required period for the portfolio is longer, than in the latter stages of retirement. Our work has shown that the maximum estimated number of years that downturns in equity markets are expected to last is about five or six years. This gives strong support to the inclusion of equities in retirement investments.

Conversely, the equity allocation can be too high. Intuitively, if returns are negative in the early years, this can dramatically affect the portfolio's ability to support the desired lifestyle for the required period. This impact can be particularly hard if too many growth assets are held when markets perform negatively to the point where growth assets have to be sold to pay for the current retirement lifestyle. This is doubly bad because growth assets are being sold at a bad time in the market. Thus, their potential to support a long retirement is lost. The damage is done and the required period and/or desired lifestyle cannot be met.

Given the consequences of a poor retirement investment strategy for the retirees of today and tomorrow, what then is an appropriate allocation to equities in retirement and for how long should it be maintained? We address this question in the next section, using simulation techniques to hypothesise the likely outcome of several alternative investment scenarios, under various retirement conditions. Our simulations provide indicative results that shed some light into the practical consequences of having equities among retirement investments.

## **5.0 Do Equities Really Add Value in Retirement?**

Our analysis shows that the scariest thing about investing in retirement is not the risk associated with equities but the possibility of outliving our funds, or longevity risk. On one hand, equities may very occasionally have bad runs of six years or more, which would put a significant strain on retiree's funds. On the other, however, is the very real possibility of living for thirty or forty years after retirement. Thus, retirement investing strategies have to walk the thin line of conservatism to avoid financial collapse through over-aggressive investments while providing for increasingly longer life spans.

To have an idea of what the experience of investing in retirement might be like for representative types of retirees, we have conducted a number of simulation experiments. We simulated the experience of investing and spending in retirement under four scenarios. These scenarios were formulated with assistance from a number of advisers who are well versed with the experiences of advising retirees. Although stylised, these simulations give an indication of the impact of equity investments in retirement.

Our simulations of the retiree experience are based on a number of assumptions. We assume that the retiring age is sixty. We do not assume a particular life expectancy – instead, we allow for the possibility of a very long lifespan of 100 years or more, which may not be unreasonable. We have assumed four levels of income/wealth for retirees.

We have divided the total number of years in retirement into three phases, according to our perceptions of likely expenditure patterns. The first 10 years of retirement are characterised by the highest annual expenditure, as this is the period in which retirees will be most likely to undertake travel and other extra-curricular activities. In the second ten years, expenditure is lower per annum than in the first ten. In the last phase of retirement, we assume that the largest portion of income is necessary for health care expenses. Excluding health care, we assume that retirees have few additional expenses. Therefore, the third phase of retirement has the lowest per annum expenditure. We assume that the investment asset allocation remains constant over each phase. The details of the assumptions used are given in the Table 1.

**Table 1: Retirement Simulation Scenarios (excluding inflation)**

	<b>SCENARIO I: Low income</b>	<b>SCENARIO II: Middle income</b>	<b>SCENARIO III: High income</b>	<b>SCENARIO IV: High net wealth</b>
Lump sum at beginning of retirement	\$ 100,000.00	\$ 250,000.00	\$ 500,000.00	\$ 1,000,000.00
<b>Phase 1: 60yrs - 70yrs</b>				
Duration (yrs)	10	10	10	10
Annual expenditure	-\$ 20,000.00	-\$ 25,000.00	-\$ 35,000.00	-\$ 50,000.00
Total expenditure	-\$ 200,000.00	-\$ 250,000.00	-\$ 350,000.00	-\$ 500,000.00
<b>Phase 2: 70yrs - 80yrs</b>				
Duration (yrs)	10	10	10	10
Annual expenditure	-\$ 15,000.00	-\$ 20,000.00	-\$ 25,000.00	\$ 35,000.00
Total expenditure	-\$ 150,000.00	-\$ 200,000.00	-\$ 250,000.00	\$ 350,000.00
<b>Phase 3: 80yrs onwards</b>				
Duration (yrs)	10	10	10	10
Annual expenditure	-\$ 10,000.00	-\$ 15,000.00	-\$ 15,000.00	\$ 30,000.00
Total expenditure	-\$ 100,000.00	-\$ 150,000.00	-\$ 150,000.00	\$ 300,000.00

For simplicity, we assume that each retiree has the choice of investing in a combination of two investment assets: a riskless asset such as cash and an equity asset that is risky. We assume an average annual real return of 10% and standard deviation of 14% for the equity asset, which correspond with the 20-year historical average return and standard deviation figures for Australian equities. Drawing values from a normal distribution with these mean and standard deviation parameters simulates the return on equities in each year.

The riskless asset is assumed to have a known real return of 3%. If each investor only invested in the riskless asset, he or she would run out of funds at the age of 66 under Scenario I, 72 under Scenario II, 79 under Scenario III and would not run out of money over a reasonable lifespan under Scenario IV.

Our task is to evaluate the benefit of investing in equities over the different phases of retirement. The criteria for a favourable investment strategy are that the retiree does not outlive available funds and can maintain a desired lifestyle.

As a measure of the gain by including equities in retirement investing, we measured longevity risk or the possibility of outliving retirement funds, given a certain asset allocation between the risky and riskless assets. If a retiree runs out of his/her own funds, he/she would have to rely on social security payments or

sell other assets not considered in this portfolio. We calculated the probability of running out of funds at each year after retirement, given a certain asset allocation.

The expenditure for each year is accounted for at the end of a particular year, after which the remaining investment funds after drawdown are carried forward to the next year. The remaining funds then earn a certain investment return for that year, which is accumulated to the fund at the end of the year. All figures are in real (inflation-adjusted) terms.

We simulated a number of alternative asset allocations for the scenarios I-IV. We have assumed that the proportion of equities in each phase remains constant, but is allowed to vary across the hypothesised phases of retirement. We do not account for any fees or taxation issues.

To simplify the scenarios given the myriad of possible combinations of the two assets, we have assumed that the proportion of equities held in each phase of retirement are 80%, 40% or 0% with the remaining proportion invested in the risk-less asset. We have deliberately chosen three extreme positions of equity allocation of 0%, 40% and 80% in order to highlight the resultant differences in outcome.

A buffer minimum allocation of 20% to the risk-less asset has been allowed, to provide some amount of guaranteed financial security to retirees. This minimum riskless allocation provides some allowance for drawdowns to be made in periods of negative market performance without having to liquidate equity assets.

A 40% allocation to equities is considered moderate and a 0% allocation to equities in any phase of retirement is the most conservative. Given that retirees would wish to be less conservative in the latter years of retirement than in the former, we have eliminated those combinations where the proportion of equities in the latter phases are higher than in the former phases.

The scenarios and allocations reported in this paper are not in any way to be regarded as advice, as they do not take into account the particulars of actual individuals. Rather than recommending actual allocations to equities, our simulations are intended to provide indicative results as a point of comparison between alternative investment strategies.

Figure 9 shows the cumulative probability of a low-income individual reaching zero wealth in the years following for the various proportions of equity investments in the three phases. Each line in the graph represents a different combination of the proportions of equity investments in the three phases. For example, "80: 40: 0" indicates that there is an investment allocation of 80% equities/20% risk-less assets in the first phase, 40% equities/60% risk-less assets in the second and 0% equities/100% risk-less assets in the last phase.

Regardless of the allocation to equities, the results for low-income individuals are bleak. For an individual with a comparatively low lump sum amount at the beginning of retirement, yet wishes to maintain some standard of living, our simulations show zero wealth at 60-70 years, regardless of the asset allocation.

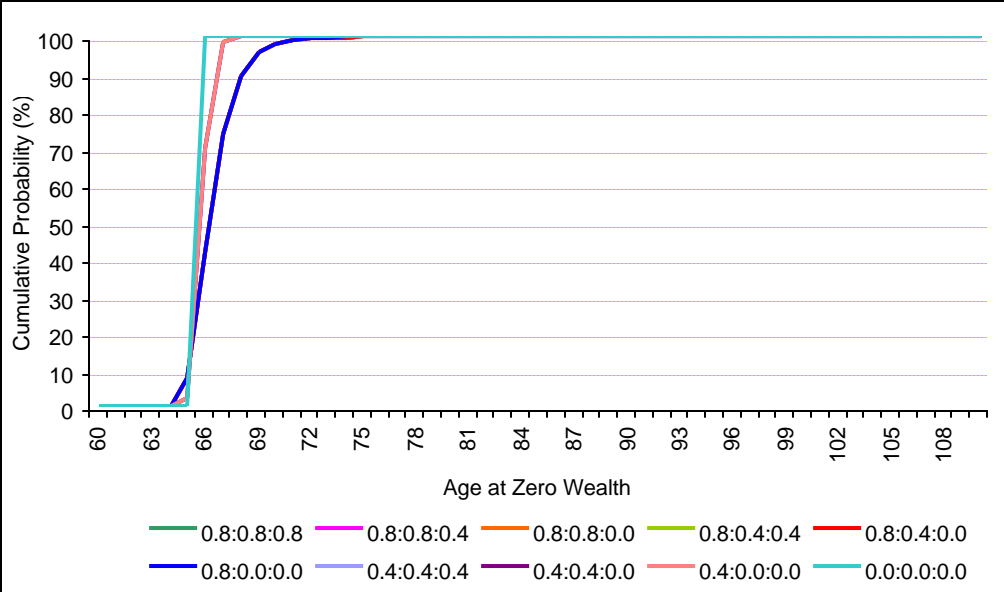
This result occurs because of the low investment fund pool combined with rapid drawdowns in the early part of retirement. An investment in equities must be held for a period sufficient to accumulate gains. Because of the rapid drawdown of funds in the first few years of retirement, the pool of funds invested deteriorates at too rapid a pace to allow income to be maintained into the second and third phases. Unfortunately, retirees with only a small lump sum available at the start of retirement will probably have to rely on social security payments and/or be willing to accept a lower-than-desired lifestyle.

The outlook for a middle-income retiree with \$250,000 lump sum available at retirement, shown in Figure 10, is more promising. In this situation, our simulations show that in the first decade of retirement, retirees can maintain their desired lifestyle with little risk of running out of money regardless of which investment strategy they adopt.

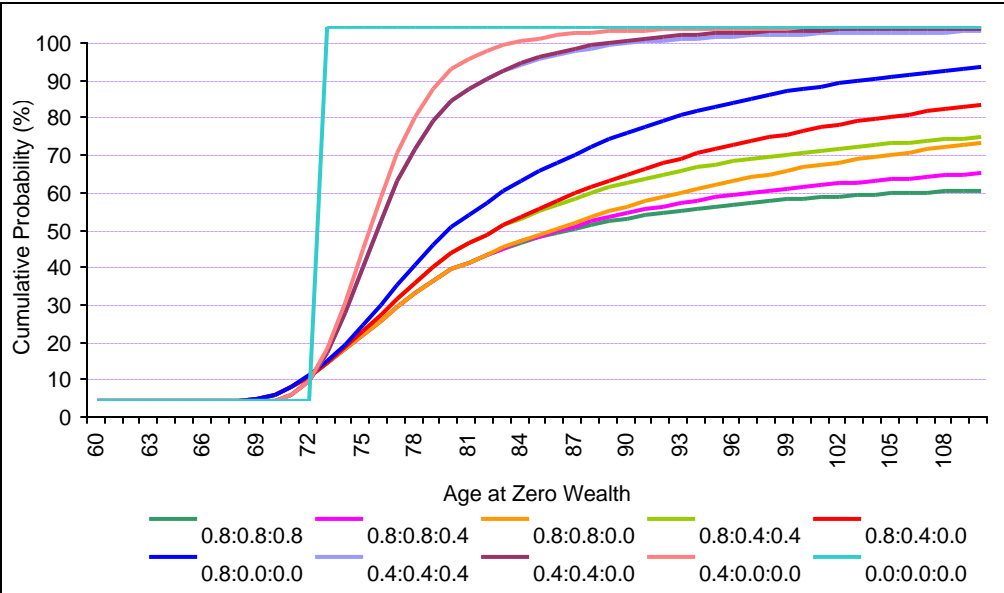
However, the asset allocation of the first phase becomes crucial in the second phase. The probabilities of running out of funds while maintaining a certain level of expenditure increase at a very rapid pace in the second phase. For retirees with no allocation to equities in any phase, our experiment indicates zero wealth with certainty from the age of 72.

For a retiree with a 40% allocation to equities in the first phase, but no allocation in the next two phases, the probability of zero wealth increases exponentially. The next-most detrimental strategy is to have a 40% allocation to equities in the first two phases, but no allocation to equities in the last phase. The probability of zero wealth is considerable, yet decreases significantly for an individual who takes an aggressive stance in equities in the first phase of retirement but no equities in the latter two phases.

**Figure 9: The Cumulative Probability of Zero Wealth in Retirement – Low-Income Retirees**



**Figure 10: The probability of zero wealth in retirement – Middle-income retirees**

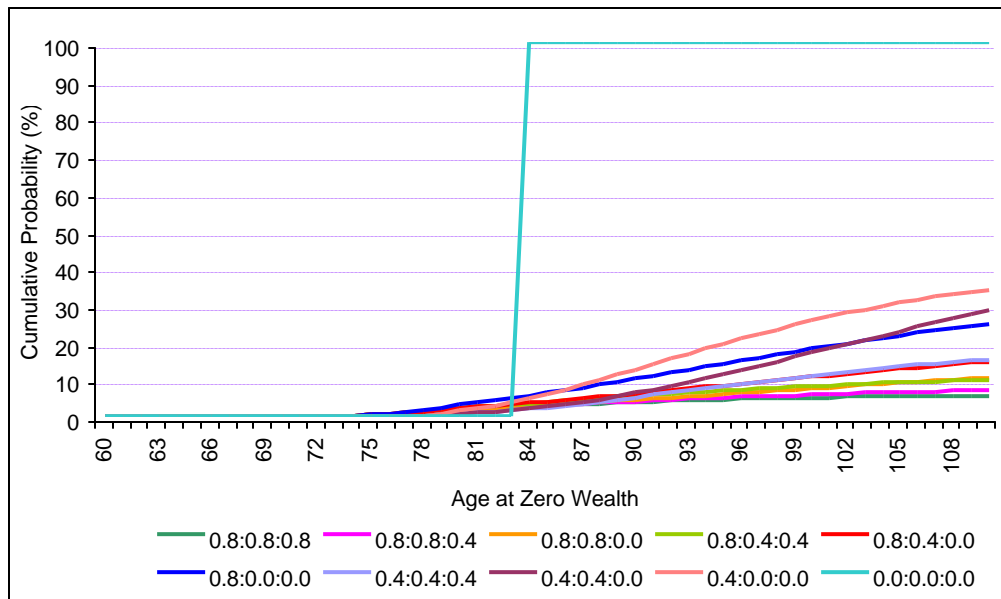


Comparing the performance of the alternative investment strategies in Figure 10, a clear pattern emerges. The simulations advocate an aggressive allocation to equities in all phases of retirement for middle-income retirees, to minimise the probability of running out of funds. For middle-income retirees, the probability of economic death in any phase of retirement is lowest when the majority of funds are

invested in equities over the whole retirement period. As the allocation to equities in each phase increases, the probability of running out of funds at each age decreases.

For strategies with a significant allocation to equities, the incremental probability of running out of funds is very low from age 85 onwards. The probability of equities sustaining a bad run over an investment period of more than 15 years is minimal. The probability of running out of money at any age declines as the proportion of equities increases because even with the longest estimated bad run of six years, equities provide the potential for gains in the long run that far outweigh their riskiness.

**Figure 11: The Probability of Zero Wealth in Retirement – High-Income Retirees**



For high-income individuals, shown in Figure 11, who choose to invest in risk-free assets only with no exposure to equities, the risk of running out of funds increases dramatically. By the age of 85, the drawdowns on their funds are far greater than the low interest accumulated by investing in a risk-free cash asset. The probability of zero wealth in the first fifteen years of retirement is insignificant, regardless of the investment strategy.

Even for a lifespan of 90 years, the probability of economic loss does not exceed 10% for any strategy excluding that which does not contain any equity investments. However, allowing for the possibility of a long lifespan of 100 years, individuals are least likely to run out of funds if they invest a significant portion of their funds in equities. Retirees are most likely to face financial difficulties when they do not undertake any equity investments in the latter phases of their retirement.

For retirees classified as 'high-net-wealth' retiring with a considerable lump sum of \$1,000,000 or more, our simulations shown in Figure 12 indicate that the chance of running out of funds at any time in their retirement is extremely low. Where such a large sum is invested, despite frequent drawdowns, the capital invested is sufficient to earn the income necessary to maintain the chosen lifestyle. The long investment period coupled with the large fund overcomes any losses in the equity portion of the investment.

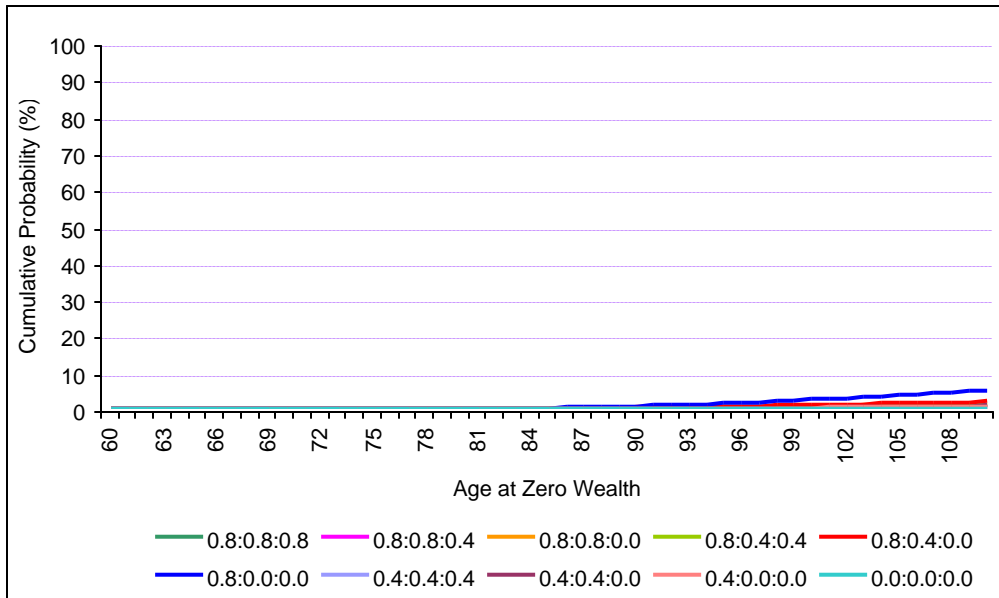
The lessons from our simulation analysis are very much in favour of including equities as part of a sensible investment strategy over an individual's entire retirement period. Regardless of the lump sum available to a retiree is least likely to face outliving funds if a significant portion of funds is invested in equities. The potential long-term profits from equities outweigh their risks, including the risk of a prolonged bad run.

However, the lump sum amount invested at the start of retirement and the annual drawdowns are crucial to this result. If these values are such that the drawdowns erode the investment capital at a pace that is too rapid, the investment capital will not have sufficient opportunity to accumulate gains. Given a healthy



lump sum payment and a sensible lifestyle, the probability of encountering financial difficulties during a lifespan is low.

**Figure 12: The Probability of Zero Wealth in Retirement – High-Net-Wealth Retirees**



## 5.0 Conclusions

We have canvassed some of the important issues facing the retirement strategies for retirees. In particular, we have focussed on the impact of investing in, or avoiding investing in equities.

We have concluded that, relative to investing in residential property, equity investment is surprisingly not that risky. This, combined with transactions costs and illiquidity, make equities a viable alternative to property and a worthy component in a diversification strategy.

Our duration analysis shows runs of loss over five years, after allowing for inflation, are possible for most asset classes but are sufficiently rare to make their returns worthwhile. Of course a cash buffer is desirable to weather any temporary downturn and good diversification strategies are essential.

Using simulations, we have experimented on what the experience of investing in equities might be like. The results of our simulations confirm our findings that equities should be included as part of a diversified investment strategy with a long-run view. Except for the low-income scenario, our simulations indicated that investments throughout retirement offer superior returns to strategies that avoid equities.

In conclusion, we assert that the underlying long-term value of equity markets is resistant to temporary bear markets. This resilience means that retiree many investors should include equities in their investments to take advantage of the benefits offered by them.

## 6.0 References

Campbell, J., M. Lettau, B. Malkiel and Y. Xu, 2001, .Have Individual Stocks Become More Volatile? An Empirical Exploration of Idiosyncratic Risk., *Journal of Finance*, 56(1), 1-43.