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THE RETIREE AND THE 100-YEAR STORM

The impact of tail events on financial outcomes

Alastair MacLeod

Executive summary

100-year storms

Two years ago, the Chinese stock market was nearing the end of a mini-meltdown during which the Shanghai Composite shed more than 40% of its value in two months. This event, plus the US Federal Reserve's decision to commence tightening later in 2015, contributed to a near 20% fall in the MSCI World Index over the following six months, with the local ASX200 index falling 25% peak to trough—and yet to recover its April 2015 highs.

Statistically, a six-month fall of this magnitude on the global benchmark should have happened less than once over the 47 years the Index has been active, or once or twice (1.5 times) during the past 100 years. Importantly for investors, these '100-year storms' are actually happening at a rate of 12 times per 100 years, or once every 8-9 years.

Impact on retirees

The increased frequency of 100-year storms, or 'tail risk', is being recognised just as millions of baby boomers move into retirement. Tail risk has a much more devastating impact on retirees, as typically their asset balances are much larger; there is a lack of time to recover from sharp losses; and most importantly, retirees rely on their savings for income and often draw down on their savings during periods of market weakness. It is this unique characteristic that most impairs money-weighted returns, or real-world outcomes for retirees.

Managing tail risk

There's no free lunch when it comes to investing, and to generate a return greater than cash on an asset just as secure is akin to alchemy. However, the gap between 'capital protected' and 'equity risk' is wide, and we believe there are opportunities to reshape returns and reduce risk while still exposing investors to the growth of equity returns.

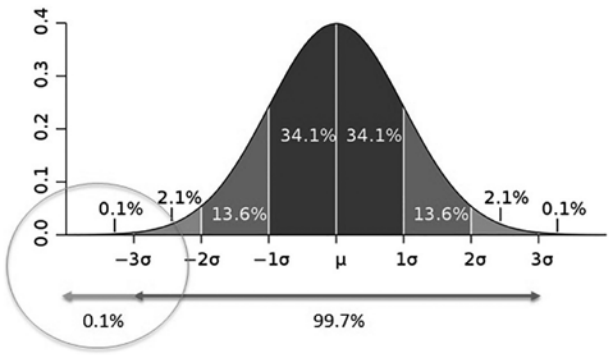
To minimise the risk to retirees, it is vital that investors and advisers first recognise the very different investment objectives of retirees, and adjust portfolios to accommodate longevity risk (people living longer) with tail risk management strategies. Humans have a finite earnings potential, and this defines our ability to take risk. As we approach retirement, we get one shot at that future path of returns—and it is this path dependency that makes active tail risk strategies valuable in terms of improving real-world outcomes.

The Wheelhouse Global Equity Income Fund employs a systematic tail risk management strategy that relies on many of the principles outlined in this paper. Additionally, Wheelhouse Partners was established to provide tailored derivative solutions to institutional clients, including tail risk strategies along with independent design and execution services.

What are tail risks?

'Tail' events, or 'outliers', are technically defined as events with a greater than three sigma (or three standard deviations from the mean) chance of happening, as shown in Figure 1.

Figure 1. Normally distributed returns



Source: Wheelhouse

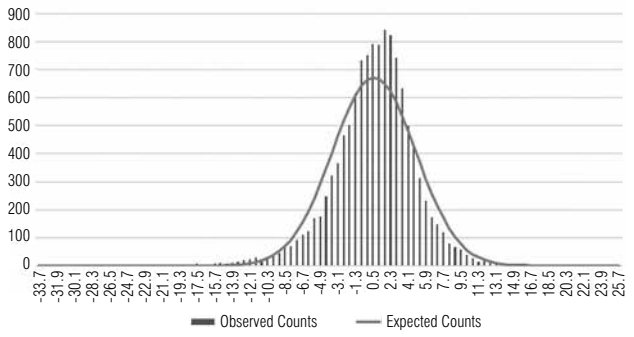
Even this technical definition relies on the construct of normally distributed returns and probability theory—in reality, we can just think of these events as very rare and unpredictable.

Within financial markets however, Modern Portfolio Theory is based on the concept of normally distributed returns. Many asset allocation models, plus internal risk models at investment banks that rely on VaR and other quantitative tools that seek to provide a framework regarding risk and return, rely on returns adhering to a predictable return pattern.

Frequency of tail events

Figure 2 plots a histogram of nearly 50 years of 1-month rolling returns for the MSCI World Index (in USD). At first glance the returns inspire confidence, but it's also clear that there are some differences compared to the model. Technically the term for this return pattern is kurtosis—specifically leptokurtic, which in layman's terms means skinny in the middle with fat tails.

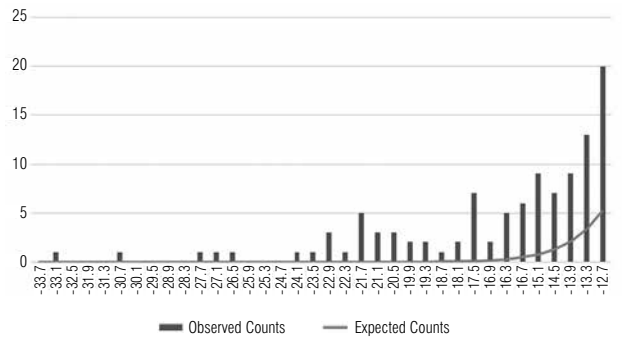
Figure 2. MSCI World Index: Normal distribution vs. Actual returns – 1 month rolling returns (1/1/70 - 13/7/17)



Source: Bloomberg, Wheelhouse

As shown in Figure 3, a closer inspection of the left tail reveals more frequent observations than the model, or negative fat tails. There were 14 expected observations over this period (according to the model), but the actual observations were far more frequent, coming in at 107 recorded observations.

Figure 3. MSCI World Index: 3-Sigma and worst movements - 1 month rolling returns (1/1/70 - 13/7/17)



Source: Wheelhouse

We also plotted this data on a rolling calendar month basis as shown in Figure 4, with consistent evidence of tails.

Figure 4. Observed versus normally distributed '3-sigma' events

Rolling Period	Observed	Expected	Multiple
Monthly (daily basis)	107.0	13.9	7.7x
Monthly (calendar month basis)	5.0	0.84	6.0x

Another way of interpreting this is to say these supposed rare events are 6-8 times more likely to occur than a normal distribution suggests. In other words, the proverbial 100-year storm is actually happening far more frequently than modelled or expected.

Volatility regimes and market timing

This analysis is based on mean returns and accompanying standard deviations over an extended period (47 years), which encompasses a number of different market cycles. Research by Peters (2009 & 2014) suggests that in addition to market cycles, there are also differing volatility regimes. These are important when it comes to assessing the frequency of tail events, as tail risk is not constant.

The research suggests that in periods of low market volatility, the occurrence of tail events is actually similar to a normal distribution. However, in periods of high market volatility, the risk is not 6-8 times more likely (as observed over the cycle) but rather more than 20 times more likely! So in theory, it makes far more sense to only have tail risk protection in regimes of high market volatility.

Unfortunately, as with many market indicators, the past is not prologue. Markets have a habit of 'melting down' more than 'melting up'—meaning the switch from a regime of low to high market volatility can happen overnight, by which time the damage is done. Interestingly, in the calendar month series we analysed above, there were 11 months when the market fell by 9.9% or more—nearly twice the frequency of an equivalent positive movement.

While macro considerations (in Donald Rumsfeld speak, 'known unknowns') can play a role in assessing volatility regimes, they are of no help for 'unknown unknowns'—such as an act of God, geopolitics or terrorism. Retirees get but one path of returns. We believe an 'always on' strategy is a far more robust and prudent approach to managing outcomes.

Why is managing tail risk important for investors?

Managing tail risk is important for anyone who relies on their wealth to fund their lifestyle or other ongoing liabilities or obligations. Obviously this applies to people in retirement or pre-retirement, but it can also be relevant to high net worth families, foundations or charities where the investment objective is to fund expenses or operations with cash flow, but also preserve and grow wealth over time. In other words, it's important for anyone who is not in accumulation mode (where returns matter far more than volatility).

There are three reasons why managing tail risk is important for these investors.

1. Sequencing risk

Large losses, particularly in the 5-10 years immediately preceding and after retirement, can be devastating in terms of outcomes. This well-documented issue is known as sequencing risk, and is particularly relevant for retirees and pre-retirees due to the large sums of money involved; the relative lack of time that retirees have to recover from these losses; and the necessity for retirees to draw down income during these periods. The principle is best explained by way of an example.

Accumulation

Assume an investor started 2007 with US$100,000 invested in the S&P 500 Index. That grew to $195,718 and earned a 7.7% annualised rate of return (as per Figure 5).

Now suppose a second investor started with $100,000 and earned the same returns, but in the exact opposite order. They would still end up with the same amount as the first investor: $195,718. The order in which the returns occur has no effect on the outcome, so long as there is no money moving in or out of the investment.

Figure 5. No impact on investment returns when money flows are static

Investor 1			Investor 2 (returns reversed)		
Year	Return	US$100,000	**Year**	Return	US$100,000
2007	5.5%	$105,494	**2016**	12.0%	$111,960
2008	-37.0%	$66,464	**2015**	1.4%	$113,509
2009	26.5%	$84,053	**2014**	13.7%	$129,047
2010	15.1%	$96,714	**2013**	32.4%	$170,843
2011	2.1%	$98,756	**2012**	16.0%	$198,183
2012	16.0%	$114,560	**2011**	2.1%	$202,369
2013	32.4%	$151,665	**2010**	15.1%	$232,852
2014	13.7%	$172,425	**2009**	26.5%	$294,475
2015	1.4%	$174,811	**2008**	-37.0%	$185,526
2016	12.0%	$195,718	**2007**	5.5%	$195,718
Closing balance		**US$195,718**	**Closing balance**		**US$195,718**
Annualised return		**7.7%**	**Annualised return**		**7.7%**

However, this is hardly a real-world scenario.

Retirement

Things look very different if we assume regular outflows from the investment portfolio. Say the first investor *retired* in 2007. The same $100,000 was invested in the S&P 500 Index, with $6,000 withdrawn at the end of each year. Over the next 10 years, the investor received $60,000 of income and now has $91,393 of capital left. The investor's capital has shrunk by 1.0% compound per year—or, if the $60,000 redemptions are included, achieved an annual total return of 4.7% compound (as in Figure 6).

Now assume the second investor also retired in 2007 (again investing $100,000 in the S&P 500 Index and withdrawing $6,000 at the end of each year), but the path of returns happened in the opposite order. Once an investor is redeeming capital, the change in the sequence in which the returns *occurred* does affect the outcome. The second investor received $60,000 of income and has $125,822 in capital remaining. Their capital has grown by 2.6% per year—or, including the $60,000 in redemptions, delivered a 7.1% total annualised return. In other words, the second investor ended 2016 with $125,822 in their investment account—nearly 40% more than the $91,393 that the first investor received—purely because of the path, or sequence, of investment returns.

Figure 6. Impact on investment returns when money flows are not static

Investor 1					Investor 2 (returns reversed)				
Year	Return	US$100,000	Redeem	Balance	**Year**	Return	US$100,000	Redeem	Balance
2007	5.5%	$105,494	-$6,000	$99,494	**2016**	12.0%	111,960	-6,000	105,960
2008	-37.0%	$62,683	-$6,000	$56,683	**2015**	1.4%	107,426	-6,000	101,426
2009	26.5%	$71,684	-$6,000	$65,684	**2014**	13.7%	115,310	-6,000	109,310
2010	15.1%	$75,579	-$6,000	$69,579	**2013**	32.4%	144,713	-6,000	138,713
2011	2.1%	$71,048	-$6,000	$65,048	**2012**	16.0%	160,912	-6,000	154,912
2012	16.0%	$75,458	-$6,000	$69,458	**2011**	2.1%	158,184	-6,000	152,184
2013	32.4%	$91,954	-$6,000	$85,954	**2010**	15.1%	175,108	-6,000	169,108
2014	13.7%	$97,720	-$6,000	$91,720	**2009**	26.5%	213,861	-6,000	207,861
2015	1.4%	$92,989	-$6,000	$86,989	**2008**	-37.0%	130,957	-6,000	124,957
2016	12.0%	$97,393	-$6,000	$91,393	**2007**	5.5%	131,822	-6,000	125,822
Closing balance				**US$91,393**	**Closing balance**				**US$125,822**
Annualised return				**(1.0%), or 4.7% including $60,000 in redemptions**	**Annualised return**				**2.6%, or 7.1% including $60,000 in redemptions**

This example, highlighting the difference in financial outcomes, is simply relying on the past 10 years of financial returns. Research by Drew (2012) plots returns over a longer period more representative of a worker's life, and records the possible *range* of outcomes. In this study, the 'best case' outcome (that received returns in the 'best' order) was more than 12 times greater than the 'worst case' outcome. While we agree with Drew that these extremes are unlikely, it is informative to acknowledge how sharply different the financial outcomes might be, and hence how relevant considerations of sequencing risk should be in retirement planning.

Ultimately, sequencing risk is exacerbated when a high proportion of negative returns occur in the early years of retirement. In many respects this is the reverse of dollar cost averaging, where rather than buying on market weakness (as one does in accumulation), the investor is selling.

Tail events, or extreme market drawdowns, can amplify this range of outcomes—as does the fact that 'new' retirees typically have their largest asset balance at play during this period, with no new income and shorter time horizons to recover from losses.

Sharpe ratios and other measures of risk versus return become less important during this period, as these measures typically trade

returns versus volatility. However, due to sequencing risk and the limited timeframe to recover from losses, drawdown risk or downside capture becomes far more important.

2. Behavioural loss aversion

Compounding the sequencing risk dilemma is the behavioural finance theory of loss aversion, referring to the human preference of avoiding losses more than acquiring equivalent gains. Put simply, the pain of losing $100 is more pronounced than the joy of making $100. Loss aversion is not the same issue as 'risk tolerance'; it is often a far more personal issue and cannot be easily categorised by age or other demographics. Anecdotally we believe most people have witnessed a friend or relative getting out at just the wrong time.

Benartzi and Thaler's paper *Heuristics and Biases in Retirement Savings Behaviour* provides some evidence of a related concept in their study of US equity allocations from new 401K plan participants during the period 1992-2002, relying on data from Vanguard. For new plan participants, the allocation to equities steadily grew from 58% in 1992 to 74% in 2000, increasing alongside the booming tech-driven stock market. However, new allocations fell to 54% in 2002 after the tech crash. In other words, "The market timing of new participants in their exposure to equities was exactly wrong."

This issue is also reinforced by Schaus (2012), who studied the money flows of investors close to retirement versus those with 30+ years to retirement, and compared to movements in the S&P500. Perhaps not surprisingly, the correlation of flows to movements in the S&P was positive (inflows during strong markets, outflows during weak), but the correlations significantly increased the closer the investor was to retirement (when it mattered more for money-weighted returns). Furthermore, the correlations increased yet again during the global financial crisis, but only for the 'at retirement' cohort where once again, the impact of selling out at market lows would have been the most damaging to money-weighted returns.

Even Harry Markowitz, the Nobel laureate who helped found Modern Portfolio Theory, found it difficult to fight his behavioural biases. In the 1950s, Mr Markowitz was working for the RAND Corporation and had to decide how to allocate his retirement account. He is quoted by author Jason Zweig in *Your Money and Your Brain* as saying, "I visualised my grief if the stock market went way up and I wasn't in it—or if it went way down and I was completely in it. So I split my contributions 50/50 between stocks and bonds." Mr Zweig adds that Mr Markowitz had proved "incapable of applying" his rational economic theory to his own money.

The point is to highlight the power of the human condition, and that the emotional magnets that cause us to act in a counter-productive fashion actually increase when markets are in crisis.

3. Diversification and liquidity

The final point that reinforces why tail risk management matters is the correlation of other risks during crises, and the source of liquidity that equities can provide during these periods.

Diversification as a risk management strategy is only effective insofar as invested assets offer diversified returns. However, historically in times of crisis, returns across asset classes have collapsed together as correlations spike—and thus the benefit of diversification as a risk management strategy evaporates. Figure 7 illustrates this during the global financial crisis.

Figure 7. Performance of Major Asset Classes (Logarithmic, Rebased)

Source: Bloomberg (MXWO Index, MXEF Index, SP5IGBIT Index, SP5HYBIT Index, DJUSRET Index)

Australians are exposed to the same problem with their accumulation of real-world assets. Typically, when stock markets are weak or falling the real-world economy could slow, making employment less secure. The housing market could soften, or at least become less liquid. Banks could be less inclined to extend credit. As discussed above, all of this only matters when investors are reliant on their asset bases to fund critical expenses, and are forced to disinvest during these periods.

The second point worth highlighting is one of liquidity, which is separate to the higher correlations exhibited in Figure 7 during the global financial crisis. Many asset classes such as credit and real estate have historically demonstrated a sharp decline in liquidity during these crisis periods, meaning the most available or liquid source of capital may be equities—which is, unfortunately, often the asset class that has fallen the most. From an asset realisation perspective, selling equities may be the only asset class providing sufficient liquidity, but is also likely to be the most damaging from a money-weighted returns perspective.

Managing tail risk

We believe managing tail risk is important when considering the above issues, and the impact they can have on investor (particularly retiree) outcomes.

In many respects, the traditional means of managing tail risks are broken. The conventional solution to lowering risk in retirement has been to increase allocations to either cash or fixed income, which both serve to reduce volatility and preserve capital better in drawdowns.

An example of this is the old '100 Minus Age' rule, which states your equity weighting should be 100% minus your age—i.e. if you are 80, your equity weighting should be 20% with either cash, treasuries or other bonds making up the balance. However, the combination of low interest rates, plus longevity risk (people living longer), means this may in fact serve to increase the likelihood of a critical failure such as a retiree outliving their savings.

Other tail risk strategies, such as simple asset diversification, have been found wanting in times of true tail events, and may prove to be expensive in terms of foregone returns. Wide-ranging cash or other asset allocations can also introduce disruption into the rest of the portfolio, and require adjustment in a client's broader strategic asset allocation decision.

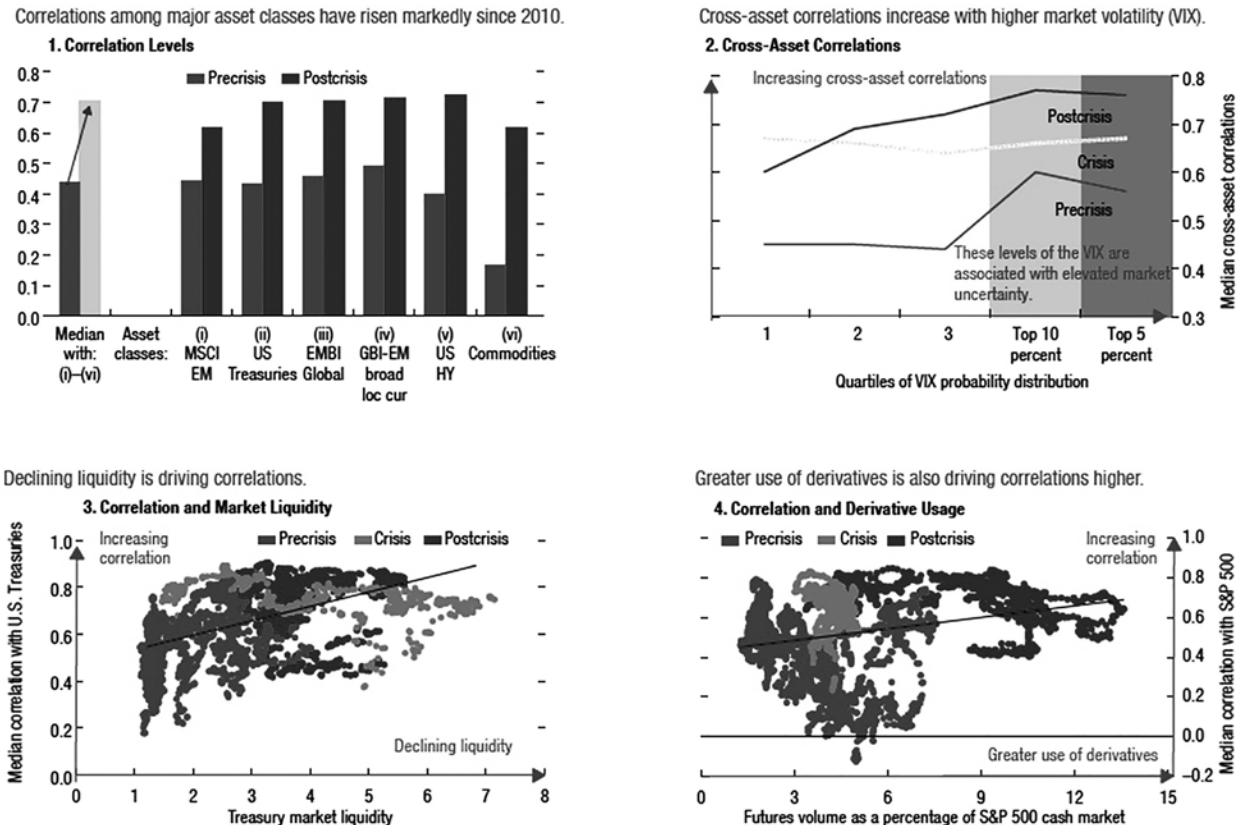
In this environment, derivatives can benefit investors in three ways.

1. **Tail risk overlays** mean assets can remain fully invested in the pursuit of equity returns. While the protection comes with a cost, there are strategies available that can minimise this cost and deliver significant value in better aligning investment returns with somewhat unique retiree investment objectives. These objectives include being more concerned with outsized losses than outsized gains, and taking into account shorter time-horizons and the inability to recover quickly from drawdowns.
2. **Derivative overlays** can add convexity to a hedge, meaning capital is increasingly protected the more markets fall. This is a significant advantage over other capital preservation approaches such as retaining excess cash balances, where the loss of equity return for every dollar not invested is unpredictable, and market timing issues are introduced.
3. **Multi-asset derivative overlays** can exploit pricing inefficiencies of indirect hedging. A diversified portfolio of indirect hedges can minimise basis risk, lower cost, and benefit from increased correlations and elevated volatility in a crisis—the opposite characteristics to many traditional capital preservation models that rely purely on asset diversification.

Foresight would be lovely when it comes to tail risk hedging. However, our crystal ball is as good or bad as anyone else's. In acknowledging the weakness of our lack of foresight, we fundamentally believe systematic strategies that are 'always on' are far better aligned with a retiree's objectives.

Costs can be minimised by a variety of different strategies. Risk budgets, put spreads and indirect hedging can all serve to increase the cost effectiveness of a hedge, while preserving the efficacy in times of a crisis.

Figure 8. Correlations increasing across all major asset classes since the GFC



Source: Bank of America Merrill Lynch; Bloomberg, L.P.; Federal Reserve; JPMorgan Chase and Co.; and IMF staff calculations.

Note: Precrisis period denotes January 1, 1997, to June 30, 2007; crisis period July 1, 2007, to December 31, 2009; and postcrisis period January 1, 2010, to December 31, 2014. Cross-asset correlation is measured as the median of the absolute values of pair-wise correlations over a 60-day window between the daily Sharpe ratios of the asset classes listed in panel 1. Market liquidity is measured as the ratio of returns on the U.S. Treasury–wide index to the turnover of the U.S. Treasury market. The higher the ratio the lower the liquidity, because large amounts cannot be traded without a significant impact on prices. The median correlations in panels 3 and 4 are of the U.S. Treasury 7–10-year index and the S&P 500 index against all six other asset classes as shown in panel 1. MSCI EM = MSCI Emerging Markets Equity Index; U.S. Treasuries = 7–10-year U.S. Treasury Index; EMBI Global = JPMorgan Emerging Markets Bond Index Global; GBI-EM broad loc cur = JPMorgan Government Bond Index-Emerging Markets in local currency; US HY = U.S. High-Yield Index; Commodities = Credit Suisse Index; VIX = Chicago Board Options Exchange Market Volatility Index.

Changes to market structure have potential to 'amplify' financial risks

While we're not attempting to predict the timing of future events, we do agree with the view that risks seem more elevated in the current environment. There are secular changes occurring, such as the apparent bottoming of the long-term rate cycle, and it appears central banks have exhausted their patience for liquidity provision. Moreover, behind the scenes there have also been some fundamental structural changes to the traditional structure of dealers and market-makers.

- Reduction in liquidity provision by investment banks: Banks claim that due to increased regulation they are less able to make markets and hold risk, citing the cessation of proprietary trading and the increasing of capital controls which has shrunk balance sheet capabilities.
- Electronic and high-frequency trading: Trading on electronic platforms using sophisticated algorithms has taken an increasing slice of market share (at least 50% of cash trading and 60-70% of futures trading activity). Even the remaining traditional market-makers are using such systems more frequently to trade out of their risk. The problem is that when periods of market uncertainty arise, the pools of liquidity made available on these platforms are dialled down or even turned off.
- Benchmarking effect: As more investor emphasis is placed on benchmarking, assets not included in the benchmark index suffer a decline in liquidity. The effect of benchmarking has also been exaggerated by the increase of derivative trading and exchange-traded funds.
- Emergence of less-regulated non-bank market intermediaries: Access of leveraged retail investors to foreign currency brokers allowing bets against the Swiss franc exacerbated the price move when the revaluation occurred in January 2015. In many cases, heavily leveraged positions involved little oversight by authorities.

The IMF's Global Financial Stability (2015) summarises, "Many of the factors responsible for lower market liquidity also appear to be exacerbating risk-on/risk-off market dynamics and increasing cross-asset correlations during times of market stress. These phenomena suggest that low market liquidity may act as a powerful amplifier of financial stability risks."

Multi-asset tail risk hedging

Indirect hedging via a multi-asset approach can exploit pricing differentials across different asset classes, but still benefit from favourable correlations in times of a crisis. Charts in Figure 8 are taken from the IMF's Global Financial Stability Report in 2015, and highlight the increased correlations witnessed across all major asset classes since the GFC.

The negative consequences of correlation in a more traditional portfolio can be turned into an advantage when seeking tail risk hedges. By way of example, the following table illustrates the payoff profiles on a variety of asset classes. Based on prior market moves, the analysis suggests the credit indices (iTRAXX EUR, CDX.IG) and AUD/USD puts would make more efficient hedges to an equity portfolio than SPX puts alone.

Wheelhouse Partners

The Wheelhouse Global Equity Income Fund (Fund) employs a systematic tail risk management strategy that relies on many of these principles. Additionally, Wheelhouse Partners was established to provide tailored derivative solutions to institutional clients, including tail risk strategies along with independent design and execution services.

While our primary objective is to deliver outperformance over the long term, we also aim to deliver these returns in a far more retiree-friendly sequence. As described above, there is no free lunch in investing. To be 100% capital protected, it is difficult for returns to resemble anything other than the return on cash. However, given the very different risk requirements for retirees, we do seek to reduce equity risk and reshape the return profile into one far more suitable for these investors.

What does 'retiree-friendly' mean?

Essentially, this means the return series has a greater proportion of return from income, lowered volatility and improved capital preservation—particularly during times of market stress.

We employ two option strategies in the Fund to deliver on these objectives.

The first strategy is a systematic option writing strategy. The short option strategy employs no leverage, and simply serves to release income from the equities in lieu of capital growth. Over time, this process alters the typical sources of equity return from two thirds capital growth and one third income (by way of dividends), to two thirds income and one third capital growth, meaning there should an income return of approximately 6-7% plus 2-3% capital growth. This one step also serves to lower the volatility of the Fund, and adds an element of capital preservation as the income stands before a loss.

However, from a capital preservation perspective, there are limitations. The return profile of a short option strategy is concave, mean-

Figure 9. Payoff profiles on different asset classes

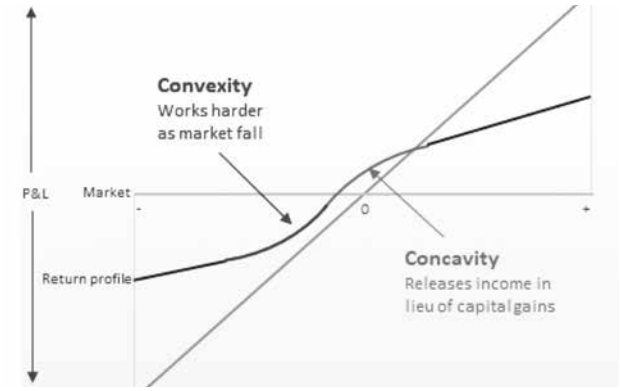
Instrument	Current Market (at 25/08/17)	Market move 2008/9	Estimated Move Now	Target Price	Strike (50% between current & target)	Strike Price	Expiry	Price	Volatility	Payoff if Target is met
SPX	2439	-50%	-25%	1829.25	-12.5%	2134.1	6M	1.15	19.1	10.9
EURUSD	1.18	-20%	-10%	1.0620	-5.0%	1.1210	6M	0.5	8.4	10.0
AUDUSD	0.7875	-35%	-17.5%	0.6497	-8.8%	0.7186	6M	0.55	11.3	**15.9**
GOLDS	1285	40%	20%	1542	10.0%	1413.5	6M	1.25	14.5	8.0
iTRAXX EUR*	57	150	75	132	95	95.0	15-Feb-17	2.5	4.1	**14.8**
CDX.IG*	60	175	87.5	147.5	105	105.0	15-Feb-17	2.5	4.1	**17.0**
US 10Y Yield*	212.5	-200	-75	137.5	175.0	175.0	6M	5.0	4.4	9.0

**Denotes priced in bps rather than % moves*

ing that as the market declines quickly the derivative overlay exhausts its capital preservation properties, and the Fund will trade more linearly to the underlying equity portfolio.

This is where the secondary option strategy engages. A long option strategy, via multi-asset derivatives or simply index options, can provide the return profile with convexity. As shown in Figure 10, this means that the more the market declines, the more the derivatives work to preserve capital. We believe this becomes an increasingly valuable attribute when considering the potential change in investors' behaviour during times of market stress.

Figure 10. Return profile with convexity



Source: Wheelhouse

The objective of the tail hedges is not to provide an absolute floor on returns or full 'protection'. As covered above, this would detract from our ability to deliver the higher returns available from equity investing. The purpose is to improve the shape of returns and drawdown characteristics during market stresses; yet from a cost perspective, limit the disruption to the equity returns generated by the rest of the portfolio.

As a result, while we are fully invested in equities and should be benchmarked accordingly, we design the tail hedges to have a downside capture of 50-60% (in USD terms) and cap the cost for this improved profile at 100 basis points of annual performance.

While the strategy is systematic, when markets have fallen and volatility is elevated we may elect to use discretion and conserve our risk budget (buying umbrellas just after it has rained). Implied volatility tends to lag market events, with option prices increasing after the event has occurred. In some ways this time-lag phenomena creates a dynamic hedge in the portfolio, and while we will always have some level of protection we believe this discretion is likely to produce a tilt that can create value over a market cycle.

We apply the same principles for our option writing process as we do for tail-risk protection. In general, these are:

Systematic under-writing	Tail-risk protection
Maximise time decay (1-2 months)	Minimise time decay (longer-dated, rolling +3 months)
Harvest higher single stock Implied Volatility	Utilise lower Index Implied Volatility, potentially across different asset classes
Maximise premium via close to the money strikes	Minimise premium via out of the money strikes and use of put spreads
Minimise idiosyncratic risk via discretionary tailoring	Minimise basis risk with index selection, and benefit from increased correlations during market corrections/drawdowns

Conclusion

The purpose of this paper is to highlight the prevalence of tail events and the impact these can have on investors' financial outcomes, particularly retirees. Tail risks matter, and we believe there are few pragmatic strategies available that permit an investor to harvest higher returns from more volatile asset classes while delivering a retiree-friendly return profile.

Within retirement, increasing life expectancies for most Australians requires capital to work harder for longer. This results in a higher required allocation to equities, which needs to be balanced with the resulting volatility and increased exposure to tail risks. As people approach and enter retirement, their financial course is unknown but already largely set. Their outcomes are dependent on the future returns with which they will be presented—and having completed their working lives, they get only one shot at this path. This means the risk of drawdowns on large balances early in retirement has a disproportionate impact on the final destination.

We acknowledge that for some, the use of derivatives may be perceived as unnecessarily complex or risky. However, we emphasise this generally only happens where leverage is used. At Wheelhouse, we eschew the use of leverage in any of our derivative positions. We use derivatives for the structural characteristics they can introduce to a portfolio, which better aligns investor objectives with underlying asset returns.

It's worth highlighting that in other arenas such as farming and agriculture, derivatives (such as forwards) are used every day to lower risk: for example, to lock in prices before harvest time and so provide the farmer with greater certainty of income. The forwards mean the farmer may be giving away some upside, but in return receives more predictability (and less volatility). While forwards are quite different to the options we refer to in this paper, the principles are similar.

We use derivatives for their structural benefits (income, lower volatility, capital preservation) and, like the farmer, to reduce risk. We are reminded of Pascal's wager, the French philosopher who argued that while there was no evidence to suggest that God existed, it cost very little to 'believe' and thus mitigate the risk of an eternity in hell. We prefer to think that tail risk hedging strategies help us sleep a little better at night. **FS**