

---

## A scenarios approach to asset allocation

---

Different approaches to asset allocation are available to practitioners. But reliance on selection of parametric return distributions, summary measures of risk and historical data as an indicator of the future remain widespread. This research paper proposes an approach that makes more complete use of information available about the future, forcing consideration of different time frames, alternate outcomes, and tail risk. It does this not by forecasting the future but by describing what has the potential to make a significant difference to long-term investment outcomes.

By MLC

This is the original version of a paper published in final form in *The Journal of Portfolio Management*, Copyright © 2010, Institutional Investor, Inc. All Rights Reserved.

---

Investment managers must allocate assets while uncertain about future investment returns. Markowitz (1952) was the first to propose application of mean–variance analysis in the investment context, this provided the first clear framework for rational investment decision making under uncertainty. This approach, which is still used by many to assist asset allocation decision making, has serious shortcomings including the assumption of normally distributed returns. Also, the well known sensitivity of optimised allocations to input assumptions and the tendency to select relatively undiversified allocations (unless allocation constraints are applied) present major problems for practitioners.

Another important problem with many approaches to asset allocation, including multi–factor modelling, is reliance on historical data. The making of informed decisions about portfolio positioning in an uncertain world requires consideration of alternative potential futures. The past is not necessarily representative of the future. It provides only a single path of returns and ignores what might have happened. In particular, before the event, certain outcomes may have been considered more likely than those that actually took place. Also, use of historical return volatilities over–simplifies the notion of risk and denies the availability of information about how risk varies through time. Arnott and Bernstein (2002) suggest considerable confusion has been created by practitioners’ reliance on historical performance to determine prospective risk premia. This has likely resulted in the misallocation of assets, including specification of quite concentrated portfolios which perform poorly out of sample.

The approach proposed here neither selects a particular parametric distribution nor is it reliant on history. Consistent with Markowitz, who emphasised the role of subjective assessment (beliefs and experience) as an input to asset allocation, this approach blends investment insight with the discipline and transparency of a quantitative framework. It is designed to capture more completely the complexity of relationships between fundamental factors and return outcomes. It recognises this real world complexity and that neither summary statistics (means, variances and correlations) nor historically based coefficients are an adequate basis for asset allocation.<sup>1</sup>

---

## The importance of investment beliefs

Investment approaches depend on beliefs about how markets and economies behave. A believer in efficient markets may be content to assume that prospective returns are the same whatever the starting point – providing the basis for static strategic asset allocation. This is an extreme and no longer widely held view. The notion that from any given starting point, and in the absence of new shocks, markets will tend to revert to equilibrium is also no doubt too simplistic. Casual observation of asset price behaviour reveals clear periods in which asset prices exhibit both prolonged mean aversion (the tech bubble is a prime recent example) as well as mean reversion (as in the ultimate tech bubble bust). Most investment practitioners now at least accept the possibility that some information may exist to permit a more insightful assessment of risk and return potential.

A number of studies, Poterba and Summers (1987) for example, have confirmed the existence of serial correlation, finding evidence that equity prices are positively correlated (implying mean aversion) over short horizons with negative serial correlation or mean reversion over longer periods. Fama and French (1986) also found that negative serial correlation increases in strength over longer time frames, implying greater predictability over say five or ten years than one. They offered two alternative explanations for this behaviour: rational responses to time variance in expectations about macro-variables; and irrational swings in investor over-optimism and pessimism. In recent years there have been significant advances in understanding investor behaviour. These provide a rationale for a divergence in asset pricing from that implied by the macro fundamentals. It has been suggested that investors may be hard-wired to respond emotionally, which results in apparently irrational responses.<sup>2</sup> Fear of being left behind encourages investors to take too much risk, or switch investment options too frequently in an unwinnable hunt for the highest return. Exacerbating the effects of these behaviours on financial markets, are the actions of funds managers in reducing their career or business risk exposure.

Looking across different asset markets, the case for market efficiency seems particularly weak because there is likely to be greater divergence in investor circumstances and objectives across than within asset sectors. This suggests the existence of information about prospective returns.

---

## Efficient use of information

Asset allocation practitioners need a methodology which uses available information but recognises the existence of and provides meaningful information about the considerable uncertainty that must exist about return outcomes. A transparent approach to this is to generate a series of explicit return forecasts or scenarios based on varying assumptions about the main sources of return uncertainty.

The two principal sources of uncertainty in prospective returns are behavioural factors (swings in investor irrationality and ‘rational’ changes in risk perception) and the ‘dynamics of macro-driving variables’.<sup>3</sup> The primary macro-driving variables are economic growth and inflation. While other fundamental drivers exist, they are typically subsets of these two broad drivers.<sup>4</sup> An exception is leverage. Leverage enables the expansion of economic activity – it increases return potential, but also raises exposure to losses. As only too clearly demonstrated in 2008, leverage increases risk and raises the probability of tail risk events.

The influence that changes in the fundamental drivers have depends on investors’ attitudes – their perceptions of risk; the difficulty they have (even if rational) in assessing new information; and their propensity for irrationality. For example, during highly speculative environments (bubbles) the level of investor optimism is the primary determinant of returns, with economic fundamentals being relatively minor. Such possibilities need to be considered. Clearly, no single set of risk premia is adequate to capture the information available about the prospective investment environment. The obvious response to this is to consider a range of potential futures, or scenarios. A scenarios approach enables extensive use to be made of the available information.

This scenarios approach might be described as providing a quantitative representation of qualitative insights. Importantly it can provide a systematic, consistent and coherent framework for the expression of investment judgement and assessment of investment strategy.

---

## Building a scenarios set

Three broad stages can be defined in building a set of scenarios: defining the individual scenarios; generating return assumptions; and setting scenario probabilities. None of these steps are trivial. While a considerable application of resources is required to build a useful scenario set, a benefit of the approach is that the practitioner is motivated to seek out new information and identify alternative views. This reduces the risk of getting caught in behavioural traps, particularly confirmation bias. Behavioural biases can make it difficult to challenge a prevailing view. Studies suggest that while information that supports a view is readily taken into account, contrary views may not be actively sought (see for example Wason, 1960). A scenarios approach requires contrary views. This is an important strength of the approach. The main objective is not to work out what will happen but describe what could happen.

### *Scenario definition*

Setting real return expectations is not a simple process. Useful forecasts don't so much predict what will happen as describe uncertainty by setting out the key possibilities. This involves looking at both risks and opportunity. Only by 'mapping' out what Saffo (2007) calls the 'cone of uncertainty',<sup>5</sup> can the robustness of a strategy be properly assessed. A range of possible futures always exist. Considering a range of potential scenarios permits a strategy to be assessed within the context of future uncertainties.

Exhibit 1 provides a simple example of how scenarios can be defined by combining assumptions about macro-drivers and investor behaviour. This covers only a very small subset of the scenarios that might be included. A range of both common and more unusual (including tail risk) scenarios are required to adequately explore uncertainty.

The set of scenarios can be specified with the intention of making this a general framework that is applicable in all conditions. In this case the scenarios are best viewed as generic representations of particular environments. As starting point valuations change, prospective scenario returns change. This approach provides information about the variation not only in return potential, but also the extent of prospective risk and sources of diversification.

There may be some information about a particular starting point which is not utilised with a generic scenarios approach. To some extent this can be captured by adjusting scenario probabilities to take into account starting point characteristics. For example, the probability of transitioning to a strong economic growth scenario might be expected to be lower than average when there exist say marked structural impediments to growth or when a process of re-

---

regulation is underway. However, use of such a supplementary time specific scenario set is useful where there are major valuation (for example as in an asset bubble) or structural issues (such as the imbalance in global savings and investment seen in the current decade) which have the potential to dominate outcomes. These scenarios are relevant to the medium term evolution of the investment environment. For example, in early 2009 the set of focused medium term scenarios would include a combination of alternative contractionary (with varying depth of recession, duration, geographical relativities, price level behaviour, and related policy responses) and recovery (with different paces of growth, inflationary consequences and geographical distribution) scenarios, plus alternative behavioural responses to market volatility.

To some extent the difference between a generic and a focused scenario set is driven by time horizon. For longer time frames (of at least ten plus years) a generic approach may be adequate, but may not be over shorter time frames because the specifics of the starting point are more dominant determinants of outcomes. The difference here might be seen as analogous to the distinction between strategic and medium term asset allocation. However it is clear that even the generic scenarios framework does not provide support for a static asset allocation. Quite the contrary, it provides a basis for the evolution of benchmark or policy assets allocations through time.

For a scenario set to be useful as a risk management tool it must be effective in capturing the cone of uncertainty. This does not imply that it needs to be exhaustive in its inclusion of combinations of input assumptions; but that it needs to be comprehensive in its consideration of potential distinctive outcomes. Exhibit 2 provides an example of the combination of environments that might comprise a generic scenario set. The objective is that the scenarios set be indicative of the distribution of distinctive alternative return outcomes. Whether or not it has the smoothness or continuity that might be expected of the true distribution depends on the coarseness of the scenario set. The lumpiness in the distribution of returns seen below in the practical examples of scenarios analysis, are a function of the coarseness of the scenario set used rather than being a consequence of the general approach. A very large number of scenarios, with lots of variations on the same basic themes are required to overcome this lumpiness (though the practitioner may judge that this is not necessary).

Except where behavioural factors dominate, economic growth and inflation (and leverage) assumptions will underpin returns in most scenarios. Thus practical scenario definitions require the setting of specific assumptions for the macro-driving variables. At a minimum, average and end point values for key macro variables – inflation and growth for each relevant geographical region – are required for a scenario to be adequately specified. Of course, relevant data and information, from wherever it can be gathered, is used to achieve such specification.

---

As mentioned, highly unlikely, but highly distinctive scenarios (tail risk events) need to be included if the scenario set is to provide adequate information about risk and diversification. Important examples include depression or persistent economic stagnation; severe deflation and even hyperinflation, as well as scenarios resulting from exogenous shocks. Traditional mean-variance approaches to asset allocation pay scant attention to the possibility of such extreme events. While by definition they are rare, when they occur they are of 'inordinate practical importance' (Mandelbrot and Hudson, 2004). Importantly, understanding the risks involved in these outlier environments requires that their potential causes and effects be carefully thought through even while they remain a remote possibility. This has a number of benefits; including assisting practitioners consider how such scenarios might arise. For example, Fisher (1933) long ago postulated that both booms and depressions have in the past been closely associated with over-indebtedness. A scenarios approach can raise practitioner's awareness of such non-consensus possibilities.

### *Return projections*

The principal output of the scenarios analysis is a matrix of real returns – each return refers to both a scenario and asset or strategy exposure. There are various models that can be used to set return assumptions; one straightforward approach is briefly mentioned here. Whatever the method used, the return setting process should take into account starting point valuations – not to do so is to waste information. While subtleties abound,<sup>6</sup> these are relatively straightforward to measure.

Equity market return projections can be generated by combining starting valuations with alternative assumptions about end point valuations and the path of earnings. Starting point valuations and dividends<sup>7</sup> are readily observable. Equity market earnings projections can for example be set to be consistent with economic growth projections in each scenario, though the shorter the time frame, the more important is the higher volatility or cyclicity of earnings versus economic growth. Behavioural assumptions are essential in postulating end point valuations. Both a concept of fair value<sup>8</sup> and the contemplation of apparently irrational market valuations are a necessary part of the richness of the scenario set.

As an example, consider the different starting points of the early 1980s and the height of the late 1990s tech bubble. Each had extreme equity market valuations. The price earnings ratio of the S&P500 was 8.0 at the end of 1981 versus 33.3 at the end of 1999. Assuming reversion to a PE of 18.9 times (the median since 1980 – although this is very likely above 'fair value'), a difference in prospective returns of 29% is implied. Of course the other components of return matter, but often these reinforce rather than offset large differences in return potential. Not surprisingly the

---

dividend yield was relatively high at the start of the 1980s and low in the late 1990s. It is possible that prospective growth in earnings offsets the differences in starting valuations. Indeed it seems rational that expectations of high (low) earnings growth should be reflected in relatively high (low) valuations. The actions of rational investors should therefore tend to equalise return potential through time. In practice, when earnings are elevated (depressed) rather than anticipating reversion, which would imply relatively low (high) share prices relative to those earnings, investors' behavioural foibles lead them to extrapolate recent trends. Price earnings ratios tend to be lowest (highest) when earnings are at their lowest (highest) as has been clearly articulated by Jeremy Grantham (2006). Unrealistic expectations must eventually change or be disappointed – reversions to mean confer a degree of predictability over the medium to longer term.

As the valuation environment evolves through time, the scenario set provides an objective and dispassionate indication of changes in the level of potential real returns, the extent of risk and sources of diversification. A scenarios framework tends to lead the practitioner to a contrarian perspective – revealing strong return potential when investors are unduly pessimistic and weak return potential when they are overly optimistic. This process helps practitioners be less prone to market-think, adaptive expectations and excessive risk taking.

A practical difficulty with this is that the short term performance focus of investors can be a powerful force for convergence if not in the expectations of funds managers then at least investment strategy. A scenarios approach assists in identifying when market valuations are inconsistent with investment fundamentals, but provides no information on whether these valuations will continue to become more extreme or revert. Being right eventually may be of little comfort if the manager goes out of business. This has to be taken into account in deciding how to apply insights of the scenarios analysis.

Appreciation of changes in return potential through time can be assisted by comparison with a static or equilibrium set of assumptions. An equilibrium scenario as envisaged here assumes that economies are in equilibrium (growth is at potential rates and inflation consistent with central bank targets) and asset prices are continuously at fair value – even in this stylised environment there is still considerable reliance on investment judgement in determining return expectations. This is effectively what economists refer to as a 'steady state'. While the assessment of equilibrium returns will sometimes change, in response for example to reassessment of prospective productivity growth, in general these returns would be expected to be relatively invariant which provides a useful 'anchor' against which to compare scenario returns.

---

Exhibit 3 provides an illustration of ‘equilibrium scenario’ returns for a sequence of portfolios consisting of different combinations of debt and equities. Three other sets of returns are shown in the Exhibit. There are two things that differentiate the three return frontiers shown in this Exhibit: the date at which the starting values are taken and the scenario probabilities (these are discussed in the next section) assigned to calculate a single return expectation.

The start date is either July 2007 (the solid line with boxes) which has the lowest return potential; or December 2008 – just after dramatic market declines. In mid 2007 return potential was assessed to be significantly below equilibrium levels (shown by the dashed line), but by the end of 2008 prospective return potential had risen sharply. If scenario probabilities are constant, the December 2008 projections (solid line with crosses) show return potential above equilibrium levels for strategies with relatively high equity allocations, but not for portfolios with high debt allocations because of relatively low starting yields. However, with the adjusted scenario probabilities, returns are not as high. Adjustment has been made to these probabilities to take into account the extreme nature of the starting scenario at December 2008 which results in lower return expectations (shown by the solid line). This reflects a judgement that, given the nature of the starting environment, the probability of transition to a strong global growth scenario was lower than is generally the case. This is of course a matter of opinion; importantly this scenarios framework makes it simple to assess the implications of alternative assumptions. (This Exhibit is discussed again later.)

The returns in Exhibit 3 and those in the following Exhibits have been generated using 40 generic scenarios drawn from a scenario set which is used by the author and colleagues. The output from this scenarios model consists of a matrix of real returns for 40 columns of scenarios and multiple rows of assets and strategies. Among the relatively likely scenarios are: one that transitions towards a steady growth and steady inflation equilibrium; environments that capture common aspects of the economic cycle (slowdown, recession and recovery); as well as a range of combinations of growth and inflation assumptions, including deflations, stagflation and disinflation. Extreme economic environments include depression, threat of financial collapse, and severe and persistent inflation. Exogenous shocks, such as a global pandemic, are also included. The scenario set also needs to allow for the possibility that the home country may experience a significantly different scenario from the rest of the global economy – both significantly more positive and more negative than the rest of the world.

An example of summary output from a scenarios model is shown in Exhibit 4. Starting valuations have been taken from early 2009. Subsequent to dramatic equity market declines and flight to the safe haven of treasuries during 2008, it was not surprising that equity return potential was assessed as above equilibrium levels, while the return potential from treasuries appeared limited.

---

The Exhibit shows expected returns (the thick grey bars) for a range of asset sectors, together with the mean return in the positive (thin white bars) and negative (thin grey bars) 10% tails. Scenario probabilities are obviously required in order to calculate these summary statistics.

### *Assigning scenario probabilities*

The analysis of the scenario set does not require the specification of scenario probabilities. The scenarios can be treated as a set of discrete investment environments under which return potential and risk exposure is systematically examined. However, unless probabilities are specified the assessment of risk is necessarily limited. Probabilities convert the scenarios set into a probability distribution of returns for individual assets, strategies, and overall portfolios.

The process of setting scenario probabilities might seem uncomfortably qualitative and subjective, but it is less unsatisfactory than the selection of a particular parametric distribution for mean–variance analysis. It is at least more explicit and considered. In setting scenario probabilities, commonsense tells us that some scenarios are more likely than others, particularly over longer time frames. For example, a 10 year recessionary scenario which assumes a high level of investor optimism seems unlikely. More generally the probabilities of commonly experienced growth and inflation environments might be taken from a combination of historical frequency, and subjective assessment based on assumed differences in the prospective versus past behaviour of policymakers. A simple approach is to equal weight all ‘mainstream’ scenarios, with more unusual and in particular tail risk scenarios with lower weightings. By definition there is little historical data to guide the setting of probabilities for tail risk events and of course not everything that is going to happen has already happened, which means judgement and imagination are necessary.

While consideration needs to be given to individual scenario probabilities, the general reasonableness of the probabilities is best assessed by looking at the scenario set as a whole. For example the implied probability distribution of returns can be compared with history or the practitioner’s expectations or judgement. It may also help to compare the implied scenario correlations, variances and higher moments with history – these are an (almost incidental) output of, rather than an input to, this process.

In practice specification of scenarios and associated probabilities often involves iteration. Of course this can be dangerous if used to fit outcomes to prior beliefs. A strength of the scenarios approach is that it may challenge the prior beliefs of the practitioner. This may seem counter–intuitive since the scenario set is a reflection of the practitioners’ judgement. However, this forces the practitioner to reconcile a multitude of micro assessments with their macro implications.

---

Since practitioners are required to undertake more deliberate, consistent and coherent assessments, this can lead to the revision of less rigorously determined prior beliefs.

Clearly, time horizon matters in the definition of scenarios. A five year versus a 20 year tail risk scenario will be very different in nature; the latter is unlikely in the absence of persistent policy mistakes while the former may be the result of mean reversion from a point of significant over-valuation. Dealing with time variance in scenarios can be complex, but it is important because a scenario in the terms described here involves a path. Each scenario represents an alternative sample path – or in Taleb’s (2004) terminology an ‘alternative history’ – what happens along the way is important as well as the start and end points. And the longer the time frame, the more important the journey is.<sup>9</sup>

---

## Output of the Scenario Set

The principal benefit of the scenarios approach is the amount of information it provides about risk and diversification. Exhibits 5 and 6 are return probability surface charts for varying combinations of debt and equities, under both the scenario set and assuming normally distributed returns (with matching means and variances). Exhibit 5 presents the data in the most conventional 3-dimensional form, while Exhibit 6 shows a 'plan-view' of the surface. Exhibit 5 illustrates more clearly the high peaks and fat tail assumptions that have been built into the scenario set. Both reflect the real world complexity that the scenario set is able to capture.

A comprehensive scenarios framework provides a richness of information. The understanding this imparts is not achievable using summary measures of risk and diversification. Correlations are summary statistics which merely capture the how pairs of returns relate to each other *on average* and that misses important information. The detail of the differing behaviour of asset returns under different scenarios is essential in working out how to combine different assets to achieve given objectives. For example, it is essential to know when long nominal bonds will diversify equity risk and when they will not, what else will.

Exhibit 7 illustrates scenario joint likelihoods of pairs of bond and equity real returns. This is a joint probability distribution or surface. In the left hand chart the data is presented in conventional 3-dimensional form, while in the second chart the surface is viewed from above – with different contour lines representing 'slices' of different probability ranges. The alternative presentations emphasise different aspects of the data. The first chart highlights the probabilities, but does not clearly identify the ranges of returns to which these apply. On the other hand, apart from the compactness of the lines, the second chart contains no information about probabilities. Nevertheless, the second chart facilitates the identification of important return ranges. For example, the high joint probability of real equity returns in the 1.5% to 6% range, together with bond returns in the 2% to 4% range; the possibility of large negative equity returns coinciding with returns around 3% for bonds. Particularly important for the management of portfolio risk and extent of diversification, is the coincidence of significant negative returns (indicated in the bottom right corner of the surface chart) which occurs in severe inflation shock scenarios. These joint probabilities are pivotal to the design of asset allocations to satisfy risk objectives.

---

## A scenarios approach to asset allocation

To illustrate some of the differences between a scenarios versus a mean–variance based asset allocation approach, consider selecting an asset allocation to generate the highest return possible while taking no more risk than a defined benchmark portfolio. The benchmark portfolio is assumed to consist of 70% equities (35% local equities and 35% global, of which 15% is currency hedged), 25% in nominal debt (of which 10% is in currency hedged global debt) and 5% in inflation linked securities.

Exhibit 8 shows the benchmark asset allocation together with three alternative allocations. The first alternative has been set using mean–variance optimisation.<sup>10</sup> Expected returns for this portfolio are above benchmark levels while standard deviation has been held constant. However, a constant standard deviation may not imply that risk exposure is unchanged. Exhibit 9 shows the differences in expected or probability weighted returns versus benchmark; and two measures of risk versus benchmark: standard deviation and mean–shortfall. Mean–short fall as defined here is the mean return in the negative tail of the distribution (in this case the 5% tail). The mean short–fall return is lower for the mean–variance portfolio than for the benchmark. This illustrates the limited, and potentially misleading, information that standard deviation provides about portfolio risk in a world where returns are not normally distributed.

The second asset allocation is the result of an optimisation which maximises expected real returns, subject to not increasing short–fall risk than the benchmark. Here neither risk measures are higher than benchmark while the expected return premium though lower than before is still positive. However, this disguises significant dispersion in the impact on returns in tail scenarios. In particular, this strategy has less inflation protection than the benchmark strategy and is more exposed in severe inflation tail scenarios. This vulnerability is increased by the particular starting point characteristics in early 2009 when little inflation risk was priced into asset valuations.

The final asset allocation shown in Exhibit 8 was derived from an optimisation which maximises real returns subject to returns not being lower than benchmark in any tail risk scenario. Expected returns are still above benchmark, though not quite as high as for the other two allocations. This is the most risk controlled strategy relative to benchmark and not unexpectedly has the greatest asset diversity, inflation linked debt now receives an allocation.

Optimisations which use more of the information embedded in the scenarios set tend to generate more diversified strategies because return relativities vary significantly across scenarios. This means that an exposure that may reduce risk in some scenarios may increase it elsewhere. For example, nominal bonds are risk reducing versus equities in a deflationary slump, but may not be

---

in stagflation – instead here inflation linked bonds and possibly commodities diversify risk. The greater the real world complexity in performance relativities that are taken into account, the broader and more diversified the final asset allocation tends to be.

More generally, it seems clear that the solutions to optimisation problems cannot be relied upon to identify the most appropriate investment strategy. For example, this third asset allocation may appear appropriate where investors are concerned about benchmark risk, but this strategy is expected to lag benchmark returns by an average 1.9% per annum in one scenario over 7 years, and this may not be an acceptable outcome.

In practice, while optimisation is useful to help reveal the information about trade-offs embedded in a scenario set, it is difficult to adequately reflect what are often multiple conflicting objectives into a single optimisation problem. It is typically necessary to build an understanding of risk by considering individual scenarios. Careful scenario by scenario assessment is required to fully understand the available information about risk and return trade-offs.

Practitioners set asset allocation by deciding how to trade-off competing objectives. A well designed scenarios framework builds understanding of the circumstances in which a strategy may or may not meet relative and/or absolute return objectives. It assists the making of informed choices about in what circumstances, in which relative risk is taken or absolute return objectives are not achieved. For example, there may be a willingness to accept peer risk when returns are relatively strong because here absolute return objectives are easily being met, return for expected out-performance in adverse scenarios – such a situation is illustrated in Exhibit 10.

The information a comprehensive scenarios set provides enables the fuller exploitation of opportunities for diversification and offers the opportunity to take advantage of distributional characteristics, particularly asymmetries. In a mean-variance world, volatility is seen as static and symmetrical – reducing downside risk is assumed to commensurately reduce upside potential. In a scenarios world, there is the potential to skew the distribution – reduce downside risk while retaining proportionately more upside potential.

Finally, Exhibit 3 provides some practical insight into broad asset allocation implications that this approach can yield. While this Exhibit shows only probability weighted returns and not the detail of the scenarios set, it nevertheless gives some broad indications of the risk return trade-off for debt and equities. Until the market declines of 2008, a progressively shrinking prospective reward for risk had been a feature of the investment environment. Notably unusual starting point characteristics included a high profit share of GDP and hence market earnings at levels that appeared inconsistent with economic growth; low and shrinking spreads for corporate and high

---

yield debt; and rising leverage. As indicated in the Exhibit, by mid 2007 the prospective reward to risk appeared unusually low.

An even more extreme compression in the prospective reward to risk was seen in the late 1990s. A scenarios assessment of prospects for the US equity market then led Gosling (1999) to note that "...the next decade's returns could prove to be the worst on average since the 1930s".

The most obvious asset allocation implication of such an assessment is to reduce exposure to risk assets. But as already noted this approach says nothing about the timing of reversion to mean. Of course strong returns can persist with progressively shrinking return potential. In order to maximise the benefit from medium term insights generated with this framework, considerable patience is often required. Indeed the short term can last for so long that many mistake it for the long term.

In early 2009, medium to longer term return potential from equities appeared significantly higher than at mid 2007. This was particularly evident relative to government nominal debt where unusually low starting yields limited prospective return potential. Over the medium term, this assessment suggested at least a benchmark allocation to equities, and a significantly below benchmark allocation to government debt (or at least a shortening of duration) whose prospective risk control properties appeared severely restricted. Again, this framework is inherently contrarian. After returns have been relatively strong, return potential is reduced and conversely. At the time of writing an exceptionally strong equity market recovery was again compressing the prospective reward for taking equity risk.

---

## Summary

This paper has discussed practical problems in making asset allocation decisions; it has made a number of assertions; and has proposed a tractable (though not simple) solution that captures the complexity of the real world. The main objective of this approach is to map uncertainty by describing what could happen.

A method for designing a scenario set has been outlined involving the definition of a series of distinct potential futures, the generation of return forecasts, and the specification of scenario probabilities. This provides an extremely flexible tool that exploits available information and at the same time embodies a recognition that there is considerable uncertainty about prospective return outcomes. With this approach, asset allocation analyses can be tailored to the needs of absolute return strategies, active or medium term overlay strategies, and funds that face peer risk constraints. Most importantly, the framework provides more information about risk and diversification than is feasible with a mean-variance approach. It also substantially reduces reliance on historical data. Perhaps most importantly this approach helps force the practitioner to be objective and dispassionate – in doing so it avoids reliance on getting a single expected scenario right. All this has the potential to improve the investment decision making process and make a significant difference to long term investment outcomes.

---

 Exhibit 1: Defining Scenarios

<b><u>Behavioural:</u></b>	<b>More Pessimistic</b>	<b>No change</b>	<b>More Optimistic</b>
<b><u>Macro-Driving:</u></b>			
<b>Strong growth, low inflation</b>	Strong equity fundamentals, adverse behavioural impact – low returns. Steady or low returns from nominal bonds.	Strong Equity Returns. Higher real yields may depress nominal bond returns.	Very strong equity return environment. Rising real yields depress nominal bond returns.
<b>Steady growth and inflation</b>	Below average equity returns, above average nominal bond returns	Steady state equilibrium: returns at potential level	Strong equity returns. Average to modest bond returns.
<b>Negative growth and deflation</b>	Highly adverse return environment for equities – negative returns. Very strong nominal bond returns.	Adverse equity return environment. Strong nominal bond returns.	Adverse equity fundamentals, supportive behavioural impact – moderate returns. Above average nominal bond returns.

Exhibit 2: Basis for a Generic Scenario Set

<b>Economic cycle basics</b>	Slowdown	Recession	Recovery	Steady/trend growth with mean reversion	Prolonged global growth & productivity boom
<b>Inflation related scenarios</b>	Disinflation	Deflation - companies lack pricing power / productivity driven boom	Inflation Surprise	Rising inflation/shock (reverse of disinflation)	Central banks fight deflation risk (risk higher inflation)
<b>Region specific scenarios</b>	Home country boom / bust	Home country economic crisis - World weak	Home country deflationary slump	Home country inflation/shock / avoidance of inflation shock	Emerging markets boom / contagion risk
<b>Thematic scenarios</b>	Credit, monetary expansion / contraction	Protectionism - adverse growth & inflation	Demographic change	Reregulation / Deregulation	Profit share mean reversion
<b>Behavioural</b>	Paradigm shift – higher/lower risk premia	Global growth boom + investor optimism	Investor pessimism + adverse economics	Persistent high inflation expectations	Persistent deflation expectations
<b>Exogenous Shocks</b>	Oil price or other commodity price shock	Global Pandemic	Global Catastrophe adverse economic environment	Global conflict/ war	Exogenous risk drives investor uncertainty
<b>Tail scenarios</b>	Global depression or stagnation	Severe inflation risk	Financial collapse Risk	Speculative Bubble / Bubble bursts	Market bust econ not okay (rise in correlations)

Exhibit 3: Real Portfolio Return Comparisons

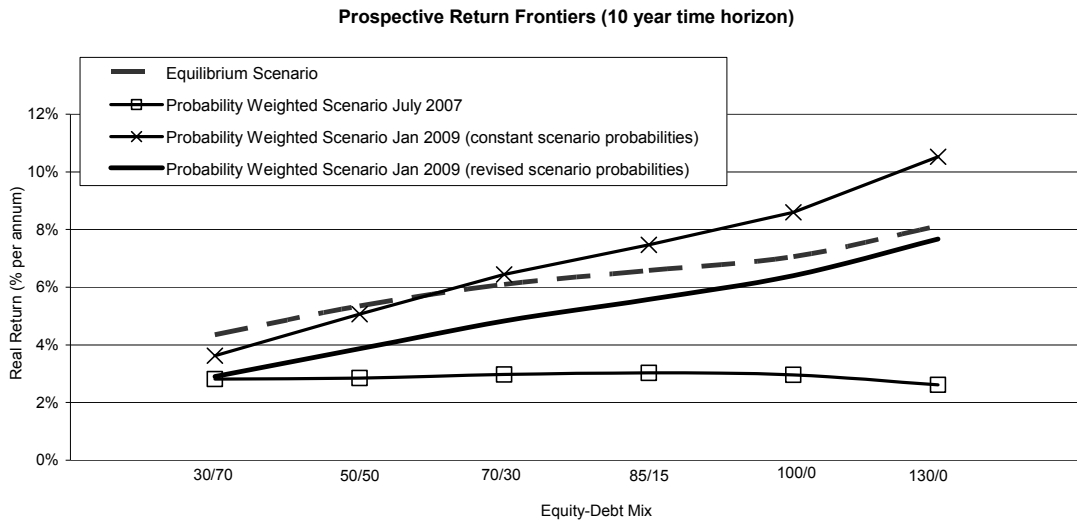


Exhibit 4: Scenario Returns

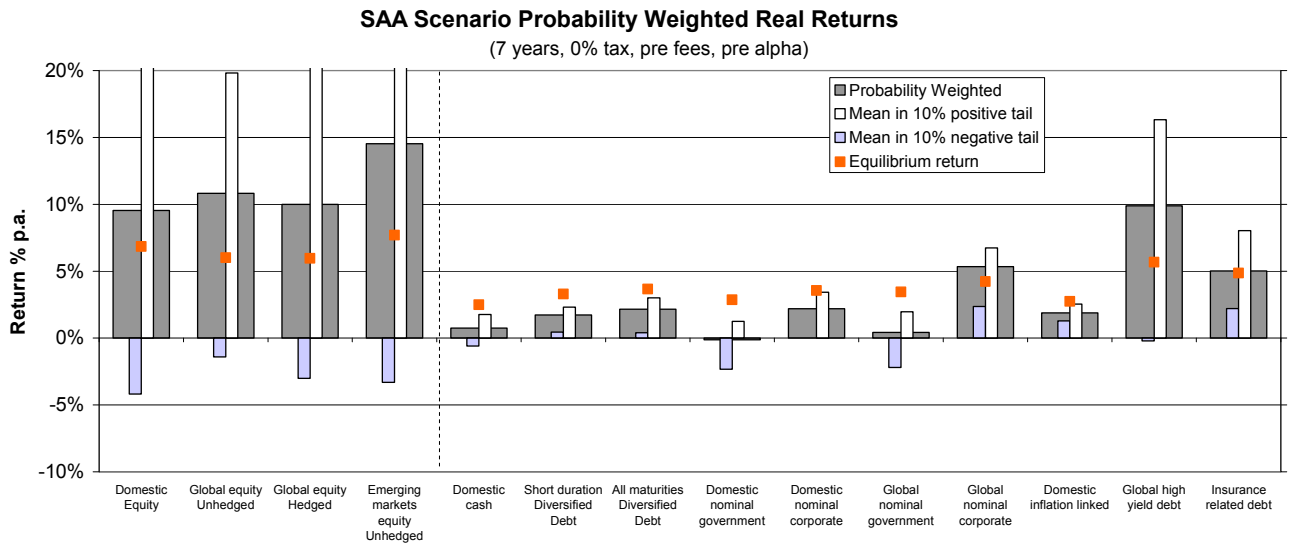
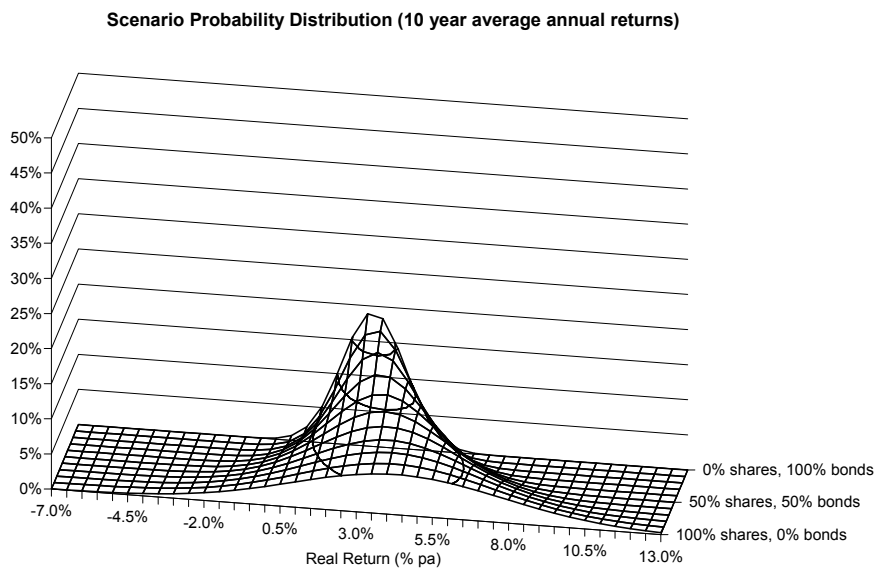
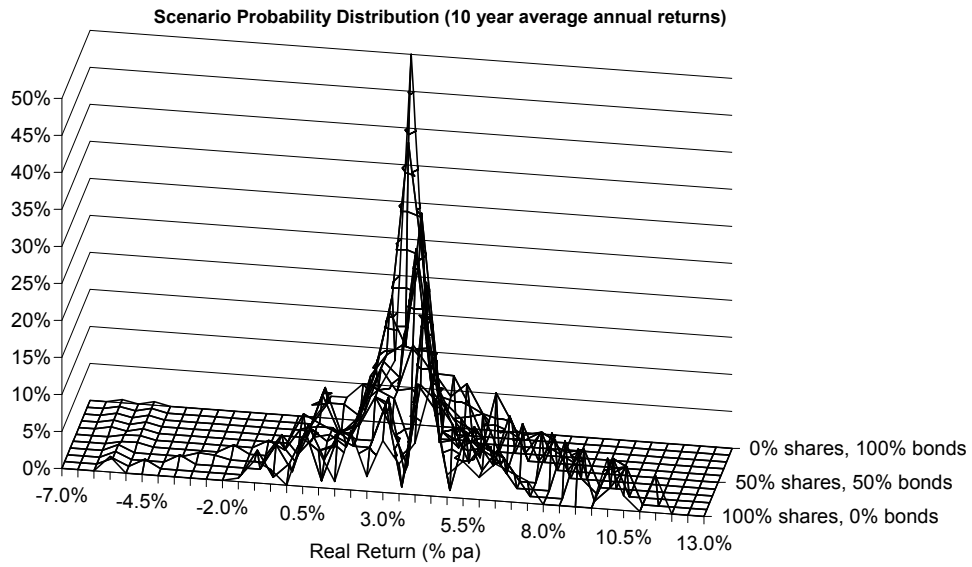


Exhibit 5: Probability Distribution Charts: Scenarios Set versus Normal Distribution



**Exhibit 6: Probability 'plan-view' portfolio distributions for different US equity and bond allocations (10 year average annual returns)**

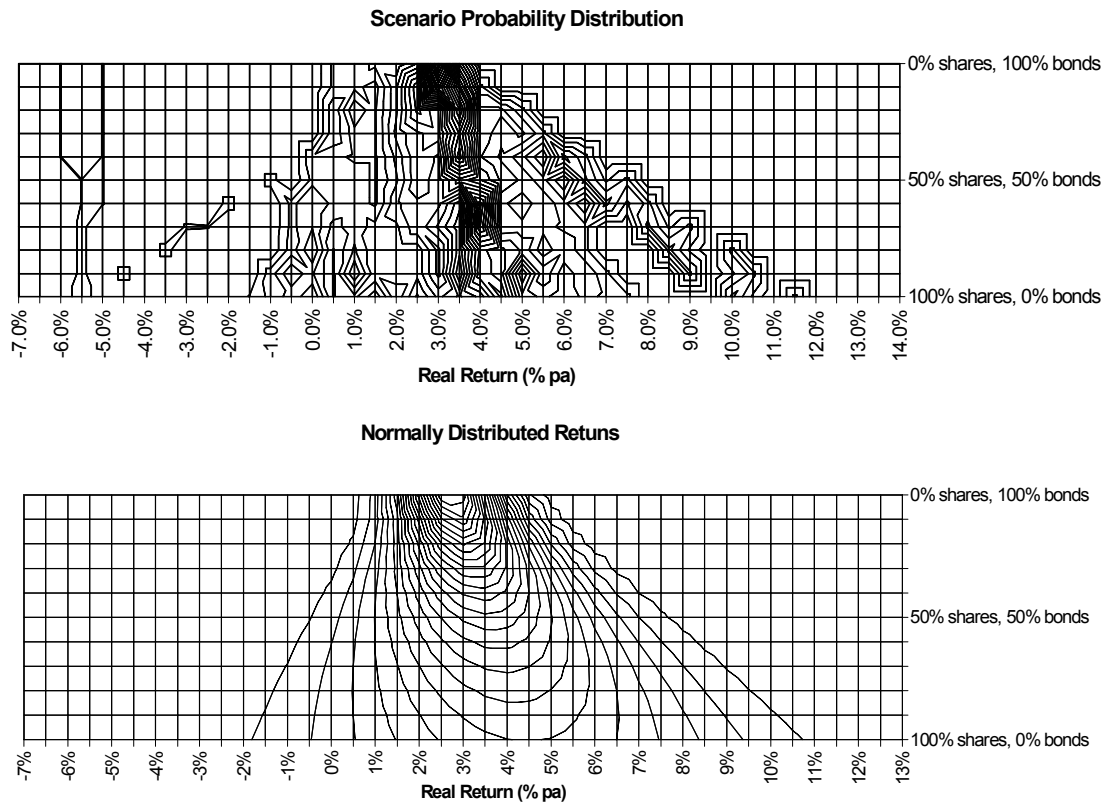


Exhibit 7: Joint Probability Distribution for US equity and bond scenario real returns

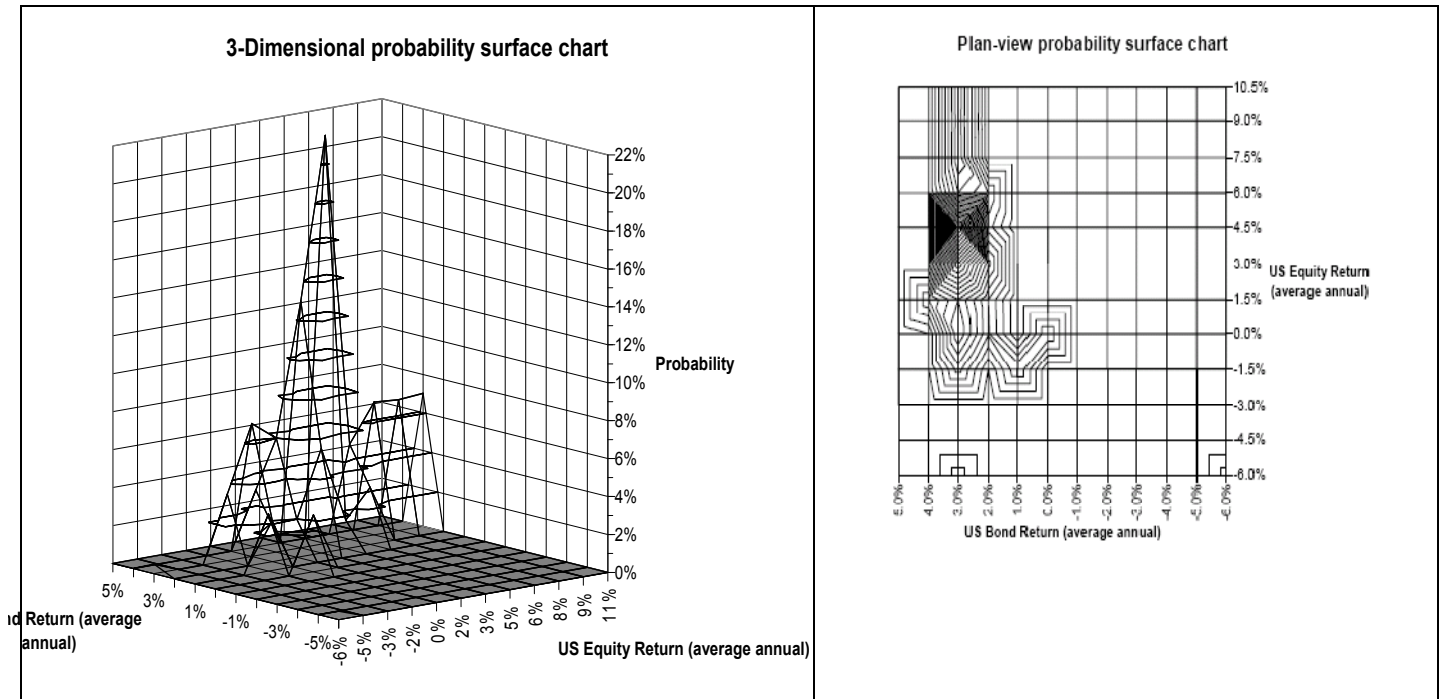


Exhibit 8: Alternative Asset Allocations

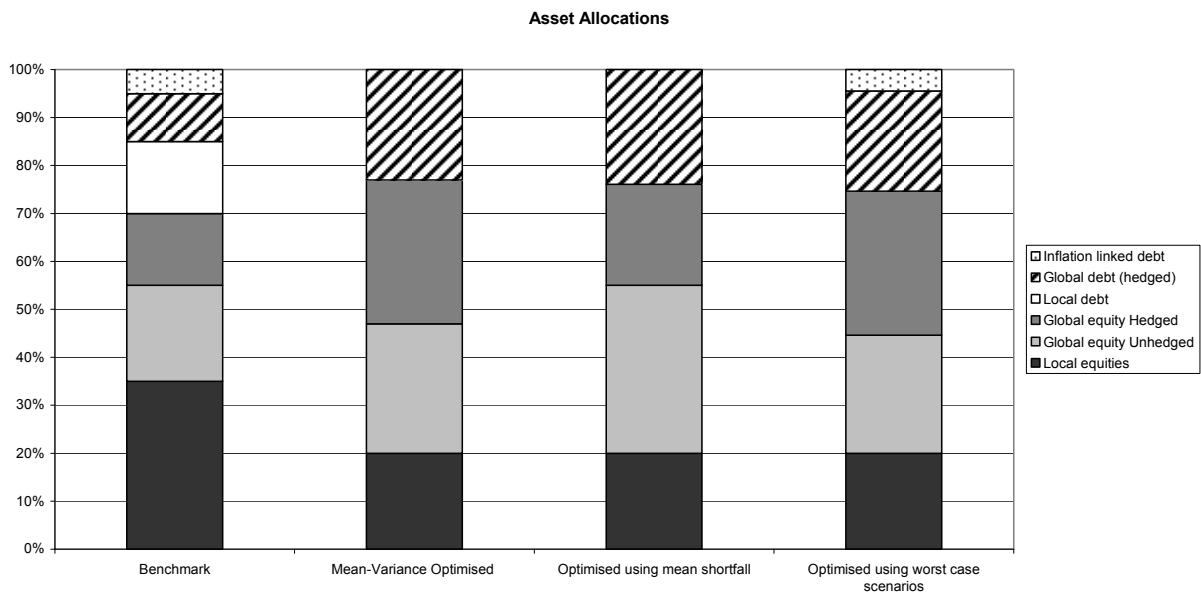


Exhibit 9: Portfolio Risk and Return (10 year time horizon)

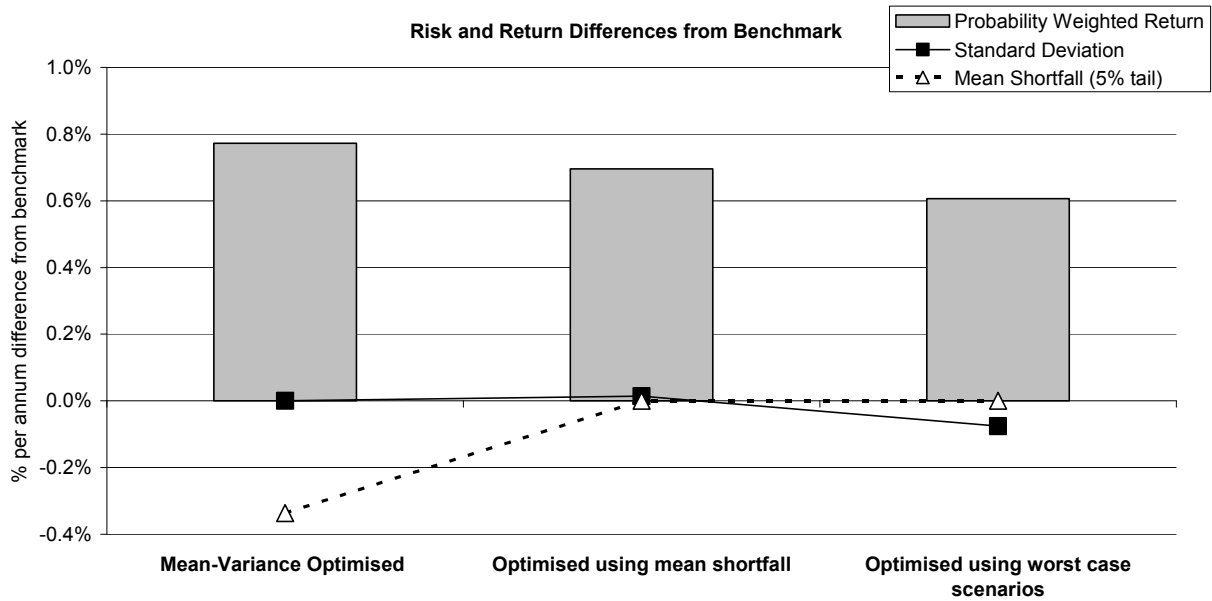
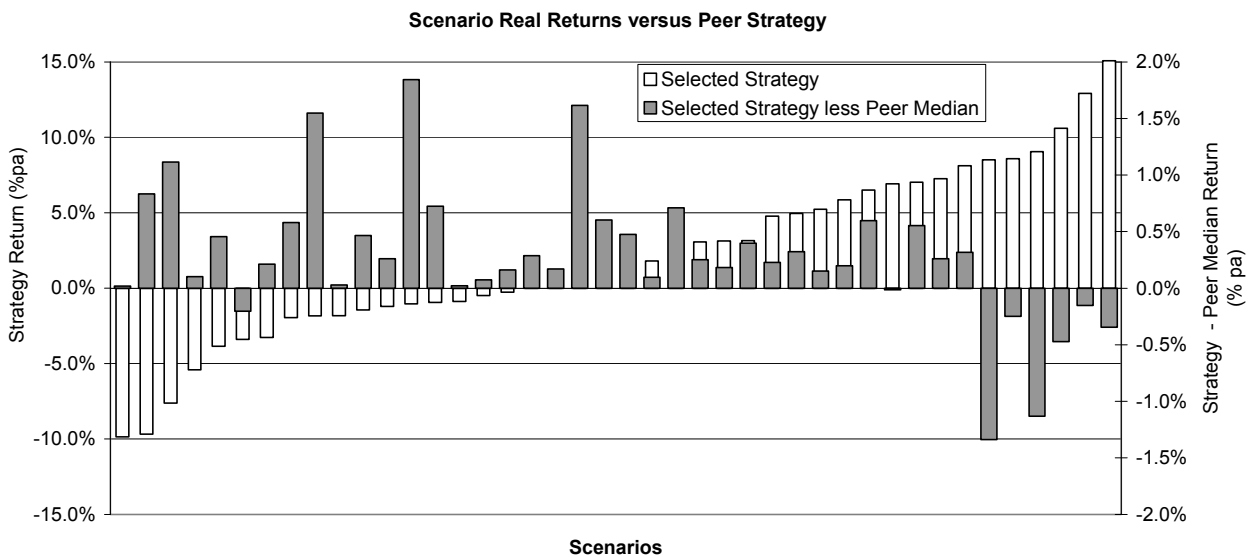


Exhibit 10: Peer Relative Returns



---

## References

Arnott, Robert D, Peter L Bernstein. "What risk premium is 'normal'?" *Financial Analysts Journal* (March/April 2003), pp. 64–85.

Fama, E., and K. French. "Common Factors in the Serial Correlation of Stock Returns" Anderson Graduate School of Management, 1986.

Fisher, Irving. "The Debt–Deflation Theory of Great Depressions", *Econometrica*, Vol. 1, Issue 4 (October 1933), pp. 337–357.

Gosling, Susan. "Taking stock: are equity markets heading for a fall?" *Journal of the Securities Institute of Australia*, Issue 3 (Spring 1999) pp. 2–6.

Grantham, Jeremy, "Risk Management in Investing (Part Two): Risk and the Passage of Time: The Extreme Importance of a Long Time Horizon", *Letters to the Investment Committee VII*, GMO, April 2008.

Kahneman, Daniel, Amos Tversky. "Prospect Theory: An Analysis of Decision under Risk" *Econometrica*, XLVII (1979), 263–291.

Markowitz, Harry. "Portfolio Selection" *The Journal of Finance*, Vol. 7, No. 1 (March 1952), pp. 77–91.

Mandelbrot, Benoit B., and Richard L. Hudson. *The (mis)Behaviour of Markets: a Fractal view of Risk, Ruin and Reward*, Basic Books, New York, 2004 (ISBN 0–465–04355–0).

Poterba, J., L. Summers. "Mean Reversion in Stock Prices: Evidence and Implications", NBER Working Paper Series, August 1987.

Saffo, Paul. "Six Rules for Effective Forecasting" *Harvard Business Review*, July–August 2007.  
Taleb Nassim Nicholas, *Fooled by Randomness – the Hidden Role of Chance in Life and in the Markets*, Random House Inc, USA, 2004 (ISBN 0–8129–7521–9).

Wason, P.C. "On the failure to eliminate hypotheses in a conceptual task" *Quarterly Journal of Experimental Psychology*, Vol. 12, Part 3 (1960), pp.129–140.

---

## End Notes

---

<sup>1</sup> I am grateful to Chris Condon, Jack Gray and Wesley Phoa for numerous helpful comments and suggestions provided during the preparation of this paper.

<sup>2</sup> See for example Kahneman and Tversky's (1979) seminal paper on prospect theory.

<sup>3</sup> This is Fama and French's (1986) terminology.

<sup>4</sup> For example, individual factors that tend to be perceived as important such as demographic trends, changes in international comparative advantage, and any driver of productivity growth, are important because they affect growth and inflation rates.

<sup>5</sup> Saffo visualises the mapping of a 'cone of uncertainty' as a process which captures uncertainty in a manner that assists strategic judgement.

<sup>6</sup> Such as measuring E in a PE ratio (by consensus, long term average or profit share of GDP) and ensuring that aggregation (of sectors or countries etc) do not mask important dynamics.

<sup>7</sup> Careful consideration needs to be given to the applicability of historical dividends and cross country adjustment may be needed to take into account differences in payout ratios.

<sup>8</sup> Fair value might be defined as the level at which prospective returns are consistent with the return required by a well informed rational investor.

<sup>9</sup> An alternative to use of scenario probabilities is the assigning of the probability of transitioning from one scenario to another. Monte Carlo simulation can then be used to generate sequences of scenarios and alternative return paths.

<sup>10</sup> For all optimisations some very simple allocation constraints have been set: plus or minus 15% around benchmark allocations plus a non-negativity constraint.