

Non-normal returns: are you underestimating the risk in your pension plan's investments?

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Peter Ball

Head of UK Institutional Business

Many pension investors suffered more significant losses during the financial crisis than they may have expected. Research from the J.P. Morgan Asset Management shows that a reliance on traditional asset allocation frameworks may have led to a significant understatement of portfolio risk. Our research shows that accepting that asset classes do not behave in a 'normal' manner and correcting for this behaviour when modelling a portfolio's expected returns will give pension plans a truer idea of their actual risk. This will allow pension plans to make more informed decisions on asset allocation.

As the financial crisis demonstrated, periods of extreme market stress can have serious consequences for investors. Thankfully, such events are rare. However, they are also unpredictable, meaning it pays to be prepared.

The extreme portfolio dislocations experienced during the crisis suggest portfolios employing conventional asset allocation techniques may actually carry a higher level of downside risk than many investors realise, or than current prevalent portfolio modelling techniques can identify. There is therefore a need to modify these models to better assess the long-term downside risk associated with market anomalies such as the financial crisis.

The non-normality of returns

Conventional asset allocation frameworks make a range of assumptions about the 'normality' of asset returns. The most problematic of these are that:

- returns are independent from period to period,
- returns are normally distributed, and
- that correlation relationships do not change.

In reality, we actually observe that in the majority of cases, returns are not independent, and in no cases are they normally distributed; negative returns occur in greater magnitude and with a higher probability than implied by the normal distribution. We also observe that during moments of market stress, correlation relationships breakdown and converge.

The conventional use of standard deviation as a measure of portfolio risk is also problematic, because it treats desirable upside movements as if they were just as undesirable as downside movements. This is inconsistent with the preferences of most investors, for whom the disappointment of a loss is likely to significantly outweigh the satisfaction of an equally sized gain. This is known as an asymmetric risk preference.

A more suitable measure may be conditional value at risk (CVaR95), defined as the average real loss (or gain) relative to the starting portfolio in the worst five percent of scenarios, based on 10,000 monte carlo simulations. It is simply the average real loss (or gain) in the worst 500 (5% of 10,000) scenarios.

CVaR95 overcomes many of the drawbacks of standard deviation as a risk measure. First and foremost, it only measures risk on the downside, which means it better reflects the asymmetric risk preferences of investors. It also captures the non-normality of returns: the fact that negative returns occur more frequently and with greater magnitude than the normal distribution implies.

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Incorporating non-normality: the impact on portfolio risk

With the right statistical tools, one can assess a plan's asset allocation within a framework that incorporates non-normality. Chart one illustrates the asset allocation of a typical medium-sized defined benefit pension plan. Initial value is GBP 1 billion.

Chart one: Sample asset allocation of a medium sized defined benefit pension plan

Initial portfolio allocation		Initial portfolio allocation	
Cash	2%		
UK bonds (Gilts)	13%		
World ex UK bonds (Sovereign)	5%		
UK corporate bonds	10%	Fixed income	30%
UK equity	30%		
World ex UK equity	35%	Equity	65%
UK direct real estate	5%	Alternatives	5%
Total portfolio	100%	Total portfolio	100%

In a traditional risk management framework that assumes asset class returns are normally distributed, the CVaR95 of the portfolio would be calculated as GBP 243 million. In other words, the calculation suggests that the portfolio could expect to lose GBP 243 million (on average) in the worst 5% of cases.

However, using the revised framework, which incorporates non-normality, the CVaR95 is GBP 286 million. i.e. the better estimate of risk is GBP 43 million, or 18%, higher.

This example helps to illustrate why losses in periods of severe market dislocation have often been of greater magnitude than investors may have anticipated.

Incorporating non-normality: the impact on asset allocation

The reason non-normality can affect asset allocation is that the downside risk associated with various asset classes is, in fact, very different. Most obviously, equity and equity-type asset classes have greater degrees of downside risk than, for example, fixed income investments. Hence, because the downside risk characteristics of various asset classes are different, and cannot be accounted for using traditional modelling techniques or risk measures, we believe investors should incorporate the impact of non-normality in the asset allocation process.

To assess the potential impact that a revised framework would have on asset allocation and risk, chart two uses the non-normal framework to assess the impact of moving from equities into a more diversified portfolio, including a higher weighting in alternative assets. The rationale for adjusting the portfolio's equity weighting, rather than its fixed income weighting, is that in general, the level of fixed income in a portfolio is based on an actuarial calculation of liabilities. In addition, fixed income provides a level of downside protection within a non-normal allocation framework, in line with investors' asymmetric risk preferences.

The chart compares the initial portfolio with two other asset allocations using the revised framework incorporating non-normality. Column A shows the initial portfolio's asset allocation (per Chart one). In column B, we move 10% of the equity weighting into hedge funds and infrastructure; column C we diversify the portfolio further out of equities into commodities, emerging market debt and increase the weighting to hedge funds. Please note that these asset allocations are for illustrative purposes only.

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Chart two: the impact of diversification on potential portfolio losses

	A: Initial Portfolio	B: Scenario One	C: Scenario Two
Cash	2%	2%	2%
UK bonds (gilts)	13%	13%	8%
World ex UK bonds (sovereign)	5%	5%	5%
UK corporate bonds	10%	10%	10%
Emerging market debt	-	-	5%
Fixed Income	30%	30%	30%
UK equity	30%	25%	20%
World ex UK equity	35%	30%	25%
Equity	65%	55%	45%
Diversified hedge funds (hedged)	-	5%	10%
Commodities	-	-	5%
UK direct real estate	5%	5%	5%
Infrastructure	-	5%	5%
Alternatives	5%	15%	25%
Total Portfolio	100%	100%	100%
CVaR95	£286	£254	£208
Improvement versus Current Portfolio		-11.3%	-27.4%

In the first scenario, increasing the diversification through the use of alternatives reduces the CVaR95 relative to the initial portfolio. Indeed, when we increase the allocation to alternatives further and add emerging market debt into the portfolio, the CVaR95 falls by 27% versus the current allocation. We should not, of course, assume that CVaR95 would be reduced in proportion to increased allocations to alternatives in all cases. A portfolio of 100% alternatives might be very risky and experience liquidity issues. However, the findings do suggest that adding alternatives and increasing diversification results in significantly better downside protection in periods of market dislocation.

In conclusion

Despite the fact that many pension plans typically have fairly well-diversified portfolios, the analysis suggests that there is scope for further improvement of portfolio downside protection. Many Trustees may be underestimating the size of the potential losses. Should a market crisis of a similar, or worse, magnitude to 2008 occur a pension plan may suffer losses from which it will be difficult to recover.

Using new statistical techniques in portfolio modelling should result in a more accurate assessment of a portfolio's risk and demonstrate the benefits of diversification. Our research shows that it is vital that pension plans use a non-normal framework when deciding on a suitable allocation, as the traditional framework may significantly understate downside risk in periods of financial crisis.

Of course, all pension plans are different, and any change to the asset allocation, in particular investing in alternatives, requires a thorough consideration of factors such as portfolio liquidity requirements and plan liabilities. However, the results show that better diversification and the inclusion of alternatives should improve protection against heavy losses in adverse economic conditions and this means that pension plans should be prepared to review their long-term allocations.

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Important Information

Investing in alternative assets involves higher risks than traditional investments and investors should consult a professional adviser prior to investing. Alternative investments have higher fees than traditional investments, may not be tax efficient and they may also be highly leveraged and engage in speculative investment techniques, which can magnify the potential for investment loss or gain. The value of investments and the income from them may fall as well as rise and investors may not get back the full amount invested. Past performance is not a guide to the future.

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