Equities for the long run?

The impact of uncertain assumptions on strategic asset allocation.

Traditional models suggest there is a very high chance equities outperform over the long term. But are they overconfident, and should long-term investors adjust their asset allocation accordingly?

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EXECUTIVE SUMMARY

- Many investors, including defined benefit (DB) and defined contribution (DC) pension schemes have time horizons extending far into the future. As such it is crucial to understand risk and return trade-offs over the long term

- Traditional models can be poor indicators of long-term risk because they do not allow for the risk that the assumptions used, particularly expected returns, could be wrong

- Allowing for this uncertainty promotes maintaining a healthy level of diversification across asset classes, even over multi-decade time horizons. It also suggests that DB and DC schemes may require higher levels of contributions to remain confident of achieving their long-term objectives.

Understanding uncertainty is critical to making good investment decisions. Stochastic models ('stochastic' simply meaning they use probabilities) are widely used in risk management to help assess the likelihood of different outcomes over different time horizons.

Whilst such models should never be used blindly, and one needs to be careful about 'driving only using the rear-view mirror', they can help investors understand the risk and return trade-offs they face both in the short and long term. Importantly, they lend a degree of objectivity and help avoid a natural tendency to bias towards a particular viewpoint at the expense of historical precedent – a behavioural effect known as base-rate neglect[1]. Ignoring base-rates – and starting from the premise that 'this time is different' – is dangerous and gets many investors into trouble.

However, a problem with traditional models is that they can paint an overly confident picture of what the long-term looks like and the asset classes that will do best. This can lead to over-aggressive or under-diversified strategies, and contributions levels that are too low. Happily, there are relatively straightforward steps that can be taken to improve these models: in this paper we explore the implications of doing so and arrive at some interesting conclusions.

1 The base rate fallacy, also called base rate neglect or base rate bias, is a formal fallacy. If presented with related base rate information (i.e. generic, general information) and specific information (information pertaining only to a certain case), our minds tend to ignore the former and focus on the latter.

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THE CHANCE OF OUTPERFORMING: A PROXY FOR ASSET ATTRACTIVENESS

Most investors believe that longer time horizons generally favour higher allocations to growth assets. For example, Warren Buffett, the famous value investor, views equities as the most attractive asset class over the long term. Whilst not completely uncontroversial[2], the essential idea is that, whilst volatile, equities are the least risky asset in the long run, at least in terms of their higher chance of outperformance. Behaviourally, investors tend to be happier with the distribution of outcomes that a more aggressive strategy offers over longer time horizons, even though it includes more extreme losses in the (increasingly unlikely) event that things go badly.

THE PROBLEM

One trouble with traditional models, however, is that they can give a misleading picture of the risk of long-term outcomes. According to these models, you can increase the chance of an asset outperforming another asset with a lower expected rate of return to as close to 100% as you like simply by increasing the time horizon. If the expected rate of return on emerging market equities is marginally higher than the expected rate of return on developed equities, for example, the models say that the chance emerging outperforms developed tends to certainty as the time horizon expands.

The issue is that this ignores the risk that the assumptions made are incorrect. We cannot be sure that emerging market equities should have a higher expected rate of return than developed market equities. As we shall see, we cannot even be totally certain that the equity risk premium is necessarily positive. Traditional models also assume that other properties of asset returns such as volatilities, correlations and the default risk on bonds[3] are known with certainty.

Admitting uncertainty in assumptions could be perceived as a weakness and a lack of confidence. This is the wrong way to see it – really it is honest and good risk management. But where does this uncertainty come from? There are two key drivers:

a) A lack of data

Part of the problem is simply statistics; you need surprisingly large amounts of historic data to be confident of expected returns. For example:

- You need 68 years of data on an asset class that has an average historic return of 4% per year over cash with 20% volatility to be 95% confident that the expected return over cash is positive.

- If you have two assets each with 15% volatility, 70% correlated and with a 1% gap in expected returns then you need more than 340 years of historic data to be 95% confident you have the ranking by expected returns the right way around!

b) Different views

The other aspect of the problem is that even if you have a lot of data, returns from the distant past may lack relevance. Uncertainty remains simply because past returns are only ever a guide to the future. The historical performance of assets is only one factor (albeit an important one) in estimating future returns.

THE EQUITY RISK PREMIUM

As a particularly important example of assumption uncertainty, we look at the equity risk premium ('ERP') – the expected excess return of developed market equity over 'risk free' instruments. The two points above – a lack of data and different views – mean there is considerable uncertainty as to its value.

In terms of data, most economists agree that the evidence shows substantial statistical power that the ERP is positive, even if there is considerable uncertainty about how positive it now is. This makes intuitive sense as a conclusion – investors should require compensation for the higher risk of investing in stocks[4].

However, some fund managers and (a minority of) economists question the existence of the ERP. Their arguments are partly based on there being insufficient data to statistically distinguish the equity risk premium

2 Nobel prize winner Paul Samuelson's 'The Long-Term Case for Equities—And How It Can Be Oversold' was published in 1994 and rejects the premise that the risk of stocks decreases over longer time horizons. Time-diversification of risk is, strictly speaking, a fallacy: taking less risk over shorter time horizons is driven by 'behavioural' factors such as loss aversion, rather than 'rational' reasons; see the 'in focus' section http://www.lgim.com/library/knowledge/thought-leadership-content/ldi-monthly-wrap/LDI_Monthly_Wrap_AUG_15.pdf for a discussion.

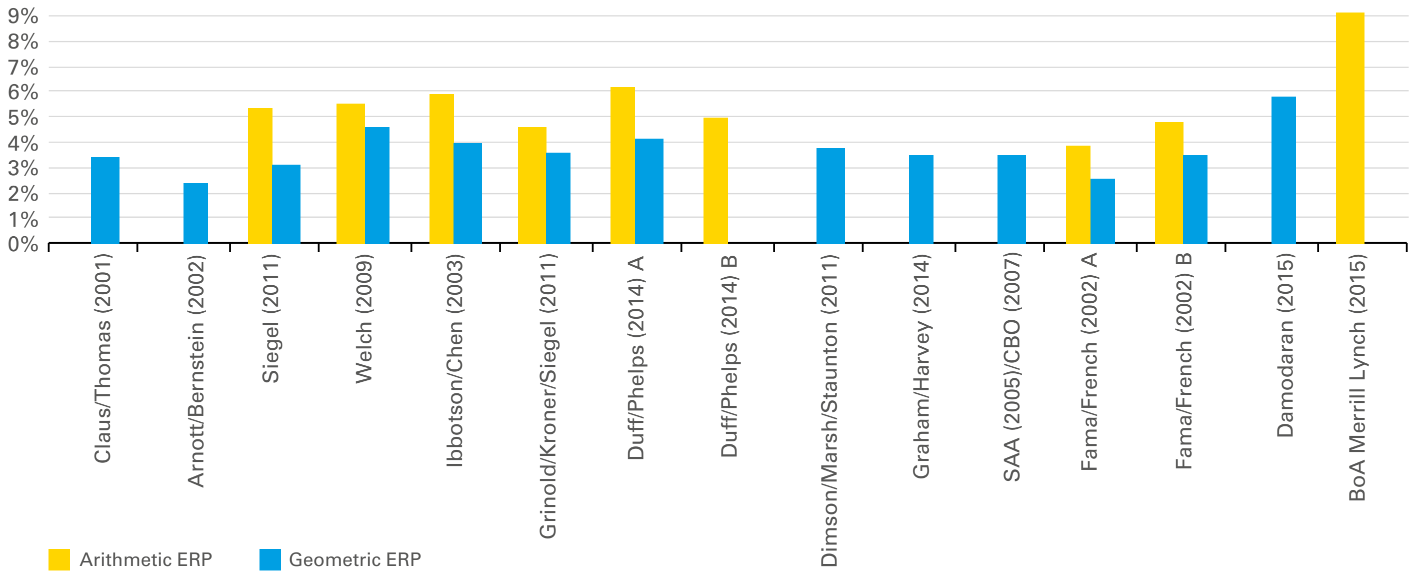
3 This risk is particularly important to understand if cashflow matching

4 Indeed, as a central, strategic assumption our (geometric) ERP is between 3.5% and 4.0% per annum.

from zero. These include selection bias of the US market in studies, survivorship bias of exchanges and a low number of data points, especially in view of the 'black-swan' effect (i.e. infrequent melt-downs – investors go up the stairs but down the elevator). Some also point out that a non-existent ERP would largely solve an interesting problem called the 'equity premium puzzle'[5].

In terms of views, Figure 1 below summarises a variety of researchers' best estimates of the ERP:

Figure 1: Different views on the ERP



Source: LGIM

Clearly there is a wide range of estimates, despite these researchers having access to (virtually) the same data. Even these, however, do not reflect the degree of uncertainty each of the authors have regarding their own estimate, or the risk that some of the authors are likely to see the world in a similar – but not necessarily correct – way.

CAPTURING ASSUMPTION UNCERTAINTY: STACKED DECKS

So how can we get around this? How can we design more robust models that capture assumption uncertainty?

A common way to model asset returns is to randomly select returns from history and glue these returns together to produce a simulation of the future. This is named a Monte Carlo simulation after the city in Monaco famous for its casinos where games of chance (e.g. roulette and blackjack) involve repetitive events with known probabilities.

The simulations are repeated thousands of times to build a distribution of potential outcomes. A problem with this process in its simplest form is that it ignores that history could have been different to the one we happened to experience. History only played out once and could have, by chance, given an unrealistic reflection of assets' underlying characteristics.

This is a bit like playing blackjack when you know the deck is stacked but you don't know exactly how. Without playing for a very long time, it's hard to work out exactly how it is different from a standard deck.

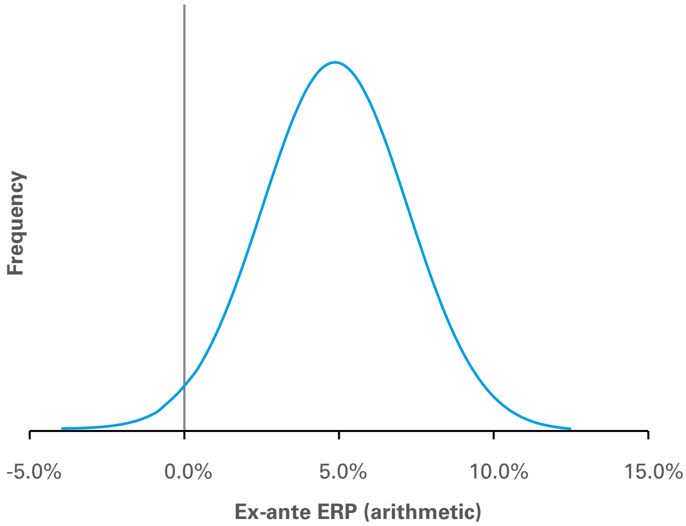
One way we developed to allow for this uncertainty is, for each simulation of the future, to first create a 'new history' (or possible deck of cards) to sample from for that simulation. Forever more in that simulation we only sample from this new history of returns (or deck in the blackjack analogy). This captures our uncertainty about the nature of different asset classes, in the same way it would capture the uncertainty our gambler has about how the deck is stacked.

5 Mehra and Prescott, 1985 'The Equity Premium: A Puzzle', found that a standard general equilibrium model, calibrated to display key U.S. business cycle fluctuations, generated an equity premium of less than 1% for reasonable risk aversion levels. There are several potential explanations of the puzzle, including Benartzi and Thaler's paper on 'Myopic loss aversion and the equity premium puzzle' (1995) that focuses on the influence of loss aversion.

THE IMPACT OF ALLOWING FOR ASSUMPTION UNCERTAINTY

To get a feel for the degree of uncertainty in expected returns this gives, Figure 2 indicates the degree of uncertainty in the ERP according to our model that allows for assumption uncertainty. Under this model[6], there is a small chance (about 2%) that the ERP is zero or negative. One can argue that over the *extremely* long-term a negative ERP should be impossible given that eventually investors should have enough data and 'wise-up'. However, given more realistic 'long-term' investor timeframes (say below 100 years), entertaining a small chance the ERP is negative is not crazy.

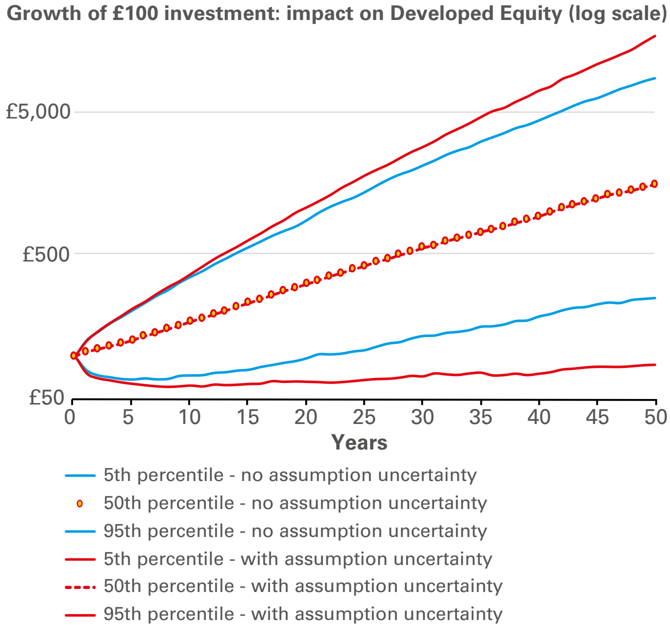
Figure 2: Uncertainty in the ERP assumption



Source: LGIM calculations

What is the impact on overall uncertainty? Figure 3 shows the impact in the case of developed equity. The increase in risk is small initially, as the short-term volatility of the asset dominates. But over the long term, the uncertainty in expected return becomes more important. Note Figure 3 uses a log scale; the impacts on the upside are much greater than the impact on the downside, due to compounding.

Figure 3: impact of allowing for assumption uncertainty on developed equity funnel of doubt (log scale)



Source: LGIM calculation

But the really interesting question is: what is the impact on long-term investment strategy? Broadly speaking there are three key implications:

(1) Investors may wish to consider less aggressive investment strategies, recognising that you cannot be as confident that assets such as equities will outperform[7]

(2) More diversified strategies could also be appropriate, recognising that you cannot be as confident in the size of the differences in expected returns across assets, or even their ranking.

(3) Higher contributions may be required to maintain the same degree of confidence of meeting long-term objectives.

To illustrate this we've shown in Figure 4 the impact for a lump sum invested now and held for 50 years. The figures show how much would need to be invested to be 90% or 75% confident of achieving a fund size of £100,000 by the end of the period for five different investment strategies.

6. Our process was to first create new histories by sampling from monthly data since 1973 using exponential weights with a half-life of 20 years. For any particular simulation we then only sampled from the new history for that simulation using uniform sampling. Clustering of random numbers was also used to help capture short-term autocorrelation effects.
7. We say in most circumstances because actually it depends on the risk appetite of the investor. Mean average outcomes are boosted when we allow for assumption uncertainty, median outcomes are left the same and downside outcomes are worsened. Most investors seek a degree of confidence greater than 50% with respect to achieving a target.

Figure 4: amounts needed to be invested now to be confident of reaching £100,000 in 50 years

	90% confidence		75% confidence	
Investment strategy*	No assumption uncertainty	With assumption uncertainty	No assumption uncertainty	With assumption uncertainty
Developed Equity	£30,553	£69,666	**£15,068**	£23,244
Moderate risk diversified growth strategy (2/3rds volatility of Developed Equity)	**£25,512**	£39,586	£16,586	**£20,810**
Lower risk diversified growth strategy (50% volatility of Developed Equity)	£26,190	**£35,400**	£18,606	£22,084
UK Credit	£37,533	£41,998	£33,280	£35,275
Cash	£58,782	£65,085	£52,565	£55,936

* Illustrative only. No alpha has been allowed for in any of these five strategies.
Source: LGIM calculations as at 31 December 2017.

The lowest figures in each column (shown in bold) correspond to the investment strategy, out of the five choices, that makes most sense to follow given the modelling assumptions made. This is because you can achieve your objective with less money. As can be seen on allowing for assumption uncertainty, higher contributions are needed (£25,512 increases to £35,400 and £15,068 increases to £20,810) and more diversified, lower risk strategies are preferred.

This is a relatively simple example: the impact on asset allocation for an actual DB or DC scheme is more subtle and complex – Figure 4 is intended only to give a flavour of its influence. For example, investors may have an inflation-linked, rather than fixed, target. The effect over shorter time horizons is also much lower. In the appendix we repeat the table twice for a target of £100,000 indexed to RPI over 50 years and 15 years.

WHAT NEXT FROM LGIM?

We would be delighted to meet with you in person to discuss our findings in more detail, and show how they could be relevant for your DB or DC scheme. To set up a meeting or request more information please contact your Client Relationship Director.

APPENDIX: RESULTS FOR A REAL TARGET OR SHORTER TIME HORIZON

The table below shows how much you would need to invest now to receive £100,000 in 50 years indexed to RPI. In the median case this amounts to a target of £493,537 but varies by scenario (dependent on how high or inflation experience.is).

Figure 5: amounts needed to be invested now to be confident of reaching £100,000 indexed with RPI in 50 years

	90% confidence		75% confidence	
Investment strategy*	No assumption uncertainty	With assumption uncertainty	No assumption uncertainty	With assumption uncertainty
Developed Equity	£135,560	£356,365	**£71,776**	£114,269
Moderate risk diversified growth strategy (2/3rds volatility of Developed Equity)	**£120,172**	£201,233	£80,667	**£105,074**
Lower risk diversified growth strategy (50% volatility of Developed Equity)	£126,882	**£186,407**	£92,334	£111,825
UK Credit	£222,575	£243,678	£180,023	£189,654
Cash	£318,364	£378,389	£272,423	£300,684

* Illustrative only. No alpha has been allowed for in any of these five strategies.
Source: LGIM calculations as at 31 December 2017.

Below we also show results over 15 years for a £100,000 target inflated with the RPI. As can be seen the impact of assumption uncertainty is much lower:

Figure 6: amounts needed to be invested now to be confident of reaching £100,000 indexed with RPI in 15 years

	90% confidence		75% confidence	
Investment strategy*	No assumption uncertainty	With assumption uncertainty	No assumption uncertainty	With assumption uncertainty
Developed Equity	£158,778	£198,517	£108,775	£121,128
Moderate risk diversified growth strategy (2/3rds volatility of Developed Equity)	£134,255	£150,549	**£106,114**	**£113,125**
Lower risk diversified growth strategy (50% volatility of Developed Equity)	**£128,809**	**£142,771**	£107,634	£113,427
UK Credit	£141,636	£144,536	£126,605	£128,142
Cash	£153,002	£161,545	£140,605	£146,020

* Illustrative only. No alpha has been allowed for in any of these five strategies.
Source: LGIM calculations as at 31 December 2017.

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