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Illiquid Assets and Capital-Driven Investment Strategies

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Overview

The recent emergence of a number of related factors has the potential to significantly impact on insurance asset strategies and the roles played by insurance asset managers. The risk-based nature of Solvency II creates an opportunity for asset managers to play a more strategic role in insurance asset management—so-called Capital-Driven Investment could be for the insurance industry what Liability-Driven Investment has been for DB pension funds. At the same time, the recent macro-economic environment has created pressures and opportunities for insurance asset management—low yields have created some significant solvency strains in European life insurance, and have caused insurance firms to redouble efforts to find extra yield, particularly when it can be achieved through improved (il)liquidity matching of liabilities rather than significant increases in market or credit risk exposures. As a result, a number of major insurance groups have made public their intention to increasingly invest in alternative illiquid asset classes such as infrastructure and commercial real estate. And so a second form of opportunity arises for insurance asset managers: as well as having an open door to playing a more strategic asset role, there may also be opportunities to offer more niche and specialist mandates for asset classes that are outside the traditional areas of expertise of insurers.

This paper attempts to bring a couple of these two strands together. First, it reviews how we can measure the illiquidity premiums on offer across the increasingly diverse range of asset classes that a long-term illiquid liability writer such as a fixed annuity business can consider investing in. These risk-adjusted return measures are then used alongside a Solvency II-style capital model to generate capital-driven investment metrics. A case study is used to analyze how these capital-driven metrics are optimized by strategic asset allocation choices.

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1. Introduction

The gradual emergence of a number of related factors over recent years has the potential to increasingly impact on insurance asset managers. The risk-based nature of Solvency II creates an opportunity for asset managers to play a more strategic role in insurance asset management – so-called Capital-Driven Investment could be for the insurance industry what Liability-Driven Investment has been for DB pension funds. At the same time, the recent macro-economic environment has created pressures and opportunities for insurance asset management – low yields have created some significant solvency strains in European life insurance, and have caused insurance firms to redouble efforts to find extra yield, particularly when it can be achieved through improved (il)liquidity matching of liabilities rather than significant increases in market or credit risk exposures. As a result, a number of major insurance groups have made public their intention to increasingly invest in alternative illiquid asset classes such as infrastructure and commercial real estate. And so a second form of opportunity arises for insurance asset managers: as well as having an open door to playing a more strategic asset role, there may also be opportunities to offer more niche and specialist mandates for asset classes that are outside the traditional areas of expertise of insurers.

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2. Estimating Illiquidity Premia in Illiquid Asset Classes

The purpose of this section is three-fold. Firstly, to provide a high-level summary of the key theoretical ideas which support the proposition that the trading liquidity of assets should influence their prices (and expected returns). Secondly, to summarize— again at a very high level – the empirical evidence for liquidity premia across difference asset types. A tentative summary of liquidity premia across asset classes is attempted. Finally, to highlight other considerations and questions which are important when considering the *strategic* exploitation of liquidity effects – when portfolio strategy might be modified for the long-term, the segmentation of investor groups and the extent to which liquidity effects may be removed by portfolio shifts and re-packaging of exposures by investors.

Liquidity and asset prices – a brief review of the theory

Asset pricing theory shows that, in a "frictionless" market (i.e. where there are no trading costs), assets with identical cash flows will sell at the same price. If this were not the case simple arbitrage profits would be available. However, in real-world asset markets there are costs for buying and selling assets and these costs are frequently material and uncertain. Further, this uncertainty in trading cost may be systematic i.e. non-diversifiable and associated with market-wide price and liquidity declines most often linked to shocks to the real economy. "Cost" here can relate to the direct costs of trading as well as the opportunity cost of waiting for a willing counterparty to take the other side of a transaction. In some markets, dealers (in various forms) risk their capital to provide liquidity and 'immediacy' taking the opposite side of desired trades in exchange for a dealing spread that must compensate them for the costs and risks of holding temporary, risky inventory. In other markets, participants might advertise their desire to buy or sell but must wait for a natural counterparty to arrive. In some markets (e.g. real estate), there may also be significant delays between agreeing and settling a deal. Across the asset types held by financial institutions, markets take many different forms, the cost (and nature of the cost) of trading varies and these properties will also change over time. There is a large literature on the 'microstructure' of financial and other asset markets which explores these ideas in detail[1].

Over the past 30 years financial economists have developed models of increasing sophistication in which investors face frictional costs so that prices must be adjusted downwards (and expected returns adjusted upwards) to compensate investors for bearing the direct costs and risks associated with illiquidity. They conclude that a liquidity discount may be observed in the price of any asset subject to trading costs. Further, assets which offer the same promised cash flows can sell at different prices without the creation of arbitrage opportunities. The *Law of One Price* must be treated with care.

When thinking about the impact of illiquidity on asset prices it is important to highlight the distinction between compensation for *expected costs* and compensation for *liquidity risk*. You might think about this as similar to the corporate bond credit spread which can be split into a component determined by the expected (i.e. average) cost of default and an additional spread for the risk of higher, unexpected defaults. As for the bond credit spread, product designers, actuaries and traders need to take care over how these spreads are shared out in financial products and how the associated risks are managed. When we consider the impact of liquidity on asset prices, it is necessary to think about both the average adjustment the marginal investor must make to

[1] See for example: Maureen O'Hara, "*Market Microstructure Theory*", Blackwell (1995)

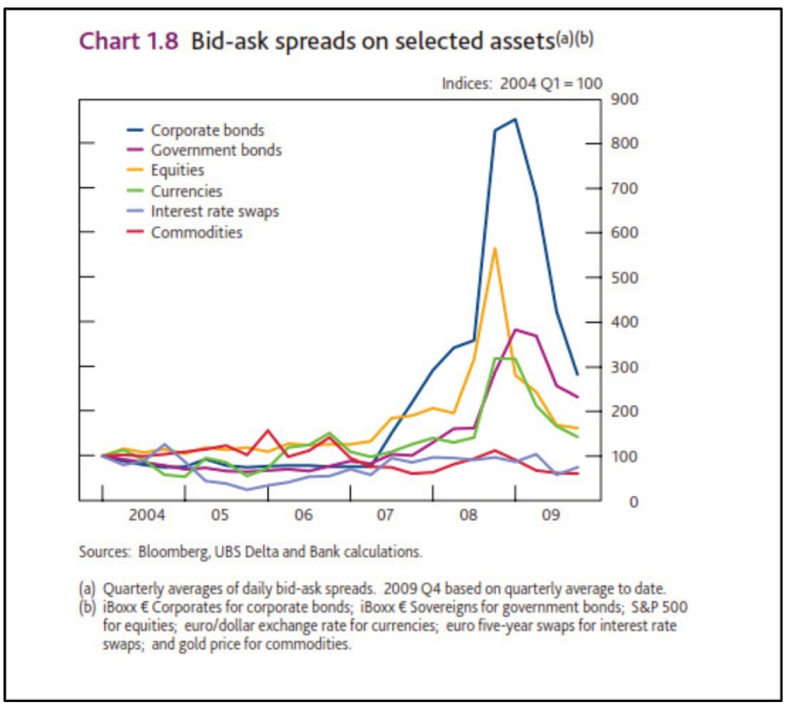
compensate for expected trading costs as well as the additional compensation for unexpected costs and how these costs co-vary with other risk factors. We will refer to these two price components as the *expected illiquidity cost* and *liquidity risk premium*. In practice, they are frequently merged into a single measure, not least because measuring them is often difficult and subjective. The practitioners' 'liquidity premium' sums up these two components.

The liquidity-adjusted capital asset pricing model (CAPM) of Acharya and Pedersen[2] provides a rigorous framework for thinking about the liquidity risk premium so it is worth considering their analysis in a little more detail. Their proposition is that market-wide shocks to liquidity are a source of risk in asset markets which affect both investors' wealth and their ability to trade. Returns *after* transaction costs are affected by two systematic factors – market price returns and market-wide changes in trading costs. The total systematic risk faced by an investor is then the sum of *four* exposures giving rise to four *betas*:

1. The sensitivity of the asset return (before costs) to the aggregate market return. (This is the familiar beta of the standard CAPM).
2. The sensitivity of the asset's own liquidity cost to market-wide liquidity shocks. This is often referred to as commonality in liquidity. A positive beta implies that an asset will become relatively less liquid as market-wide liquidity declines. Evidence suggests this is the case, for example, for small-cap equities.
3. The sensitivity of asset return's exposure to market-wide shocks in trading costs.
4. The sensitivity of an asset's illiquidity costs to market-wide returns.

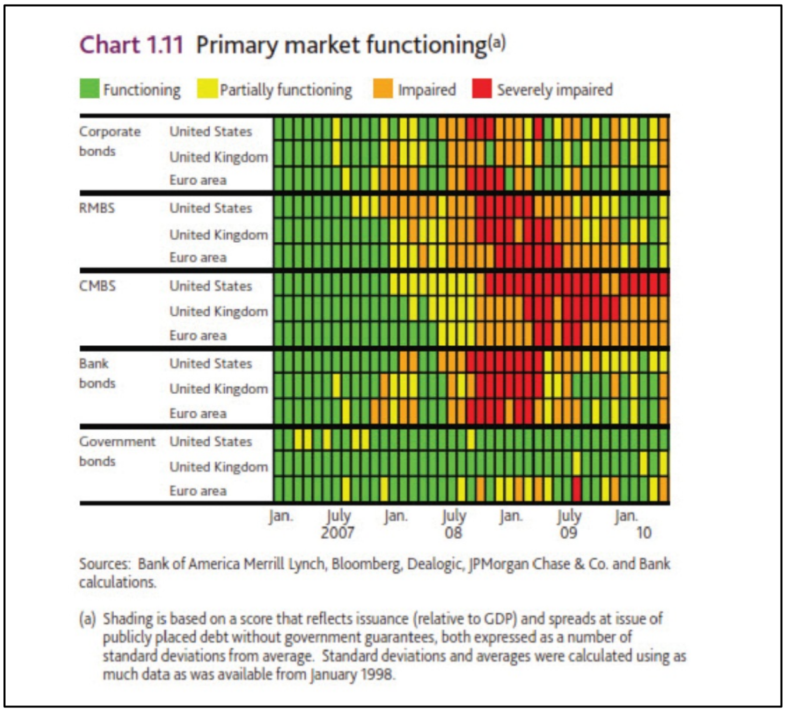
Figures 1 and 2 below, published by the Bank of England, illustrate both how market-wide dealing costs increased during the 2008/9 financial crisis and also that certain markets were more severely affected than others. In an approximate sense, the charts suggest that corporate bonds are more exposed to a market-wide liquidity shock that government bonds.

Figure 1 Extract from Bank of England Financial Stability Report #26 (December 2010)



[2] See Acharya, V. and Pedersen, L. *Asset pricing with liquidity risk*. Journal of Financial Economics 77 (2005)

Figure 2 Extract from Bank of England Financial Stability Report #27 (June 2010)



Whilst Acharya and Pedersen's array of additional betas can be somewhat confusing, we can simply say that assets which have trading costs which are relatively robust (or even fall) during periods of stress – in either market prices or liquidity – will sell at relatively high prices. You might observe correctly that all these risks are probably strongly related to each other and this will make disentangling their effects difficult for researchers. Statisticians refer to this problem as *co-linearity* and it does mean that empirical estimates for the various betas are subject to significant estimation errors. Nevertheless, Acharya and Pedersen analyzed US equities over the 35-year period ending 1999 and estimated the overall effect of illiquidity differences between stocks to be 4.6% p.a. in expected returns. Of this 1.1% is for *liquidity risk* (as opposed to expected illiquidity cost) and of this risk component, the largest part is for the last beta – sensitivity of asset liquidity to market-wide returns. These estimates are sensitive to the model specification and time period. For other plausible specifications and for tests spanning the financial crisis, estimates can be materially higher.

Someone might easily ask: "*Is this detailed dissection of liquidity effects on asset prices useful for the formulation of real-world strategy?*" In a recent book[3] which summarizes the liquidity literature, the authors cite the collapse of Long-Term Capital Management (LTCM) as a good example of a strategy (albeit highly-leveraged) where conventional market risk was hedged but liquidity risk (as measured by the three betas augmenting the standard CAPM model) was not. In fact, LTCM's positions essentially leveraged liquidity risk. In benign markets they generated a (liquidity) risk premium but in a market-wide deterioration in liquidity their liquidity 'bet' produced catastrophic losses. Liquidity risk premia present an opportunity for investors with long holding periods and sufficient capital to weather liquidity crises. However, this is no anomaly in market pricing. Those who choose to bear liquidity risk should understand how and when it affects their strategies and the robustness of these strategies when market liquidity is severely impaired. Note that liquidity risk premia embedded into market prices will *change* through time. LTCM was hurt not only by the collapse in trading liquidity but also decline in the mark-to-market value of their positions as the *market price of liquidity risk* was elevated. [Those readers familiar with the evolving Solvency II capital rules for insurers will be aware that the prolonged gridlock in the project has been partly a consequence of the difficulty of reconciling a short-term mark-to-market capital measure with long-term, buy-and-hold exposures to illiquid assets].

We have highlighted the distinction between expected costs and compensation for bearing liquidity risk and argued that exposure to market-wide liquidity shocks is important. It is worth noting that considerable research has been generated on the causes of

[3] Amihud, Y., Mendelson, H. and Pedersen, L. *Market Liquidity: Asset pricing, Risk and Crises*, Cambridge University Press (2013)

liquidity crises including the 2008/9 financial crisis. Researchers show mechanisms which exhibit the positive feedback, 'liquidity spirals', flight-to-quality and flight-to-liquidity observed during the crisis[4].

Other considerations

The research literature also considers so-called "clientele effects" whereby different groups of investors with different needs for trading liquidity cause holdings to become segmented across investor groups. The basic idea is that different investors have different liquidity needs. For any holding period, the probability of experiencing a 'liquidity shock' or the arrival of a new investment opportunity that requires portfolio adjustment varies among investors given their different liabilities, strategies and skills. For each investor, trading costs will make a different impact on their net-of-cost returns. A frequent trader will require higher (pre-cost) returns than a buy-and-hold investor/low-frequency trader. The long-term investor can spread the trading costs of asset acquisition and disposal over a longer period so demands a lower per-period return than a short-term investor. Although, in principle, buy-and-hold investors are prepared to pay a higher price (i.e. accept a lower per-period expected return) for *all* assets, it makes sense for them to specialize in assets where they have the greatest relative cost advantage. These are the assets that are most expensive to trade. Low liquidity assets are avoided by traders and discounted in price as a result. Long-term investors bear lower costs and 'earn' an additional return in excess of their expected trading costs. In the equilibrium that emerges, liquid assets are held by frequent traders and low-liquidity assets are held by long-term, buy-and-hold investors. The idea is developed within a formal technical framework in Amihud and Mendelson's paper[5].

Further reading and references are contained in our 2009 report[6] and an excellent recent survey prepared for the Norwegian ministry of finance[7].

The difference between an investor's time horizon and the time horizon of a typical, 'marginal' investor (who is notionally assumed to set the market price of an asset) is fundamentally important and warrants additional comment:

- We have talked in terms of 'long' horizons but what does this really mean? i.e. 1 day, 1 year, 10 years or 50 years? The answer must be linked to the *relative* liability profiles of investors and this will vary across markets and asset types. 'Long-term' liquidity providers in a futures trading pit might hold positions overnight. A long-term holder of annuity liabilities will hold exposure for decades.
- Capital– at least in an economic sense – will depend on liabilities. If liabilities are fixed, the increase in holding period return volatility that arises from illiquidity should demand capital. Subject to diversification through time this would be expected to produce a term structure of liquidity risk.
- Finally, when liquidity risk capital is required to back fixed liabilities, it would need to be invested in liquid assets in order for them to be available to fund shortfalls arising from liquidity 'shocks'. This implies the mix of illiquid and liquid assets that a balance sheet with significant fixed liabilities could support might be significantly constrained.

Empirical evidence

Many academics and most practitioners would now argue that the global financial crisis has provided a dramatic reminder of the importance of liquidity costs and liquidity risk and their impact on risk management strategy and on asset prices. Although much of what was observed would have been familiar to financial historians, it was new to many market participants and many financial economists. In parts of the academic world, there appears to still only be a grudging acknowledgement of the importance of changing asset premia in explaining movements in asset prices. John Cochrane, a leading finance academic, attempts to look forward in his 2011 address to the American Finance Association[8] which provides a post-crisis summary of his thoughts on asset pricing and is notable for its frankness and on the disarray among financial economists on basic questions. Yet, in the 60-odd pages, he writes only half a page on liquidity suggesting that there are still different views on its relative importance in determining asset prices.

Specific asset classes

Researchers have employed a wide array of methods in order to estimate liquidity premia across different asset classes. The results of this empirical work generally support the theoretical ideas summarized above: that difficult-to-trade assets sell at lower prices

[4] See as an example: Brunnermeier, M. and Pedersen, L. *Market liquidity and funding liquidity*, The Review of Financial Studies (2009)

[5] See for example Amihud, Y. and Mendelson, H. *Asset pricing and the bid-ask spread*, Journal of Financial Economics 17 (1986)

[6] Hibbert, J. at al, *Liquidity Premium: Literature review of theoretical and empirical evidence*, Barrie & Hibbert (2009)

[7] De Jong, F. and Driessen, J., *The Norwegian Government Pension Fund's potential for capturing illiquidity premiums*, Tilburg University (2013)

[8] Cochrane, John H., *Presidential Address: Discount Rates*, Journal of Finance 66 (2011) 1047-1108

(or higher yields) compared to otherwise equivalent assets which offer better liquidity; further, that liquidity risk is priced—especially so during financial crises. However, the conclusions do not appear to be fully consistent across asset types. This is hardly surprising given the technical challenges of gathering and analyzing data.

Most of the research work on liquidity in asset markets involves comparing assets with relatively high and low levels of trading liquidity (and other attributes). For example, small versus large cap equity, on-the-run versus off-the-run Treasury bonds etc,. However, it is worthwhile observing that every asset should be considered to be subject to liquidity costs and risks. We could ask about the extent to which large-cap equity returns exceed on-the-run Treasury bonds because of their low-liquidity (and quite possibly higher liquidity risk). In practice, unpicking this complex picture across asset types is rarely attempted. When we talk about a liquidity premium, it's also worth asking the question: 'relative to what?'

EQUITIES

Small-cap Equities

Highlighted by researchers in the early 1980s9, the 'small-cap' effect refers to the tendency of small firm equities to deliver higher risk-adjusted returns than large cap stocks over very long investment horizons. Various explanations for this apparent anomaly have been proposed but higher trading costs of small stocks and their liquidity risk is now increasingly accepted as the most compelling explanation. It is worth emphasizing Acharya and Pedersen's estimation of the liquidity-adjusted CAPM suggests a material part of the 'premium' is a consequence of liquidity risk – small stocks suffers relatively greater declines in liquidity in falling markets. A large number of studies have been carried out with most focused on US equity markets.

The 'Small Cap Premium' refers to the difference in (expected) returns between small and large cap equities. In practice, different researchers define these groups in different ways. The premium has been estimated in the range of between 3% and 8% p.a. across different markets and time periods with the greater part attributed to costs and perhaps 1-2% pa in compensation for the higher (systematic) liquidity risk of small stocks. Remember that these 'premia' are a consequence of both the high dealing costs and liquidity risks of small cap. Active investors will (on average) suffer a drag on investment performance as a result of their activity (and the opportunity cost of waiting to trade during liquidity crises). A few additional points are worth noting:

- Studies of the impact of liquidity level on pricing often focus on very small cap stocks which may not be accessible to institutional investors.
- A recent study[10] argues that returns delivered since around 1990 and forward-looking liquidity premia have declined – in particular in US equity markets where the authors argue liquidity premia are largely eliminated. This may be a result of improved market liquidity through regulation, new trading technology and possibly the increasing use of ETF 'wrappers' for illiquid assets. This adjustment downwards in the premium may also have caused estimates based on periods prior to the 1980s to be biased upwards.
- Studies confirm that the liquidity risk premium is time-varying with estimates in the range of 1-2% pa.

GOVERNMENT BONDS

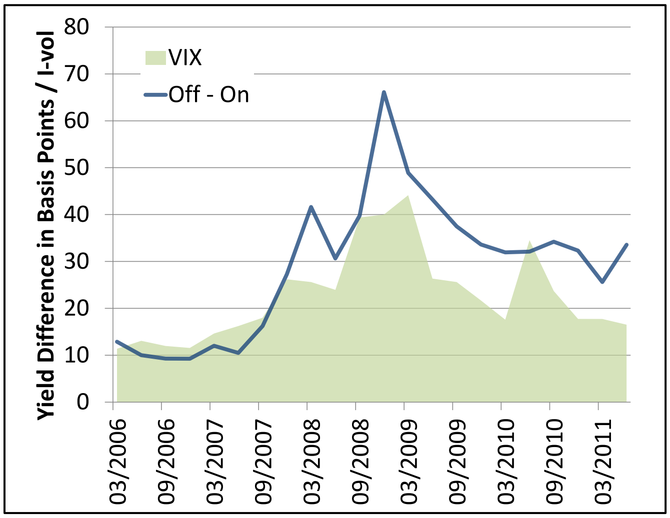
Government & Covered Bonds

Government and covered bond markets offer an opportunity for researchers to compare assets with virtually identical promised cash flows but different liquidity characteristics. This contrasts with corporate bonds where liquidity effects must be disentangled from credit effects on bond prices. Consider the chart below which shows the difference in the yield between 'on-the-run' (i.e. very liquid) and 'off-the-run' (less-liquid) 10-year US government bonds. When bonds move to off-the-run status trading volume typically falls by 90-95% and spreads approximately double. Before the onset of the financial crisis, this 'spread' in yields was around 10 basis points (0.10%) but during 2008/9 was elevated to a quite extraordinary 60 basis points.

[9] Banz, R. *The Relationship Between Return and Market Value of Common Stocks*, Journal of Financial Economics, 9 (1981)

[10] Ben-Rephael, A., Kadan, O. and Wohl, A., *The Diminishing Liquidity Premium*, Journal of Financial and Quantitative Analysis, (2014, forthcoming)

Figure 3 On- versus Off-the-Run yield differential for 10-year US Treasury bond & VIX index



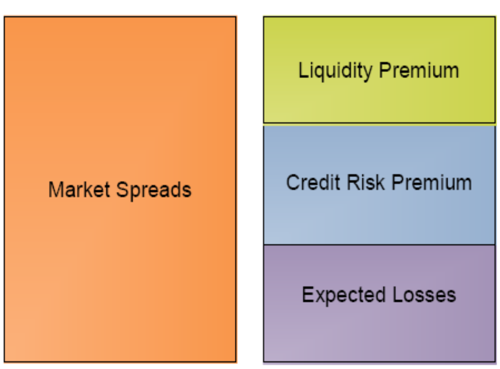
In addition to this relative comparison at the security level, now consider the overall government bond market. A striking property of government bond markets in aggregate is their *liquidity risk* characteristics. As Figure 3 (published by the Bank of England in 2010) above shows, through autumn 2008 and into 2009, liquidity held up in major government bond markets in marked contrast to other fixed income markets which were severely impaired.

Although, the primary focus of researchers has been on US markets, other studies have documented liquidity effects in non-US government bond markets and covered bond markets where assets offer comparable levels of security but markedly different issue sizes[11].

CORPORATE BONDS

There is a large body of research aimed at quantifying the impact of illiquidity on corporate bond prices (or yields). The awkward challenge facing researchers is how to disentangle the various components of market credit spreads over liquid, default-free bonds:

- Expected credit losses (as a result of expected downgrades and defaults)
- Credit risk premia
- The liquidity premium comprising:
  - Expected illiquidity costs
  - Liquidity risk premia



[11] Schwarz, K., *Mind the Gap: Disentangling Credit and Liquidity in Risk Spreads* (2010) SSRN: http://ssrn.com/abstract=1486240

As you might expect, estimating these individual components (and the constituents of the liquidity and credit risk premia) turns out to be a very difficult task, not least because the credit and liquidity characteristics of individual bonds must also be estimated in some way. A number of approaches to liquidity premium estimation have been proposed and implemented by researchers. None of them are completely satisfactory.

Our 2009 report provides a summary of academic work and work at the Bank of England on Sterling bond liquidity premia[12]. This research has generated a spectrum of estimates which vary according to the creditworthiness of issuers, term of bonds and the market 'price' of liquidity. A regression-based study of US corporate bonds published in 2012[13] which compares pricing in the 2005/7 pre- and 2007/9 post-crisis periods finds, for A-rated issues, the liquidity premium rising from under 10 bps to over 50 bps. For sub investment-grade bonds the change is from c60 bps to close to 200 bps. The research highlights the effect of liquidity betas for bonds outside the AAA rating. It would seem reasonable (to us) to assume that both the periods analyzed are extreme and that 'normal' liquidity premia probably fall somewhere within these ranges as suggested by other, earlier studies and our own work on 'proxy' measures. The proxy developed for the liquidity premium embedded in (average A-rated) corporate bonds subtracts a 40 bps per annum allowance for expected defaults from the observed spread and attributes the residual – equally – to credit risk and a liquidity premium. For a 100 bp spread this implies a liquidity premium of 30 bps, broadly in line with the regression study.

REAL ESTATE

The costs of trading direct property assets are notoriously high. These costs are the sum of the opportunity costs of delay (rather than dealer spreads) and the tangible costs of legal and professional fees and taxes. Holding periods are necessarily long by comparison with securities, so you might well argue that – as theory suggests – long-term investors will demand some additional return in exchange for giving up liquidity. However, given that illiquidity is a fundamental attribute of direct property investment and that illiquidity is priced in traded asset markets, there are surprisingly few references to liquidity premia in the property literature. It highlights a familiar problem – where we might expect to observe the highest liquidity premia as a consequence of poor liquidity, measurement will be most challenging.

The UK-based *Investment Property Forum* compiled a detailed report on liquidity in 2004[14] which provides useful background and detailed analysis of specific features of property markets and assets but they did not attempt to make an estimate for a liquidity premium. An informal survey of property practitioners suggests a consensus estimate is in the range of 1-2% pa (in expected returns)[15]. As a crude check for reasonableness, research suggests that UK institutional property is held for an average of 7-10 years and round-trip costs are approximately 6%, which implies a lower bound for expected illiquidity cost for holding property of around 0.6% - 0.9% pa and a liquidity risk premium of similar magnitude[16].

Now consider a different perspective. As a general proposition, if liquidity effects on asset prices are high we might expect intermediaries to consolidate, package and securitize illiquid assets into more liquid forms. All other things equal, if the consolidated, securitized assets offer better trading liquidity than the underlying assets, they should sell at a premium to aggregate underlying asset value. If sufficient quantities of assets are re-packaged in this way, the illiquidity effect may be reduced or even removed over time. So, an interesting approach to property is to compare the behaviour of direct real estate investments with indirect vehicles such as Real Estate Investment Trusts (REITs). Researchers have used this approach[17] to investigate the US REIT market and estimated the price premium on liquid REITs – relative to illiquid underlying – in the range of 12% - 22%. Note that, for asset pools of less than $100M, these 'gains' were largely offset by the fixed costs of establishing the vehicle.

The magnitude of this premium appears to be approximately consistent with the 1-2% p.a. for the liquidity premium in gross returns: a price discount of say, 20% will raise the expected return to long term investors, buy-and-hold investors on an asset yielding 6% by 1.5% pa. Clearly, there is a wide range for plausible estimates here.

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[12] See for example Bank of England, *Financial Stability Report #30*, December 2011, p 28

[13] Dick-Nielsen, J., Feldhutter, P. and Lando, D., *Corporate bond liquidity before and after the onset of the subprime crisis*, Journal of Financial Economics 103 (2012) 471–492

[14] Investment Property Forum, *Liquidity in Commercial Property Markets*, Research Findings, April 2004

[15] In addition, an estimate of 2% is attributed to Dubben, N and Sayce, S., Property Portfolio Management (1991), Routledge

[16] See also Collett, D., Lizieri, C. and Ward, C., *Timing and the Holding Periods of Institutional Real Estate*, Real Estate Economics (2003) 31(2) although anecdotal evidence suggests holding periods may have declined since this study was carried out.

[17] Benveniste, L., Capozza, D. and Seguin P., *The value of liquidity*, Real Estate Economics 29 (2001). See also http://www.reit.com/REIT101/REITAttributes/Liquidity/AcademicStudies.aspx

PRIVATE EQUITY

Private equity (PE) is another asset class which necessarily requires a long-term investment perspective and where liquidity is low relative to publicly traded markets. As for real estate, there is a dearth of published research. However, a recent study[18] analyzes private equity returns over a 30-year period ending in 2006. The returns analyzed are remarkably consistent across time periods and geographical regions averaging out at 19% p.a. (gross of fees) and 12% p.a. net. The authors attribute an estimated (gross) risk premium of 18% to market risk (10%), a value tilt (5%) and reward for liquidity risk (3%). The implicit sensitivity to market-wide liquidity risk is attributed to exposure to shocks to *funding liquidity* of both the underlying (leveraged) investments and private equity managers. Here, in the appendix to their report the authors argue that compensation for illiquidity costs in PE pricing is not material (as opposed to liquidity risk).

A quite different idea is proposed by Lerner[19] where illiquidity is used by private equity managers to select long-horizon investors less likely to signal poor manager performance in future financings and thereby reduce the cost of capital. Whilst this does seem somewhat contrived, it illustrates the large number of possible factors at work in asset pricing (and the seemingly endless research directions for academic researchers).

Finally, a small survey of practitioners suggests an assumption of 1% p.a. for the liquidity premium in PE expected returns without strong views on how this is attributed between expected costs and compensation for risk. Anecdotally, listed PE funds are observed to trade at a (price) premium to underlying assets.

INFRASTRUCTURE

As for real estate and PE, direct infrastructure investments are illiquid (in terms of the time and cost of acquisition) and the size of individual investments. Although practitioners assume liquidity premia in infrastructure assets which are comparable to real estate assets (c 1-2% p.a.) we have not seen academic research to support the view. A priori the practitioner view appears to be reasonable. Listed infrastructure funds have traded [recently] at premia of 5-10% to underlying assets, other things equal, implying liquidity premia somewhat lower than for real estate assets.

Conclusions & implications

Where does this leave us? Liquidity effects on asset prices have strong theoretical and empirical support. In considering liquidity, it is helpful to distinguish between compensation for expected trading costs and compensation for liquidity risk. However, liquidity premia (the sum of these two effects) appear to vary widely over time and across asset types. They turn out often to be very difficult to measure with any confidence. The research literature is not very coherent across asset classes – in the sense that researchers might agree on common terminology and better integrate their thinking. Empirical measures are all relative but few researchers (if any?) attempt to place their estimates into an overall framework. As we have observed before, this is largely because it is very difficult.

Having reviewed research across different asset classes, many niggling questions remain. The role of the 'marginal' investor (or in Amihud's terms, the liquidity policies and needs of investors) is important. Yet, across different asset classes it appears that the marginal investor could be quite different. The incentive for, and impact of, securitization suggests that material liquidity premia may be eliminated over time and so may not offer strategic (i.e. permanent) opportunities. (And there is some evidence to support this view in US equity markets).

Finally, the chart below is intended to do no more than give a crude summary of the scale of unconditional liquidity premia estimated by researchers. They could be far higher during liquidity crises. Note that it is plotted on a log scale. Given the challenges in estimation and likely time variation these should be viewed as no more than 'ball-park' figures for the consensus.

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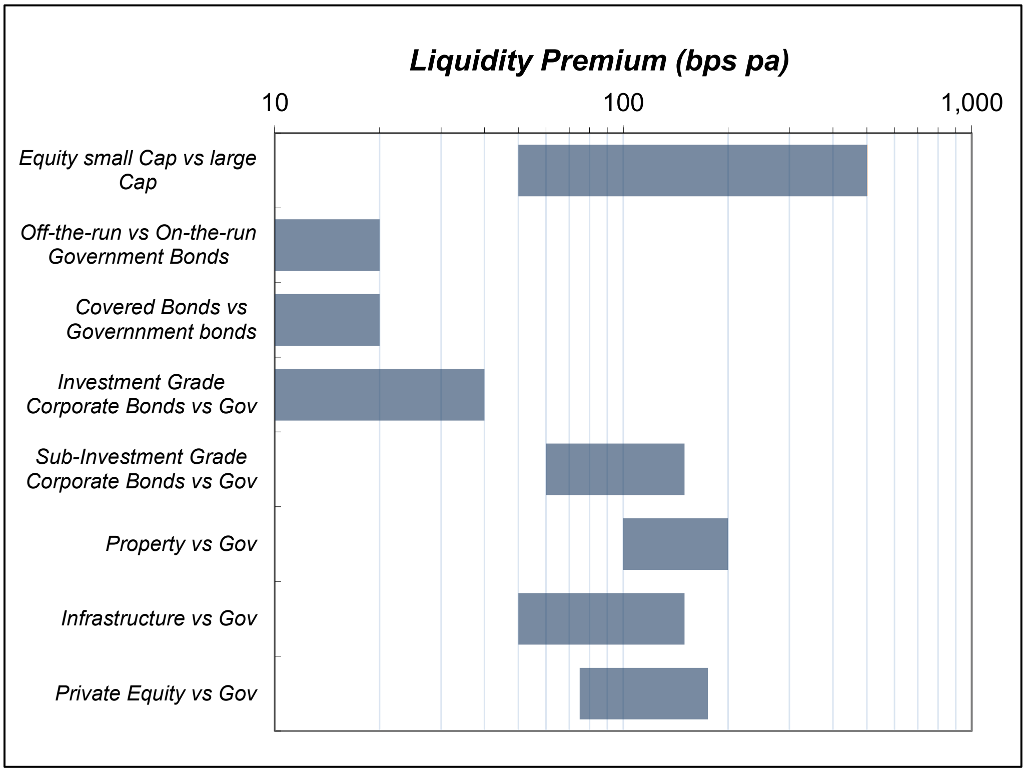
[18] Franzoni, F., Nowak, E. and Phalippou, P., *Private Equity Performance and Liquidity Risk*, Journal of Finance (2012) LXVII(6)

[19] Lerner, J., and Antoinette S., *The illiquidity puzzle: Evidence from private equity partnerships*, Journal of Financial Economics 72 (2004)

Figure 4 Summary of approximate liquidity premium estimates of researchers



3. Risk-and-capital-based metrics for investment strategies backing illiquid liabilities

A range of metrics has been developed to assess the financial performance of a business in ways that adjust for the riskiness of the business and the capital required to support it. In this section, we describe a couple of such metrics that can be applied to a long-term liability business.

We begin with perhaps the most basic metric for a capital-driven investment strategy: the 1-year expected return from the business (in the form of expected increase in surplus of assets over liabilities) per unit of capital that is required to support the investment strategy.

$$Expected\ Return\ on\ Capital\ Employed = \frac{Expected\ Change\ in\ Surplus}{Capital\ Requirement}$$

This is an intuitive measure that gives the business's expected return on capital employed. It will be considered in some form by most insurance businesses when appraising investment strategy choices. This measure could even be given to an asset manager as a form of investment mandate, i.e. maximize the expected return on capital employed subject to the capital requirement not exceeding a specified limit. Mandates of this form would be difficult to implement for participating life business due to the complexity of the liabilities and their capital requirements, but could be a lot easier for non-profit or general account business such as fixed annuities.

However, it could be argued that the above metric has limited economic value. In particular, it does not make any adjustment for the *nature* of the risk that drives the capital requirement. Standard financial economic theory tells us that a higher return should be required (and expected) on investments that have higher *systematic* or *non-diversifiable* risk. So a lower return would theoretically be required on risk-based capital requirements that arise from non-market risks than that required on the same amount of risk-based capital arising from market risks (because shareholders can diversify away the non-market risk exposure through other holdings, whereas the market risk exposure is, by definition, non-diversifiable). So it could be argued that the above is a capital-adjusted metric that ignores important characteristics of the nature of the investment risk.

To further risk-adjust this performance metric, we need to consider expected returns relative to those that are rationally required for bearing the risk exposure. In well-functioning financial markets, expected asset returns will generally equate to the return required for bearing the risks of the asset. Changing the risk profile of the investments impacts on both required and expected returns, and has no direct impact on shareholder value. In that case, there are still three general reasons why expected returns in excess of the economically-required return may be, at least theoretically, achievable by an insurer:

- The investment manager is able to generate 'alpha' on the investment strategy.
- The insurance product pricing requires the policyholder to pay more than the market-consistent value of the liability.
- The investment strategy is able to take advantage of the illiquid liability structure to generate a liquidity premium.

In this paper we will ignore the possibility of investment alpha, and, as we are focusing on investment strategy decision-making, we will not consider product pricing but will make the simple assumption that the insurance product is priced at its market-consistent value. So this leaves the accessing of liquidity premium as the unique source of economic value for illiquid liability businesses. Further, from an economic value perspective, the capital requirements of the business impacts on its economic profitability because there are costs associated with holding capital[20]. This leads to the following metric of economic profitability:

$$Economic\ Profit = (Liquidity\ Premium\ x\ Assets) - (Cost\ of\ Capital\ x\ Capital\ Requirement)$$

This expression can be generalized to the fuller version given below, but in the case studies we now develop, the above definition will be used.

$$\begin{aligned} Economic\ Profit\ (full\ version) = &\{\,(Liquidity\ Premium + Alpha)\ \times\ Assets\,\} \\ &-\{\,Cost\ of\ Capital\ \times\ Capital\ Requirement\,\} \\ &+\{\,Insurance\ Product\ Price -\ Market\ Consistent\ Value\ of\ Liability\,\} \end{aligned}$$

Cost of Capital

The cost of capital represents the additional return required to compensate shareholders for investing their capital via the insurance company rather than directly. The cost should therefore compensate for the additional costs incurred as a result of this indirect investment route. These are typically referred to as frictional costs and can include allowances for effects such as double taxation, bankruptcy costs and so on. It is not a directly observable quantity and its estimation is somewhat subjective. Current Solvency II proposals set this rate at 6%[21]. In 2008, the CRO Forum estimated the rate at 2.5% - 4.5%[22].

In the following section, a case study will be used to explore how these two metrics of return on capital employed and economic profit behave under different asset allocation choices.

4. Fixed Annuities Case Study

This section uses a case study of a UK fixed annuity business to explore the dynamics of the capital-driven investment metrics explored in the previous section, and in particular, how they can be used in the appraisal of candidate investment strategies.

We consider a UK annuity portfolio where the liabilities have a current present value of 10,000, valued using the GBP swap curve at 31/12/13 and a best estimate of future mortality rates. The liability cash flow profile implies a duration of 10.5 years. There is no allowance for matching adjustment in the liability valuation. Assets of 13,000 are held to back the liabilities with the surplus of 3,000 invested in short-dated gilts. In this case study we will investigate the impact of different asset mixes for the backing assets of 10,000. We assume that annuities have been priced according to the market-consistent value and hence the shareholder capital required is equal to the assessed Solvency Capital Requirement.

[20] Shareholders face a number of potential disadvantages to having capital invested via an insurance company rather than simply investing in funds directly. Shareholders face an additional layer of taxation and there could be significant frictional costs such as agency costs.

[21] See CEIOPS' QIS 5 Calibration Report.

[22] "Market Value of Liabilities for Insurance Firms" CRO Forum, July 2008.

Case Study Assumptions: Capital Requirement Methodology

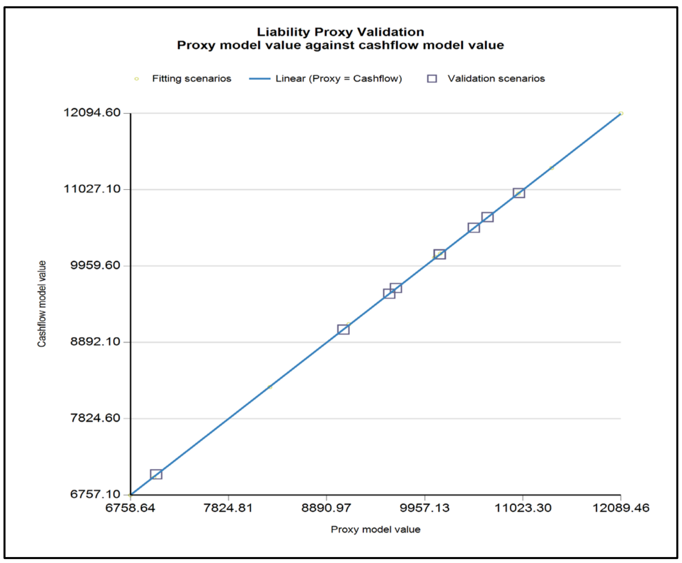
In the case study a simulation-based internal model with the following components is used to assess the capital requirements of the business:

» The B&H Risk Scenario Generator is used to simulate the yield curve and asset returns over the next year with its standard 1-year VaR calibrations.

» A proxy function for the liabilities produced using the B&H proxy generator. The liability portfolio consists of annuities in payment and the liability value is dependent upon only two risks—the level of the yield curve and longevity. The technicalities of the fitting process are excluded from this paper, but three risk factors are included in the polynomial: interest rate risk is modeled using two factors (as a 2-factor interest rate model is chosen in the Economic Scenario Generator) and the third risk factor represents longevity. Given that the liability discount curve is defined to be the risk-free curve, there is no liability dependence on credit risk. The resulting polynomial has terms up to order 3 and cross terms are included.

  To validate the accuracy of the proxy function, out-of-sample testing was performed and the chart below confirms that the liability proxy function provides an excellent fit to the actual liability results from the cash flow valuation model.

Figure 5 Validation of the liability proxy function



» The assets and liabilities are projected over one year. The asset projection directly uses the 1-year returns output from the economic scenario generator and the valuation of the liabilities at time 1 is determined using the proxy function. The net asset value is evaluated in each of the 10,000 scenarios to enable a full distribution of capital at time 1 to be produced.

Case Study Assumptions: Liquidity Premium and Cost of Capital assumptions

The Economic Profit metric discussed in section 3 requires assumptions about the liquidity premiums available on asset classes, and the (frictional) cost of capital of the insurer. The case study's liquidity premium assumptions will be based on the results produced in section 2. The following assumptions will be used:

Figure 6 Case Study's Liquidity Premium Assumptions

Asset Class	Liquidity Premium Assumption (basis points)
Investment-Grade Corporate Bonds	40
Sub-investment-Grade Corporate Bonds	100
Infrastructure	100
Private Equity	125
Real Estate	150
Small-Cap Equities	200

Finally, we assume a (frictional) cost of capital of 4%.

Case Study Results: 100% Government Bond Strategy

This section considers the behavior of the expected return on capital employed and expected economic profit metrics for bond-only strategies.

As a baseline, we first consider where the backing assets are assumed to be invested entirely in UK government bonds. The profile of projected asset cash flows is shown alongside the expected liability outgo in Figure 7. As assumed in all the examples, the surplus of 3,000 is invested in short-dated gilts.

Figure 7 Asset and liability cash flow profile (100% Government bonds strategy)

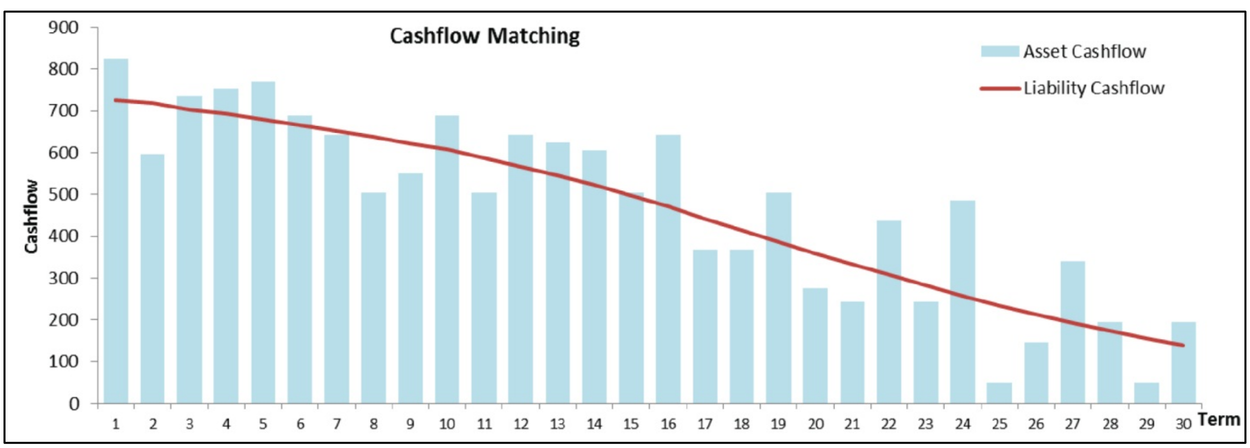
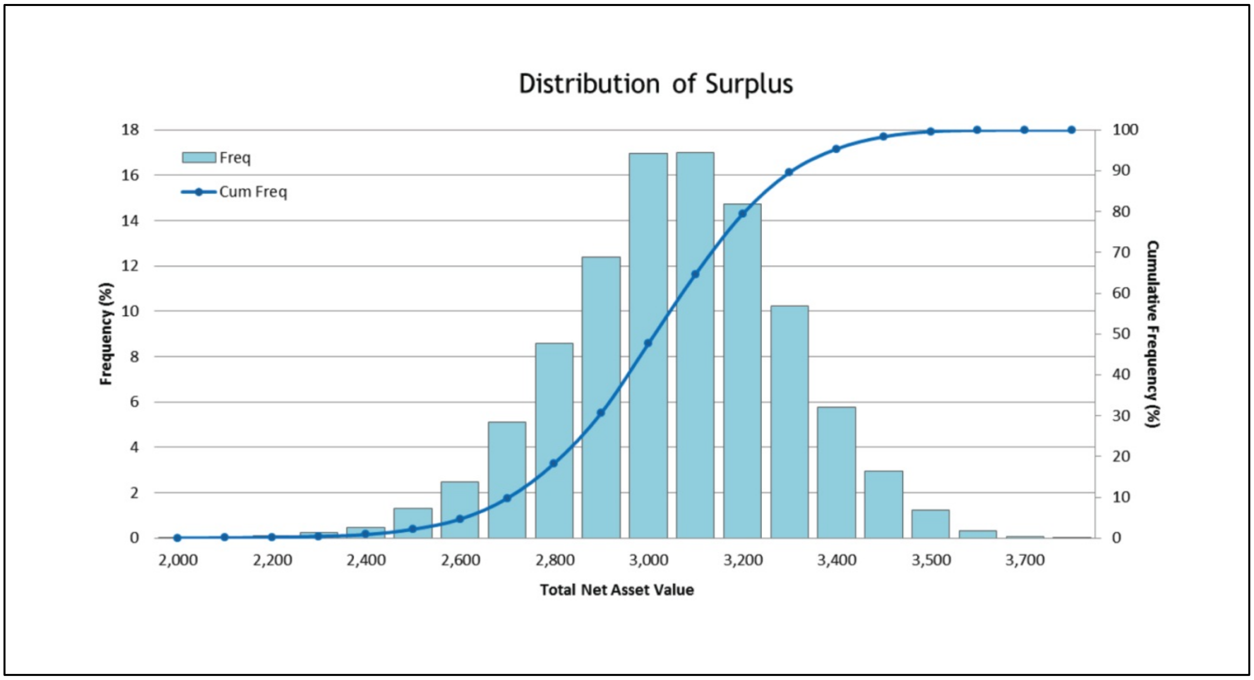


Figure 8 shows the simulated probability distribution for end-year net assets.

Figure 8 Distribution of Total Net Assets (100% Government bonds)



The initial surplus is 3,000. The mean surplus in one year's time is slightly higher at 3,021, reflecting the expected return on the surplus invested in short-dated gilts. In this example the balance sheet is exposed to only two sources of risk – interest rate risk and longevity risk. Given that the assets and liabilities are relatively well matched, the main source of interest rate risk arises from mark-to-market changes in the surplus gilts. The longevity risk in the annuity portfolio is unhedged. Consistent with the Solvency II definition of the capital requirement, the capital requirement is the 0.5th percentile of the distribution which gives a value of 637, 6.4% of liabilities. This implicitly incorporates the diversification benefit within the business as the real-world scenarios capture diversification across risks, due to the dependency structure embedded within the Economic Scenario Generator. A correlation of zero is assumed between longevity and all market risks. We assume no liquidity premium is provided by the Government bond portfolio.

The following results are then obtained for our two metrics:

» Expected Return on Capital Employed = 21 / 637 = 3.3%
» Expected Economic Profit = 0% x 13,000 – 4% x 637 = -25

The government bond strategy appears unappealing under both metrics. We now consider how the introduction of corporate bonds impacts on the capital-driven investment metrics.

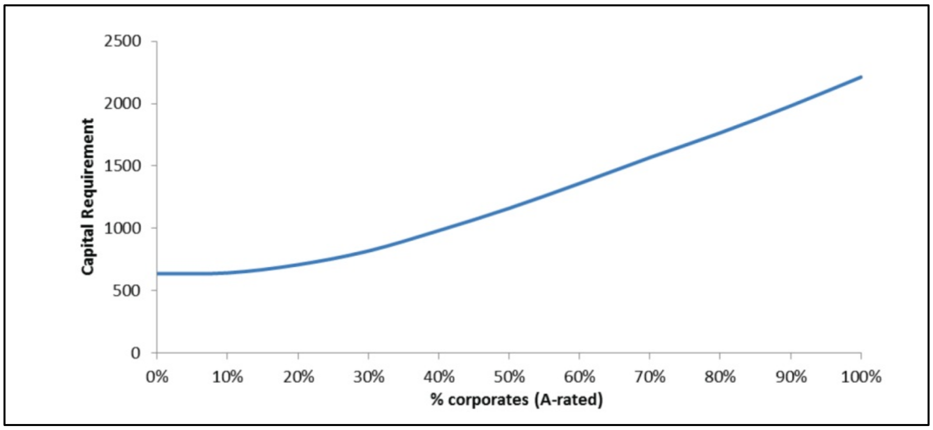
Case Study Results: Investment-Grade Corporate Bond Strategies

The traditional investment strategy for assets backing annuity business is to invest in fixed interest securities which are a mix of (mainly) investment-grade corporate and government bonds. In this section we analyze how this strategy behaves in our case study.

Initially, we assume that the corporate bond portfolio is invested in a diversified portfolio of A-rated credit with a similar degree of cash-flow matching as in the government bond portfolio case. The investment-grade corporate bond liquidity premium assumption of 40 basis points is used as per Figure 6.

Figure 9 shows the Internal Model's assessment of the Solvency Capital Requirement varies with the allocation between the government bond portfolio and investment-grade corporate bond portfolio.

Figure 9 Impact on SCR of varying the % invested in Corporate Bonds



You can see from Figure 9 that small allocations to the corporate bond portfolio have minimal impact on the total Solvency Capital Requirement— this effect arises because of the diversification benefit between the credit and longevity risks. However, allocations of higher than around 10% to 20%, have a larger the marginal impact on capital requirements.

Figures 10 and 11 show the results for the two capital-driven investment metrics.

Figure 10 Expected Return on Capital as a function of investment-grade corporate bond allocation

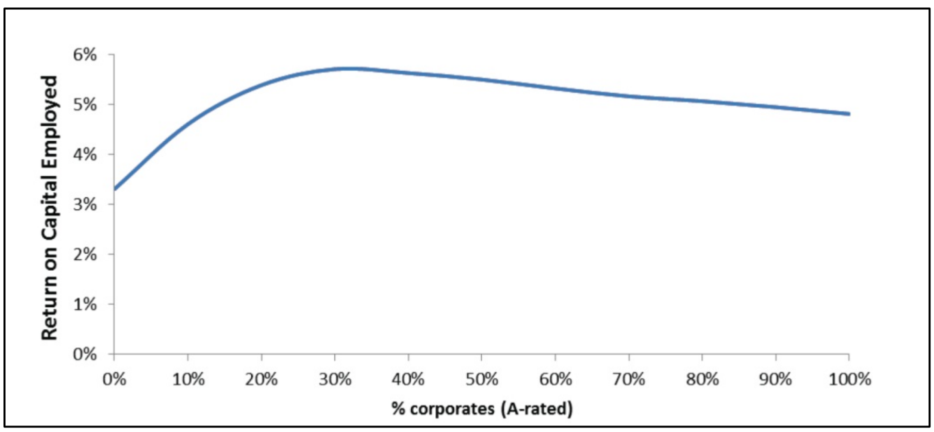
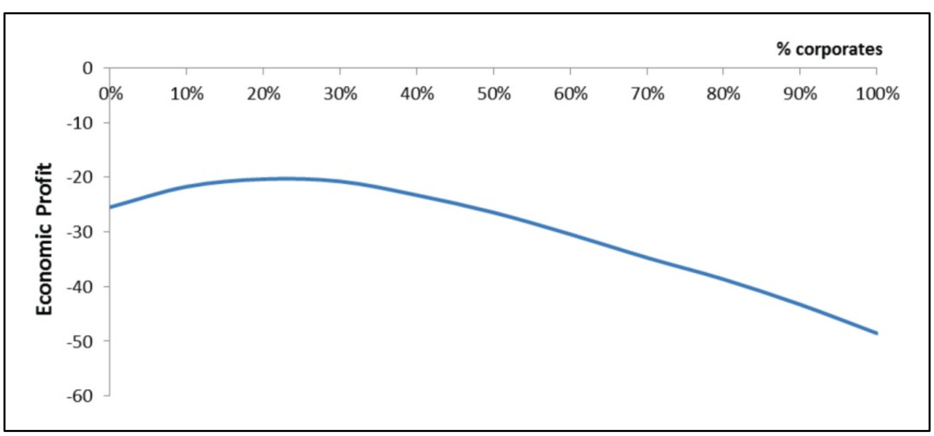


Figure 11 Expected Economic Profit as a function of investment-grade corporate bond allocation

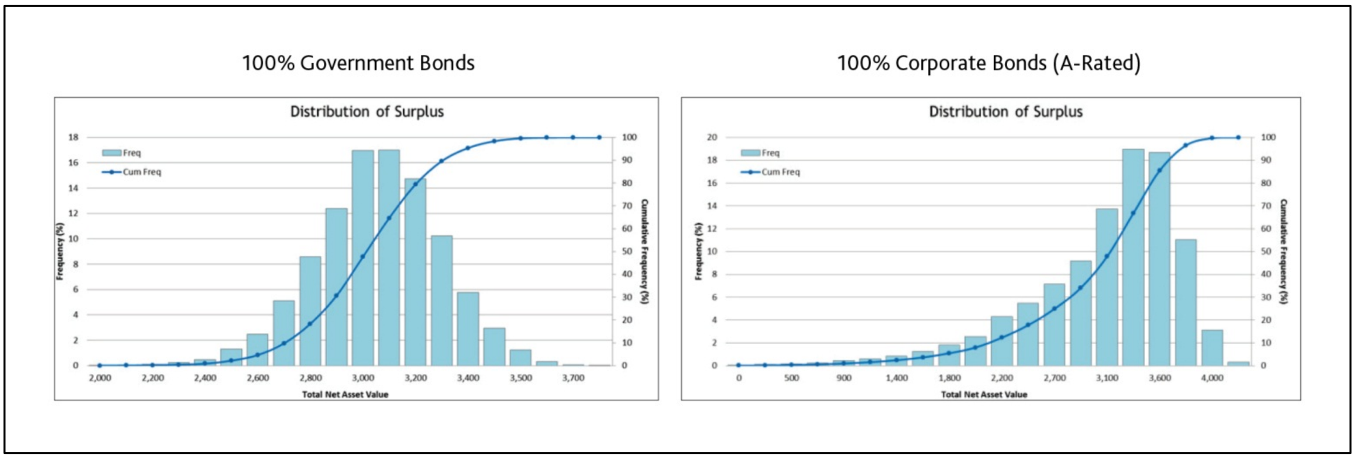


It is clear from Figures 10 and 11 that initially increasing the investment-grade corporate allocation from zero is beneficial under both investment metrics. Increasing the allocation to corporates clearly increases credit risk capital but, for low credit allocations, the diversification benefit (primarily with longevity risk) is high. An optimum return is achieved for both metrics with an allocation of around 30% to corporates. This generates an expected return on capital for shareholders of around 5.5%. However, the expected economic value metric remains negative for all allocations to investment-grade corporates: the cost of capital required to support the business always exceeds the liquidity premium earned on the corporate bond portfolio.

It is worth noting that the case study considers an annuity book in isolation— the conclusions may differ when several different lines of business are considered jointly and potentially greater diversification benefit can be achieved.

The full distributions of surplus can also be compared for the different asset mixes, as seen in Figure 12.

Figure 12 Comparison of capital distributions for different asset mixes



The differences in the two distributions are clear to see. The investment strategy involving 100% investment in corporate bonds has much greater upside potential but also a much wider left-hand tail. There is a probability of 9% that there is insufficient net assets after one year to meet the SCR.

We now consider how the metrics behave when we add sub-investment-grade bonds to the strategy. Recall from Figure 6 that sub-investment-grade corporate bonds are assumed to offer a significantly higher liquidity premium than the investment-grade bond portfolio: 100 basis points instead of 40 basis points.

Case Study Results: Adding Sub-Investment-Grade Corporate Bonds

The case study is extended to consider a diversified corporate bond portfolio containing both investment and sub-investment grade bonds. Projected returns for both asset classes are output from the Risk Scenario Generator. Increasing the proportion of the portfolio held in sub-investment grade inevitably produces both a higher expected return and a higher modelled volatility for the assets (and thus higher SCR). The graphs below show the SCR and investment metric results for portfolios which varying mixes of investment grade and sub-investment grade corporate bonds.

Figure 13 Solvency Capital Requirement as a function of corporate bond allocation

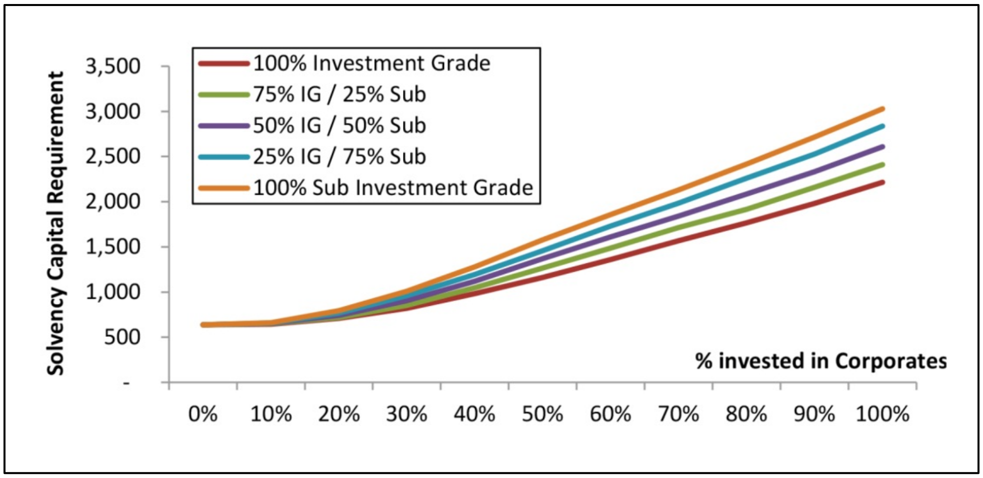


Figure 14 Expected Return on Capital as a function of corporate bond allocation

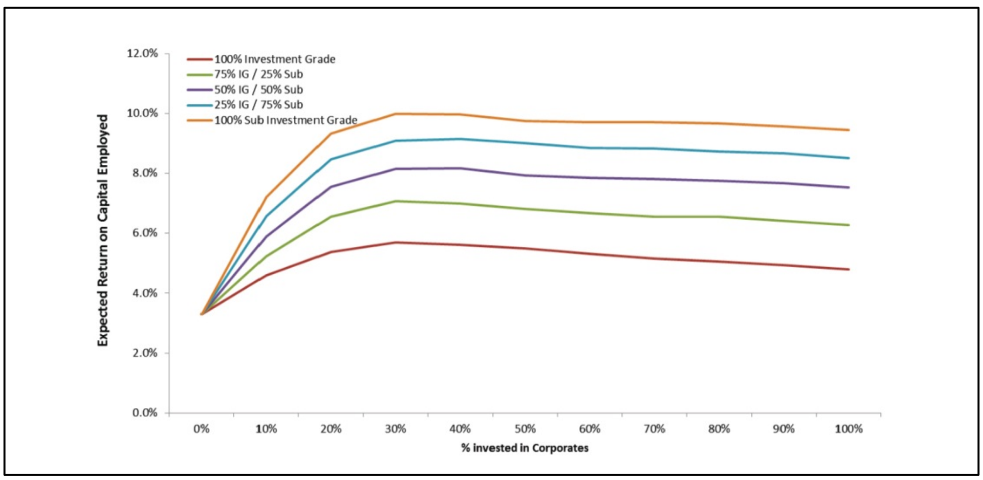
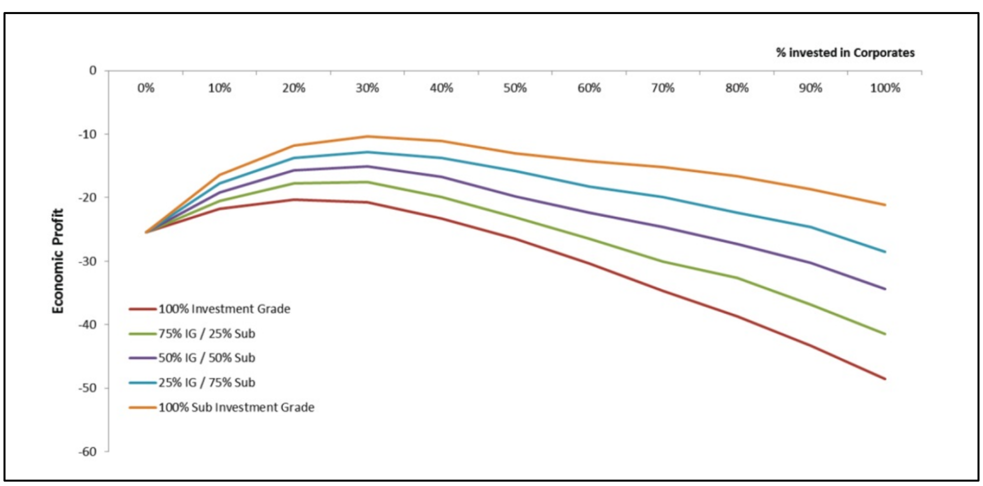


Figure 15 Expected Economic Profit as a function of corporate bond allocation



Based on the above results, investing a higher percentage in sub-investment grade improves both the expected return on capital employed and the expected economic profit. The optimal allocation between corporates and gilts is around 30%-40% allocation to corporates irrespective of the credit mix. Under both metrics, better results are always produced when all corporate bond assets are invested in sub-investment grade bonds rather than investment-grade bonds: the higher expected returns and liquidity premia assumed to be on offer more than compensate for the marginal increases in capital requirements produced by switching from investment to sub-investment grade bonds. As an example, consider the results for the 100% corporate bond allocations. In this case, switching from investment-grade to sub-investment grade bonds results in the SCR increasing by around 1000. With a 4% cost of capital assumption, this has an economic cost of 40. We have assumed that the sub-investment grade portfolio offers 60 basis points more than the investment-grade portfolio in liquidity premium (i.e. 100 basis points instead of 40 basis points). This 60 basis points of additional liquidity premium is earned on the 10,000 bond portfolio, generating 60 of additional economic value, and more than compensating for the additional 40 of cost incurred from the increase in capital requirements.

It should be emphasized that these results are based on the internal model as outlined at the start of section 4 and is calibrated to market spreads at 31/12/13. Results would be different if the insurer opts to use the Standard Formula to quantify the SCR and also due to different diversification benefit arising from multiple business lines.

Even allowing for the higher expected liquidity premia assumed to be available on the sub-investment grade bond portfolio, the expected economic profit always remains negative. This leads us to widen our investment universe to include asset classes which provide a higher illiquidity premium.

Case Study Results: Adding a Diversified Risky Illiquid Asset Portfolio

This section considers the impact of adding an equally-weighted portfolio of the four non-bond asset classes into our strategy (small-cap equities, private equity, infrastructure and real estate). Figure 6 implies a liquidity premium of 144 basis points would be provided by this portfolio (significantly higher than the 100 basis points assumed to be available from the sub-investment grade bond portfolio).

Calibration of the models for the alternative asset classes such as infrastructure debt and private equity is particularly challenging for two broad reasons: the difficulty in obtaining a sufficiently large historical dataset; the investments available within these asset classes will tend to be quite heterogeneous. For this case study, generic calibrations have been developed for each of the asset classes which are intended to be illustrative of the key risk and return characteristics of the asset classes[23]. Investment in these assets is likely to require more granular and sophisticated credit risk modeling approaches than that typically used by an insurer for a well-diversified 'vanilla' corporate bond portfolio.

We now consider asset portfolios backing the annuity liabilities that are comprised of two sub-portfolios:

(A) A bond portfolio which consists of a 50% / 50% allocation between sub-investment grade corporate bonds and government bonds. Based on the previous analysis, in terms of the risk-based metrics, sub-investment grade was preferred to investment-grade and further increasing the allocation to corporates beyond 50% was detrimental.

(B) An alternatives portfolio consisting of equal investments in four alternative asset classes – small-cap equities, private equity, infrastructure debt and real estate.

The analysis is completed in the same way as before, using simulated returns from the B&H Risk Scenario Generator. In this example we vary the percentage allocation between portfolios (A) and (B).

[23] Private equity and small-cap equities are modelled as 'children' of the FTSE 100 equity index, i.e. with betas and residual specific risks relative to the main equity index. The 1-year 99.5% VaRs of each of small-cap equities, private equity, infrastructure debt and real estate are modelled to be 48%, 75%, 44% and 31% respectively.

Figure 16 Solvency Capital Requirement as a function of allocation to alternative assets

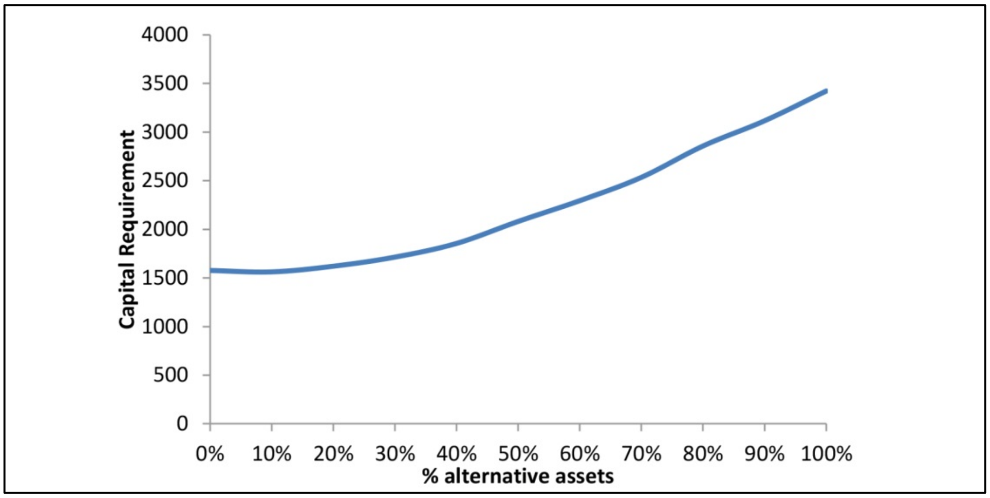


Figure 17 Expected Return on Capital as a function of allocation to alternative assets

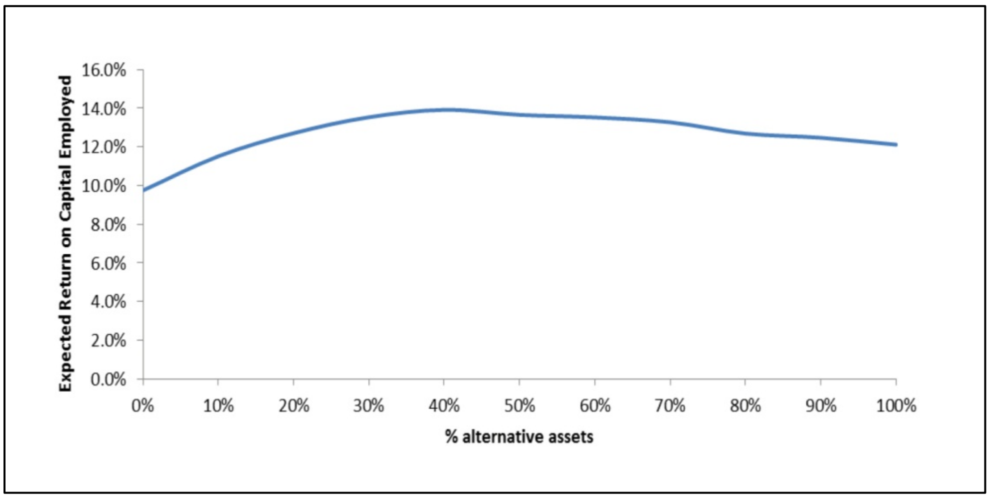


Figure 18 Expected Economic Profit as a function of allocation to alternative assets

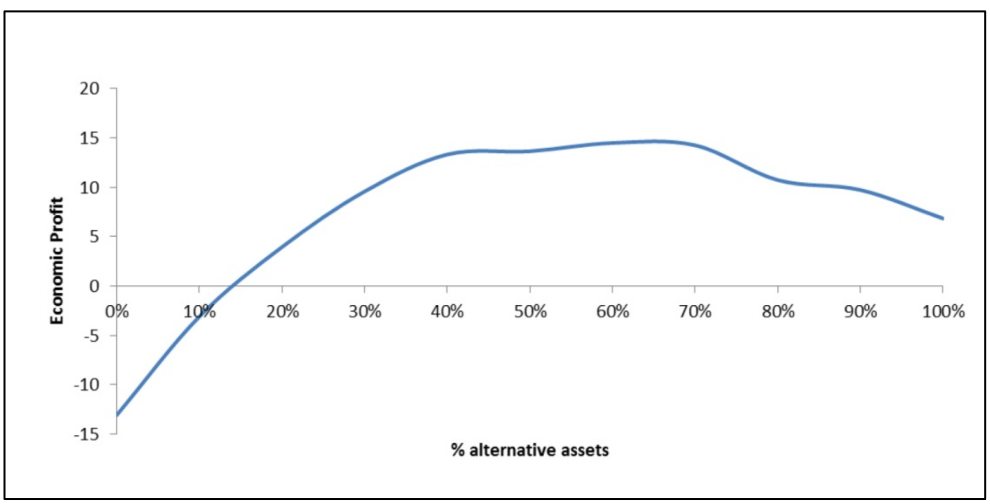


Figure 16 shows that the inclusion of the alternative asset portfolio generates positive expected economic profit under our assumptions. As well as considering the two risk-based metrics, it is also important to consider the absolute size of the SCR. Given the riskier nature of the investment strategy, it is no surprise that for high allocations to alternative assets, the SCR exceeds the initial surplus.

If it is believed that increasingly illiquid asset structures generally offer increasingly large liquidity premiums, then the conclusions of this analysis are intuitive enough. The traditional corporate bond portfolio of an annuity portfolio is much more liquid than annuity liabilities. This 'liquidity surplus' has not been monetized in the way that is possible if we subscribe to the belief that more illiquid assets offer more liquidity premia. A quantitative analysis of these possibilities is generally going to suggest investing significantly in the assets that generate value by spending the unrewarded liquidity surplus, subject to the costs associated with any increase in capital requirements. And if capital requirements are risk-based and do not penalize lack of liquidity, it should be possible to find a portfolio of assets that offer similar risk and capital requirements to today's typical annuity asset strategy that also make greater utilization of the liquidity surplus generated by the highly illiquid form of liability.

5. Conclusions

This paper has explored two distinct, but related, topics:

» What (il)liquidity premia can be expected from different types of asset classes? Do such liquidity premia vary over time? What evidence can be used to support conclusions on the quantification liquidity premia?

» How can insurance asset strategy choices be appraised in a risk-based, economically meaningful way that reconciles with Solvency II?

Section 2 presented an analysis of the first of these topics. This provided a survey of the relevant academic literature and estimates of the liquidity premia on offer across a range of asset classes including corporate bonds, small-cap equities, real estate, infrastructure and private equity.

The paper has used a simple fixed annuity liability to provide a case study of how insurance asset strategies can be appraised in a risk-based and economic way. Two capital-driven metrics were considered – one that simply calculates expected return on capital employed, and a second, more economically-sophisticated measure that considers access to liquidity premiums as a source of shareholder value in illiquid liability business, and the cost of the capital required to support that business as the major shareholder cost. Both these metrics produced similar relative behavior across the different asset classes considered in the paper. They both implied that more 'exotic' alternative asset classes may fit well into the economics of long-term illiquid liability business: both as potential sources of risk diversification, and as a better monetization of the 'liquidity surplus' that these businesses have traditionally had on their balance sheets.

Naturally enough, any generic quantitative analysis of unusual, heterogeneous asset types needs to be carefully caveated. There are several details of this analysis that can be developed further: how does the Solvency SII Standard Formula treat these asset classes? Which assets will qualify for the matching adjustment? What are the likely liquidity needs of an annuity business and how do unavoidable trading costs impact on expected holding period returns? We may further explore these questions in a future paper. In the meantime, we hope this high-level work has provided some insight into how the potential costs and benefits of illiquid asset strategies can be measured and analyzed in a Solvency II world.