Liabilities & Matching Strategies: Modelling realities

Con Keating identifies some key problems in asset-liability modelling and liability-driven investment based on mixed-attribute accounting

The liabilities of a DB pension scheme are well-defined – the scheme's rules ensure this. The liabilities, the future cash flows of pension payments collectively, display the familiar 'armadillo' shape of so many actuarial reports. These payments are not known, ex ante, with certainty, as many of their determinants are stochastic variables. Among the sources of uncertainty are wage inflation and longevity. These risks are real in the sense that they determine the amounts ultimately payable to pensioners.

Actuarial practice, regulation and accounting all report, and focus upon, the current values of these liabilities. These immediate values are all estimates derived under models. It is important to realise that these estimates are subject to random change in the model parameters used in their derivation. This is true, even with the added constraint of market consistency. These risks are not real since they affect only our present estimates, and not the ultimate values of assets and liabilities. We should explicitly recognise that there is no 'correct' model, no unique parameterisation.

Simplicity in a model is much cited as a desirable attribute – the principle of Occam's razor – but Einstein's caution that 'Everything should be made as simple as possible, but not simpler', should not be forgotten. On this note, the use of normal and log-normal distributions for modelling assets and liabilities deserves attention. This is a familiar approximation widely used in academia, but problematic when comparing the present value estimates of assets and liabilities. If we use the ratio of asset to liability estimates, the funding ratio, there is a statistical problem since the ratio of two log-normally distributed entities is another distribution, known as a Cauchy distribution. This has some very unfortunate properties – its mean, variance and higher moments are all undefined, which reduces the use of the current funding ratio as a decision tool to nonsense.

If, by contrast, the current deficit or surplus is used, another problem emerges. This statistic is the difference between two large numbers and, like all such figures, is inherently unstable. Errors in both terms distort the outcome. This phenomenon is well known in portfolio management: the optimisation tools of Markowitz are often described as 'error-maximisers', and result in asset allocations that are frequently outperformed by simple heuristics such as an equal weight allocation among assets. This is an instance where the information in data is overwhelmed by the noise.

Asset and liability management as a concept is itself problematic. A pension liability is some other party's asset and there is little or nothing that we can do to alter or manage it without the owner's consent. This is a fundamental tenet of the law of property. We can alter our current estimate of its present value, but this does not change the ultimate real pension liability, in amount or risk.

The practice, common in liability-driven investment, of 'hedging' interest rate 'risk' using swaps is questionable in this light. After all, pension liabilities are not determined by interest rates; they are set by reference to members' contributions, length of service and longevity, and inflation. However, if the discount rate – the measure under which the present value of those future payments is estimated – is 'hedged', a real sensitivity to interest rates and yield curve shape is introduced. In addition, a basis risk is introduced that can be very substantial – the spread between the discount function and the swap rate. In the case of long-term swaps and gilts, this has varied by more than 100 basis points over that past year, producing a valuation variation of the order of 25% of a typical scheme's liabilities.

By contrast, assets are valued at market price. The first problem here is that it isn't possible to know what implicit discount function is reducing the uncertain future cash flows of those assets to any current market price – it is the product of fear and greed, and can behave capriciously. There is also a problem for any regulator concerned with the aggregate systemic position, which Keynes summarised well: "It forgets that there is no such thing as liquidity of investment for the community as a whole." The combination of discounted present values for liabilities and market prices for assets is known as mixed attribute accounting, and is a deeply flawed model. Not only do these measures differ, but their differences also vary in time – the measures are elastic. This results in outcomes that are both biased and more volatile than the liabilities ultimately payable. Even the dividend streams of equities are markedly less volatile than market prices. These present values are less useful for decision-making than the ultimate liabilities.

It is worth dwelling a little on the relation between an asset and a liability; one is a mirror image of the other. Mathematically, this is a rigid rotation about zero, or multiplication by minus one, with the result that the odd moments all change sign. But there is a more profound consequence; the risk that lowers the value amount of an asset also lowers the (negative) value amount of the corresponding liability – both move towards the zero origin. In other words, if it is rational for an investor to dislike risk in an asset, then it is also rational for that investor to

seek risk in a liability. This change of risk preference behaviour is widely observed empirically and often presented incorrectly as a 'paradox'.

In this context, interventions, such as those seeking to enhance member security and confidence, need to be thought through carefully, since lowering the volatility of both assets and liabilities increases their costs. (Prior to the Maxwell affair in the UK, the overwhelming effect of regulation was to increase the pensions ultimately payable – limited price inflation, preservation of deferred members' rights and spouses' benefits are all obvious illustrations – but since Maxwell, the emphasis has shifted onto member security and confidence, bringing with it costs for sponsor and scheme but no enhanced pensions benefits for any members). Varying the volatility of either assets or liabilities alone, of course, confounds any matching ambition.

The best way to address the asset and liability problem is to project the cash flows of assets in addition to the liabilities, matching these at the future dates of liability payments, with shortages and surpluses then being discounted to deliver a meaningful present value.

Projections of asset and liability cash flows are made under uncertainty, which gives rise to the question as to which of these values constitutes the 'best' estimate. Rationally, for coherence and consistency, the best technical estimate is the value of maximum likelihood. Pension legislation frequently uses the qualifier 'prudent' with respect to estimates and model parameters, which the regulator has interpreted as the 'best' estimate with added margins. This reading is a miscomprehension. Prudent estimates are merely rational and well-informed. Using estimates biased by margins greatly complicates the modelling process, and consistency and coherence may become entirely unachievable. The Board for Actuarial Standards should, as a public service, publish guidance on all of these issues.

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