# Locked-in stochastic discount rates under IFRS 17

IFRS 17 is fast approaching, and one of the new concepts that insurers have had to grapple with is the idea of “locking in” to a set of discount rate assumptions. In particular, for the purposes of the Contractual Service Margin (CSM) calculation under the General Measurement Model (GMM), the discount rate assumption for a group of contracts is locked in at initial recognition. Whilst not without its problems, for example the resulting mismatch between the measurement of CSM and Fulfilment Cash Flows (FCF), locking-in is likely to remain a fundamental feature of the new regime. Further background on the locking-in requirements can be found in <https://www.actuaries.org.uk/system/files/field/document/IFRS17_CSMWP_Article_Locked-in%20assumptions_20190312.pdf>

This article considers specific considerations around liabilities for which stochastic valuations are employed. Stochastic techniques are typically employed where options and guarantees are embedded within insurance contracts, and this is no different under IFRS 17 to other regulatory regimes such as Solvency II. In the UK, it is fair to say that many of these embedded features exist within policies that fall outside of the scope of the GMM, for example with-profits and unit-linked business which are largely in scope of the Variable Fee Approach (VFA) and for which the concept of locking in is irrelevant. However, this will not be the case in general, for example

* Participating policies with that fall outside of the scope of the VFA
* Universal Life type policies with interest rate guarantees

Our focus here is on discount rates, however the arguments could equally be applied to other items considered to be “financial risks”. We focus on two potential areas where challenges may arise in implementing stochastic locked-in discount rates, i.e.:

* Storage requirements, and the operational challenges of locking-in large assumption sets, and
* Grouping and averaging of new business locked-in assumptions, in particular the distortions that may arise where stochastic guarantees exist.

While there is clear interaction between these issues, for the purposes of clarity they have been treated here as distinct.

## Storage requirements

Unless Closed Form solutions, such as Black-Scholes and its variants, are used, valuation of options and guarantees are typically performed via Monte Carlo simulation. This involves the random generation of many thousands of discount curves (and other assumptions), typically using long-term Economic Scenario Generators (ESGs). The interpretation of “locking-in” in the context stochastic scenarios is unclear, and three possible options are presented.

Option 1 – ‘Full Storage’

A very literal interpretation of locking-in would require the stochastic scenarios to be stored at cohort inception. Solutionising this approach would require the following convoluted calculation, per cohort (or sub-cohort if, say, locked-in assumptions are set separately for each quarter’s new business), on future CSM re-measurement:

1. Accrete the CSM (relating to the embedded guarantee) at the average forward rate across the discount curves. Where risk-neutral scenarios have been used, however, this average converges to the forward rate from the locked-in inception risk-free curve.
2. Recalibrate the CSM for future service, e.g. resulting from demographic assumption changes. Whereas the FCF is revalued using a new set of (current) stochastic scenarios, the CSM is revalued based on the rolled-forward locked-in stochastic curves. The roll-forward mechanics are illustrated in the diagrams below. For simplicity, we assume a contract term of two years, and two stochastic scenarios. The item being modelled is the one-year forward risk-free rate.



roll-forward



At the valuation date (end of year 1), the year 1 rates are replaced by the average across the scenarios. The rates for year 2 are retained at their locked-in values.

One variant of this approach replaces the year 1 rates with the actual realised rate, rather than the expected. In other words, the lock-in is applied to future assumptions and not historic assumption which are assumed to relate to historic service. In this case the value of the underlying, e.g. Asset Share, coincides with that used for the calculation of FCF, and the mismatch relates only to future assumptions. The relative merits of this approach are not considered further here.

Another variant of the approach is to assume that the stochastic scenarios are locked in at inception for the full contract term, i.e. with no averaging of scenarios between inception and valuation date. Here the time value of the option does not reduce, for the purposes of the CSM recalibration, as it would in valuing the FCF. The implementation of this approach is likely to be very complex, as there are multiple ‘starting points’ for the stochastic valuation at the valuation date, and nested stochastic simulations may be required.

A potential limitation of the overall approach is that the implied forward curves from the inception scenarios are, in some scenarios, inconsistent with the average (or realised) year 1 rate.

1. Amortise the CSM. The amortisation pattern reflects the timing of service coverage over the contract life, as measured by Coverage Units. A range of potential approaches to defining coverage units exist – where options and guarantees exist it is possible that the calculation of coverage provided during the reporting period, or, more likely, outstanding coverage units at the end of the period, will rely on a stochastic valuation. For example, a firm may define the coverage provided in the period, in respect of an embedded option, as the realised cost of that option, and the outstanding coverage as the (stochastic) option value at the end of the period. In this case, the outstanding coverage is simply the locked-in BEL, and problem of calculating coverage units reduces to the problem in (2). A more complex definition of coverage units may however lead to further complexity.

This purist approach seems impractical, as many tens or hundreds of scenarios sets (one per cohort or sub-cohort), each containing many thousands of scenarios, would need to be stored at any point in time. The requirement to then roll each of these scenarios forward, as well as double-up on the number of stochastic runs at each valuation date (i.e. one stochastic run for the BEL, and another for CSM re-measurement), further increases operational complexity.

Lastly, an ability to re-create historical scenario sets (see below) might compromise the control environment.

Option 2 – ‘Scenario regeneration’

Under this approach, the aim is to regenerate the locked-in scenarios at the valuation date, thereby removing the onerous system storage requirements of Option 1. The approach does not however address the complexity of the CSM calculations, i.e. steps 1-3 above.

Additionally, it may be impossible to recreate precisely the historical scenario sets, firstly because scenarios are typically generated through random sampling, and secondly because of historical changes to the modelling environment and the practical challenges of storing and working with multiple versions of models and input / output formats.

Option 3 – ‘Pseudo scenarios’

In trying to find a pragmatic alternative, the question becomes: “What exactly are we required to lock in?” One possibility would be to lock-in to the inception risk-free discount curve and key distributional assumptions around it, rather than the inception scenario set itself. The aim would then be to generate, at future measurement dates, a proxy to the rolled-forward stochastic set. Crucially, the start point for these ‘pseudo scenarios’ would be the valuation date, enabling the most up-to-date model versions to be used, consistent with the FCF calculations. Such distributional assumptions would be product and model specific, but may include for example the volatility of forward rates, mean-reversion parameters, etc.

Ideally, the number of ESG inputs requiring storage would be kept low, for example by only storing inputs relating specifically to discount rates, i.e. the marginal distribution. It may be, however, that the full ESG input set requires storage, not least because the firm is locking-in to a number of economic variables. Care to be taken not to engineer a solution that is more complex than the problem that we first set out to solve.

Another consideration is that certain assumptions, other than the risk-free forward curve, could have term structures, in which case these too would require some form of roll-forward to the valuation date.

## Grouping and averaging

Another challenge arises from the impracticality of storing separate locked-in discount curves per contract. This problem already exists in the deterministic case – individual contracts within a cohort are priced under different economic conditions, however firms will typically calculate average discount curves per cohort for the purpose of future CSM re-measurement. So an annuity provider, for example, might price contracts over the course of a calendar year at a range of discount rates, starting the year at x%, ending the year at y% and then carrying forward a locked-in rate for that year of (x% + y%) / 2. If y > x, the policies written at the end of the year appear to be loss-making when valued the following year. At inception, the policy was correctly classified as non-onerous, but does it now have to be disclosed as onerous owing to an artificial distortion from averaging? No doubt, firms are looking for practical solutions to this problem, possibly involving the level of granularity at which onerousness is assessed for the purposes of subsequent measurement and disclosure.

The problem is more pronounced however when considering options and guarantees. Here the benefits are non-linear functions of the underlying assumptions, e.g. small changes in interest rates can lead to large changes in guarantee costs. Here it is not so clear that the problem can be ‘grouped away’.

Take the following simplistic and heavily contrived example. A firm writes contracts with embedded investment guarantees. As the fee for the contractual guarantee is fixed, the level offered varies over the course of the year as market conditions change. Consider these two contracts:

* Contract 1: written with 2.5% interest rate guarantee in January, when risk-free discount rates are at 3%. This contract is out of the money, hence classified as profitable.
* Contract 2: written with 1% interest rate guarantee in December of the same year, after risk-free rates have plummeted to 1.5%. This contract too is profitable.

The combined discount rate for the cohort, carried forward to future years, is 2.25%. This places Contract 1 artificially in-the-money. Without a solution, this triggers further disclosure requirements, and firms are left with the unenviable task of explaining why loss components have so quickly arisen within CSM units of account that have been designated profitable.

The ‘natural’ solution to this problem would be to derive multiple locked-in curves per cohort, however specifying the required granularity within the system design may prove to be challenging. Another, even less appealing, possibility is to close the unit of account every time there is a material change in market conditions, creating multiple Units of Account for a given cohort - aside from the modelling complexity, it may be difficult to justify (“If pricing is dynamic, then do the contracts really carry different risks?”) Another, possibly more palatable alternative, would be to address the issue via the averaging method – here the average discount curve could be weighted based on a ‘cost of guarantees’ target, rather than, say, the policy premium.

Note: This article is written on behalf of the IFRS 17 Future of Discount Rates working party of the IFoA. The objective of this article is to encourage discussion and debate in this developing area. It does not constitute guidance, and has in no way been tested with standard setters or audit firms. Comments are welcomed and will be understood to be made in a personal capacity.