MOODY'S ANALYTICS

Scenario Modeling for IFRS 17

Economic Scenarios and Yield Curves

Introduction

IFRS 17 Insurance Contracts introduce a requirement for insurers to adopt fair value and market-consistent methodologies within the overall development of insurance contract liabilities used for financial statements.

The principles-based nature of IFRS 17 means that insurers must choose the methodology for the valuation of liabilities, including derivation of the liability discount curve. Insurers with participating business will need to place a market-consistent value on the options and guarantees, most likely using a scenario generator. For most insurers, this is not a new concept. However, for some insurers, particularly outside of Europe and North America, this will be a new requirement. Regardless of whether an insurer is implementing a scenario generator for the first time or is an established user, insurers should review their choice of models and calibrations in their scenario generator and validate that they are appropriate for IFRS 17.

There are multiple challenges insurers must address for market-consistent valuation across all lines of business:

- The assessment whether there is a need for a scenario generator within the IFRS 17 valuation.
- The development of a methodology for setting the discount curve and a process to produce the yield curve at each valuation date.
- The choice of stressed yield curves and stressed scenario sets if needed for disclosures.

Implementing a scenario generator

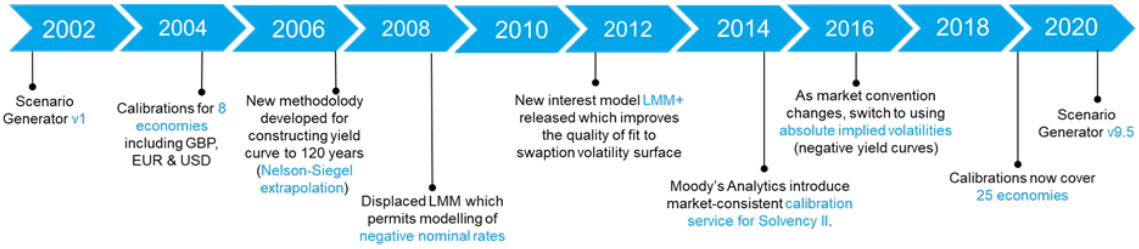
Insurers implementing market-consistent valuation for the first time must assess if a scenario generator is required. The valuation of participating business, which has options and guarantees, may require the use of stochastic methods. Although the IFRS 17 standard does mention that replicating portfolios can be used to determine the fair value of selected cash flows, it is unlikely that such assets are readily found. Therefore, a scenario generator is usually adopted for this purpose. The most common stochastic modeling technique applied is based on the

technique of risk-neutral pricing. Risk-neutral methods have been widely applied in both the banking and insurance industry to price contingent claims. A scenario generator is calibrated to observable market prices and then used to simulate risk neutral scenarios. (See the appendix for an overview of risk neutral pricing.) The scenarios are fed into the insurer's cash flow projection model and Monte Carlo valuation is then applied to value the insurance liability.

Model selection

When implementing a scenario generator, the user must first select the appropriate model for each asset class, and consider the nature of their liabilities and desired level of sophistication. More complex models are better able to capture market dynamics (for example, skewness in option markets) and dependencies across risk factors. Models should be arbitrage-free and produce prices consistent with markets. Quantitative expertise is required to design and calibrate the models in the scenario generator. Since the launch of the first version of Moody's Analytics Scenario Generator in 2002, we have continually refined the models to incorporate new features, reflect developments in financial markets, and meet the evolving demands of the insurance sector. Taking interest rate modeling as an example, there have been several notable advances over the past 20 years (Figure 1), including the enhancement of the models to achieve a more accurate fit to the full swaption surface and their adaptation for the negative rate environment.

Figure 1: Developments in Interest Rate Models



Model calibration

To achieve the objective of market-consistent valuation of the options and guarantees within insurance liabilities, the scenario generator must be calibrated to the observed price of relevant market instruments. This means parameterizing the models such that when the simulated scenarios are used to value financial instruments, the resulting value aligns with market prices.

The first task in model calibration is sourcing the relevant data and, where there is insufficient data, developing a justifiable and documented approach to setting assumptions. IFRS 17 does not give explicit instruction but does state that an entity should maximize the use of

observable market inputs. A common challenge when calibrating the models is that the term of the liabilities often extends beyond the availability of market instruments. For example, an insurance contract may contain long-term minimum interest rate guarantees, with the term of the liability exceeding the maturity of the swaptions and/or equity options available in the market. An approach must be developed to extrapolate beyond the observable market data, which inevitably involves expert judgment.

Automation

Naturally, insurers should aim to calibrate models and generate scenarios based on an efficient process that uses technology such as cloud computing to minimize run times when the reporting window is compressed. Calibration and production should be performed in an automated framework with limited manual intervention to reduce operational risk and key man dependency. The calibration process should be tested for stability of calibrations and its ability to cope with extreme market movements.

Defining the discount curve

The discount curve is a key element of IFRS 17. Calculating the fulfillment cash flows under IFRS 17 requires insurers to discount their cash flows to reflect the time value of money and the financial risks related to those cash flows. Discount rates also feature in the calculation of the contractual service margin. Thus, the choice of curve will have a direct impact on the liabilities established at contract recognition and the timing of subsequent profit.

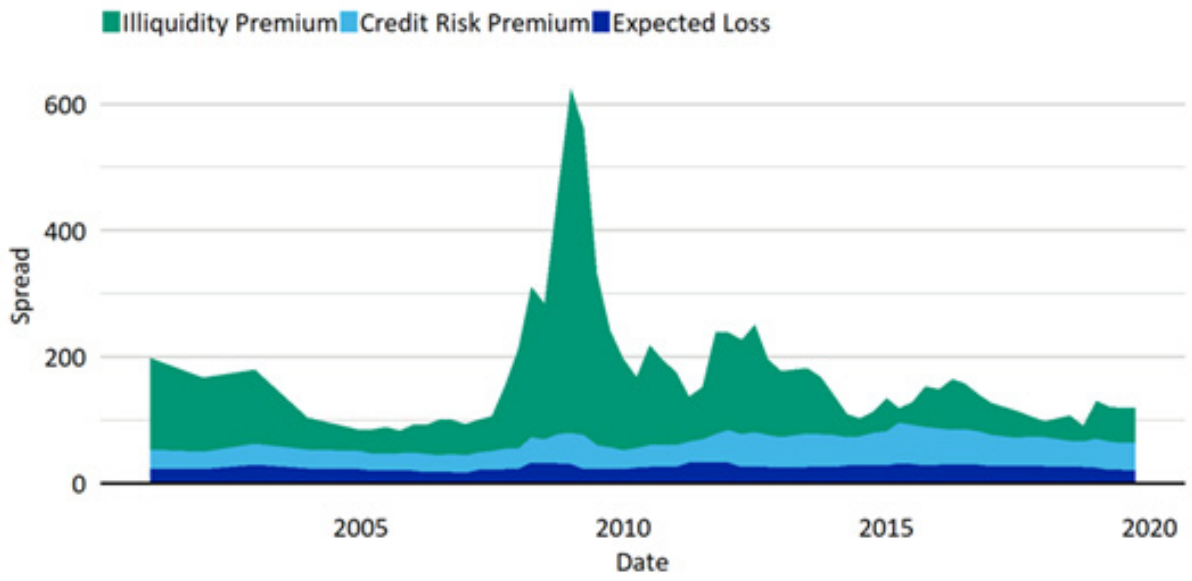
Another consideration is that the standard is principles-based rather than prescribed. As a result, it is up to insurers to define a suitable methodology for the discount curve that aligns with these principles. In Europe, this presents a marked difference from the regulatory regime, Solvency II, where the reference curve is prescribed and published by the European Insurance and Occupational Pensions Authority (EIOPA).

IFRS 17 allows two different approaches for yield curve construction and discounting which, in theory, but not necessarily in practice, produce equivalent results. The two approaches are known as the top-down and bottom-up approach. However, defining the discount curve methodology involves more than selecting between top-down and bottom-up. IFRS 17 introduces the requirement for insurers to use a discount rate that is consistent with market prices and reflects the characteristics of their liabilities, particularly the cash flow, and liquidity characteristics. The first requirement—to reflect market prices—will be familiar to any European insurer, as it is necessary for regulatory reporting under Solvency II. However, this still presents challenges in terms of what instruments to use and the availability of appropriate market data. To satisfy the second requirement—to reflect the characteristics of liabilities—a two-step approach may be adopted in practice:

» First, assess and quantify the degree of liability illiquidity in a contract or group of contracts, based on an analysis of the surrender characteristics of the contracts. The output may be reminiscent of the Solvency II QIS5 bucketing approach, which proposed a sliding scale whereby only the most illiquid contracts qualified for 100% of the illiquidity premium. There are multiple challenges insurers must address for market-consistent valuation across all lines of business:

» Second, calibrate the illiquidity premia to a market estimate of liquidity premia. There are various methods for deriving an illiquidity premium estimate. One approach, adopted by Moody's Analytics, is to apply a structural model to estimate the fair value spread that accounts for the credit risk, and then attribute the excess of the market spread over the fair value spread to illiquidity premium (Figure 2). This approach uses Moody's Analytics EDF™ (Expected Default Frequency) software and the CreditEdge™ tool that financial institutions use to estimate the expected credit loss under IFRS 9.

Figure 2: Decomposition of historical credit spreads for USD corporate bonds



Here are other challenges in deriving the discount curve:

» Insurers must decide whether it is justifiable to derive the discount rate from their actual asset portfolio or whether to use a reference portfolio. European insurers (primarily in the United Kingdom and Spain) who currently apply the matching adjustment are familiar with applying a discount rate that is directly linked to the (risk-adjusted) yield on the backing assets. IFRS 17 does not refer to actual assets held except for the measurement of contracts where the features are linked to the performance of a pool of underlying assets. Indeed, as emphasized previously, the standard states that the discount rate should be determined with reference to the characteristics of the liabilities. Therefore, a reference portfolio could be used to match those characteristics.

» Insurers will need to extrapolate the discount curve beyond the market data. This was a key topic for Solvency II, where Smith Wilson was chosen as the extrapolation method and EIOPA specified a last liquid point (LLP) and ultimate forward rate (UFR). IFRS 17 is principles-based, so insurers have more flexibility to choose an extrapolation method. Smith Wilson is one option, but there are others such as Nelson Siegel. Moody's Analytics enables clients to customize the extrapolation of the curve using their calibration tools.

Sensitivities

IFRS 17 requires the entity to disclose information that enables a clear understanding of the entity's exposure to market risk, including a sensitivity analysis that shows how profit or loss is affected by changes in risk exposure. Insurers must assess the implications of changes in risk exposure for stress scenario production. Also, they must determine appropriate stresses to apply to each market risk, produce the relevant output (for example, stressed discount curve) and, where applicable, produce market-consistent scenarios to value their liabilities under the sensitivity.

There will likely be a further requirement to produce historical discount curves to support the calculation of the contractual service margin (CSM) if entities choose to look back to the date of initial recognition to determine the discount rate and calculate the CSM. These historical discount curves would then also be used to accrete interest on the CSM in future years.

Conclusion

IFRS 17 is principles-based; thus, there are many methodology decisions that insurers will have to make. This paper outlined the challenges related to deriving the liability discount curve and implementing a scenario generator. Moody's Analytics is at the forefront of yield curve and scenario modeling for insurers. Moody's Analytics Scenario Generator helps insurers meet the requirements of the new accounting regime. If you would like to discuss the topics in this paper in more detail, contact your Moody's Analytics consultant.

Moody's Analytics Solutions

Scenario Generator

The Market Consistent Scenario Generator is a suite of stochastic asset modeling tools in a flexible framework that allows insurers to produce risk-neutral scenarios to value optionality in their insurance liabilities. For insurers implementing a scenario generator for the first time, Moody's Analytics can help them assess and choose a market-consistent scenario generator model and define their calibration approach for each asset class, the nature of the liabilities, and desired level of sophistication.

Automation Module

Moody's Analytics Automation Module lets insurers streamline their modeling processes by automating model setup, execution, and validation, which helps reduce production time and cost.

Scenarios as a Service

For insurers who do not have the resources to take ownership for scenario production in-house, Moody's Analytics Scenario Service offers an alternative to the Market Consistent Scenario Generator. As part of this service, Moody's Analytics manages the production of regular scenario output for insurers based on a pre-agreed specification. This enables insurers who do not have the capacity to own Scenario Generator to benefit from the same high-quality modeling framework without the resources associated with implementing the software and managing, running, and calibrating Scenario Generator models in-house.

IFRS 17 Discount Curve Service

Moody's Analytics offers a discount curve service for IFRS 17. This new service offers insurers a flexible and robust solution to the significant challenge of building discount curves required to value future cash flows under IFRS 17. The Discount Curve Service offers illiquidity-premium term structures for a range of credit ratings, allowing insurers to tailor the content to the characteristics of their liabilities under valuation, such as duration, liquidity, and currency.

RiskIntegrity™ for IFRS 17

The RiskIntegrity for IFRS 17 solution helps insurance companies make the transition from current insurance accounting frameworks to IFRS 17. It helps insurance entities of any size efficiently meet the new reporting challenges. To arrange a demonstration of this solution, go to www.moodysanalytics.com/product-list/riskintegrity-ifrs17 or contact your Moody's Analytics representative.

Appendix: An Overview of Risk-Neutral Pricing

Risk-Neutral pricing is a clever mathematical trick developed by economists for the purposes of valuation of contingent claims.

There are two types of financial assets. Bonds, currencies, and equity shares are fundamental assets - 'underlying' direct claims on capital. Derivatives (such as forward contracts and options) are indirect financial claims which are contingent on the behavior of the underlying asset. The understanding of financial economists is that – subject to some important assumptions – the value of a contingent claim depends only on what is possible for future asset prices rather than the specific set of probabilities assigned to possible events. The real probability of an event does not enter into the pricing calculation. The pricing methods developed also reveal replicating portfolios for contingent claims – portfolios which (if necessary, adjusted over time) exactly match the payoffs from a derivative.

This surprising analysis tells us that, so long as we work with a set of probabilities that are consistent with market prices and possible outcomes, any set of probabilities could be used for pricing contingent claims.

However, for a given set of probabilities, a special set of discount rates must be used to correctly value contingent claims. Generally, these discount rates are difficult to calculate, since they are state-specific. However, it turns out that there is one set of probabilities that is much easier to work with than any other. The best set of probabilities to work with is the 'risk-neutral' set of probabilities, so-called because they are consistent with asset prices and possibilities in a world in which investors are neutral towards risk, and therefore demand the same risk-free return from all assets. If we choose to work with risk-neutral probabilities, it is possible to discount all expected payoffs at the risk-free rate, which simplifies the implementation of pricing calculations enormously. One should note that risk-neutral pricing gives no information on real-world expected returns (except that they are not required for pricing contingent claims). It is a clever computational short-cut for valuation calculations. The technique also brings understanding into the drivers of contingent claims valuation.

It will be no surprise that the assumptions used to develop risk-neutral models (like any model) do not hold in the real world. In practice, prices do deviate from their model-predicted values. In applying option pricing models, practitioners recognize this and frequently choose to modify the inputs to the model rather than build more complex models under a more general set of assumptions.

CONTACT US

Find out more information about Moody's Analytics award winning solutions for IFRS 17.

www.moodysanalytics.com/IFRS17

CONTACT DETAILS

Visit us at **moodysanalytics.com** or contact us at a location below.

AMERICAS
+1.212.553.1653
clientservices@moodys.com

EMEA
+44.20.7772.5454
clientservices.emea@moodys.com

ASIA (EXCLUDING JAPAN)
+852.3551.3077
clientservices.asia@moodys.com

JAPAN
+81.3.5408.4100
clientservices.japan@moodys.com