Options and Guarantees

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This IFRS17 Working Paper aims to facilitate discussion among actuaries and other stakeholders to capture the range of opinions on the application of IFRS17 in the Singapore context and are not meant to serve as mandatory practice notes.

Any interpretation of IFRS17 set out in this Paper represents a plausible treatment given the text of IFRS17. However, it shall neither be construed as the only possible treatment nor the agreed interpretation for Singapore insurers. Users of this Working Paper shall be mindful that differences in the exact fact pattern and operating context facing each insurer may drive different interpretations. Users shall also be mindful that for the same fact pattern and operating context, there is scope for the substance of same transaction to be articulated differently depending on how the transaction is analysed. (For example, in substance, cash flows from a call option with strike price $X on an asset is equivalent to the combined cash flow from the underlying asset and a put option with strike price $X on the asset, less cash of $X.) Differences in articulation can give rise to a range of plausible treatments. An insurer remains responsible for justifying its choice of treatment after discussion with its auditor. Opinions expressed in the working papers are not representative of that of the Singapore Actuarial Society.

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1. IFRS17 Standards

Under IFRS17 paragraph 33, the estimates of future cash flows within the contract boundary of each group of contract shall incorporate the amount, timing and uncertainty of the cash flows in an unbiased way. The standard further refers to Appendix B (paragraph B36 – B95) on specific requirement around the estimates of cash flows, and the following summarizes the guidance around valuing options and guarantees:

Paragraph 33
An entity shall include in the measurement of a group of insurance contracts all the future cash flows within the boundary of each contract in the group (see paragraph 34). Applying paragraph 24, an entity may estimate the future cash flows at a higher level of aggregation and then allocate the resulting fulfilment cash flows to individual groups of contracts. The estimates of future cash flows shall:

(a) incorporate, in an unbiased way, all reasonable and supportable information available without undue cost or effort about the amount, timing and uncertainty of those future cash flows (see paragraphs B37–B41). To do this, an entity shall estimate the expected value (ie the probability-weighted mean) of the full range of possible outcomes.

(b) reflect the perspective of the entity, provided that the estimates of any relevant market variables are consistent with observable market prices for those variables (see paragraphs B42–B53).

(c) be current—the estimates shall reflect conditions existing at the measurement date, including assumptions at that date about the future (see paragraphs B54–B60).

(d) be explicit—the entity shall estimate the adjustment for non-financial risk separately from the other estimates (see paragraph B90). The entity also shall estimate the cash flows separately from the adjustment for the time value of money and financial risk, unless the most appropriate measurement technique combines these estimates (see paragraph B46).

Paragraph 36
An entity shall adjust the estimates of future cash flows to reflect the time value of money and the financial risks related to those cash flows, to the extent that the financial risks are not included in the estimates of cash flows. The discount rates applied to the estimates of the future cash flows described in paragraph 33 shall:

(a) reflect the time value of money, the characteristics of the cash flows and the liquidity characteristics of the insurance contracts;

(b) be consistent with observable current market prices (if any) for financial instruments with cash flows whose characteristics are consistent with those of the insurance contracts, in terms of, for example, timing, currency and liquidity; and

(c) exclude the effect of factors that influence such observable market prices but do not affect the future cash flows of the insurance contracts.

Paragraph B39
When considering the full range of possible outcomes, the objective is to incorporate all reasonable and supportable information available without undue cost or effort in an unbiased way, rather than to identify every possible scenario. In practice, developing explicit scenarios is unnecessary if the resulting estimate is consistent with the measurement objective of considering all reasonable and supportable information available without undue cost or effort when determining the mean. For example, if an entity estimates that the probability distribution of outcomes is broadly consistent with a probability distribution that can be described completely with a small number of parameters, it will be sufficient to estimate the smaller number of parameters.

Similarly, in some cases, relatively simple modelling may give an answer within an acceptable range of precision, without the need for many detailed simulations. However, in some cases, the cash flows may be driven by complex underlying factors and may respond in a non-linear fashion to changes in economic

conditions. **This may happen if, for example, the cash flows reflect a series of interrelated options that are implicit or explicit. In such cases, more sophisticated stochastic modelling is likely to be necessary to satisfy the measurement objective.**

Paragraph B48

Techniques other than a replicating portfolio technique, such as stochastic modelling techniques, may be more robust or easier to implement if there are significant interdependencies between cash flows that vary based on returns on assets and other cash flows. Judgement is required to determine the technique that best meets the objective of consistency with observable market variables in specific circumstances. **In particular, the technique used must result in the measurement of any options and guarantees included in the insurance contracts being consistent with observable market prices (if any) for such options and guarantees.**

Paragraph B65

Cash flows within the boundary of an insurance contract are those that relate directly to the fulfilment of the contract, including cash flows for which the entity has discretion over the amount or timing. The cash flows within the boundary include:

(a) premiums (including premium adjustments and instalment premiums) from a policyholder and any additional cash flows that result from those premiums.

(b) payments to (or on behalf of) a policyholder, including claims that have already been reported but have not yet been paid (ie reported claims), incurred claims for events that have occurred but for which claims have not been reported and all future claims for which the entity has a substantive obligation (see paragraph 34).

(c) payments to (or on behalf of) a policyholder that vary depending on returns on underlying items.

(d) **payments to (or on behalf of) a policyholder resulting from derivatives, for example, options and guarantees embedded in the contract, to the extent that those options and guarantees are not separated from the insurance contract** (see paragraph 11(a)).

Paragraph BC20

The underlying objective of the Board's approach to the measurement of the fulfilment cash flows is to achieve consistent measurement with current market information when possible. That market-consistent measurement includes any options and guarantees embedded in the insurance contracts. The Board decided that the use of a market-consistent current value measurement model for the fulfilment cash flows is desirable because it provides the most relevant information about:

(a) fulfilment cash flows, by incorporating all reasonable and supportable information available without undue cost or effort on a timely basis;

and, hence,

(b) changes in the fulfilment cash flows, including changes in the economic value of options and guarantees embedded in insurance contracts. This means that there is no need for a separate liability adequacy test.

Paragraph BC152

Many insurance contracts contain significant embedded options and guarantees. Many previous insurance accounting models attributed no value to embedded options or guarantees that lack 'intrinsic value' (ie when they were 'out of the money'). However, such embedded options and guarantees also have a time value because they could be 'in the money' at expiry. To the extent that those options and guarantees remain embedded in the insurance contract (see paragraphs BC104–BC107), the expected present value of future cash flows is an estimate based on all possible outcomes about cash flows. IFRS 17 also requires the measurement to include the effect of financial risk, either in the estimates of future cash flows or in the discount rate. The measurement approach in IFRS 17, therefore, incorporates both the intrinsic value and the time value of embedded options and guarantees. The use of the IFRS 17 approach will mean that the measurement of any options and guarantees included in the insurance contracts is consistent with observable market variables (see paragraph B48 of IFRS 17). The Board

concluded that this measurement approach provides the most relevant information about embedded options and guarantees.

2. Interpretation of Standards

Financial options and guarantees should be measured as part of FCF	Para 33(b) requires that the estimates of future fulfillment cashflow should be consistent with observable market prices, and Para 36 requires the estimates of future cash flows to reflect financial risks relating to these cashflows. Para B48 also explicitly describes measuring the options and guarantees in the insurance contracts. It is clear that IFRS 17 requires that measurement of fulfillment cashflows should include the value of options and guarantees which are not unbundled and measured under IFRS 9.
Valuation of options and guarantees should be market consistent	The same passages (Para 33, B48) requires that valuation of financial options and guarantees should be consistent with observable market prices. Further under BC20, the IASB Board confirms that market consistent measure is a desirable approach under IFRS 17.
Choice of valuation techniques is not prescribed	The standard does not prescribe any methodology on valuing options and guarantees, with Para B48 allowing the exercise of judgement on the choice of technique that best achieve the objective of market consistency. It might imply that sophisticated stochastic modelling is likely required, subject to the nature of the underlying fulfillment cash flows. For example, if there are significant interdependencies between cash flows that vary based on returns on assets and other cash flows, then the stochastic technique may be necessary.
Using simplification	Para B39 suggests that that fulfillment cash flows may be estimated based on deterministic or simplified approach as long as the outcome is broadly consistent or within an acceptable range of precision. However, in cases where the above is not possible, more sophisticated modelling techniques may be necessary.

3. How it applies to Singapore

Many types of life insurance products sold in Singapore contain embedded financial options and guarantees and have asymmetric relationship between assets and liabilities, and the more common ones are listed below:

Participating products	Majority of the participating products in Singapore provides reversionary bonus (“RB”) where these bonuses are guaranteed to the policyholders once declared and vested usually on an annual basis. This vested RB subsequently forms a guarantee to the policyholders where the benefit level (e.g. death, surrender and maturity) increases over the lifetime of the contract. There is a 90/10 profit sharing arrangement exists between

	policyholders and shareholders, and shareholder's profit (or transfer) is determined based on the cost of bonus declared. Bonus smoothing practices and PRE may also form additional guarantees for participating products. For example, during adverse economic environment such as falling equity returns and interest rates, management may choose to maintain the bonus rates or smooth the rates over a period of time rather than reducing the bonus rates immediately. In such scenarios, burn-through cost may occur where the guaranteed payout exceeds the asset share. In particular for Singapore, participating products with minimum guaranteed death benefit through multiplier rider or built-in feature are common, and companies should account for cost of guarantees of this feature.
Universal life products	Universal life products with lifetime coverage are commonly sold to high net worth individuals or for legacy planning in Singapore. Benefits are based on account value accumulated on crediting rate declared by insurers (less charges), and subject to a minimum crediting rate determined at the start of the contract. The premium is typically set such that the accumulated account value using best estimate crediting rate is equal to the face amount at the end of the policy term. Actual crediting rates are usually determined based on the assets backing the universal life portfolio (mostly bonds with some equities), and insurers have discretionary in managing the timing of gain / losses as well as the volatility by setting up additional smoothing mechanism. However, there is a minimum crediting rate which ranges from 1.5-2%. Other features that may potentially increase the TVOG for universal life products are: • No-lapse guaranteed – to prevent policy from lapsing when account value falls below 0, and is typically provided for the first few years where account value is still low • Rate-lock feature – to lock the crediting rate for a selected period • Guaranteed insurance charge – cost of insurance rates (vary by attained age) may be guaranteed when a policy is issued, or the company has discretion to increase the charges under specific scenarios but up to a contractual maximum limit As such, the cost of guaranteed for universal life products may be material and should be accounted for explicitly under IFRS 17.
Investment-linked products	Investment-linked products in Singapore typically provide the following guarantees (similar to Universal Life) • No-lapse guarantee • Guaranteed insurance charge However, the financial risk for ILP products are typically substantially transferred to the policyholder and the cost of guarantees are expected to be low.

Variable annuity products	Guaranteed Minimum X benefit (X refers to death, income, withdrawal etc)
Term products	Conversion and renewability options

4. Valuation methodology for options and guarantees

There are several approaches to valuing the cost of financial options and guarantees. Valuing the time value of financial options and guarantees (TVOG) is generally the more challenging aspect and would be the focus of the discussion below.

1. Stochastic modelling

The most common approach to calculating TVOG is via the technique of stochastic modelling. It involves quantifying the cost under a large number of possible economic scenarios, as opposed to a deterministic model provides a point estimate under the best estimate scenario. The economic scenarios used in a stochastic model can be classified under two broad classes: risk-neutral or real-world.

Risk neutral valuation, is a technique where cash flows are projected within a stochastic model on a market consistent basis using set of economic scenarios that is calibrated to observable market prices at a specific date. In a risk neutral world, all investors are indifferent to risk and therefore expects or requires that rate of returns for all investment assets to be the risk free rate. The assets and liabilities cashflows are projected and discounted using risk free rate under a large number of simulated scenarios. The main advantage of risk neutral valuation is to eliminate the need for subjective choice of the discount rate, and it reflects the expected hedging cost and the price at which the liability cash flows would be exchanged between market participants.

Real world valuation is performed based on a set of economic scenarios in which the evolution of market variables reflects realistic distribution of outcomes and the risk preferences of the market. Calibration of real world scenarios are generally tied to the historical observation, and the results may be very sensitive to the assumptions used in developing the scenarios. The main advantage of using real world scenarios is that it is more realistic and reflects the relationship between asset classes.

There are some challenges related to stochastic modelling:

- High computing power and storage is needed to perform large amount of complex simulation runs and to store the data and results. Model point grouping can be used to reduce run time, but the precision of the results may be compromised.
- Explaining the stochastic model is complex as data and assumptions are input into the model without knowledge of how they are being used and subsequently hard to justify the output.
- Time and effort required to model and implement stochastic models is high.

	Risk Neutral	**Real World**
Pros	• Expected values are consistent with market's valuation (consistent volatility, market prices of derivatives, correlation assumptions) • Arbitrage free, martingale property eliminates risk premium • Easy to satisfy accounting regulations and provides justifications	• Realistic dynamic of market prices and estimation of extreme events • Realistic probabilities and distribution of projected risk • Includes features of markets that management believes in (e.g. mean reversion)
Cons	• Lead to onerous triggering of life insurance guarantees and unintended consequences (e.g. bonus cut, high dynamic lapse). However, this is to ensure guarantees are considered under risk neutral and it is one of the market consistent characteristics. • Unrealistic distributions such as potential negative interest rates	• May be difficult to get within required tolerance for market data • Non-market consistent and may not be appropriate to value options and guarantees; i.e. do not pass martingale test that show no arbitrage property • Difficult to project over a long duration

	• Limited available key market parameters e.g. implied volatility	

2. Replicating portfolio techniques

Replicating portfolio is a portfolio of hypothetical assets whose cash flows and economic sensitivities match well with a portfolio of actual assets or liabilities. It aims to find the asset cash flows that exactly match the liability cash flows under every possible future scenario and is commonly used as a proxy model for economic capital calculation. These portfolios of assets are referred to as the replicating portfolio, and the value of the replicating portfolio equals to the value of liabilities. Replicating portfolio allows insurer to estimate the market value of liabilities under different economic environment without time consuming stochastic runs.

There are 2 types of replicating portfolios: static and dynamic. The static replicating portfolio is a buy-and-hold strategy, for example buying put options or derivatives bought to hedge guaranteed minimum benefits. Dynamic replicating portfolio requires constant rebalancing of assets to match the liability exposure under different financial conditions.

In reality though, finding the matching derivatives under the dynamic portfolio is extremely complex due to changing economic environment. Creating replicating portfolio would also require stochastic runs to produce risk neutral and real world fitting points. Policyholders' behavior and dynamic management actions are also hard to be reflected under the replicating portfolios.

Some examples of replicating portfolios[1]:

	Features and Behavior	**Potential assets**
Fixed Cash flows	• Fixed cash flows • Index-linked cash flows • Credited based on bond yields • Longevity based cash flows	• Zero-coupon bonds • Equity / Property total return index • Bond total return index • Life table amortizing bonds, mortality swaps
Embedded Guarantees	• Guaranteed accumulation values • Participation in investment profit • Guaranteed minimum crediting rates • Guaranteed annuity rates, GMIB • Guaranteed reinvestment terms of future premiums • Ratchets / non-negative reversionary bonus	• Equity put options • Equity call options • Bond put options / swaptions • Vanilla swaptions • Forward start options • Cliquet / look back options

3. Closed-form solutions

Closed-form solutions are analytical techniques where future cash flows are assumed to follow some mathematical distributions. It is used as a way to approximate cost of guarantees without having to use a stochastic approach. Common closed form equations such as the Black Scholes formula are used to value embedded option(s) for guaranteed minimum surrender/death/income benefit(s).

However, for more complicated products such as universal life and participating products, closed-form solutions may not be suitable, and it may be more desirable to use stochastic scenarios to value the TVOG. Closed form solutions have not been widely used as life insurance guarantees are often

[1] SOA – Investment Symposium 2010, Replicating Portfolios in the Insurance Industry

complex, and formula based on a static asset is not reflective of the dynamics of the economic market, dynamic policyholders behavior and management actions.

5. Conclusion

- Challenging to implement stochastic especially for companies that currently do not have the capability
- Common approaches adopted in Singapore (Risk neutral, real world stochastic modelling, one company using group-wide closed form solution)
- Need to link with the IFRS 17 FCF calculation basis, where discount rates used for TVOG and FCF should be internally consistent