# Valuation of non-life technical provisions under Solvency II

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Solvency II introduces a new—and, for many, a fundamentally different—approach to establishing technical provisions for outstanding claims and premiums. The new approach is driven by the need to calculate liabilities on a market-consistent basis. Thus, in the absence of suitable hedge portfolios, the technical provisions on a Solvency II basis are determined as a discounted best estimate augmented by a risk margin. These three components may be interpreted as follows:

- **Best estimate.** The best-estimate (undiscounted) provision is equal to the probability-weighted average of future cash flows.
- **Discounting.** The *best estimate* is discounted for the time value of money (expected present value of future cash-flows), using the relevant risk-free interest rate term structure.
- **Risk margin.** The risk margin is determined as the present value of the cost of holding the solvency capital requirement (SCR) for non-hedgeable risks during the whole run-off period of the in-force portfolio, using the relevant risk-free interest rate term structure.

The published results from submissions for the fourth quantitative impact study (QIS4) appear to indicate that technical provisions (discounted best estimate plus risk margin) are usually lower than their counterparts as calculated under the Solvency I regime. If we consider the main European markets, the average reduction of the technical provisions is close to 17%. The main reasons identified are:

- Use of discounting (long-tail lines of business showed the biggest reduction)
- Absence of implicit margins of prudence
- Recognition of anticipated profits on unearned premiums
- Removal of equalisation provisions

In the rest of this paper we look at these various issues in some detail.

## NON-LIFE[1] TECHNICAL PROVISIONS

Solvency II represents a *total balance sheet* approach, and the technical provisions are the most important liability on the balance sheet of non-life insurance companies. Long-established actuarial practices of estimating technical provisions on an undiscounted basis have received criticism from modern finance practitioners as not being market consistent and, in some markets, overly prudent. Given that a large percentage of non-life insurance insolvencies over the past few decades have been heavily correlated with the understatement of technical provisions, actuaries are reluctantly accepting the new principles that are expected to come with Phase 2 of international financial reporting standards (IFRS). Given the high level of uncertainty in the estimation of the undiscounted technical provisions for many long-tailed lines of business, as observed in the results of stochastic models—e.g., bootstrapping or generalised linear models (GLM)—adding additional uncertainty, in terms of the timing of future payments, only further challenges the ability of actuaries to adequately communicate their ranges of reasonable estimates, from which management selects the best estimate for the balance sheet. The proposed principles as gleaned from the Solvency II quantitative impact studies are understandable, but there are enough open issues to keep all parties busy prior to the proposed inception in 2012/2013.

For non-life business, the Solvency II framework directive requires that valuations of the best estimate provision for claims outstanding and for premium be carried out separately. Theoretically, calculations should be based on the exit value, and make use of information provided by financial markets and generally available data, in addition to an entity's own data. Both best-estimate provisions should be valued on a gross of reinsurance basis. The amounts recoverable from reinsurance contracts should be shown separately, on the asset side of the balance sheet. The value of reinsurance recoverables should be adjusted in order to take account of expected losses due to counterparty default, whether this arises from insolvency, dispute, or another reason.

## WHAT IS A BEST ESTIMATE AND WHOSE ESTIMATE IS IT?

Prior to applying the effects of the time value of money (discounting) and adding back a risk margin, which are fundamental changes in current actuarial practice, convergence on a definition of an undiscounted best estimate across Europe would be helpful. To date, there is neither a standardised definition of a *best estimate for unpaid loss and claims handling expenses (CHE)*[2] across Europe, nor a consensus as to who (*the actuary* or *management*) has ownership of the best estimate. In the most general sense, the best estimate for unpaid loss and CHE refers to the difference between the actuary's ultimate loss estimate and the known aggregate-paid loss found in an actuarial analysis as of a valuation date.

1. Referred to as general insurance or property and casualty insurance in other markets.
2. Claims-handling expenses have various names in various markets, including loss-adjustment expense (LAE). Different markets tend to split and model these expenses in different ways (e.g., allocated / unallocated and internal / external) but the intent is to include all expenses that will have to be paid in the future to service an insurance contract.

Actuaries generally rely on a variety of techniques, each producing a reasonable undiscounted estimate for a homogeneous segment. Segments, which are subsets of the entire historical portfolio of premium and losses, are typically defined by variables that differentiate patterns of observable behaviour in the underlying triangles—for example, line of business (LOB). These techniques, both deterministic methods and stochastic models, require the application of judgment based on sound reasoning and business logic as well as stress and scenario testing to explore and describe the key drivers of uncertainty associated with the resulting reasonable undiscounted estimate. After credibility weighting the undiscounted estimates resulting from all techniques applied (or using some other combination scheme), an undiscounted actuarial central estimate is selected and presented to management together with a discussion of the inherent variability of the estimate. After reviewing the actuary's conclusions, an estimate is booked as a technical provision in the balance sheet, which in some jurisdictions must be equal to the actuarial central estimate in the documentation of the actuarial analysis[3] produced by the appointed actuary.

It is convenient to assume that the actuarial central estimate is a mean for the purpose of additivity (the aggregate estimate is equal to the sum of the estimates over the segments), but there is no reason why this should be true unless the estimate is based on a model. Currently, article 76 of the Solvency II framework directive states that "the best estimate shall be equal to the probability-weighted average of future cash flows, taking account of the time value of money (expected present value of future cash flows), using the relevant risk-free interest-rate term structure." Taken at face value, this statement may be interpreted as meaning that the use of stochastic models will become a requirement for all segments. However, this language appears to be inconsistent with QIS4, whose valuation guidance is segregated by level of uncertainty as described below. Although the use of models (stochastic or otherwise) does result in the ability to select a mean of the resulting distribution, stochastic models fall short in other areas. Models are often unable to provide solutions when deterministic methods fail and there is no guarantee that a stochastic model will produce a more reliable estimate than a deterministic method.

## CLAIMS OUTSTANDING

### Scope of technical provisions for claims outstanding

The Solvency II framework directive considers the best-estimate outstanding-claims provision to relate expected future paid losses and CHE for claims that have occurred as of the valuation date. The period of time between claims incurred and claims settled is referred to as the settlement period. During the settlement period, the insurer is at risk due to uncertainties regarding, for example, the number of claims incurred but not reported (IBNR), the stochastic nature of claim sizes, and the timing of claim payments (reflecting the claims-handling processes and the potential reopening of claims) as well as uncertainties related to changes in the legal environment.[4]

The results of an analysis of the provision for claims outstanding should be documented in a written report, including detailed descriptions of the methods and approaches used, as well as the results of goodness-of-fit tests applied to all statistical methods considered (if applicable). Systematic back-testing of best estimates against experience[5] should also be well documented and support adjustments to actuarial methods used.

### Valuation methods for best estimate of claims-outstanding technical provisions

Because non-life actuaries often have long-standing preferences with respect to actuarial methodologies, actuarial standard practice can be very different from country to country, or even company to company. The prevalence of and preferred source for proxies, which are used in place of *less than adequate* data, varies as well. As such, guidance from the Committee of European Insurance and Occupational Pensions Supervisors (CEIOPS) with respect to the valuation of a best-estimate provision for claims outstanding in the QIS4 technical specifications takes the form of general principles.

**Guidance based on uncertainty**[6]

**Case 1**: Annuities arising from non-life insurance contracts, which are certain both in timing and amount, are to be treated as life insurance obligations. For example, a bodily injury award could be settled between an insurance company and a claimant such that the claimant agrees to receive a fixed monthly payment for life in exchange for the collection and submission of medical and rehabilitation expenses on top of a loss-of-earnings amount; i.e., a structured settlement. In this case, the best estimate of the provision for claims outstanding would be the present value of a series of cash flows defined as the product of the monthly nominal amount and the probability of survival to receive the monthly amount (mortality decrement). To formulate a discounted best estimate, a third term would be included to account for the time value of money (interest decrement).

**Case 2**: For claims with low uncertainty, both in timing and amount, either individual case-by-case or statistical methods may be assumed as reasonable proxies of their best estimates, provided the entity has completed back-testing to verify the reasonableness of the proxy. For example, a motor policy includes a promise to provide towing services upon an occurrence of mechanical breakdown and an insurance company has contracted with a third party to provide this service to its policyholders at a given rate for a stipulated period of time. In this case, a simple evaluation of the number of towing occurrences at the valuation date that had not been entered into the database multiplied by the agreed-upon rate per occurrence could serve as the best estimate of the provision for claims outstanding. The impact of discounting would be negligible.

**Case 3**: For claims with significant uncertainty, in either timing or amount, the best estimate should in principle be valued using standard actuarial methods based on run-off triangles. In order to control for model and parameter error, at least two methods should be used that are considered reliable, relevant, and suitably different

3. Some jurisdictions require a reserve report or reserve opinion to be filed with the regulator, and many actuarial bodies have put standards of practice in place that require the actuary to document all assumptions at a level where another actuary could understand and replicate the analysis from input data to conclusions.
4. CFO Forum, *Elaborated Principles for an IFRS Phase II Insurance Accounting Model*, page 3.
5. Article 82 of the amended directive proposal.
6. QIS4 Technical Specifications (MARKT/2505/08), section TS.II.E.



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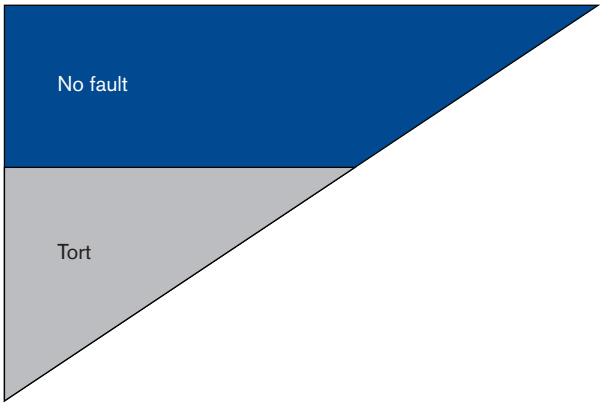
(i.e., based on different assumptions and techniques). Judgment should then be used to select the most appropriate method. Most lines of business for which triangles are compiled and analyzed fall into this category, so we elaborate below.

**Case 4**: Where credible data is not available, the user should attempt to adjust the historical data using objective and verifiable criteria. If such an adjustment is not possible or reliable, a case-by-case approach is deemed preferable. For example, if a motor market switches from a no-fault regime to a tort regime as of time *i*, there is an expectation that the historical payment pattern is no longer applicable for claims incurred after time *i*. In this case, an actuary might split its triangle into two pieces, the old regime and the new regime. In order to calculate the best estimate, the old regime would continue to use the pattern consistent with the observable history. For the new regime, however, a proxy would need to be used. The proxy would take the form of a payment pattern from a reasonably similar market with an observable and applicable history (if one exists) or the proxy would be the historical pattern after the imposition of several adjustments to lengthen or shorten the expected payment pattern to account for the expected impact of the regime change.

**FIGURE 1 : AN ILLUSTRATION OF THE EXAMPLE FOR CASE 4**




### Further guidance with respect to Case 3

Actuarial methods and models add value where significant uncertainty exists. As such, CEIOPS provides additional guidance for Case 3.

The use of homogenous groups[7] of data in the calculation of the best estimate of the claims-outstanding provision is encouraged (which may be more granular than the segments listed in the specification). Because segmentation can result in groups that are too small to analyse in isolation, any decision that further segments the data into smaller components needs to consider the credibility (which generally increases with volume) of the resulting segment.

Techniques compatible with standard actuarial methods, such as the chain-ladder method and the Bornhuetter-Ferguson method, are to be used where practicable, and adjusted for factors that would have a material impact on the results, such as development after the observable tail, expected inflation levels materially higher than observed inflation levels, etc. Typically this will require the use of claims data on an occurrence-year (or accident-year) basis or an underwriting-year basis for the run-off triangles.

### Proxies

Proxies are generally allowed in order to assess non-life claims provisions for the best estimate, to estimate a reasonable amount of discount or risk margin, and to transform a gross provision to a net provision for the estimation of the reinsurance recoverable. Generally, best-estimate proxies can be understood to be any deviation from the company-specific observable data, including but not limited to market-development patterns, Bornhuetter-Ferguson loss ratios (whether based on external market studies or on internal independent pricing studies), average expected frequency rates or severity amounts, and ratios of CHE to losses.

### Discounting

Once best-estimate provisions have been calculated (on a nominal basis), a payment pattern can be used to separate expected future cash flows into annual incremental amounts. The payment pattern does not necessarily have to have been a parameter of the method or model used to estimate the provision, i.e., when a deterministic incurred method is used. Incremental expected cash flows are then discounted at the risk-free discount rate applicable for the relevant maturity at the valuation date. These should be derived from the risk-free interest-rate term structure at the valuation date. Where the financial market provides no data for a given maturity, the interest rate should be interpolated or extrapolated in a suitable fashion.

An advantage of using stochastic models would be the inclusion of the discounting effect on the scenario level. It is important to note that *a specific percentile* in this case refers to a percentile of the discounted amount of future payments to the policyholders under all possible scenarios. This is not the same as applying a static discount factor to a specific percentile of a modelled undiscounted distribution.

## PREMIUM

### Scope of technical provisions for premium

The Solvency II framework directive considers the best-estimate premium provision as a replacement for the current provisions for unearned premium and unexpired risks. The calculation of the best estimate of the premium provision relates to all future claims payments arising from future events that are insured under existing in-force policies, corresponding future administrative expenses, and all expected future premium.

According to CEIOPS,[8] "The premium provision is determined on a prospective basis taking into account the expected cash-in and cash-out flows and the time value of money. The expected cash flows should be determined by applying appropriate methodologies and models, and using assumptions that are deemed to be realistic for the LOB or homogeneous group of risks being valued. The cash flows should not include expected future renewals that are not included within the current insurance contracts."

7. Article 79 of the amended directive proposal.
8. QIS4 Technical Specifications (MARKT/2505/08), section TS.II.E.16.

This is a fundamental change compared to the current common accounting practice of calculating unearned premium reserves using a *pro rata temporis* method. This means that companies now need to consider what would be their ultimate combined ratio (covering claims costs, CHE, and other underwriting expenses) associated with unearned premium. It follows that where an a priori discounted combined ratio applied to unearned premium is lower than 100%, expected profits are immediately recognised, which is not the case under the current unearned premium reserve (UPR) methodology; and that an a priori discounted combined ratio greater than 100% would give rise to an unexpired risk reserve (URR), similar to the current approach except that the added URR provision would be smaller due to the effect of discounting. A simplified approach using an expected discounted combined ratio is described below.

The best estimate technical provision for premium (TP Prem) should be gross of reinsurance, and net of insurance premium tax (being a levy on the insured, and therefore not legally part of the premium). Deferred acquisition costs (DAC) are no longer recognised as an asset, but a provision for premium ceded is retained as an asset. Thus, the calculation of calendar-year (CY) earned premium (EP) for the income statement would be equal to the written premium (WP) less the increase in the premium provision less the increase in the gain on the unearned premium (UEP), as shown in the table in Figure 2.

**FIGURE 2: COMPARING IFRS PHASE 1 WITH SOLVENCY II**

| | IFRS PHASE I | | | SOLVENCY II | | |
|---|---|---|---|---|---|---|
| (1) | (2) | (3) | (4) | (5) | (6) | (7) |
| CY | WP | UEP | $EP_{OLD}$ | TP PREM | IMMEDIATE GAIN ON UEP | $EP_{NEW}$ |
| | | | [(2) + PRIOR(3) - (3)] | [95% × (3)] | [(3) - (5)] | [(2) + PRIOR(5) - (5) + PRIOR(6) - (6)] |
| 2004 | 0 | 0 | 0 | 0 | 0 | 0 |
| 2005 | 20 | 10 | 10 | 9 | 5 | 10 |
| 2006 | 30 | 15 | 25 | 14 | 8 | 25 |
| 2007 | 40 | 20 | 35 | 19 | 1 | 35 |
| 2008 | 50 | 25 | 45 | 24 | 1 | 45 |

Assume expenses are zero (WP are pure premiums).
Assume combined ratio is exactly 100%.
Assume discounted combined ratio is exactly 95%.
Assume all policies effective 1 July of the CY and business commenced 1 July 2005.

We have used several simplifications in this example. Note that the sum of the earned premium (column 7) plus the 2008 technical provision for premium (last value in column 5) plus the 2008 gain on unearned premium (last value in column 6) is equal to the sum of the written premium (column 2). Note that the amount of earned premium by year has not changed in this example (columns 4 and 7). The new approach does not affect the amount of earned premium, as every unit of written premium will be earned as before.

## Valuation methods for best estimate of premium technical provisions

Under the Solvency I valuation principles, the technical provision for premium is calculated as the sum of the unearned premium reserve and the potential unexpired risk reserve resulting from a liability adequacy test. Because the Solvency II valuation principles use a prospective approach, the provision for unearned premium (and the liability adequacy test) is no longer appropriate, as it is not consistent with best-estimate valuation principles.

As mentioned above, estimating premium reserves on a best-estimate basis is a significant shift in approach and there is no widely recognised method to achieve it. In the QIS4 technical specification, CEIOPS puts forward two simplified approaches (proxies) to calculate the best estimate for the premium provision.

### Accounting-based proxy

This proxy is intended to derive a best estimate for the premium provision, based on the unearned-premium provision and the provision for unexpired risks shown in the statutory balance sheet. For this proxy to be applicable, the premium provision is supposed to decrease at an even rate during the forthcoming 12 months.

The best estimate (BE) for the premium provision is derived as follows:

$$BE = (\text{provision for unearned premium} + \text{provision for unexpired risks})/(1+i/3)$$

where $i$ is the risk-free interest rate (for a one-year maturity) used for discounting purposes.

### Expected-loss proxy

This proxy derives a best estimate for the premium provision based on the estimate of the combined ratio for the LOB being valued. For this proxy to be applicable, the following conditions need to be met:

- The combined ratio is expected to remain stable over the run-off period of the premium provision.
- A reliable estimate of the combined ratio can be made.
- The unearned premium provision is an adequate exposure measure for estimating future claims during the unexpired risk period.

The combined ratio may be considered to be the sum of the expense ratio (ratio of expenses to written premium) and the claims ratio.

The best estimate for the premium provision is derived as follows:

$$BE = CR \times UPR + (CR - 1) \times PVFP,$$

where

BE = best estimate of premium provision
CR = estimate of combined ratio for the LOB being valued
UPR = unearned premium reserve
PVFP = present value of future premium (discounted using CEIOPS term structure of risk-free interest rates)

An alternative and more sophisticated (albeit still approximate) approach would be to use the distribution of in-force premium by day over the future 12 months, relative to the valuation date, to make adjustments to the expected payment pattern to ultimate (i.e., to get more accurate cash flows in and out) before applying the effect of discounting. This method requires good data quality as, ideally, information about effective and expiration dates for each policy are required. This method has the advantage of being more consistent with the prospective approach recommended by the framework directive. This method also allows for differentiated combined ratios for subsets of the underlying business, allowing an entity to calibrate their premium provision to granular levels of their internal analyses.

Another alternative would be to incorporate pricing techniques, such as a burning-cost model, which may help assess the expected claims amount related to premiums. It has the advantage that it better matches the risks to the mix of business within the portfolio because it often happens that the business written is slightly different to the original forecast (e.g., a different age mix of policyholders leading to a different risk profile for a private motor insurance book). Therefore, forecast combined ratios (often calculated at a high level) may not be the best indicator for assessing the premium provision. This approach requires detailed information, as each policy record would need to contain information about the different rating factors. It may therefore be very difficult to implement.

## RISK MARGINS

### Valuation methods for the risk margin

The risk margin under Solvency II is to be derived using a cost of capital (CoC) approach presently employing an annual factor of 6% above the risk-free interest rate. Under the CoC approach, the risk margin is calculated by determining the cost of providing the capital necessary to support the insurance and/or reinsurance obligations over their future lifetime. Necessary capital in this context is considered to be equal to the SCR (for non-hedgeable risks) as defined within the Solvency II framework, not the amount of available capital (eligible own funds).

To determine the risk margin, the following four steps need to be made:

1. Project the $SCR_t$ for non-hedgeable risks for all future time periods (t), i.e., until the portfolio has run off.

2. Multiply each SCR by the CoC rate (6%).

3. Discount the amounts calculated in the previous step at the risk-free rate ($r_t$).

4. Sum the discounted values.

The formula to calculate the risk margin (RM) is thus:

$$RM = \sum_t 6\% \times SCR_t \times (1 + r_t)^{-t}$$

As it may be difficult to project the SCR for all future time periods, a simplified approach can be used by applying factors to the expected future premium and outstanding claims provisions. Provisions for future calendar years will generally decrease until all claims are paid and closed. Nevertheless, relative to current provisions, the valuation of expected provisions at future dates will be larger due to the amortization of the discount (one less year in the calculation of a discount factor) and smaller due to the expected nominal incremental payments. The factors in question from CEIOPS are organized by LOB and by member state in the form of matrices.

The risk margin is designed to augment the value of technical provisions so that together they are equivalent to the amount that an insurance (or reinsurance) undertaking would be expected to require to take on and meet such obligations. Depending on the situation, the risk margin should be broadly consistent with the return on equity (ROE) underlying a pricing exercise to acquire such liabilities.

## OUTSTANDING ISSUES

Following the framework directive issued by the European Commission (EC), there are still some grey areas regarding the calculation of the technical provision for claims outstanding and for premium.[9]

For claims, the following short and not exhaustive list of items requires clarification:

- Some companies include paid CHE or a portion thereof (e.g., defense costs only) in their loss triangles in order to estimate unpaid CHE. The soundness of the approach is dependent on the completeness of the CHE information and the applicability of triangular methodologies to the CHE historical data. Practice varies widely across Europe.

- It is assumed that any fair-value estimate would be net of both accrued and anticipated recoveries (e.g., salvage and subrogation, deductible and franchise), but actual practice varies widely. Including accrued and received recoveries in triangles can cause distortions in otherwise stable observable development patterns, especially if the level of such recoveries changes over time. Further, accrued but not received and/or anticipated recoveries, if estimated, might fit better on the asset side along with the reinsurance recoveries rather than hidden as an offset to the technical-provision liability.

- Alternative risk transfer (ART) and finite-risk programs are generally handled on an individual basis, because they can be very complex (including multiple years of coverage, loss-sensitive premium features, dependence on accounting regime, etc.) Often the valuation of technical provisions is discussed at length with regulators as well as the auditor before agreement is reached on an appropriate way forward, although all parties are basing their arguments on the same principles. Simply distinguishing between the categorization of a provision as a premium provision, as opposed to a loss provision, is difficult under a rules-based regime, and we expect, given the absence

9. Articles 74-84 of the amended directive proposal.

of specific guidance, at least as much difficulty with a principles-based regime.

- Although potentially material, the benefit of diversification in aggregating technical provisions for multiline insurance companies has been ignored. Under the assumption that the best estimate for each segment is the mean of a distribution of reasonable outcomes, diversification (and correlation) can be ignored, as they are additive. The use of a method as opposed to a model, inclusion of judgment, a proxy, or a selected tail factor would imply that the resulting best estimate is not necessarily a mean and therefore a diversification effect is present and worth accounting for.

- Though tools have been provided to help insurance companies estimate technical provisions (e.g., the German Insurance Association [GDV] spreadsheet[10]), it is important to stress test both undiscounted and discounted best estimates by segment and in total using a distribution-free stochastic model (such as Milliman's Reserve Variability Model, which is based on the bootstrap technique). Although the GDV tool is helpful, overreliance on tools that are not fully understood is a recipe for disaster. The assumption of a distribution in the GDV tool or in the Mack method generally is a significant assumption, the appropriateness of which should be tested thoroughly.

For premium, the following short and not exhaustive list of items requires clarification:

- Many policyholders choose to pay their insurance premium through instalments. As a result, the insurance companies typically charge instalment fees. As these fees are not directly related to any insurance risk but are borne by the policyholders, companies may chose to exclude instalment fees from their calculations of the best estimate of premium reserve.

- It may occur during the life on an insurance contract that the item insured changes (e.g., the policyholder changes the type of vehicle insured) or ceases to exist (e.g., the policyholder sells and does not replace the vehicle insured), otherwise known as policy cancelations or mid-term adjustments. This leads to a change in the risk exposure of the insurance company and will therefore affect the calculation of the best estimate of the premium reserve. Making no assumption regarding policy cancelations or mid-term adjustments could lead to an over- or underestimate of the premium reserve. Whether such an approach is cautious or not will depend upon the circumstances. However, clear guidance regarding this particular matter would be welcomed.

10. The CEIOPS QIS4 Web site includes a spreadsheet created by the German Insurance Association that calculates a discounted unpaid loss estimate and percentiles, including a generalized curve-fitting technique for long-tail business and an uncertainty estimation based on the Mack method.



If you would like to discuss any of the issues examined in our *non-life technical provisions* paper, please speak with your usual Milliman consultant at one of our European offices listed here. Alternatively, please contact the authors directly.

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