MILLIMAN REPORT

Setting discount rates under IFRS 17: Getting the job done

Paper 2: Setting the approach

February 2021

Pierre-Edouard Arrouy, FFIA
Charles Boddele, FFIA
Grzegorz Darkiewicz, PhD, FRM
Russell Ward, FIA
Freek Zandbergen
Sihong Zhu, FIA

Milliman

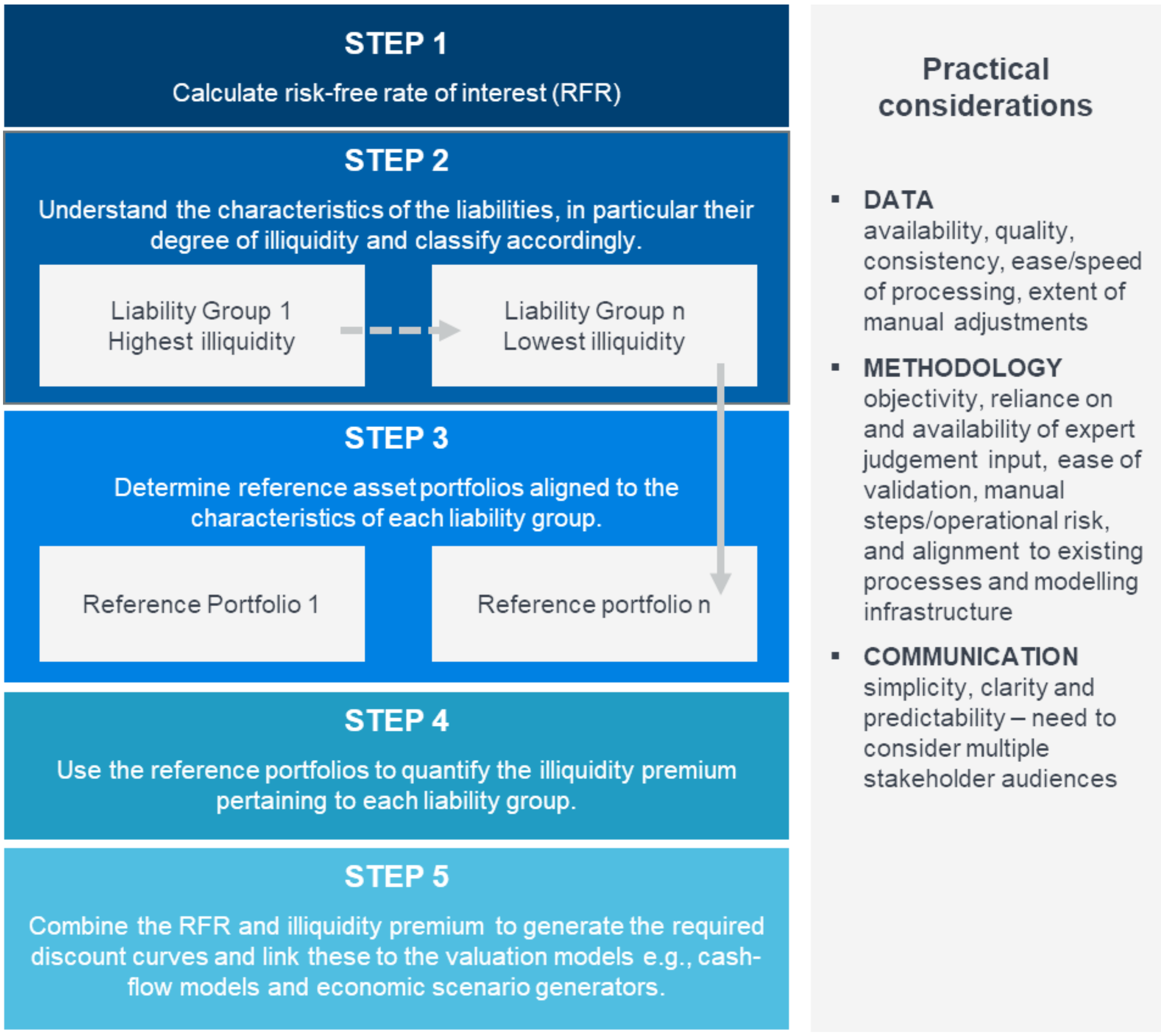
Table of Contents

Introduction

In the first paper of this series[1] we set out the overall process to derive discount rates for insurance liabilities under IFRS 17. This section provides a brief recap before we delve into the detail of each step in the subsequent parts of the paper.

A number of steps are required to set the discount rate for any particular block of business. Under IFRS 17 one of two approaches can be taken, the so-called "top-down" and "bottom-up" methods.[2] Our view is that, whilst the selected method may influence the order and content of some of the steps, the steps themselves are relevant to both approaches. As an illustration, Figure 1 provides an overview of the steps required. The order represents where a bottom-up approach is adopted.

FIGURE 1: HIGH-LEVEL PROCESS FOR SETTING IFRS DISCOUNT RATES



The remainder of this paper now addresses the technical areas firms will need to consider in arriving at their preferred approach. Taking each step in turn, the sections below consider steps 1 through 4 as described in Figure 1.

Practical considerations around implementation will be touched on in places but the primary discussion of those aspects will be covered in the final paper of our series.

[1] https://uk.milliman.com/en-gb/insight/Setting-discount-rates-under-IFRS-17-Getting-the-job-done

[2] IFRS 17 refers to two main approaches for computing the discounting yield curve. The bottom-up (resp. top-down) approach starts from the risk-free curve (resp. the reference portfolio yield curve) and adds (resp. subtracts) layers in order to reach an appropriate discounting yield curve. For further discussions see https://www.milliman.com/en/insight/ifrs-17-discount-rates.

Step 1 – Determining the risk-free interest rate curve

INTRODUCTION

IFRS 17 allows for two possible approaches to the derivation of discount rates for the valuation of re/insurance liabilities. The determination of an appropriate risk-free interest rate curve is particularly relevant to the bottom-up approach, which builds up the discount rate as the risk-free rate plus an illiquidity premium on top. For the top-down approach, the development of a risk-free interest rate curve is a less fundamental element of the process. Nevertheless, we still expect it to play a role. For example, it is necessary when we need to separate the total spread of a financial instrument into its components in order to derive the credit risk component required to be deducted from the gross yield curve, or in validating an illiquidity premium component derived by a more direct method.

The requirement and associated methodology to develop risk-free rates for use in discounting long-term insurance liability cash flows is already well-established, in particular under the European Solvency II (SII) framework introduced in January 2016. Taking a pragmatic perspective, we see little value in reinventing the wheel but rather consider the extent to which we might reasonably borrow from an already established regime permitting us to leverage existing data, processes, and documentation. In what follows, we take as a starting point the SII approach and then consider where we might need to adjust, and how. For illustration purposes, we took instruments dominated in Sterling or EURO as examples, however, a similar concept or framework can also be applied to instruments dominated in other currencies.

Solvency II risk-free rates

For each month, the European Insurance and Occupational Pensions Authority (EIOPA) produce the SII risk-free rates (RFR), a smoothed curve, dominated in a range of currencies.[3] Market consistent valuation is the fundamental principle under SII, which requires insurers to use risk-free rates for discounting future liability cash flows. This sounds promising but we need to consider two areas carefully:

1. How closely aligned are the requirements and priorities of SII to those of IFRS 17?
2. How consistent is the actual SII practice with what we need for IFRS 17?

A conundrum that occurs in a number of areas when deriving the RFR is that there can often be a tension between the objective of maintaining consistency with observable data from financial markets and with the desire to see stability in reported results. Under the SII regime, stability carries significant weight and has resulted in some material departures from market consistency. Thus, an important question to consider is whether to weight the objectives differently for IFRS 17. Paragraph 36(b) of the IFRS 17 Standard provides a clear direction to developing discount rates consistent with market data:

"(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;"

The stability point remains relevant though as excessive short-term volatility in results may obfuscate an understanding of the true picture of a firm's financial position and performance. Nevertheless, in the round, there will be a heavier lean towards market consistency for IFRS 17 though there is no simple answer and firms must exercise judgement.

We consider the determination of the RFR in the following broad segments, and discus each in order:

- Market segment – rates are underpinned by observable market data
- Ultimate segment – a very long-term expected rate supporting the extension of the curve beyond durations for which suitable market data is available
- Transition segment – bridges the gap between the Market and Ultimate segments

[3] Fifty-three currencies as at end of June 2020.

MARKET DATA SEGMENT

Selecting the instruments from which to derive rates

As noted already, paragraph 36(b) of the IFRS 17 Standard requires a market consistent discount rate to be used for discounting future re/insurance liability cash flows.

Although paragraph 36(b) refers to the whole discount rate, what this implicitly means for the setting of the RFR is that the RFR is:

- Either directly obtained from the market price of a financial instrument considered risk-free, or
- Derived using information that can be directly observed from the financial markets

The RFR is essentially a theoretical rate, as an investment completely free from credit risk does not exist in practice. Nevertheless, certain financial instruments can be a useful proxy because there is virtually no credit risk perceived by the market. The prime candidates are highly rated government bonds or interest rate swaps with the choice influenced by a range of factors, such as:

- Data availability for different terms
- The level of depth, liquidity, and transparency (DLT) of the market for the instrument in question
- The extent of adjustment needed to remove residual risk(s), if any

For example, investors in the UK generally consider UK government bonds (gilts) issued domestically as risk-free investments. This is because in an extreme scenario, as a sovereign currency issuer, the UK government can print the money required to ensure coupon and redemption obligations continue to be met in nominal terms. Further, investors consider the UK gilt market to be deep, liquid, and transparent, and hence an insurance company with liabilities in the UK may select the UK's gilt yield as the reference for the RFR, without any adjustment for credit risk, albeit that there might be a small element of illiquidity incorporated.

However, if the same insurance company also has some liabilities in Brazil, the UK's gilt yield may not be an appropriate direct reference as the RFR for these liabilities, as an adjustment needs to be made to the gilt yield to remove currency risk.

An alternative to choosing government bonds is to use interest rate swaps. Here, only the difference in the interest calculated using the fixed rate versus the floating rate defined in the interest rate swap contract changes hands (not the notional principle amount). This much-reduced counterparty exposure results in the credit risk embedded in an interest rate swap contract being considered to be low, particularly when a collateral arrangement is defined within the contract.

Currently, there are two types of swap rates generally quoted in the market:

- Interbank offered rate (IBOR) – this represents the expected cost of unsecured borrowing between banks. As it is unsecured borrowing, it incorporates unsecured bank credit risk. So to derive the RFR using IBOR, an adjustment needs to be made to remove credit risk.
- Overnight indexed swap (OIS) rate – this represents the central bank rate used for secured borrowing between banks. This is generally considered risk free by the market, with no need for further adjustment.

The table below, as an example, compares the main characteristics of UK gilt yields, Sterling London IBOR (LIBOR) and Sterling Overnight Index Average (SONIA) rates in terms of referencing them for the RFR in the UK market. It is worth noting that as part of the ongoing IBOR transition to SONIA rates, the future of Sterling LIBOR is in doubt[4] making it a less desirable candidate for UK insurers going forward despite having a relatively long back history. Insurers in other markets are experiencing a similar transition from LIBOR, for example, US Dollar LIBOR is to be superseded by Secured Overnight Financing Rate (SOFR); where in Europe, Euro LIBOR is to be superseded by Euro Short-term Rate (ESTR).

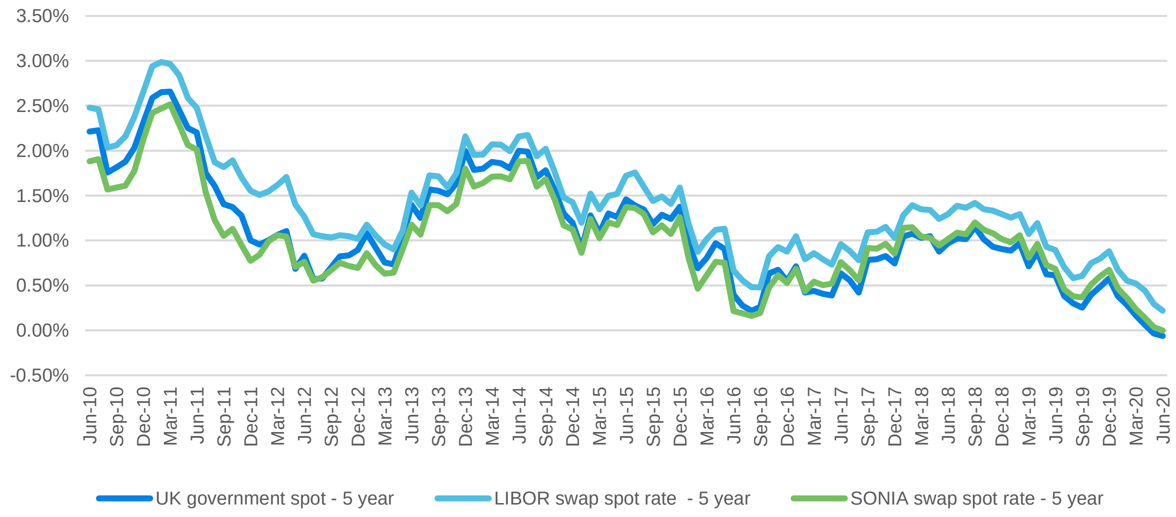
[4] Bank of England: https://www.bankofengland.co.uk/markets/transition-to-sterling-risk-free-rates-from-libor.

FIGURE 2: A HIGH-LEVEL COMPARISON OF MAIN CHARACTERISTICS OF POSSIBLE REFERENCE RATE IN THE UK

MAIN CHARACTERISTIC	UK GOVERNMENT BOND YIELD	STERLING LIBOR	SONIA
Data availability	- History back to 1970 - Tenors available 6M–40Y from Bank of England	- History back to 1990 with significant gap - Tenors available 6M–-40Y from Bank of England	- History back to 2009 - Tenors available 1M–5Y from Bank of England
Depth, liquidity, and transparency	Considered deep, liquid, and transparent for majority of maturities	Considered deep, liquid, and transparent for maturities up to 50 years	Considered less deep, liquid, and transparent at the moment relative to its peers; but market may develop fast in coming years
Need for risk adjustment	None	Yes	None

The chart below shows the yield of UK government bonds, LIBOR, and SONIA for the duration of five years in the past 10 years. It can be observed that the government bond yield and SONIA rates have tracked each other reasonably closely during the period; whereas LIBOR can sometimes diverge markedly from these two reference rates, due to the involvement of the credit risk component.

FIGURE 3: UK GOVERNMENT BOND YIELD, LIBOR SWAP RATES, AND OIS RATES FOR THE PAST 10 YEARS



Looking around the world, there are a number of markets where the solvency regime requires a market consistent valuation of insurance liabilities (and assets). We note the approaches taken are consistent in referencing government bonds and/or swaps.

FIGURE 4: A SELECTED NUMBER OF CAPITAL REGIMES USING MARKET CONSISTENT VALUATION[5]

INSURANCE CAPITAL REGIME	BASE FOR INITIAL YIELD
Bermuda SCR	Swap rate
Hong Kong RBC (QIS 2)	Swap yield
Insurance Capital Standard (ICS) FT 2018	Swap rate or government bond yield
Singapore RBC 2	Government bond yield
Solvency II	Swap rate or government bond yield

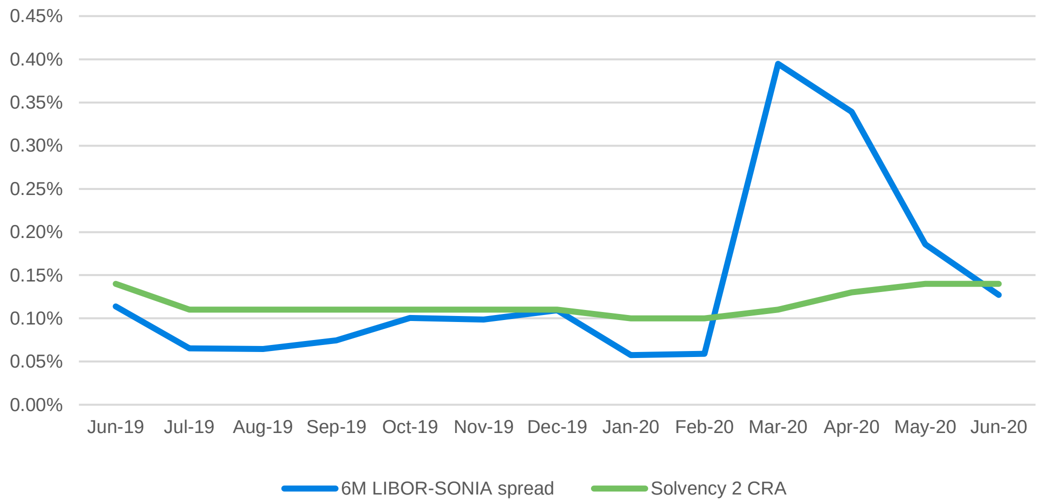
In summary, for IFRS 17, we see little to drive a departure from the established approach of using swap or government bond rates for the RFR. However, depending on the nature of the instrument some adjustment for credit risk or illiquidity, if deemed material, may still be required.

[5] Milliman Research: Life insurance capital regimes in Asia.

Assessing the adjustment for credit risk

The existing construction of the SII RFR is based on IBOR as the preferred approach. As discussed earlier, this means an adjustment should be made in order to remove the credit risk embedded. This adjustment is called the Credit Risk Adjustment (CRA) under SII. Calculation of the CRA is relatively straightforward, referencing the selected IBOR and OIS rates that meet DLT criteria. However, the spread between IBOR and OIS can be volatile as Figure 5 illustrates.

FIGURE 5: UK GBP SWAP CREDIT RISK VERSUS SII CRA DURING COVID-19



SII mitigates volatility in the IBOR-OIS spread through two mechanisms:

1. The spread is not referenced at a single date but based on a simple average of daily data over the preceding 12 months.
2. A corridor is applied such that the CRA has a minimum value of 10 basis points and a maximum value of 35 basis points.

From an IFRS 17 perspective, it feels to us that insurers may be able to justify retaining some level of averaging in order to manage the tension between strict market consistency and potentially spurious volatility in results; the extent of this will inevitably be an area of expert judgement. However, the SII corridor is a feature that some insurers may choose not to carry into their IFRS 17 approach. Thus, some insurers may elect to make adjustments with the SII CRA being replaced with a more market consistent assessment made by the insurer. To that end, we note that where the SII RFR is based on swaps the CRA is applied to the par swap rates before the zero coupon rates are derived. This means the SII CRA cannot simply be added back to the EIOPA curve and the firm's assessment applied, but rather a recalculation from the underlying swap rates is to be preferred, though in practice the additional accuracy may not be material.

As part of the transitioning to alternative reference rates. EIOPA has been consulting in its Discussion Paper[6] issued in February 2020 for moving away from IBOR in the SII RFR production. The consultation highlighted that the CRA would no longer be needed if the RFR becomes based on OIS rates, rather than IBOR. However, there remains a question mark around how quickly the market in OIS swaps will develop to the point that SII DLT requirements are met in all the key terms. In reality, the CRA may take some time to phase out completely.

[6] EIOPA: Discussion Paper on IBOR transitions.

Curve smoothing

Many actuarial valuation models evaluate cash flows in monthly time-steps. Such a model will require an RFR curve with rates specified at these monthly points. However, even in markets with very rich selections of instruments there will not be a market observable rate aligning neatly to every monthly duration point. Thus, an approach is needed to take a set of rates derived from market data and interpolate them to develop the monthly rates needed for the model.

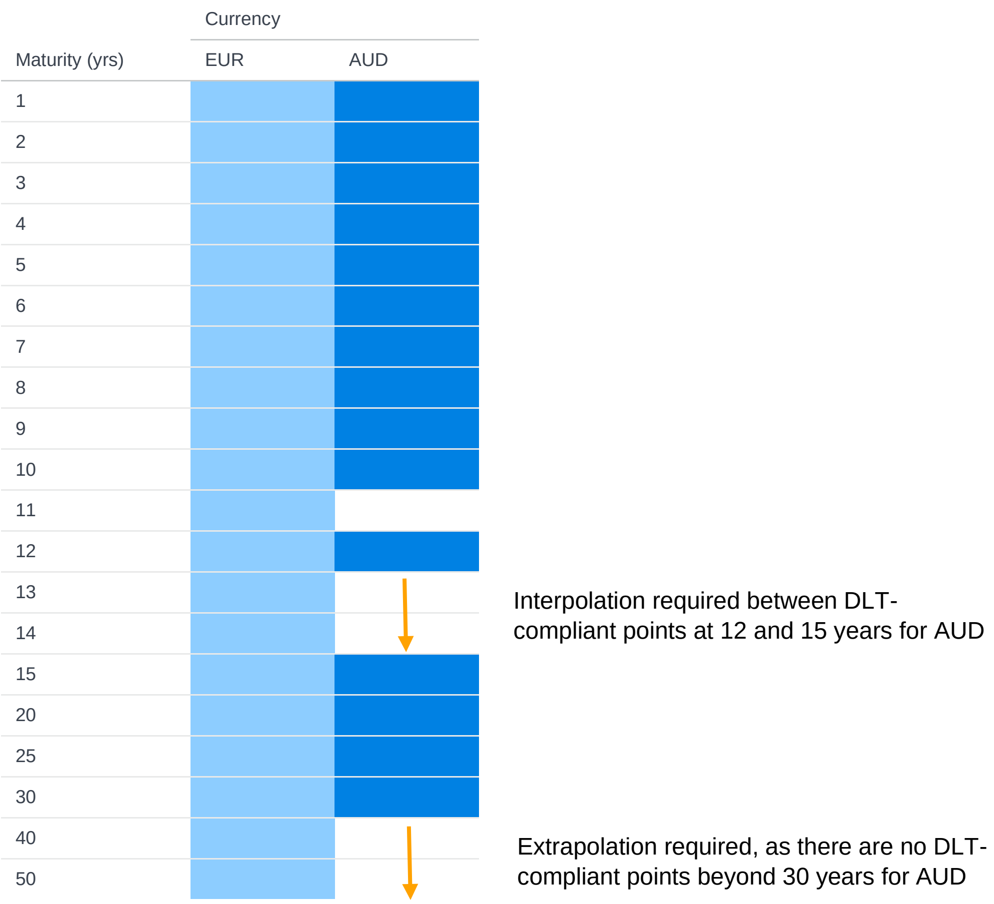
Under SII, EIOPA already produce a smoothed RFR curve comprising annual term points. The adopted approach uses the Smith-Wilson method to develop a smooth curve that passes through the rates derived from market observable data—that is, those term points at which the underlying market instruments meet the DLT criteria.

We have some way to go yet on our journey to a final RFR curve but already we have noted that IFRS 17 is likely to result in some departure from SII. Therefore, insurers are likely to have to apply a smoothing approach in constructing their own RFR curve for the IFRS 17 use case. The Smith-Wilson method (adopted by SII) and the Cubic Spline method are widely used by market practitioners. Details of these techniques and others are available via many public references—one example is this book published by the International Actuarial Association.

DLT assessment of market data and its implications

The deep, liquid and transparent ("DLT assessment of market data affects two important aspects of the derivation of the RFR curve; illustrated by Figure 6:

FIGURE 6: DATA EXTRACTED FROM EIOPA 2017 SWAP DLT ASSESSMENT[7]



In Figure 6:

- Light blue shading denotes terms for which swaps denominated in euro meet EIOPA's DLT criteria.
- Dark blue shading denotes terms for which swaps denominated in Australian dollars meet EIOPA's DLT criteria.
- Terms between 1 and 50 not listed failed to meet the DLT criteria for either currency.

[7] EIOPA: Opinion on the Solvency II 2020 review, page 31.

Performing a DLT assessment can be a non-trivial task in particular where we must consider multiple instrument types and / or currencies.[8] EIOPA has undertaken such an assessment periodically for SII with the last based on data from 2017. Clearly, it will make sense for insurers to leverage this existing work where possible. However, we note there is no commitment from EIOPA to undertake and publish further DLT assessments at any particular frequency. Thus, it remains something of an open question as to whether insurers will always be able to lean on the EIOPA assessment or have to develop the capability to perform a DLT assessment of their own (or find another external source).

Once undertaken, the DLT assessment reveals a number of gaps—term points at which the market data fails to meet the DLT criteria. The first application of the "curve smoothing" described in the previous section will be to bridge gaps between adjacent DLT compliant points such as that between the 12- and 15-year terms in the case of the Australian dollar in Figure 6. Such smoothing will introduce departures from the market data but the deviations should be minor.

The greater challenge relates to the following:

- Setting the last liquid point (LLP) – the longest maturity of the financial instruments being used (government bonds / swaps) for which a DLT compliant price is available.
- If cash flows on the insurance liabilities extend beyond the assessed LLP, determining how to extrapolate the RFR curve to provide the necessary discount rates.

Once again, we can look across to SII where EIOPA determine the LLP taking into account three factors:

1. The DLT assessment
2. The so-called "matching criterion" – the ability to match insurance liability cash flows up to the LLP with bond cash flows[9]
3. The so-called "residual volume criterion" – this applies only to the euro and requires the market for bonds denominated in euro should not be regarded as deep and liquid where the cumulative volume of bonds with maturities larger than or equal to the last maturity is less than six percent of the volume of all bonds in that market.[10]

The result is that the LLP under SII can be set at a point well before the longest term indicated by the DLT assessment alone—for example, the current LLP for the euro is 20 years where the DLT assessment indicates 50 years might be used. This difference can be very material as it determines how significant a role the extrapolated part of the RFR curve plays in the valuation of the insurance liabilities. Not surprisingly, the setting of the LLP and approach to extrapolating the RFR curve under SII remain areas of significant debate and potential change as part of the SII 2020 review.

Returning to IFRS 17, we note that there are no specific requirements relating to how insurers should determine any cut-off in the market data they use to develop discount rates. Notwithstanding, it is reasonable to want to anchor our RFR curve to market data we deem reliable. This may indicate the retention of a pure DLT assessment though insurers may also be able to justify the retention of the other two criteria currently adopted under SII.[11]

Streamlining the process to focus on the DLT assessment may offer an opportunity to extend the LLP thereby improving the market consistency of the RFR curve. The implications of this are illustrated in Figure 7.

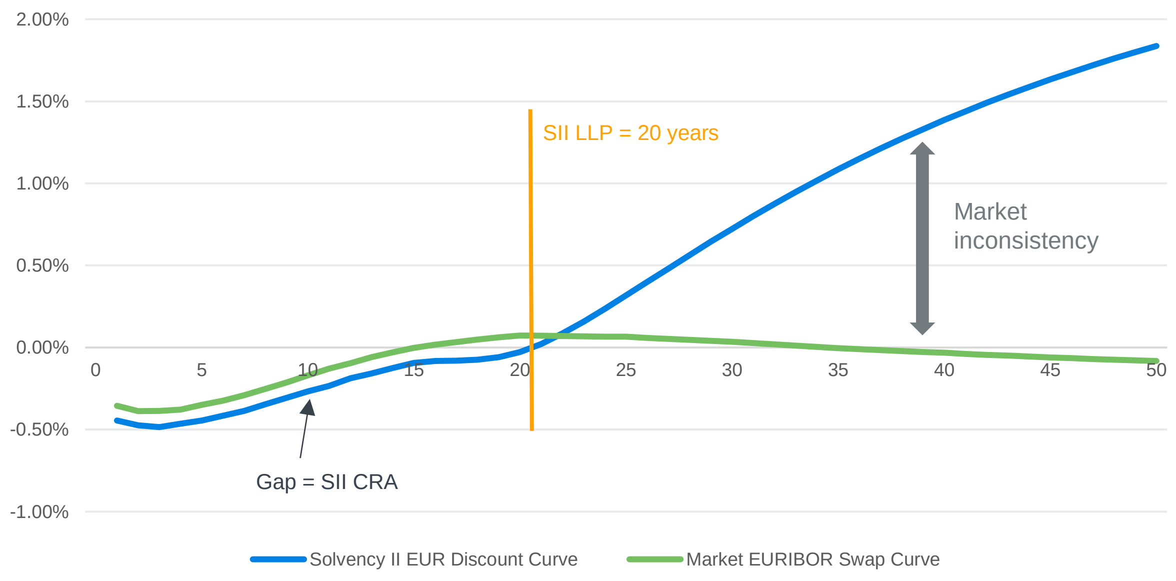
[8] Considerable detail of the EIOPA approach is provided in the document referenced in footnote 4.

[9] See Recital 30 of the Omnibus II Directive.

[10] See Recital 21 of the Solvency II Delegated Regulation.

[11] It should be noted that a number of the options for change in the construction of the RFR curve proposed by EIOPA in the SII 2020 review involved stepping away from these two criteria.

FIGURE 7: COMPARISON OF THE EURIBOR SWAP CURVE AND EIOPA SII DISCOUNT CURVE[12]



The RFR curve at 30 June 2020 for the euro under SII diverged very significantly from the market EURIBOR curve for terms after 20 years. The market inconsistency arises from the choice of LLP and the approach taken to extrapolating the curve beyond it. For IFRS 17, in the case of the euro, if we were to adopt an LLP based solely on the DLT assessment then the market inconsistency is removed out to 50 years and it seems unlikely that we will have material insurance liability cash flows beyond that horizon, thereby making the issue of extrapolation inconsequential. Unfortunately, not all markets deliver an LLP at 50 years—we saw earlier that the EIOPA DLT assessment for the Australian dollar indicates a shorter horizon of 30 years. Hence, we cannot entirely escape the need to extrapolate.

ULTIMATE SEGMENT

The challenge we now address is how we develop rates to discount liability cash flows beyond the LLP. This brings us to the rather thorny problem of how to set an ultimate target rate to anchor the very long end of the risk-free curve. For those seeking to take a very market consistent approach, extrapolating the last forward rate from the DLT compliant part of the curve is an option. Alternatively, it may be helpful to look across to SII where the approach taken by EIOPA is:

- Develop an Ultimate Forward Rate (UFR) as the sum of:
  - A single long-term expected real interest rate (i.e., interest rate in excess of inflation) which applies to all countries, and
  - A country-specific measure of inflation which is generally taken as the relevant Central Bank target rate, if available
- The calculation is updated annually to deliver an updated target UFR, though movements from the current UFR to the new target rate are constrained.[13]

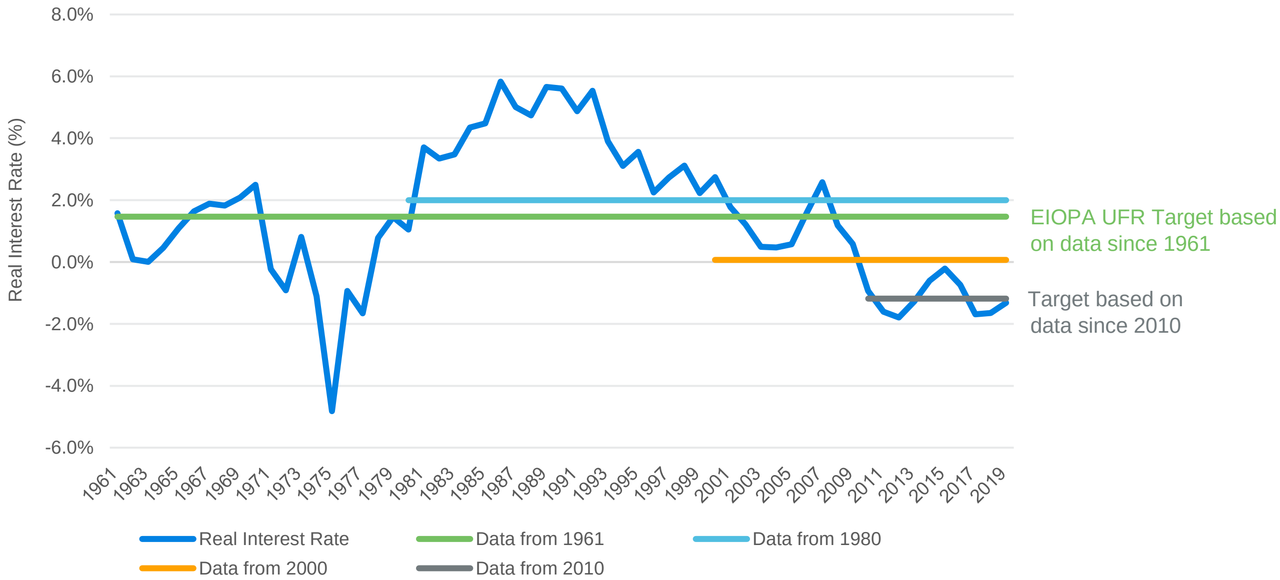
The SII methodology provides a stable anchor point for the longest end of the risk-free curve but, as we observed in Figure 7, can result in rates that depart markedly from observable market data.

[12] Milliman analysis using data from Bloomberg and EIOPA.

[13] The UFR at the implementation of SII in 2016 was 4.2%. The latest review for 2020 calculates a target rate of 3.5% with the constraints on change, i.e., 15 bps per year, resulting in an adopted rate of 3.6% from 01/01/2021 (see "17.07.2020 - Report on the-calculation of UFR for 2021.pdf - EN.pdf").

Expected real interest rate

FIGURE 8: IMPACT OF HISTORICAL DATA PERIOD ON EXPECTED REAL INTEREST RATE[14]



EIOPA generates the expected real interest rate via a simple averaging of real rate data over a very long time window (1961 to present). This approach has the advantage of providing stability to the result and could be seen as consistent with the concept of a UFR that refers to an *ultimate* view. Conversely, the approach is slow to react to changes in the market thereby offering scope for significant divergence between the calculated UFR and that implied by market data at a particular point in time. The analysis in Figure 8 illustrates this as we note that, since the mid-1980s, real rates have generally been in decline and indeed, they have been negative for the last 10 years. The EIOPA approach recognises this, but only very slowly, producing a UFR of 3.5% before constraints are applied. The length of data window to adopt will be an area of expert judgement and will depend on factors such as:

- The materiality of the extrapolated part of the RFR curve in relation to the insurance liability cash flows
- The importance placed on the stability of the RFR curve at very long terms
- Belief in mean reversion and long repeating economic cycles
- Desire to recognise potential regime shifts sooner rather than later

Figure 8 shows the impact of different choices of data window with results ranging from 2.0% (based on data from 1980) to -1.2% (based on data from 2010).

A further aspect to note is that EIOPA also average the real rate data across several countries (Belgium, Germany, France, Italy, the Netherlands, the United Kingdom, and the United States) and applies the same expected real rate across all currencies. Under IFRS 17, the requirement is to develop discount rates that align with the characteristics of the insurance liabilities—one of these being the currency in which they are denominated. With that in mind it is debatable if an approach that mixes data across currencies is compliant.

[14] Milliman analysis using EIOPA data taken from "17.07.2020 - Report on the-calculation of UFR for 2021.pdf - EN.pdf."

Expected inflation rate

Considering the Eurozone, the European Central Bank (ECB) has been pursuing a policy of inflation targeting since 1999. Since May 2003, the target has been a rate of consumer price inflation of "*below, but close to, 2% over the medium term.*[15] So how has the ECB performed against that goal?

FIGURE 9: EUROZONE REALISED INFLATION EXPERIENCE VS ECB TARGET

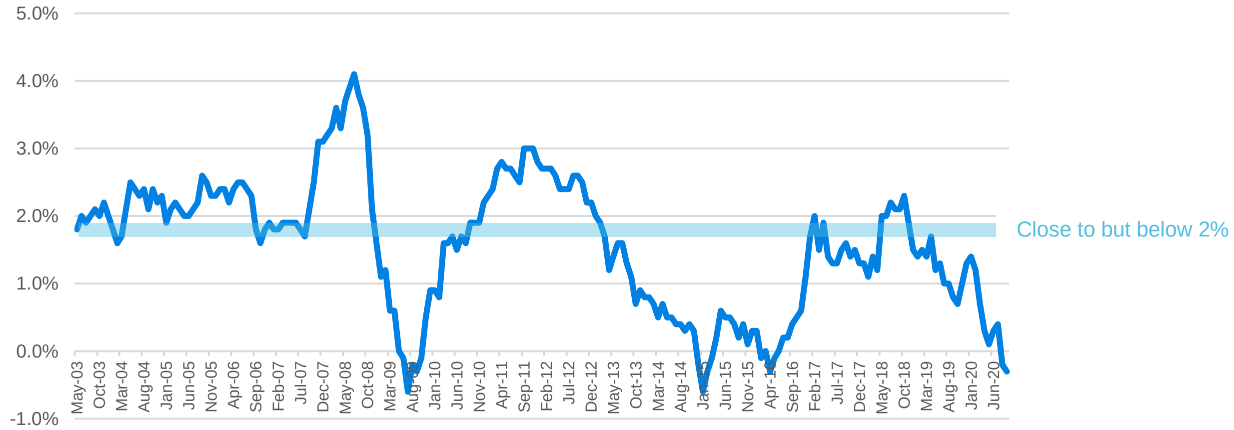
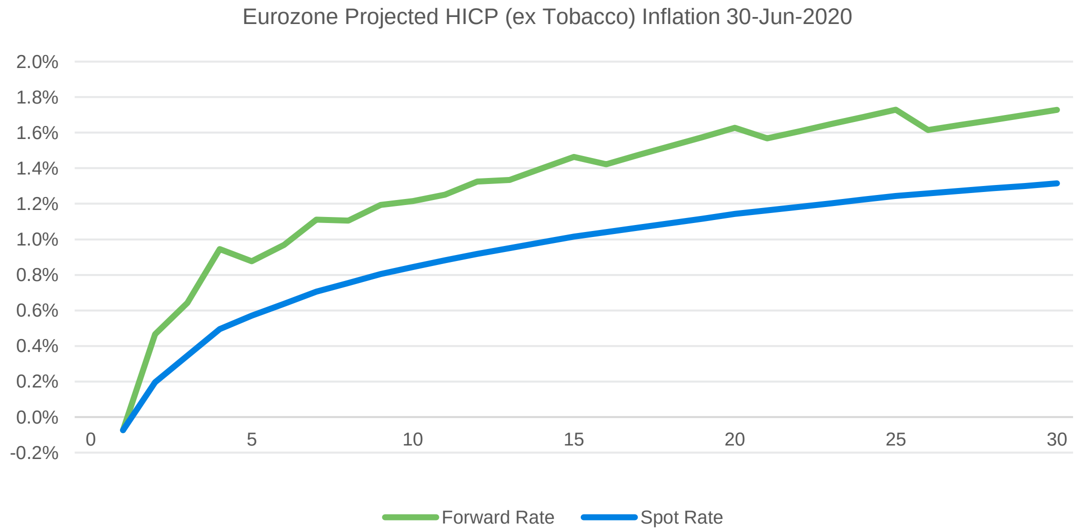


Figure 9 shows the annual rates of change in the Eurozone Harmonized Index of Consumer Prices (HICP – All Items).[16] Things got off to a good start but from 2008, departures have become significant with a persistent tendency for inflation to undershoot the ECB target—despite strenuous efforts to push inflation up. Average realised inflation over the period since May 2003 has been 1.6%.

FIGURE 10: EUROZONE MARKET IMPLIED INFLATION[17]



Turning to the market's view of future inflation, Figure 10 indicates expectations of annual inflation rates in the long-term of around 1.4%.[18]

Our conclusion is that setting the UFR is a non-trivial task and even from the limited analysis permitted within this paper rates ranging from 4.0% (2.0% real rate + 2.0% ECB inflation target) to just 0.2% (-1.2% real rate + 1.4% market view of future inflation) can be deduced.

[15] ECB Monetary Policy (europa.eu).

[16] Milliman analysis using data from EuroStat - https://appsso.eurostat.ec.europa.eu/nui/setupDownloads.do.

[17] Milliman analysis using data from Bloomberg.

[18] Around 1.3% p.a. based on the "ex-tobacco" index + a spread of c0.1% vs the "all items" index.

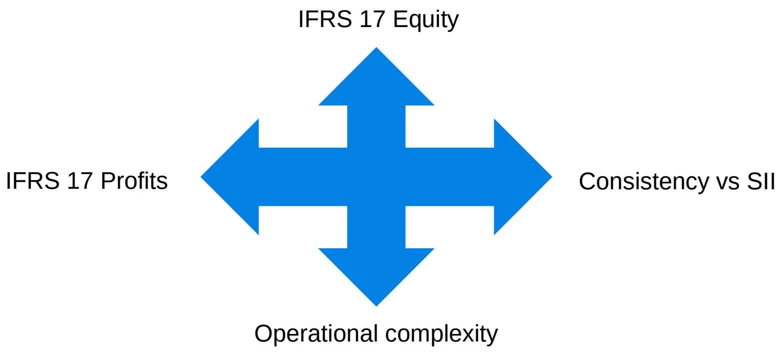
Implications of setting the UFR too high / low

In the context of the current economic outlook, approaches that lean on long-term historical data to develop the UFR will tend to produce higher values than implied by current market rates.

Use of a relatively high UFR, based on long-term historical data, places a lower value on long-term insurance liabilities and can provide immediate balance sheet relief. However, this approach places significant reliance on a mean reversion mechanism for interest rates whereby they will rise back to historical average levels in the future. For a peacetime period, public debt burdens were already high coming into 2020, and the fiscal measures taken to mitigate the health and economic impacts of the COVID-19 pandemic have increased them further. Consequently, there is now a very big question mark over the appetite, or indeed feasibility, of raising nominal interest rates in the foreseeable future in light of the clear consequences for debt sustainability.

Should nominal interest rates remain very low for a very long time then use of an elevated UFR will place a strain on future earnings, as the value of liabilities will increase at a higher rate than can be earned on risk-free assets. This problem arises under both SII and IFRS 17. However, under SII it is not so readily apparent—it will show up in the analysis of change of Own Funds but is not a key metric. Under IFRS 17, setting a high UFR will increase up-front IFRS 17 equity at adoption of the new Standard but will produce a drag on ongoing profitability each year thereafter.

FIGURE 11: FACTORS TO BALANCE IN SETTING THE UFR



Other factors to consider (see Figure 11) include consistency with SII and operational complexity. Regarding the former, departures from the SII approach feel to us inevitable but should be readily explainable in the context of a principle-based approach under IFRS 17 versus the result prescribed by EIOPA under SII. Given that for SII insurers can rely on an RFR delivered by EIOPA, then IFRS 17 will see an increase in operational complexity, as there is no equivalent blanket provision. Nevertheless, as noted above, there are areas where it may make sense for insurers to lean on data and analysis already provided for SII to limit the incremental effort.

TRANSITION SEGMENT

Following the determination of the LLP and UFR, a mechanism needs to be set up to extrapolate rates from the LLP towards the UFR in order to fill the gap.

The importance of the extrapolated part of the term structure beyond the LLP will inevitably vary between insurers depending on, for example:

- The current economic outlook – will influence the level of divergence between the nominal interest rate observed at the LLP and the UFR
- The nature of the insurer’s liabilities and in particular the extent to which cash flows extend beyond the LLP
- The sensitivity of the insurer’s valuation of liabilities to possible alternative extrapolation approaches

The extrapolation mechanism requires a mixture of both quantitative and qualitative inputs as illustrated in Figure 12.

FIGURE 12: PARAMETERS FOR THE RFR CURVE EXTRAPOLATION

Input	Description	Impact
Transition period	After how many years beyond the LLP do we require the extrapolated rates to converge to the UFR?	A shorter period increases the influence of the UFR.
Speed of convergence	This might be broadly linear but could equally be front- or back-end loaded.	A faster convergence profile increases the influence of the UFR.
Mathematical extrapolation formula	This is used to calculate the nominal rate at each time point in the extrapolation, and to smooth the resulting curve.	Model choice influences the relative weight placed on the market data around the LLP, any available market data after the LLP, and the UFR.

Regarding the mathematical extrapolation formula, SII adopts the Smith-Wilson method. The results from this approach are influenced significantly by the observed forward rate at the LLP and no reference is made to any market data beyond the LLP—these facets have been widely criticised. As a result, as part of the ongoing SII 2020 Review, EIOPA has proposed an alternative approach. This extrapolated rate uses a weighting scheme to combine market data beyond the LLP and the UFR by reducing the weights on the former and increasing the rates on the latter as we move through the transition period.[19] Our view is that such an approach is helpful in providing flexibility to recognise, at least partially, market data beyond the LLP.

SUMMARY

In our view, there are clear benefits to borrowing from an already established insurance regime where a market-consistent valuation approach is central, and a methodology for deriving the RFR is well established. EIOPA's approach under SII is an example, however, an equivalent approach adopted by other markets can be useful too.

It is also clear to us that insurers who would envisage a "direct-drop" of the existing work will have to document and justify that this approach is fully compliant with the IFRS 17 Standard. We expect that the exact methodology, approach, assumptions, and rationales used in deriving the RFR curve will vary between insurers initially, particularly across geographies. However, following an initial transition period, a consensus seems likely to emerge within each market.

[19] This Milliman paper discusses the existing SII approach and its alternative extrapolation methods.

Before moving to the next step of setting the discount rates for IFRS 17, we have summarised in Figure 13 some key considerations at each major step in determining the RFR curve.

FIGURE 13: A SUMMARY OF KEY STEPS IN THE DETERMINATION OF THE RFR CURVE

Segment	Step	Key consideration
Market segment	Instrument selection	- Practically speaking, choose between (highly rated) government bond yields and interest swap rates. - Some instruments have material credit risk element incorporated, e.g., IBOR, that require adjustment (see next step). - Some existing capital regimes around the world already provide a version of the RFR offering a good starting point.
	Credit risk adjustment	- CRA is required, where applicable, and is partially driven by the decision made regarding instrument selection. - Any existing CRA should be tested against the IFRS 17 Standard for compatibility. - A balance between being market consistent and offering stability to some extent may be needed requiring judgement from the insurer.
	Curve smoothing	- The Smith-Wilson method adopted by SII provides the benefit of a consistent approach used for both interpolation and extrapolation (see below). - However, a wide range of equally justifiable techniques are available in the public domain for insurers to choose from. - There are pros and cons for each method, and the decision must be made given an insurer's individual circumstances.
	Setting the LLP	- EIOPA has developed an approach to assessing DLT. However there has been no commitment to publishing the results on a regular basis. - For certain currencies (e.g., the euro), considerations beyond market-based DLT criteria are involved in setting the LLP. - For these currencies, insurers looking to leverage SII will need to ensure they are comfortable that the approach is fully compatible with the requirements of IFRS 17.
Ultimate segment	Setting the UFR	- This is typically considered as a rate combining an expected real interest rate and a forward-looking inflation rate. - SII uses a historical averaging of real interest rates for this calculation, an approach the insurer could borrow from, but possibly adjust to remove the impact of different currencies and employ an internal choice of the averaging period. - A forward-looking inflation rate could be set according to the government's monetary policy given a currency, for example, or could be derived from market data. - Each element from above may vary considerably where expert judgement is required at a low level in the calculation, e.g., how long is the averaging period?, etc.
Transition segment	Extrapolation	- The importance of this step will vary between insurers and markets. - Ultimately, it requires a mechanism to be set up with an involvement of both quantitative and qualitative inputs from the insurer. - A more sophisticated approach could be seen where both the market data beyond LLP and an appropriately set UFR are used within the transition period.

Steps 2 and 3 – A framework for assessing illiquidity

One of the key IFRS 17 principles related to discount rates is that they should reflect the characteristics of the liability cash flows to which they will be applied. "Characteristics" here refers to timing, currency, but also—critically—the liquidity of the underlying insurance contracts.

This principle applies to both a top-down and bottom-up approach to determining discount rates. In the top-down approach, it is implicitly reflected in selecting a reference portfolio of assets whose cash flow characteristics, including liquidity, are similar to the liability profile. In the bottom-up approach, the alignment is directly considered in the explicit calculation of the illiquidity premium. In this section, we elaborate in more detail on the insurance liability characteristics, different approaches to bucket liabilities, and the potential effect to determine the illiquidity premium.

In reality the quantification of an illiquidity premium for liabilities boils down to the determination of the illiquidity[20] premium of a certain portfolio of assets, called a reference portfolio. In this chapter we will give a summary of the different options on the determination of a reference portfolio, either based on the insurer's own portfolio or on a theoretical portfolio. We summarise the pros and cons of the two approaches and discuss the implied impact on the next step of the illiquidity premium calculation: the use of application ratios.

We introduce the drivers of illiquidity for insurance contracts and show different ways to address these in the illiquidity premium calculation. Depending on the approach in terms of the asset portfolio, different options are available, either to test and demonstrate whether the own portfolio has sufficient liquidity, or to apply an application ratio to reflect the difference between the liquidity characteristics of a theoretical asset portfolio and those of the liabilities. One of the options to do this, based on EIOPA's approach, is worked out in more detail along with a simplified example.

USE OF A REFERENCE PORTFOLIO

In general, there are two main approaches to select an asset portfolio to start from:

a. Use of an actual portfolio of the insurer's own assets, which back the liabilities on the balance sheet. Looking for analogies in the SII context, the matching adjustment is also based on an insurer's actual portfolio of assets backing certain illiquid liability portfolios (like annuities in payment).

b. Use of a theoretical portfolio of assets, selected to provide a close match to the liabilities but unrelated to the actual assets held. The use of a theoretical portfolio is adopted, though in a broader sense, to underpin the volatility adjustment (VA) approach under SII.

We would like to emphasise that while the IFRS 17 rationale and justification of an illiquidity premium is clearly different to the SII matching adjustment and VA, the techniques already developed can be relevant in both contexts and so do not need to be developed from scratch.

When making a choice between using the insurer's own portfolio versus a theoretical portfolio, there are a number of factors to consider carefully, below we elaborate on three of these.

First, it is critical to understand the level of granularity at which the asset portfolio has been segmented. In an ideal world we would have a separate asset portfolio for each liability bucket—the application ratio would then simply be 1 in every case (this is explained in more detail in section 2.b of this chapter). In reality, this is likely impractical in particular where the insurer's own portfolio is used as the business is unlikely to hypothecate assets to the level required. This practical constraint then raises a risk of double counting the haircut on the illiquidity premium when using the own portfolio. For example, the asset portfolio linked to a product which can lapse without a penalty will be invested in relatively liquid instruments from a liquidity risk management perspective. Consequently, the illiquidity premia will be at the low end. If application ratios were derived following a liquidity bucketing approach (to be discussed in more detail in section 2.b of this chapter), the application ratio will also be at the low end. The combination of the two would lead to a double whammy reduction on the level of the illiquidity premia to be applied in the valuation.

[20] In the literature and in practice, the liquidity-related part in asset yields is usually referred to as liquidity premium. In order to avoid ambiguity, throughout this paper we apply uniformly the IFRS 17 term illiquidity premium both to assets and liabilities. We note that for assets illiquidity premium means exactly the same as liquidity premium in this context.

Second, using a theoretical portfolio can potentially lead to mismatches and volatility in the Profit & Loss due to differences between assets and liabilities. In particular, it could be the case when there are significant differences in the asset allocation between the theoretical portfolio and the actual asset portfolio. The current SII regime suffers from a similar issue where the VA is based on a theoretical portfolio and leads to what is known as the over- and undershooting effect on Own Funds. The over- and undershooting effect is the result of a difference in impact on the asset and liability valuations, where overshooting implies a larger offset in an insurer's liability valuation compared to the actual losses incurred in its asset portfolio and vice versa. In particular, in times of spread widening, several insurers (in particular in northern Europe) have experienced this effect.[21]

Third, one should think about management incentives in the case where an insurer's own portfolio is used. Without boundaries, it can potentially trigger the wrong incentives to invest in particular assets, which will increase the illiquidity premia to be applied in the discounting of liabilities. For example, there may be a temptation to invest in assets with which the insurer has insufficient origination and management experience. In any case, the illiquidity of the assets used should remain aligned to that of the underlying liabilities and a regular test might be applied to verify this. Note that this is the most important reason for SII to stick with the use of a theoretical portfolio in determining the VA.

Actual portfolio

Based on the IFRS 17 requirements, one can conclude that if the insurer's own portfolio of assets produces cash flows that are consistent with the characteristics of the liabilities, then this can be used as a starting point.

Pros:

- Portfolios already exist with yields available as a starting point.
- Less volatility in the balance sheet due to more linkage between the assets and liabilities.
- Characteristics of different liabilities are reflected if the actual assets and liabilities are well matched.

Cons:

- May not be a match for the level of liquidity of the liabilities.
- Suitable allowance for reinvestment risk will need to be taken into account for longer dated liabilities.
- May have constraints in the amount of illiquidity premium.
- Own assets portfolio changes every time due to market movements if using actual portfolio.
- Liability valuation is less objective and may create inappropriate investment incentives, for example, if investing in risky assets reduces liability value accordingly.
- Operationally onerous as frequent updates are required for actual assets changes at each valuation date.
- May be difficult to determine the market yields for special assets (e.g., infrastructure debts).

Where assets, such as traded equities are present within the reference portfolio, while they may not provide a non-zero illiquidity premium themselves, they should be included in the overall assessment of the portfolio illiquidity premium.

An alternative approach to resolve certain shortcomings of the own asset portfolio is the use of an approved target mix, based on the strategic asset allocation. This would reduce the operational hazard and would stabilise outcomes significantly. In addition, this avoids short-term tactical positions having a direct impact on the valuation of liabilities.

[21] The proposed changes by EIOPA in the Solvency II 2020 review to remove the overshooting effect are described in the Milliman briefing note: https://milliman-cdn.azureedge.net/-/media/milliman/pdfs/articles/briefing-note-va-dynamics.ashx.

Theoretical portfolio

When the actual asset portfolio is not consistent with the liabilities, for example when invested much shorter than the liabilities even though longer dated assets are readily available, then a theoretical portfolio may need to be used.

One of the most well-known theoretical reference portfolios is the one used the calculate EIOPA's VA. This portfolio represents an average insurer investing in a certain currency.

A theoretical portfolio can be created in different ways but should generally respect certain criteria. In line with criteria for EIOPA's matching adjustment, assets with fixed income characteristics are considered to be eligible. As an extension to the onerous criteria, it is possible that when assets **can** be structured in a certain way—the unstructured asset, potentially minus a cost—should be eligible as well. This can potentially avoid (unnecessary) structuring of portfolios for regulatory purposes, as we have seen happening to get assets eligible for the matching adjustment. However, it is expected that auditors would require strong justification and references to existing structuring transactions. The inclusion of assets such as traded equities feels less likely when adopting a theoretical portfolio but should such assets be included they should, consistent with the own portfolio approach, be allowed for in evaluating the portfolio illiquidity premium.

✓ **Pros:**

- More control over the discount rate, more stable results.
- Operationally easier than Own Portfolio, as it is a static approach.
- May be easier to align with the level of illiquidity of the liabilities.

✗ **Cons:**

- Reference asset portfolios will need to be constructed to match different liabilities
- May introduce greater volatility in the balance sheet.
- May lead to negative investment spreads if discount rate is higher than assumed earned rate.

The key items to consider when setting up a theoretical portfolio(s) are

Granularity

- One portfolio for all products or apply different ones to different groups of products (or reflect this variation via an application ratio)?
- Country specific, insurance type, maturity.

Composition

- Should the portfolio be a single asset or multiple assets?
- Which assets should be selected?
- Should it align to your current target asset mix, future mix, or something else?

Risk

- Should the portfolio be higher, lower, or yielding the same as the actual portfolio?
- How risky should the portfolio be?

As an example, when searching for a single asset class—the use of a mortgage portfolio with low loan-to-values (LTVs) can be considered. The spread of the portfolio should represent illiquidity as credit risk in such a portfolio is negligible.

LIQUIDITY CHARACTERISTICS OF THE LIABILITIES

When the illiquidity premium is derived from a theoretical asset portfolio, an application ratio is required to reflect the characteristics of the liabilities. Depending on the granularity of the theoretical portfolio in terms of maturities and liquidity, more adjustments to the application ratio are required.

This is different when the corresponding asset illiquidity premium is based on an actual asset portfolio. In this case, the illiquidity of the asset portfolio should already take into account the extent to which the liability cash flows can change in response to potential shocks such as lapses. As a consequence, the illiquidity premium will be lower because it will be driven partly by liquid assets as a buffer for scenarios of adverse policyholders' behaviour.

Drivers of the liquidity characteristics of insurance liabilities

The liquidity of insurance contracts is in principle defined similarly to the liquidity of other financial instruments. In practice it boils down to the ability to convert the asset into cash or terminate the insurance contract upon demand, quickly and without material loss of value. In the case of assets, a loss can be related, e.g., to a bid-offer spread and in the case of insurance contracts to exit costs.

Different features may influence the liquidity of an insurance contract. These features can be of a contractual nature (for example: are surrenders allowed or not? How significant are the surrender penalties?) or of a more general nature, which define whether discontinuing an insurance contract may be attractive to customers or not. Examples of such features could include the remaining term of a contract, fear of having to be re-underwritten, enjoying a high guaranteed interest rate in the low interest rate environment, the possibility of losing certain tax advantages, and many others.

Although there could be many features defining the exposure of the contract to unexpected lapses, in reality—following **Exposure Draft of the Proposed International Actuarial Note (IAN) 100 on Application of IFRS 17 Insurance Contracts**—liquidity of insurance contracts is driven by two principal values:

- **Exit value**: the higher the exit value, the higher the liquidity of the contract (contracts with higher exit value are more attractive to lapse than contracts with lower exit values). The exit value is impacted by contractual definition of the surrender value and all explicit (contractual) and implicit costs which need to be incurred by the policyholder in the case of discontinuation of an insurance contract. For example, losing certain tax advantages can be considered an implicit cost upon surrender.
- **Inherent value**: If a contract's pricing / construction is such that there is negligible / no inherent value (or value build up), or if it is lower than the exit value, then it is likely to be considered liquid. Some elements of the inherent value can be priced, but in reality it is much more subjective than the exit value as it reflects how policyholders perceive the value of holding the contracts. For example, clients could undoubtedly attach significant value to the fact that they had already undergone underwriting examination, which could stop them from lapsing life insurance contracts even if, theoretically, the inherent value does not look that high. Different features can impact inherent values such as the presence of embedded guarantees, the ability to pay fixed-level premiums against an increasing underlying risk of the health of the policyholder who might be afraid to undergo another underwriting process, the state of the economy, etc.

It is difficult to use these features to quantify directly the illiquidity premium of insurance contracts. That's why in practice, it is the illiquidity premium of the assets in the reference portfolio that is assessed, then linked to the liabilities. If necessary, an application ratio can be used.

In the following we discuss how the liquidity characteristics of the liabilities could be taken into account when using either an own asset portfolio or a theoretical asset portfolio.

Case of own portfolio: Test if the asset portfolio is sufficiently liquid

Based on considerations of exit value and inherent value, our sense is that using a portfolio of assets that is more liquid than theoretically optimal for the liabilities may be pragmatic—in particular, as elements of inherent value will be difficult to assess reliably let alone replicate with financial assets. Such an approach appears to us, though still aligned to the spirit of IFRS 17 and, in this case, that one needs to consider the implied reinvestment risk.

The statement that the liquidity characteristics of the liabilities are already reflected in the asset allocation can be tested explicitly by using a liquidity test. In our view, it makes good sense for such testing to be aligned with and absorbed into a broader liquidity risk management framework. Milliman has developed such a framework in response to growing interest in liquidity risk and its management—not least from insurance regulators.[22] In addition, the CRO Forum has published a paper on liquidity risk management best practices.[23] [24]

In short, a liquidity test should cover increased and/or accelerated payment obligations (liquidity needs) and a reduction in available liquid funds. The liquidity needs should cover scenarios with actuarial events, change of policyholder behaviour and financial markets developments (including credit rating events which might trigger additional liquidity needs). The available liquidity should be measured under stress by incorporating financial markets developments (including credit rating events) leading to reduced market values and longer liquidation times. In addition, a distinction can be made between committed and uncommitted funding lines when evaluating the excess liquidity. For example, a committed funding line with a third party is different from the assumption that a repurchase agreement program (repo) is successful in stressed times.

FIGURE 14: A SIMPLIFIED EXAMPLE OF A LIQUIDITY STRESS TEST

Required Liquidity		
	Stressed payments, for example, due to mass lapse or mortality catastrophe	160
	Derivatives collateral calls, for example, driven by rising interest rates	25
	Other cash outgo	5
	Total	190
Available Liquidity		
	Cash resources	150
	Other cash income	15
	Total	165
Excess Liquidity		
	Surplus / (Deficit)	(25)

A local management view, and agreement with the auditor, needs to be taken on the severity of the stress test (e.g., 1-in-200) and an associated decision-making framework. For example:

- Surplus / deficit within agreed tolerance – this outcome indicates the liquidity of the actual asset portfolio is sufficiently aligned to that of the liabilities and supports the case for using the asset portfolio to determine the IFRS 17 illiquidity premium.
- Surplus / deficit outside agreed tolerance – this outcome indicates the actual asset portfolio is either too liquid (surplus) or too illiquid (deficit). Here, consideration should be given to adjusting the asset portfolio or, if this is not feasible or desirable for other reasons, then a theoretical portfolio approach might be adopted.

[22] Reference to Milliman paper: https://www.milliman.com/-/media/milliman/importedfiles/ektron/liquidity_risk_management_an_area_of_increased_focus_for_insurers.ashx.

[23] Reference to external paper of the PRA: https://www.bankofengland.co.uk/-/media/boe/files/prudential-regulation/consultation-paper/2019/cp419.pdf.

[24] Reference to external paper of the CRO Forum: https://www.thecroforum.org/wp-content/uploads/2019/09/CRO_Forum_Managing-liquidity-risk_2019_Final-1.pdf.

Case of a theoretical asset portfolio: Determining the application ratio

IFRS 17 does not prescribe any specific rules regarding the composition of the theoretical reference portfolio. In this section we would like to present the general idea of constructing the theoretical asset portfolio as a weighted average of two parts:

1. A benchmark illiquid portfolio – this might be derived by contemplating the assets appropriate to back the most illiquid liabilities, like annuities in force.
2. A benchmark liquid portfolio – this might be derived by contemplating the assets that might be held to ensure an adequate level of liquidity within an Asset and Liability Management (ALM) programme, such as cash and government bonds.

In this case, the theoretical asset portfolio for liability portfolio *k* can be written as:

Theoretical asset portfolio (*k*) = w (*k*) * benchmark illiquid portfolio + (1 – w (*k*)) * benchmark liquid portfolio[25]

Where: "w (k)" lies between 0 and 1 and is the weight to be placed on the illiquid benchmark portfolio for liability portfolio *k*.

This type of approach can align to the considerations an insurer's ALM strategy would make in managing the liquidity risk of the liabilities: exposure to the illiquid portfolio corresponds to the part of the liabilities which almost surely won't drive forced selling, while the liquid assets provide a liquidity buffer held in case changes in policyholder behaviour generate increased demands for cash to satisfy claims. The more the liability portfolio is exposed to varying cash demands arising from policyholders' behaviour, the larger the liquidity buffer required to manage this risk and the lower the scope to invest in highly illiquid assets.

Within this overall conceptual framework, we believe there is potential for different approaches to be taken to determine exactly how the two benchmark portfolios are defined. We will consider this subject in more depth in the final paper in this series. For now, we turn our attention to how the weight "w (k)" might be evaluated using a quantitative approach based on stress testing.

A method to determine the application ratio

We propose a method based on stress testing which is inspired by the approach described by EIOPA in the Consultation Paper on the Opinion on the Solvency II 2020 review (the discussion is related to the dynamic VA).

In particular, EIOPA investigate approaches to align a reference asset portfolio to the company-specific duration of liabilities and to capture liquidity characteristics of insurance contracts. As the forthcoming changes are practically in line with IFRS 17 requirements, similar ideas could be considered also in the context of setting the illiquidity premium for IFRS 17.

What is notable is that EIOPA prefer methods based on stress testing over creating homogeneous liquidity buckets. EIOPA argue that the method based on well-designed stress tests can implicitly take into account relevant contract features and at the same time can be much simpler to implement.

The EIOPA approach is interesting and the prospect of using a single quantitative measure to assess liquidity is certainly attractive.

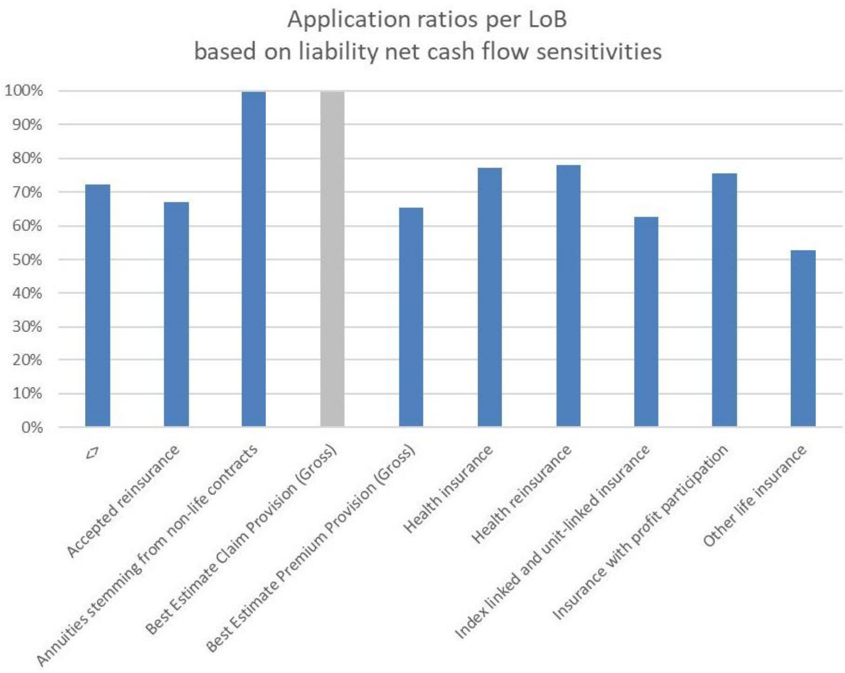
In this paper we don't describe the technical details of the EIOPA stress test approach—we refer interested readers to the original consultation paper, pp. 120–130.

---

[25] Note - if the illiquidity premium for the liquid asset portfolio is very close to 0, then we can write:

Liability Illiquidity premium (*k*) = w (*k*) * illiquidity premium on illiquid benchmark portfolio adjusted for duration (k). In this case, the weight "w" can be interpreted as an application ratio for bucket *k.*

FIGURE 15: EIOPA ASSESSMENT OF APPLICATION RATIOS



Source: EIOPA

Note that in the paper EIOPA showed the derivation of an application ratio across different lines of business per Figure 15. One can see that the application ratio varies between 50% for “Other life insurance” and 100% for annuities in force and claim provisions. The relationships between different lines of business are not far from the intuitive ones, nevertheless the ratios are rather high. As an example, consider the ratio of 60% for the unit-linked business, which one would consider as high.

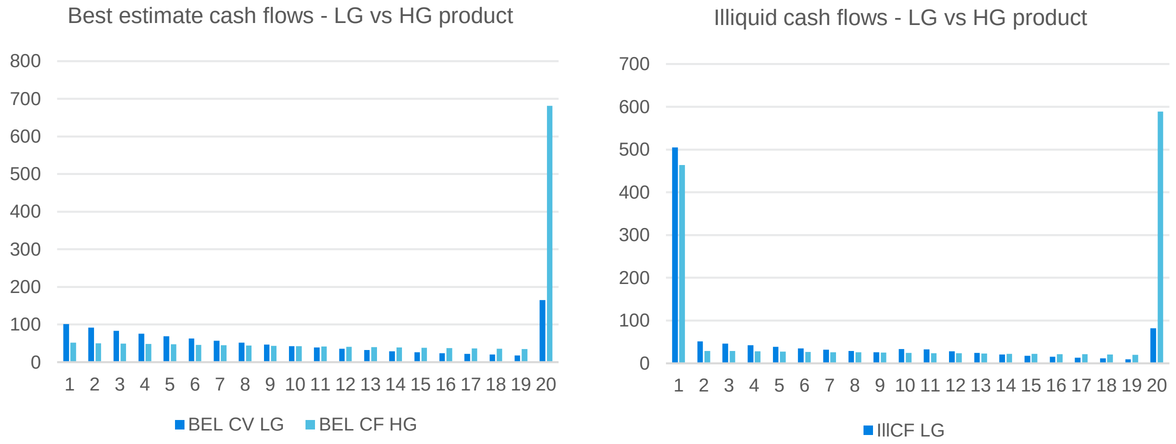
In order to illustrate this method, we have performed the following simple case study.

Let’s consider two single premium products (in force), one with a guaranteed interest rate of 1% and lapse rate of 10% p.a. - a low-guarantee (LG) product. The second product has a guaranteed interest rate of 3% and lapse rate 5% p.a. - a high-guarantee (HG) product. We assume both products have a maturity of 10 years and that no profit sharing will be paid out in the future.

For both products we perform the EIOPA calculations for two Solvency Capital Requirement (SCR) shocks: 40% mass lapse shock and a 50% permanent increase in lapse rates. We have not performed mortality shocks as in our opinion these do not impact the illiquidity characteristics of insurance products under IFRS 17 definitions.

For illustrative purposes we will assume that the discount rate is flat and equal to 0%. The result was the best estimate vs. the illiquid cash flow profile shown in Figure 16.

FIGURE 16: ILLUSTRATIVE BEST ESTIMATE VS ILLIQUID CASH FLOW PROFILE



For a LG product, we got a ratio of 63.7%; for the HG product, a ratio of 78.3%. It is in line with expectations that the HG product will be considered more illiquid than the LG product; nevertheless the range of results for this example appears to be quite narrow. One of reasons for that is that the main driver, mass lapse test, is expressed in absolute terms (40% of lapses), while—intuitively—it should be lower for the HG product and higher for the LG product.

A simple way to address it could be to replace the flat absolute mass lapse shock with a relative one-off shock. If a company believes that a 40% shock is reasonable at the total portfolio level, the relative shock could be calibrated as a ratio of 40% and the experienced total base lapse rate. We believe that a relative shock will better reflect the nature of products as the susceptibility of the product to lapses is naturally reflected in the base lapse rate. We show a simple example below:

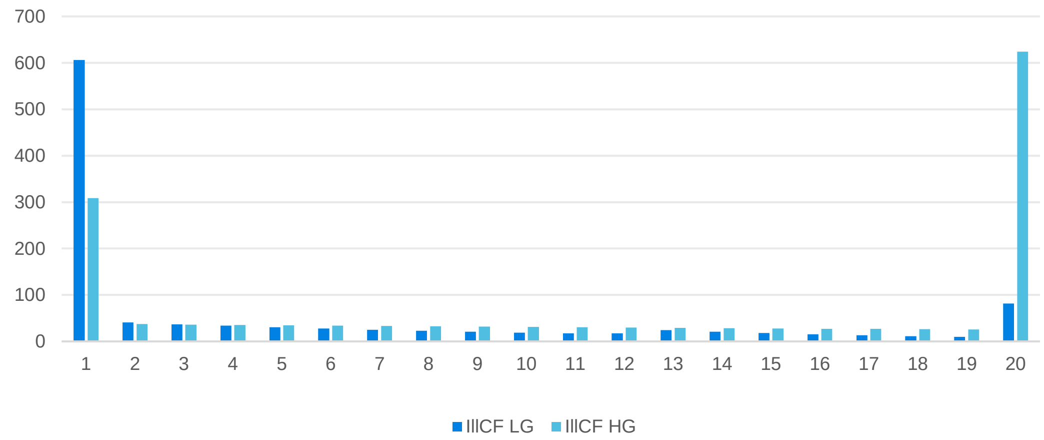
Derivation of Relative Mass Lapse Stress (Simple Example)

	HG Product	LG Product	Overall
Base lapse rate	5%	10%	7%
SF mass lapse stress (absolute)	40%	40%	40%
Liability weight	67%	33%	100%
Scaling factor 1			6.00
Mass lapse stress (relative) - option 1	30%	60%	
Scaling factor 2	0.8	1.2	
Mass lapse stress (relative) - option 2	22%	75%	

In the example here, “option 1” develops relative stress factors that align with a 40% mass lapse shock across the whole portfolio. The example also considers “option 2” where an additional scaling factor is applied to reflect the relative historical volatility of lapse experience across the two products—here we posit that not only does the HG product exhibit a lower current base lapse rate, the historical volatility of lapses is also less than for the LG product.

We have now recalculated results for our example products with a relative mass lapse test of 600% (“option 1”). From this, we obtained the illiquid cash flow profiles shown in Figure 17, which differ significantly from the absolute mass lapse case.

FIGURE 17: ILLIQUID CASH FLOWS – RELATIVE MASS LAPSE STRESS



The calculated application ratios would be, in this case, 57% for the LG product and 86% for the HG product. Thus, the difference in application ratios would be much more intuitive, although some actuaries might argue that the application ratio for the HG product might be too high. On the other hand, who would get rid of a product with a guarantee of 3% in the environment of negative interest rates?

Advantages of the stress test approach to derive the application ratios

Summarizing, the stress testing approach proposed by EIOPA offers significant advantages, especially after some fine-tuning:

- It offers a relatively simple method for measuring the illiquidity of liabilities which is objectivised and can be comparable between different companies and lines of business.
- It reflects relatively well the contractual nature of the illiquidity of liabilities.
- It gives quite intuitive relative results between different lines of business.

Homogeneous liquidity buckets

The described stress testing approach can be used to split the portfolio into relatively homogeneous illiquidity buckets. This could be done simply by splitting the portfolio according to the range of application ratio, for example:

- Segment 1: policies / products with application ratio 0% - 25%
- Segment 2: policies / products with application ratio 25% - 50%
- Segment 3: policies / products with application ratio 50% - 75%
- Segment 4: policies / products with application ratio 75% - 100%

For example, companies could develop four levels of illiquidity premium, each one corresponding to a different illiquidity bucket.

SUMMARY

The determination of the illiquidity premium is a complex process. It is key to understanding the drivers of (il)liquidity for insurance contracts, a process that contains two key design decisions: 1) the determination of the asset reference portfolio, and 2) the level of (il)liquidity on the liabilities.

We have given considerations for the use of different asset reference portfolios, either based on the insurer's own portfolio or on a theoretical reference portfolio. The pros and cons suggest that both approaches require justification and need to be discussed carefully with auditors. The decision on the reference portfolio has a clear link to the next step of the illiquidity premium calculation: the use of application ratios.

Either one should test and demonstrate whether the own portfolio has sufficient liquidity, or one should apply an application ratio to reflect the difference between the asset portfolio characteristics and the liability characteristics. One of the options in performing the latter is via stress testing.

Step 4 – Quantify the illiquidity premium

As per paragraph 36(b) of the IFRS 17 Standard and as developed in the previous sections, it is required to compute the illiquidity premium of assets. This section aims to present and compare the different approaches that can be used to achieve this purpose. First, we introduce the existing approaches from a methodological point of view. Then, we study their implementation within a practical framework by comparing the needed data, expert judgements, ease of application, and theoretical robustness.

Liquidity refers to the degree of ease with which an asset can be converted into cash. It can also correspond to the ability to sell large quantities of the asset without any adverse repercussion on the price. Therefore, an illiquidity premium is a premium, required by investors, to compensate them for the risk they may be forced to hold an asset for a certain period and/or accept a significant loss of value in the event of an early sale.

The expected return of an asset over the risk-free rate, called the spread, is generally separated into two parts:

- Remuneration of the credit risk, often split into expected cost of default and credit risk premium
- Remuneration of the illiquidity of the asset

Even though the liquidity risk has been addressed in the literature for many years, it received a particular consideration during the 2007–2008 financial crisis. At that time, spreads increased sharply, drawing the attention of the financial industry. Numerous research works appeared and provided evidence of the existence of the illiquidity component that was less visible before, such as Schwarz (2019), Huang et al. (2019), or Van Loon (2015).

Asset pricing can also encompass some allowance for residual components such as for example: tax effects, option-type features (callable, convertible bonds), market imperfections referring to limited number of buyers and sellers, high barriers to entry or exit, and no full disclosure of information. When computing illiquidity premium, option-type features are generally subject to specific adjustments, however, other components such as market imperfections and tax effects are often embedded in the value of the illiquidity premium. It is worth mentioning the work by Driessen (2003) that provided a framework to specifically isolate tax effects on corporate coupon bonds, following the work of Elton et al. (2001).

1.1 DESCRIPTION OF THE APPROACHES

Several methods to compute the illiquidity premium can be identified in the literature. As suggested by Van Loon (2015) these methods can be classified into three main groups:

- **Direct approaches**: The illiquidity premium is computed as the difference between the yield of two financial instruments that have the exact same characteristics apart from their liquidity.
- **Structural models**: Such models use option-pricing techniques on firm's assets to calculate both expected and unexpected credit risks. Expected credit risk refers to the historically observed probability of default while unexpected credit risk arises from the real-world credit risk premium. Subtracting the sum of expected and unexpected credit risks from the actual market spread then results in the illiquidity premium.
- **Regression models**: The illiquidity premium is obtained as a function of an illiquidity measure.

Furthermore, we identify a fourth class of approaches referred to as proxy approaches in this paper. From Quantitative Impact Study (QIS) 5 to SII frameworks numerous such proxies have been developed consisting in measuring illiquidity as a fixed percentage of spreads, or by assessing credit risk by relying on historical default and transition probabilities. These approaches have been widely used in the insurance industry as being core reference methods under the current regulation. Therefore, they constitute a natural source of inspiration for the construction of the yield curve under the IFRS 17 framework.

1.1.1 Direct approaches

Direct approaches consist of finding two financial instruments that have the exact same characteristics (like maturity, coupon, reimbursement...) apart from their liquidity. The illiquidity premium is directly computed as the difference between the yields of these instruments. The main instruments considered in practice are:

- Credit Default Swap (CDS), a financial swap that protect the buyer in the event of the default of the underlying asset
- Covered Bonds, bonds that are backed by cash generated from an underlying investment pool

Longstaff et al. (2005) analyses CDS and observes that the difference between the CDS premium and the corporate bond spread with the same characteristics is negative. While both instruments embed the credit risk, they explain that since the CDS includes pure credit risk, this negative basis can be interpreted as a direct quantification of the illiquidity premium.

Schwarz (2019) compares the yield of a German federal government bond with the agency counterpart KfW, which is collateralised by the German federal government (covered bond), so that they both ensure identical credit guarantees. He refers to the yield difference between these assets as the so-called "k-spread" and demonstrates that this is a valid estimation of the illiquidity premium.

The direct approach based on CDS relies on strong assumptions because it assumes that CDS are a direct representation of credit risk, whereas it has been observed that, in practice, the instrument embeds counterparty risk and liquidity risk, as mentioned by CEIOPS (2010) and Van Loon (2015). These components are particularly visible in times of crisis, which heavily questions the use of the CDS negative basis as a liquidity measure. Moreover, it requires selecting CDS and bond indices; however, in practice, such indices may not be perfectly aligned with each other so the comparison is not appropriate and results can be distorted.

For the direct approach based on covered bonds the issue in practice is to find totally risk-free bonds so that the only difference between bonds' returns is the credit risk premium. A practical assumption would be, for example, to consider only AAA covered bonds; however, such bonds could still embed residual credit risk. As for the CDS approach, a strong assumption is that the bonds on which we are trying to derive an illiquidity premium have close characteristics with available covered bonds. Finally, the market may not be complete enough to be able to construct covered bond curves for every economy.

Despite the ease of use of this approach, its limitations lead researchers to focus on other and more complex approaches, like structural models.

1.1.2 Structural models

Structural models use option-pricing techniques on a firm's assets to calculate both expected and unexpected credit risks. Expected credit risk refers to the historically observed probability of default while unexpected credit risk arises from the existence of a credit risk premium in the real world. In other words, unexpected credit risk characterises the remuneration of investors for bearing the risk. The Merton (1974) and the Black-Cox (1976) models constitute two famous structural models and, more generally, Eom et al. (2004) present several structural models as well as the wide range of credit spreads they are able to handle.

Hull et al. (2005) compare real-world and risk-neutral default probabilities and note that corporate bonds actually embed an extra risk premium over the unexpected credit risk premium of structural models. They argue that a large part of this extra risk premium might be attributed to liquidity risk.

Various references also demonstrate that the sum of expected and unexpected credit risks is smaller than market spreads. Huang and Huang (2012) show that once calibrated, various structural models produce similar values of spreads that fall well below the historically observed spreads. This phenomenon, also enlightened by Chen et al. (2009), is often referred in the literature as the so-called "credit spread puzzle." The latter has been largely addressed, in particular after the 2007–2008 financial crisis.

Huang et al. (2019) enhance his analyses by calibrating a Black-Cox model on a cross-sectional default frequency based on Feldhütter and Schaefer (2018).[26] They confirm these pricing errors are unlikely to be a reflection of measurement errors in the data but rather stand for the existence of systematic factors missed by the structural model of debt such as liquidity. They use a regression approach to demonstrate that pricing errors are highly correlated with illiquidity measures.

For these reasons, structural models are widely used by financial institutions to quantify liquidity risk. As an example, Webber (2007) is regularly used by the Bank of England to monitor market illiquidity premiums. It extends Churm and Panigirtzoglou (2005) which consider the structural model of Leland and Toft (1996).

[26] Feldhütter and Schaefer (2018) criticise most of the structural model calibration and question the existence of the credit risk puzzle. This article has been criticised by more recent works of Bai et al. (2020) and Huang et al. (2019). Nevertheless, this discussion recalls that prudence in the estimation of liquidity risk is warranted.

From a more theoretical point of view, structural models provide a representation of the capital structure of a firm. The original approach introduced by Merton in 1974 considers that the assets A_t of the firm writes as the sum of the debt D_t held by debtholders and the equity E_t held by shareholders as shown in Figure 18.

FIGURE 18: CAPITAL STRUCTURE OF A FIRM

Under this simple framework, the face value of the debt D_T must be reimbursed at a fixed maturity date T; the Merton model debt structure can be assimilated to a simple zero-coupon bond. In the case that the assets fall below the face value of the debt at the reimbursement date T, the firm defaults. Debtholders are refunded what remains of the assets, and shareholders receive nothing. Alternatively, if the asset is sufficient to repay the debt, the residual part is given to shareholders. Figure 19 summarises the payoffs of each counterparty at time T.

FIGURE 19: PAYOFFS TO DEBTHOLDERS AND SHAREHOLDERS

	Debtholders	Shareholders
$A_T \geq D_T$	D_T	$A_T - D_T$
$A_T < D_T$ (default)	A_T	0

As such, shareholders own a call option on the asset firm with maturity, the reimbursement date of the debt, and strike the face value of the debt. The equity value can then be obtained relying on option valuation technics. The same reasoning applies to the debt that can be assimilated to a put option.

There exist extensions of the Merton model in which the bankruptcy can be triggered before the maturity of the debt if the firm value falls below a threshold called the default boundary as originally proposed by Black-Cox (1976). Extensions of this approach consider an endogenous default boundary. For instance, Leland and Toft (1996) take into consideration that the firm can issue additional equity to service the debt. Based on an equilibrium condition, they derive an endogenous value of the default boundary. Practical implementations of structural models can also consider more complex capital structures, such as the implementation of Kealhofer, McQuown and Vasicek (KMV), which, in particular, differentiates short-term and long-term debt and takes into account cash leakages (dividends, bond coupons, loan expenses…).

Most of the structural models assume that the asset dynamics is log-normal under both risk-neutral and real-world probabilities as shown in Figure 20.

FIGURE 20: PROJECTING THE ASSETS OF A FIRM

Risk-neutral	Real-world
$\frac{dA_t}{A_t} = (r - \delta_t)dt + \sigma_A dW_t^{\mathbb{Q}}$	$\frac{dA_t}{A_t} = (r + \mu_t - \delta_t)dt + \sigma_A dW_t^{\mathbb{P}}$

Where r is the risk free rate, σ_A is the asset volatility, μ_t is the asset risk premium and δ_t is the fraction of value paid out to security holders.

Refinements of these dynamics can be found in the literature; the ones of main interest are:

- Longstaff and Schwartz (1995) model assumes that the short risk-free rate is itself stochastic and follows a Vasicek (1977) process.
- Huang and Huang (2012) introduce a jump-diffusion process in the asset dynamics whose analytical tractability is provided by the Kou and Wang (2003) double exponential jump-diffusion model. Depending on the modelling assumptions such a feature can be particularly relevant. Bai et al. (2020) discuss the need for introducing jumps to the asset dynamics when considering a constant default boundary across firms.

Starting from the asset dynamics, structural models provide a representation of both the real-world and risk-neutral default probabilities. If the risk premium of the asset is positive, the risk-neutral default probability is higher than the real-world one, since the asset is more likely to fall below the default boundary.

The conventional credit spread valuation formula writes as follows in terms of the risk-neutral default probability $\pi^{\mathbb{Q}}$ that includes both expected and unexpected credit risk:

$$s(m) = -\frac{1}{m}\ln\left(1 - LGD \times \pi^{\mathbb{Q}}(m)\right)$$

Where m is the tenor of the spread and LGD the loss given default.

The illiquidity premium element of the spread is then defined as the difference between the spreads outputted by the structural model (that encompasses only default risk) and the spreads observed on the market which are higher since they also embed illiquidity risk.

Structural models can be used to assess the risk-neutral probability and there are two ways to present the problem. The first would consist in starting from the risk-neutral dynamic of the asset, so that it is possible to directly infer risk neutral default probabilities. The main issue with such an approach is that, in practice, it does not necessarily ensure consistency with observed real world default frequencies. The second view relies on real-world default probabilities to characterise the expected credit component and then, uses the real-world risk premium to compute the unexpected credit component. The credit risk premium can be estimated based on different approaches:

- To match real-world default probabilities.
- By considering a cost of capital approach to assess the return expected by investors to carry the risk. To this extent, the Canadian Institute of Actuaries (2020) proposes, for instance, to use either the LICAT or the Basel III cost of capital approaches.

Eventually, the modelling of spreads and default probabilities can also be achieved thanks to reduced form models that model the unobservable default intensity with a diffusion process. Such approaches are generally favoured for the modelling of spreads within risk-neutral insurance economic scenario generators, for instance Jarrow et al. (1997) or Longstaff et al. (2005). Although less popular and natural for modelling liquidity risk compared to structural approaches, reduced form models can also encompass an allowance for illiquidity risk as suggested by Duffee et al. (1999) and implemented by Driessen (2003).

Alternative models to measure illiquidity take into account explanatory variables, such as regression models based on illiquidity measures as available in the market, as detailed in the following.

1.1.3 Regression models

The principle of the regression models is to explain a part of the yield of bonds using liquidity measures.

The regression models are generally based on three steps:

- Creation of the liquidity measure (LM) as a function of trading variables (Y_i) (bid-ask spread being the most widely used)

$$LM = f(Y_i)$$

- Credit spread regression:

  A regression model is constructed expressing the credit spread of the bond as a regression of the parameters and the previous liquidity measure

$$S_{Credit} = \beta X + \alpha LM$$

  Where β is the coefficient matrix to estimate, X matrix of explanatory variables made of bond characteristics (coupon, maturity, …), α a coefficient.

- Deduction of the liquidity premium:

  To obtain the liquidity premium it is necessary to calculate the spread of a theoretical bond S_{Liquid} that is perfectly liquid, by setting the liquidity measure to 0:

$$S_{Liquid} = \beta X$$

  Equivalently, the liquidity premium is the difference between the spread of the bond and the spread of its corresponding theoretical perfectly liquid bond:

$$Illiquidity\ Premium = S_{Credit} - S_{Liquid} = \alpha LM$$

Another approach that relies on regression is by using the residual part of the spread implied by another approach (e.g., a structural model) and then performing a regression based on a liquidity measure as suggested in Huang et al. (2019). The obtained proxy allows us to compute the illiquidity premium based on the liquidity measures of the bonds.

The literature proposes different ways to measure liquidity:

- The bid-ask spread detailed, for example, by Edwards and Piwowar (2007).
- Market depth indicators such as trading volume equals the number of shares traded over a certain period of time. For instance, the measure by Amihud (2002) captures the ratio of an asset return over its traded volume expressed in terms of currency units.
- Trading intensity variables, which frequently cover both measures based on turnover and zero-trading-days (Chen et al., 2007).

Flemming (2001) compares several liquidity measures and concludes that the bid-ask spread is a useful measure for assessing and tracking liquidity. By contrast, quote size, trade size, and the on-the-run/off the-run yield spread are found to be only modest proxies for market liquidity. Moreover, trading volume and trading frequency are assessed to be weak proxies for market liquidity, as both high and low levels of trading activity are associated with periods of poor liquidity.

For practical implementations custom liquidity measures are often used:

- Van Loon et al. (2015) use the relative bid-ask spread referred to as RBAS, a measure of a bond's liquidity relative to bonds with identical characteristics.
- Chen et al. (2007) consider the Lesmond, Ogden, and Trzcinka (1999) model as an alternative of the bid-ask spread which uses only daily closing returns to estimate liquidity costs.
- Dick-Nielsen et al. (2012) build a new liquidity measure aggregating exiting ones: The Amihud measure, a measure of round-trip cost of trading, and the variability of each of these two measures.

1.1.4 Proxy approaches

Over the years, under the SII framework, EIOPA suggested many proxies to compute the illiquidity premium, for instance as a fixed percentage of spreads or by assessing credit risk, thanks to historical default and transition probabilities. In this section, we define proxy approaches as the adaption of these methods to an IFRS 17 context.

The report of the CEIOPS Task Force on liquidity premium (2010) explores the implications of using an illiquidity premium for the valuation of insurance business. This paper first considers three approaches to compute the illiquidity premium of assets, namely two direct approaches based on both CDS and covered bonds, and a structural model method. The task force members conclude that these methods are not reliable enough. Indeed, they notice the underlying assets of direct approaches can embed allowance for residual liquidity and counterparty risks, and that structural models require a high number of assumptions to be made. As a result, they suggest a simple proxy based on a linear function of a spot spread index, to be applied by currency. This proxy has then been retained for the QIS 5 exercise:

$$LP_{currency} = \max\left(\frac{s_{currency} - 40bps}{2}, 0\right)$$

Where $s_{currency}$ denotes a corporate bond benchmark spread index relative to the considered currency.

For the application of SII, EIOPA refined this proxy and introduced the so-called VA. It is based on a currency-specific reference portfolio maintained by EIOPA and is supposed to be representative of European insurance business. This portfolio contains governmental and corporate bonds. For each of its constituents, the risk of default, also called risk correction, is assessed as the maximum between:

- A fixed percentage of a long-term average spread (LTAS); 30% (resp. 35%) for governmental (resp. corporate) spreads estimated on 30 years of daily data. This quantity appears to be very stable over time.
- For corporate bonds, an estimation of the cost of default of a buy and hold strategy (PD) plus the cost of downgrade of a buy-and-replace strategy (COD). Unlike structural models, this PD+COD quantity only relies on real-world probabilities.

The VA is then obtained taking the difference between the reference portfolio spread and the risk correction and multiplying it by an application ratio of 65%. The latter is often interpreted as capturing the mismatch between assets and liabilities, however, it might also adjust for other effects. In the Technical Findings on the Long-Term Guarantees Assessment (2013), EIOPA introduced the “Volatility Balancer,” which is the direct ancestor of VA and preconises a 20% application ratio to correct two effects:

1. Beyond credit and liquidity risks, the spread also encompasses crucial information such as management expense risk, taxes, or costs of market imperfections.
2. Insurers do not actually “buy-and-hold” all their bonds. As such, they should not earn the totality of the liquidity premium.

A value of the VA is also computed at the country level, considering a country-specific bond portfolio. This country VA is triggered if an activation threshold is reached.

More recently, the Consultation Paper on the Opinion on the Solvency II 2020 review (2019)[27] put into light weaknesses of the current SII VA approach:

- The impact of the VA may overshoot or undershoot the impact of spread exaggerations on the asset side, due to asset allocation, credit quality, duration mismatches, ...
- The VA application ratio (65%) does not take into account the liquidity characteristics of insurance contracts.
- The activation mechanism of the country VA does not work as expected.
- The risk of default may be badly estimated because, in general, it only depends on the LTAS component which is almost constant over time. Indeed, in practice, the PD+COD component is smaller than the LTAS component most of the time.

[27] https://www.milliman.com/en/insight/solvency-ii-2020-review.

- The VA is almost always positive and is not symmetric, thereby implying no resilience during non-crisis periods.
- The motivations of the VA are unclear; is it a tool that compensate for spread shocks on the asset side, or an illiquidity premium on assets that allow for the replication of liabilities.
- Risk-free interest rates with VA added are not market-consistent.

To overcome these issues EIOPA propose alternative options for the computation of the illiquidity premium on the asset side. In particular, they preconise the use of weights specific to the insurer portfolio, instead of EIOPA reference portfolio weights. Besides, they explore the computation of the risk correction, as a fixed percentage of spot spreads; 30% (resp. 50%) for governmental (resp. corporate) spreads. EIOPA propose refinements of this proxy:

- In option 1 of the Consultation Paper, they establish a split in between corporate bonds depending on their rating in order to penalise bad ratings. The risk correction is estimated as 30% of AAA spreads, 40% of AA spreads, 50% of A spreads, and 60% of BBB and beyond spreads.
- In their holistic impact assessment, EIOPA (2020) consider, under certain conditions, a weighted sum between spot spreads and long-term average spreads.

In an IFRS 17 context it might be interesting to consider these improvements even though they are still not implemented in the SII framework, to address the granularity in terms of fixed percentage and ensure alignment with spot conditions.

Finally, most of these proxies assume that the liquidity risk arising from the assets other than bonds is null. In other words, the illiquidity premium obtained for bonds is diluted by multiplying it by the portfolio bond share.

To the extent of IFRS 17, the use of a proxy approach would require that insurers adapt existing implementations under SII, already accepted by regulators in this specific context in order to reflect more precisely the illiquidity of their insurance liabilities. For instance, insurers could try to modify the current SII VA calculation for their IFRS 17 implementation by:

- Adjusting the weights of the reference portfolio to align with the ones of the portfolio that best reflect the features of the insurance liabilities
- Re-calculating the spread of the reference portfolio
- Adjusting the credit risk computation by using companies' own assumptions (like studies on recovery rates, transition matrices, etc.)
- Questioning the 65% application ratio so that it captures the differences between the illiquidity of the insurance liabilities and the illiquidity of the reference portfolio of assets

1.2 COMPARISON OF METHODS

This section aims to compare the different approaches to calculate the illiquidity premium. To this extent, several characteristics will be studied:

- Assumption and expert judgement
- Nature of the data
- Temporality of the data

1.2.1 Assumptions and data

The purpose of Figure 21 is to set out the different assumptions and data sources required for each model.

FIGURE 21: SUMMARY OF ASSUMPTIONS ACROSS THE DIFFERENT APPROACHES

	Direct approaches	Structural models	Regression models	Proxy approaches (VA)
Assumption and expert judgement	CDS embed only default risk, no counterparty risk Covered bonds are totally risk free Link between the market indices considered for the estimation of liquidity and the reference asset portfolio	Underlying dynamics of the asset Definition of the default event Structure of the debt Calibration of the model Choice of the historical depth	Choice of the liquidity measure. The liquidity measure is assumed to fully capture the liquidity risk Choice of the regression variables Choice of the historical depth	LTAS approach: ▪ Assumes that the default risk is almost constant over time ▪ Assumes 35% haircut of the LTAS PD+COD approach: ▪ Properly captures the credit risk premium ▪ Buy and replace strategy ▪ Constant RX factors allows for the ability to properly assess the market value of risky bonds
Nature of the data	CDS and corresponding bond indices Covered bonds	Depending on the implementation, : ▪ Leverage of the debt ▪ Default boundary ▪ Firm volatility ▪ Loss given default ▪ Equity risk premium ▪ Real world default probability	Time series of: ▪ Spreads ▪ Values of the liquidity measure ▪ Values of the other regressors	LTAS PD+COD: ▪ Transition matrix ▪ RX factors ▪ LGD
Temporality of the data	Spot	Historical, except for balance sheet data (leverage of the debt)	Historical	Historical data and spot risk-free rate

In practice, it is difficult to gather the required data for each bond part of the reference portfolio. A solution would be to split the portfolio and apply the methods at each segment level. The segmentation requires justification to show that the segments have similar characteristics and that the aggregation method is appropriate.

1.2.2 Pros and Cons

Figure 22 provides a comparative analysis of the different strengths and weaknesses of the models.

FIGURE 22: COMPARING THE DIFFERENT APPROACHES

	Direct approaches	Structural models	Regression models	Proxy approaches
Availability of data	× Mismatch between bond portfolio and reference CDS or covered bonds indices. A mapping of the reference portfolio on these indices is likely to be required.	× In theory, structural models require inputs at the firm level. Accessibility and reliability of these data are not straightforward. This can be mitigated using aggregated data (see below).	✓ Regression can be performed on market indices.	✓ Own Data and segmentation.
Ease of application	✓ Limited source of data. ✓ Direct computation, no model dependence.	✓ Consensual representation or default risk widely used in the literature. × Important granularity at firm level. ✓ Many practical implementations consider aggregated inputs: ▪ Huang and Huang (2012) use averages of leverage debt ratio by rating, estimate the asset risk premium based on equity premium, and calibrate the asset volatility parameter relative to each rating to fit real-world probabilities. ▪ Feldhütter et Schaefer (2018) estimate a common Sharpe ratio parameter and calibrate a constant default boundary across firms in order to fit several cross-sectional default frequencies at different maturities and ratings.	× Important initial work to perform the regression. × Need to update annually. ✓ Ease of use when implemented.	✓ Direct implementation (for example: re-use of the VA).
Level of expert judgement	✓ Few expert judgement	× In practical implementations, several assumptions are made to compensate for the lack of accessibility and reliability of data at firm level and to bring robustness. × Some implementations rely on additional economic expert judgements, for instance using a cost of capital model to estimate the credit risk premium. × The implementation choices can significantly affect the results. It requires choosing carefully the modelling assumptions and performing a deep analysis / benchmark of the results in order to ensure robustness. For example, Bai et al. (2018) and Huang (2019) address such a criticism to Feldhütter and Schaefer (2018) implementation.	× Non negligible numbers of expert judgements that would need robust justifications.	Justification of the application of this general method to a specific liability portfolio could be challenging as under IFRS 17 discount rates shall reflect the liquidity characteristics of the liabilities.

	Direct approaches	Structural models	Regression models	Proxy approaches
Accuracy and robustness	× The CDS price linkage broke down during the financial crisis. × In practice. pricing of CDS can embed a substantial part not due to default.	✓ Granular representation of illiquidity, since structural models aim at capturing credit risk at firm level. ✓ Market practice for assessing credit risk in the finance industry. Structural models are widely integrated within operational frameworks used for regulatory purposes (Bale 3, IFRS 9, …). × Structural models remain a simplistic modelling setup, for instance, for the specification of the capital structure or the specification of the asset dynamic.	✓ Good interpretation of the spread in terms of bond characteristics and liquidity part. ~ Really dependent on the choice of explicative variables, but overall, if well calibrated, prove to be an excellent proxy to derive the illiquidity premium.	✓ Underlying methodological framework already used for SII and used by European insurers for prudential reporting. × Generally, use of theoretical simplifications.

We have shown that the robustness of direct approaches has been largely questioned by the financial industry during crises. It can also be challenging to find appropriate data that match the reference portfolio. As a consequence, direct approaches must be carefully considered as their justification can be difficult despite their ease of application.

The theoretical basis of structural models are widely recognised by financial institutions because they allow credit risk to be addressed at a granular level. These models are nevertheless complex and require a great deal of expertise to justify them.

Regression models perform well and require a solid expertise in the choice of the liquidity measure and of explanatory variables to perform a satisfying regression. The necessary information is not easy to retrieve and justify. Once implemented, they provide a direct comprehension of the liquidity part of every bond.

Proxy approaches are mainly inspired by SII developments and as such are the most straightforward to implement for European insurers. However their transposition to IFRS 17 reporting needs to be supported by appropriate and specific justifications.

CONCLUSION

In conclusion, every approach is conceivable, provided it is sufficiently justified. In fact, it is required to demonstrate that:

1. The used data are reliable
2. The implementation of the method is robust and appropriate
3. The whole process is mastered by the user

That’s why the choice of the approach heavily relies, first, on the availability of the data, even though segmentation of the portfolio allows for the use of more aggregated source data. Second, the insurance company needs to be able to perform the necessary expert judgement and demonstrate the relevance of the method. While it is largely accepted that assets like rated equities are totally liquid, the insurance company could consider integrating the computation of the illiquidity premium assets like property or infrastructures.

These approaches allow us to assess the credit risk of firms. In that sense, they can be used to address the liquidity of assets priced with reference to default probabilities such as bonds or CDS. Beyond these assets, the range of application of these approaches to address the liquidity risk is limited. These methods can be applied on assets that will likely be the ones eligible for the SII Matching Adjustment. For other non-bond assets, notably the Matching Adjustment, the insurance company might consider securitization to build debt instruments from them, for which an illiquidity premium can then be derived and earned. Unlike the Matching Adjustment, IFRS 17 has no strict definition of eligible assets, it could then be conceivable to compute an illiquidity premium on non-bond assets by using only a theoretical securitization that would not have to be implemented in reality.

An alternative for these other non-bond assets would be to consider in their return an illiquidity spread, which would be computed as the difference between the total return of the asset and the risk-free rate plus the market risk premium. The market risk premium that represents the price of bearing the risk of volatility of the asset, could be computed, thanks to a cost of capital approach as suggested by the Canadian Institute of Actuaries (2020).

Summary

What is clear is that no matter which step of the discount rate setting process we look at there is no simple one-size-fits-all solution. In the sections above we have aimed to lay out the key areas that must be considered and have sought to highlight where it might be reasonable for firms to leverage approaches already established for other regimes—and where these need to be modified. Where alternative approaches are available we have tried to summarise the pros and cons from a mainly technical perspective. Insurers will inevitably weight these differently and arrive at different conclusions as to their preferred approach. However, any decision will have to also take into account the ease, or otherwise, of implementation and ongoing operation. Thus, in our upcoming final paper of this series we will switch our focus to these practical aspects.

BIBLIOGRAPHY

3. Amihud, Y. (2002). Illiquidity and stock returns: cross-section and time-series effects. Journal of financial markets, 5(1), 31–56.
4. Bai, J., Goldstein, R.S., and Yang, F. (2020). Is the credit spread puzzle a myth?. Journal of Financial Economics.
5. Black, F., and Cox, J.C. (1976). Valuing corporate securities: Some effects of bond indenture provisions. The Journal of Finance, 31(2), 351–367.
6. Canadian Institute of Actuaries (2020). IFRS 17 Discount Rates for Life and Health Insurance Contracts. Draft Educational Note, Committee on Life Insurance Financial Reporting
7. CEIOPS (2010). Task force on the illiquidity premium: Report. Technical report, Committee of European Insurance and Occupational Pensions Supervisors.
8. Chen, L., Lesmond, D.A., and Wei, J. (2007). Corporate yield spreads and bond liquidity. The Journal of Finance, 62(1), 119–149.
9. Chen, L., Collin-Dufresne, P., and Goldstein, R.S. (2009). On the relation between the credit spread puzzle and the equity premium puzzle. The Review of Financial Studies, 22(9), 3367–3409.
10. Churm, R., and Panigirtzoglou, N. (2005). Decomposing credit spreads. Bank of England. Quarterly Bulletin, 45(1), 54.
11. Dick-Nielsen, J., Feldhütter, P., and Lando, D. (2012). Corporate bond liquidity before and after the onset of the subprime crisis. Journal of Financial Economics, 103(3), 471–492.
12. Driessen, J. (2005). Is default event risk priced in corporate bonds?. The Review of Financial Studies, 18(1), 165–195.
13. Duffie, D., and Singleton, K.J. (1999). Modeling term structures of defaultable bonds. The review of financial studies, 12(4), 687–720.
14. Edwards, A.K., Harris, L.E., and Piwowar, M.S. (2007). Corporate bond market transaction costs and transparency. The Journal of Finance, 62(3), 1421–1451.
15. EIOPA (2013). Technical Findings on the Long-Term Guarantees Assessment. Technical report, European Insurance and Occupational Pensions Authority.
16. EIOPA (2019). Consultation Paper on the Opinion on the Solvency II 2020 review. Consultation Paper, European Insurance and Occupational Pensions Authority.
17. EIOPA (2020). Technical specification of the information request on the 2020 review of Solvency II. Holistic impact assessment, European Insurance and Occupational Pensions Authority.
18. Elton, E.J., Gruber, M.J., Agrawal, D., and Mann, C. (2001). Explaining the rate spread on corporate bonds. The journal of finance, 56(1), 247–277.
19. Eom, Y.H., Helwege, J., and Huang, J.Z. (2004). Structural models of corporate bond pricing: An empirical analysis. The Review of Financial Studies, 17(2), 499–544.
20. Feldhütter, P., and Schaefer, S.M. (2018). The myth of the credit spread puzzle. The Review of Financial Studies, 31(8), 2897–2942.
21. Fleming, M.J. (2001). Measuring treasury market liquidity. FRB of New York Staff Report, (133).
22. Huang, J.Z., and Huang, M. (2012). How much of the corporate-treasury yield spread is due to credit risk?. The Review of Asset Pricing Studies, 2(2), 153–202.
23. Huang, J.Z., Nozawa, Y., and Shi, Z. (2019). The global credit spread puzzle. Working paper.
24. Hull, J.C., Predescu, M., and White, A. (2005). Bond prices, default probabilities and risk premiums. Default Probabilities and Risk Premiums (March 9, 2005).
25. Jarrow, R.A., Lando, D., and Turnbull, S.M. (1997). A Markov model for the term structure of credit risk spreads. The review of financial studies, 10(2), 481–523.
26. Kou, S.G., and Wang, H. (2003). First passage times of a jump diffusion process. Advances in applied probability, 504–531.
27. Leland, H.E., and Toft, K.B. (1996). Optimal capital structure, endogenous bankruptcy, and the term structure of credit spreads. The Journal of Finance, 51(3), 987–1019.
28. Lesmond, D.A., Ogden, J.P., and Trzcinka, C.A. (1999). A new estimate of transaction costs. The review of financial studies, 12(5), 1113–1141.
29. Longstaff, F.A., and Schwartz, E.S. (1995). A simple approach to valuing risky fixed and floating rate debt. The Journal of Finance, 50(3), 789–819.

30. Longstaff, F.A. (2004). The Flight-to-Liquidity Premium in US Treasury Bond Prices. The Journal of Business, 77(3), 511–526.
31. Longstaff, F.A., Mithal, S., and Neis, E. (2005). Corporate yield spreads: Default risk or liquidity? New evidence from the credit default swap market. The journal of finance, 60(5), 2213–2253.
32. Merton, R.C. (1974). On the pricing of corporate debt: The risk structure of interest rates. The Journal of finance, 29(2), 449–470.
33. Schwarz, K. (2019). Mind the gap: Disentangling credit and liquidity in risk spreads. Review of Finance, 23(3), 557–597.
34. Webber, L., and Churm, R. (2007). Decomposing corporate bond spreads. Bank of England. Quarterly Bulletin, 47(4), 533. Van Loon, P.R., Cairns, A.J., McNeil, A.J., and Veys, A. (2015). Modelling the liquidity premium on corporate bonds. Annals of Actuarial Science, 9(2), 264–289.
35. Van Loon, P.R., Cairns, A.J., McNeil, A.J., and Veys, A. (2015). Modelling the liquidity premium on corporate bonds. Annals of Actuarial Science, 9(2), 264–289.

Milliman

Milliman is among the world's largest providers of actuarial and related products and services. The firm has consulting practices in life insurance and financial services, property & casualty insurance, healthcare, and employee benefits. Founded in 1947, Milliman is an independent firm with offices in major cities around the globe.

milliman.com

CONTACT

Pierre-Edouard Arrouay
pierre-edouard.arrouay@milliman.com

Charles Boddele
charles.boddele@milliman.com

Grzegorz Darkiewicz
grzegorz.darkiewicz@milliman.com

Russell Ward
russell.ward@milliman.com

Freek Zandbergen
freek.zandbergen@milliman.com

Sihong Zhu
sihong.zhu@milliman.com