



**THE SOCIETY OF ACTUARIES IN IRELAND**

**Discussion Paper on Sovereign Exposures**

**May 2011**

*This is a discussion paper produced by a Working Party of the Society of Actuaries in Ireland (“Society”). The purpose of the paper is to provoke and contribute to an informed debate that will enhance the profession’s consideration of “Sovereign Exposures” in professional practice. It is intended to stand on its own and be freely interpreted. As such, it is not guidance. Ultimately, it is the Society’s Code of Professional Conduct and Actuarial Standards of Practice that govern the professional responsibilities of actuaries. However, the Society’s Council believes that this paper will assist actuaries in applying the Code and Standards to their individual situations and that expanded discussion of the concepts and suggestions offered in the paper will benefit the profession.*

# 1 Introduction and Background

Over the last year, government bond yields for several developed countries have increased reflecting the market's perceived increase in risk. The life insurance regulations require the actuary to assess the credit risk of bonds backing actuarial liabilities when setting valuation interest rates. Actuarial analysis involves the review of historical data to project future experience. However, such techniques are less helpful when considering sovereign credit risk of developed countries, due to limited historical data and the unique circumstances of each country.

The purpose of this paper is to assist the actuary in making an informed decision when setting the valuation interest rate. It is highly desirable that there is consistency in how actuaries adjust government bond yields to allow for credit risk. The paper outlines the factors to consider when making this adjustment and summarises a number of approaches used to estimate credit risk of sovereign bonds. In addition, it identifies some issues the actuary should consider where a company has material sovereign exposures. The paper is from the perspective of a life insurance company and therefore only life insurance regulations and actuarial guidance applying to life actuaries are considered. However, the paper also has relevance to actuaries who practice outside life insurance.

## 1.1 Regulation

In determining the valuation interest rate used in calculating actuarial liabilities, the insurance regulations (European Communities (Life Assurance) Framework Regulations, 1994) require bond yields to be adjusted (where relevant) to reflect credit risk. The regulations refer to the need to have regard to the yields available on risk-free investments of a similar term in the same currency when assessing the adjustment for credit risk. Appendix 1 outlines the regulatory requirements in more detail.

Furthermore, the Central Bank of Ireland usually writes to Appointed Actuaries prior to the year-end, setting out views regarding financial parameters to be used in forthcoming valuations, particularly with respect to the resilience test. In the letter of December 2010, the Central Bank advised that it was expected that actuaries would explicitly understand changing market perceptions of risk and, if appropriate, allow for them as described in the above regulations. Therefore, from a regulatory perspective, the actuary is explicitly required to assess the credit risk attaching to bonds backing actuarial liabilities, including government bonds.

## 1.2 Guidance

Actuarial guidance issued by the Society of Actuaries in Ireland (Section 3.3.4 of ASP LA-3<sup>1</sup>) comments that "it is appropriate to have regard to any differences in yield which arise from differences in marketability of the asset in question as compared with the risk-free alternative when assessing the deduction for the default risk". Therefore, in assessing credit risk attaching to government bonds, the actuary is assessing how much of the yield on government bonds above risk-free rates is due to credit risk and how much is due to other factors, such as liquidity.

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<sup>1</sup> ASP LA-3, Additional guidance for Appointed Actuaries on valuation of life assurance business - <https://web.actuaries.ie/standards/asp/asp-la-3>

## 2 Approaches to Estimating Credit Risk

This section sets out some general considerations together with several approaches to estimating the credit risk on government bonds. Risk-free interest rates are mentioned throughout this report, and can generally be taken as defined under Solvency II or alternatively, the yields on AAA government bonds of the same currency and similar duration.

### 2.1 General considerations

The actuary should consider the following when allowing for credit risk while setting the valuation interest rate:

- The actuarial valuation is required to take account of the nature and term of assets backing the actuarial liabilities. In considering the allowance that can be made for an illiquidity premium (that is, the difference in yield which arises from differences in the marketability of the asset compared to the risk-free alternative) in the valuation interest rate, the actuary should consider the possibility of sale of bonds before the maturity date, for matching purposes or other reasons. For example, the actuary should have regard to the extent of cashflow matching between the actuarial liabilities and the bonds backing those liabilities (where relevant) as well as other scenarios where the underlying bonds would need to be traded. That is to say, allowing for all of an illiquidity premium in the calculation of the valuation interest rate implies that the relevant bond is held to maturity.
- The inclusion of an illiquidity premium in setting the valuation interest rate could incentivise companies to increase their concentration in a particular government bond as this could lead to the ability to calculate the actuarial liabilities using a higher valuation rate of interest than the risk-free rate. Alternatively it can create a disincentive to sell government bonds where there is an illiquidity premium allowed for within the valuation interest rate. Therefore, if an illiquidity premium is implicitly reflected within the valuation interest rate, it should be considered whether there is a limit to the extent to which this illiquidity premium should be taken into account. For example, the actuary may stipulate an upper limit on the allowance for an illiquidity premium in the valuation interest rate.
- The estimates of credit risk can change over time, particularly where the estimate reflects the market perception of risk. Therefore, the allowance for credit risk within the valuation interest rate must be regularly reviewed.

### 2.2 Approaches to estimating credit risk

#### 2.2.1 Credit default swaps (CDS)

This approach involves basing the illiquidity premium on the residual spreads available from bond yields less the cost of credit default swaps. Credit default swaps are a form of insurance which can protect investors in the event of default. As such they could be viewed as the market price of the credit risk for particular bonds. They provide a useful measure of the market's perception of default risk. On the other hand, CDS prices can also be affected by issues of supply and demand and by views about the credit-worthiness of the CDS provider.

## 2.2.2 Market Based Metrics such as Bloomberg

There are a number of market based metrics quoted on each bond that are used by market participants when examining the credit risk they are taking on in return for holding a particular asset. Two of the more widely used metrics in this space are:

- **Z Spread (or Zero volatility spread)**  
The parallel shift in the LIBOR zero rate curve required in order that the adjusted curve re-prices the bond (can be thought of the yield being paid above the LIBOR curve for holding this risky asset).
- **ASW - Asset Swap Spread**  
The asset swap spread is the spread over LIBOR paid on the floating leg in a par asset swap package. Unlike other measures it is a traded spread rather than an artificial measure of credit spread.

It should be noted that neither of the above two metrics can be taken as a perfect measure of credit risk. The Z-spread is a measure of the spread above the LIBOR curve. However, this full spread cannot be solely attributed to credit risk but rather only taken as a guide. As the Asset Swap Spread is a traded spread it too suffers from many of the issues associated with the CDS spread e.g. supply and demand concerns etc.

## 2.2.3 Solvency II illiquidity premium

For Solvency II, an approach has been developed to determine an illiquidity premium in calculating the technical reserves for certain liability classes<sup>2,3</sup>. This is the approach that is likely to apply for insurers in 2013 regardless of the actual assets held by insurers. The approach is based on a proportion of the spread over EURIBOR-linked swaps of the yield on an index of corporate bonds.

## 2.2.4 Historical experience approach

This approach involves using historical experience of bond default rates, downgrades and loss on default as a guide to likely outcomes for given holdings. The approach has been used in the past by insurers holding portfolios of corporate bonds.

In addition to the fact that past experience is not necessarily a reliable guide to future experience, there is also an issue regarding the amount of data in respect of government bond defaults and the extent to which this can be extrapolated to apply across bonds of other nations.

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<sup>2</sup> “QIS 5 Technical Specification Risk-free interest rates”, CFO Forum, CRO Forum – [http://ec.europa.eu/internal\\_market/insurance/docs/solvency/qis5/cfo-forum-cro-forum-paper-risk-free-rates\\_en.pdf](http://ec.europa.eu/internal_market/insurance/docs/solvency/qis5/cfo-forum-cro-forum-paper-risk-free-rates_en.pdf)

<sup>3</sup> “Task Force Report on the Liquidity Premium”, CEIOPS 2010 – [https://eiopa.europa.eu/fileadmin/tx\\_dam/files/publications/submissionstotheec/20100303-CEIOPS-Task-Force-Report-on-the-liquidity-premium.pdf](https://eiopa.europa.eu/fileadmin/tx_dam/files/publications/submissionstotheec/20100303-CEIOPS-Task-Force-Report-on-the-liquidity-premium.pdf)

## 2.2.5 Bank of England's summarised analysis of corporate bond spreads

In 2007, the Bank of England published a summarised analysis of corporate bond spreads<sup>4</sup> which suggested a best estimate of circa 50% (albeit less at times of high stress) of the excess spread over risk-free rates as being attributed to an illiquidity premium for holding corporate bonds.

This approach should, however, be understood to relate to a fully diversified holding of corporate bonds (with varying credit ratings) rather than a single exposure to a specific counterparty. In addition, the application of this approach in the UK typically involved adjusting outlying yields towards the mean.

## 2.2.6 Expert market opinion

A further approach involves gathering the views of a number of market experts to derive a consensus estimate of the amount of the spread which relates to risk. Although the approach is, by definition, subjective, arguably so too is the question. The result would be based on the opinion of independent professionals with market expertise.

## 2.2.7 Other possible approaches

**Covered Bond Method:** This method involves assessing the illiquidity premium level by reference to a collateralised or covered bond approach to compare yields against similar assets with similar levels of credit risk. In practice difficulties can arise where perceptions about credit risk e.g. credit ratings, lag or diverge from the market-implied level of risk associated with an asset.

**Structural Model Method:** In 1974, Merton described a structural asset model that could be used to decompose corporate bond spreads into credit yields and the remainder (including illiquidity)<sup>5</sup>. A recent example of applying this approach can be found in Webber & Churm (2007)<sup>4,6</sup>.

## 2.3 Application of the approaches to a sample scenario

For illustration purposes, the approaches listed above were applied to Irish government bonds at 31<sup>st</sup> December 2010. This is shown in Appendix 2.

No single approach can be taken as the definitive approach to estimate credit risk. Each actuary should consider alternative approaches and decide on the appropriate allowance for credit risk in the valuation interest rate.

The Working Group was mindful of the overall requirement for prudence in the valuation assumptions. After evaluating the data as at end 2010, the Working Group considered that, under general circumstances, the largest part or bulk of the excess spread of Irish government bonds over risk-free rates would be attributable to credit risk when calculating the valuation interest rate.

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<sup>4</sup> “Decomposing corporate bond spreads”, Bank of England Quarterly Bulletin, Volume 47, No. 4, 533-541 - <http://www.bankofengland.co.uk/publications/quarterlybulletin/qb0704.pdf>

<sup>5</sup> “On the pricing of corporate debt: The risk structure of interest rates” - Merton, R. (1974), The Journal of Finance, 29:449–470

<sup>6</sup> Hibbert et al (2009) provide some analysis of the different outcomes from some of these approaches in “Summary of liquidity premium estimation methods”- Barrie & Hibbert Research Document Version 1.2 - <http://www.ma.hw.ac.uk/~mcneil/ftp/LPmethods.pdf>

The Working Group noted that estimates of credit risk can change over time, particularly where the estimate reflects the market perception of risk. Therefore, it is recommended that the actuary reviews the approach being used to estimate credit risk, and the resulting assumptions, on a regular basis. Furthermore, the actuary may wish to consider an upper limit on the implicit allowance for an illiquidity premium within the valuation interest rate.

### 3 Sovereign Bonds and Concentration Risk

In dealing with risk arising from sovereign bonds, there has to be an acknowledgement that concentration risk exists. It needs to be acknowledged that credit risk may be associated with sovereign bonds. Where a company has significant concentration risk, there is a binary outcome, i.e. there is either default or there is not.

In addition to being responsible for determining actuarial liabilities, the actuary is responsible for drawing the attention of the Board to the following considerations:

- the potential impact of sovereign exposures on the capital position of the company;
- his or her interpretation of policyholders' reasonable expectations in the context of sovereign bond concentration risk.

The Board decides whether the concentration of sovereign bonds is tolerable having weighed up its views of the likely outcomes and its risk appetite. However, the Appointed Actuary has additional responsibilities where he or she considers that there is a material risk that a life insurance company will have insufficient funds or will fail to meet its obligations under the Insurance Act 1989 in relation to its life insurance business. These responsibilities are outlined in Paragraph 2.4 of ASP LA-1<sup>7</sup>.

#### 3.1 Scenarios to Consider

The Working Party recommends that the actuary provide the results of the following scenario tests to support a Board discussion:

1. A consideration of the impact on the solvency position of a widening of excess spreads on government bonds over risk-free rates;
2. A calculation of the solvency position on the basis of switching all the assets to a "risk-free asset" (such as more highly rated government bonds), or equivalently, setting the credit risk assumption on the government bonds to equal the excess yield of government bonds over risk-free assets;
3. A calculation of the solvency position on the basis outlined above with allowance for a further reduction in market values on the government bonds. This allowance could take the form (amongst others) of a reverse stress test to determine what level of "loss given default" a company can withstand. The actuary should be explicit with respect to assumptions on the disruption that a default may cause and the resulting asset yields.

#### 3.2 Further Considerations

The Working Party recommends that the actuary also consider the following with respect to sovereign bond concentration risk:

- Impacts on liabilities where the counterparty risk has been passed on to the policyholder;
- Interpretation of policyholders' reasonable expectations as per ASP LA-4<sup>8</sup> (in the case of a life insurance company).

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<sup>7</sup> ASP LA-1, Appointed Actuaries and life assurance business - <https://web.actuaries.ie/standards/asp/asp-la-1>

<sup>8</sup> ASP LA-4, Additional guidance for Appointed Actuaries on policyholders' reasonable expectations - <https://web.actuaries.ie/standards/asp/asp-la-4>



## APPENDIX 1: Extract from the regulations

The European Communities (Life Assurance) Framework Regulations, 1994 (S.I 360 of 1994) require that:

Proper provision shall be made for all liabilities on prudent assumptions having regard to the relevant factors and using a sufficiently prudent prospective actuarial valuation and taking account of the liabilities as determined by the policy conditions for each existing contract

A prudent valuation is not a "best estimate" valuation but shall include an appropriate margin for adverse deviation of the relevant factors.

In determining the rates of interest to be used in calculating the present value of future payments by or to an undertaking, regard shall be had to the yields on the existing assets attributed to the life assurance business and, to the extent appropriate to the yield which it is expected will be obtained on sums to be invested in the future.

The assumed yield on an asset attributed to the life assurance business, before any adjustment to take account of the effect of taxation, shall not exceed the yield on the asset .....reduced by 2.5 per cent. of that yield

Adjustment shall be made to exclude that part of the yield estimated to represent compensation for the risk that the income from the asset might not be maintained or that capital repayments might not be received as they fall due.....In making these adjustments, regard shall be had wherever possible to the yields on risk-free investments of a similar term in the same currency.

**Section 3.3.4 of ASP LA-3<sup>9</sup> gives the following guidance:**

Paragraph 7(7)(a) of Annex IV requires an adjustment (where relevant) to the yield on assets other than equity shares or land to recognise the possibility of default. This is in addition to the 2.5% margin required by Paragraph 7(3) of Annex IV. This Paragraph refers to the need to have regard to the yields available on risk-free investments of a similar term in the same currency when assessing this adjustment. It is appropriate to have regard to any differences in yield which arise from differences in marketability of the asset in question as compared with the risk-free alternative when assessing the deduction for the default risk. Provision for the possibility of default for credit-rated securities must be made on a prudent basis. This provision should normally be made by reference to historic default rates of securities with a similar credit rating, and this may result in adjustment to current default rates. Provision for the possibility of default for securities that are not credit-rated must be made on principles at least as prudent as those adopted for credit-rated securities.

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<sup>9</sup> ASP LA-3, Additional guidance for Appointed Actuaries on valuation of life assurance business - <https://web.actuaries.ie/standards/asp/asp-la-3>

## APPENDIX 2: Example of applying the approaches to estimating credit risk

As an example, in this section the approaches to estimating credit risk are applied to Irish government bonds at 31 December 2010. These approaches can equally be applied to other government bonds.

### **Background:**

The table below indicates the spread on 10-year Irish government bonds compared to German government bonds in the 5 years up to 31 December 2010.

31-Dec	Yield p.a. Irish 10-yr bond	Yield p.a. Germany 10-yr bond	Difference
2006	3.95%	3.88%	0.07%
2007	4.46%	4.31%	0.15%
2008	4.26%	2.95%	1.31%
2009	4.84%	3.39%	1.45%
2010	9.05%	2.96%	6.09%

### **Liquidity of European government bonds – bid-offer spread:**

The size of the difference between the bid price and ask price of a bond can be taken as an indicator of liquidity, with larger differences indicating lower liquidity. As can be seen from the table below, government bonds from Ireland and other peripheral countries are trading at a significant bid-offer spread compared to other government bonds within the Eurozone, and the bid-offer spread widened considerably in 2010.

Government Bond	Tenor	31/12/2010			31/12/2009		
		Bid Price	Ask Price	Bid/Offer Spread (% of Bid)	Bid Price	Ask Price	Bid/Offer Spread (% of Bid)
Portugal	10yr	78.9	80.4	<b>1.9%</b>	104.7	106.1	<b>1.3%</b>
Italy	10yr	91.9	92.1	<b>0.2%</b>	103.8	104.0	<b>0.1%</b>
Ireland	10yr	73.7	75.8	<b>2.9%</b>	96.3	97.6	<b>1.3%</b>
Greece	10yr	65.4	67.4	<b>3.2%</b>	105.0	106.2	<b>1.1%</b>
Spain	10yr	95.3	96.0	<b>0.7%</b>	102.4	102.8	<b>0.4%</b>
France	10yr	103.2	103.4	<b>0.2%</b>	101.0	101.5	<b>0.5%</b>
Germany	10yr	96.1	96.2	<b>0.1%</b>	98.8	98.9	<b>0.1%</b>

Source: iBoxx

The data above points to a decline in the liquidity of government bonds in peripheral countries from the second half of 2010, which suggests a possible illiquidity premium within yields at end 2010 (that is, the full spread above risk-free rates may not be entirely attributable to credit risk). Given this, the remainder of this section considers approaches to estimating the credit risk at end 2010 on Irish government bonds.

## ***Application of approaches to estimating credit risk:***

The approaches set out in the paper can be applied as follows:

### ***Credit default swaps (CDS)***

Over the last three years the CDS price on five year Irish bonds has risen from less than twenty basis points to over six hundred basis points indicating that, under this approach, practically all of the spread on Irish gilts is considered to be in respect of credit risk.

31-Dec	CDS price on 5-yr Irish bond (bps)
2007	18
2008	181
2009	158
2010	619

### ***Market Based Metrics such as Bloomberg***

Recent values in early 2011 show that the Z-Spread suggests that 90% of the current Irish bond spread is risk related and the Asset Swap Spread approach suggests that 75% of the spread is risk related (source: Bloomberg).

### ***Solvency II illiquidity premium***

At December 2009 this approach lead to an illiquidity premium of 53 bps and at December 2010 it would have been 46 bps. However, it should be noted that this calibration is based on corporate bonds.

### ***Historical experience approach***

Moody's "Sovereign Default and Recovery Rates, 1983-2009" (April 2010) provides an analysis of the credit experience on government bonds. However, care should be taken in interpreting this data as historic experience of defaults on government bonds has largely applied to emerging economies, and the experience can be quite case-specific. Furthermore, the paper analyses risk according to credit ratings, whereas Irish government bonds are currently trading at spreads significantly in excess of the levels seen on corporate bonds with equivalent credit ratings.

### ***Bank of England's summarised analysis of corporate bond spreads***

This approach indicates that less than 50% of the additional spread should be attributed to an illiquidity premium at times of high stress.

## **Summary:**

The results of the above approaches can be summarised as follows:

*Irish government bonds, as at 31 December 2010:*

<b>Approach to estimating credit risk:</b>	<b>% of the excess spread that can be considered credit risk</b>
Credit default swaps	>100%
Market based metrics	75% - 90%*
Solvency II illiquidity premium	92%
Historical experience approach	**
Bank of England's analysis on corporate bonds	>50%

\* Based on data at 15 February 2011

\*\* Depends on the analysis of historical experience.

## Appendix 3: Working Party Membership

The membership of the Working Party that prepared this paper was comprised of the following:

- Thomas Farrell
- Billy Galavan
- Linda Kerrigan
- Brendan McCarthy
- Colin Murray
- Aidan O'Donnell
- Emily O'Gara
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