17 November 2011

Mrs Helen Rowell
General Manager
Policy Development
Australian Prudential Regulation Authority
400 George Street
SYDNEY NSW 2000

Dear Helen

Illiquidity Premiums

The attached paper prepared by an Actuaries Institute working group provides some information on methods of determining the illiquidity premium for use in regulatory prudential capital calculations, specifically for the calculation of the Prescribed Capital Amount of Pillar 1 of the proposed regulatory capital framework.

This work has been carried out as a continuation of the responses provided by the Institute in its submission to APRA dated 31 July 2011, and this paper is to be construed as an addendum to that submission.

Please do not hesitate to contact Melinda Howes, Chief Executive Officer by email melinda.howes@actuaries.asn.au or phone (02) 9239 6106 to discuss any aspect of this paper.

Yours sincerely

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Discussion of Approaches for Determining Illiquidity Premiums in Australia for Regulatory Purposes

17 November 2011

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1.0 Introduction

APRA is developing revised capital standards and intends to allow an illiquidity premium to be included in the discount rates used for certain products.

This paper has been prepared by a working group of the Actuaries Institute (the Institute) to provide information on methods of determining the illiquidity premium for use in regulatory prudential capital calculations, specifically for the calculation of the Prescribed Capital Amount of Pillar 1 of APRA's proposed regulatory capital framework.

This paper describes possible approaches for determining illiquidity premiums, and discusses relevant issues. The paper sets out:

- the background to the work undertaken;
- the range of methodologies currently available to determine estimates of the illiquidity premium over time;
- a possible simplified proxy formula for determining the illiquidity premium;
- an approach for setting a term structure of illiquidity premium; and
- an approach for stress testing the illiquidity premium as part of the calculation of the Asset Risk Charge.

The working group has used Australian data when considering the options for determining an illiquidity premium.

This work has been carried out as a continuation of the responses provided by the Institute in its submission dated 31 July 2011, and this paper is to be construed as an addendum to that submission.

We set out below an approach which aims to meet APRA's stated criteria. We have not considered the appropriateness of applying an illiquidity premium to specific product structures. We refer APRA to the Institute's various submissions made during APRA's consultation process for the Institute position on such issues as they relate to illiquidity premiums, and we are available for further discussion.

2.0 Summary

APRA's requirements for determining illiquidity premiums, as set out in the response to submissions to the capital discussion paper[1] are that:

- A satisfactory method must have reasonable assurance of giving appropriate results in both normal and stressed conditions; and
- The amount of insurer/actuary discretion involved in determining the illiquidity premium should be small, so that all insurers use approximately the same illiquidity premium at the same point in time.

Further discussions with APRA indicated that they were seeking a formula-based approach which references one or more observable market parameters, with the parameters being calibrated using a range of market-based methodologies.
An example of an approach that may meet APRA's needs is:

- A representative formula-based approach for calculating the illiquidity premium (LP) for terms of up to seven years such as

$$Simple\ Proxy\ LP = \max\{0, 90\% \times RBA\ Single\ A\ Index\ Spread\ to\ Bond - 60\% \times RBA\ Single\ A\ Index\ Spread\ to\ Swap + 2bps\}$$

  where:

  - *RBA Single A Index Spread to Bond* is the "Spread over bonds issued by the Australian Government" for A securities as set out in table *F3 Capital Market Yields and Spreads – Non-government Instruments*; and
  - *RBA Single A Index Spread to Swap* is the "Spread over swap issued by the Australian Government" for A securities as set out in table *F3 Capital Market Yields and Spreads – Non-government Instruments*.

  Beyond a seven year period, the illiquidity premium could revert linearly over the next five years to a level determined by the formula

$$Simple\ Proxy\ LP = max\{0, 7.5\% \times RBA\ Single\ A\ Index\ Spread\ to\ Bond + 9.3\% \times RBA\ Single\ A\ Index\ Spread\ to\ Swap + 24bps\}$$

  and then remain at that level for terms above 12 years.

- In the determination of the PCA, the A bond credit spread shock could be applied to the RBA Single A Index Spreads (both to Bond and to Swap) in the above formulae and the resulting illiquidity premium term structure applied to the relevant liabilities. The shock can be applied in both an upward and downward direction, with the more adverse of the two shocks being used as the result of the credit spread module for the purposes of the aggregation benefit.

[1] "*Response to submissions Review of capital standards for general insurers and life insurers*", APRA, March 2011 p30 http://www.apra.gov.au/CrossIndustry/Documents/GLI_RS_RCSGILI_032011_ex_r[1].pdf

3.0 Background

Illiquidity Premium and LAGIC Project

APRA is undertaking a review of its capital standards for life insurers and general insurers, the Life and General Insurance Capital (LAGIC) Project.

APRA has noted[2] that it intends that the level of required capital for both general and life insurers would be set such that an insurer would have sufficient capital to absorb unexpected shocks or losses that may arise over a one-year period, with a 99.5 per cent level of probability, and continue to be able to meet its obligations to policyholders at the end of that period.

Under the proposed framework, insurers' required capital consists of a Prescribed Capital Amount (PCA) and a supervisory adjustment. An insurer must maintain a sufficient capital base to meet its capital requirements.

In determining the valuation of liabilities and determining regulatory capital requirements, APRA requires that future cash flows are discounted at a risk free discount rate. APRA's view is that the risk free discount rates appropriate for valuing liabilities should reflect the rates that can be earned on assets that:

- have no credit risk;
- are readily realisable or liquid, even in times of stress; and
- match the term and currency of the future liability cash flows[3].

APRA has further stated that it considers the zero coupon spot yield on Australian Commonwealth Government Securities (CGS) as the best proxy for risk free rates. This view has been reiterated in APRA's response to submissions[4].

APRA has also noted that for liabilities that are illiquid, it may be appropriate to add an illiquidity premium to the risk free rates. The argument for using illiquidity premiums described in APRA's consultation is that, if the future cash flows of an insurance liability are certain and liquidity was not required, then it would be possible to match such liabilities with more illiquid securities (implying a higher discount rate)[5].

Illiquidity can be defined as occurring where an asset is not readily saleable due to uncertainty about its value or due to the lack of a market in which it is regularly traded. Where assets are illiquid, theory suggests that investors demand an additional premium as a reward for the risk of being unable to realise the asset as required or for incurring additional transaction costs where the asset has to be sold. This additional premium leads to an increase in the implicit yield of the instrument, and thus a spread over and above the discount rate for an otherwise liquid asset.

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[2] "*Discussion Paper Review of capital standards for general insurers and life insurers*", APRA, May 2010, p9. http://www.apra.gov.au/CrossIndustry/Documents/GLI_DP_RCSGILI_032010_v7[1].pdf

[3] "*Discussion Paper Review of capital standards for general insurers and life insurers*", APRA, May 2010, p48. http://www.apra.gov.au/CrossIndustry/Documents/GLI_DP_RCSGILI_032010_v7[1].pdf

[4] "*Response to submissions Review of capital standards for general insurers and life insurers*", APRA, March 2011 p29 http://www.apra.gov.au/CrossIndustry/Documents/GLI_RS_RCSGILI_032011_ex_r[1].pdf

[5] "*Discussion Paper Review of capital standards for general insurers and life insurers*", APRA, May 2010, p49. http://www.apra.gov.au/CrossIndustry/Documents/GLI_DP_RCSGILI_032010_v7[1].pdf

Literature on illiquidity premium in asset markets[6] suggests that an illiquidity premium can be substantial, varies through time, and is expected to increase in stressed market conditions.

While not directly observable, a cost for illiquidity in these markets can be estimated using a variety of methods. As there is limited market data on life insurance policy values on which to base an illiquidity premium estimate, these methods and estimates of illiquidity premium typically involve the use of bond yields and other credit market data. It is noted that the instruments involved are generally more liquid than the life insurance policy values for which APRA intends to permit the application of a liquidity premium.

6 For a detailed review of the literature on liquidity premiums in asset markets, see http://www.barrhibb.com/documents/downloads/Liquidity_Premium_Literature_Review.PDF. The theoretical literature is supported by empirical studies showing that illiquid securities are priced at discounts to identical liquid securities, irrespective of the time period studied or the method used.

4.0 Content of this Paper

The aim of this paper is to provide some information on methods of determining the illiquidity premium for the purposes of the proposed capital standards.

For this paper, we have considered:

- APRA's requirements for illiquidity premiums, as set out in the response to submissions to the capital discussion paper[7], including:
  - A satisfactory method must have reasonable assurance of giving appropriate results in both normal and stressed conditions;
  - The amount of insurer/actuary discretion involved in determining the illiquidity premium should be small, so that all insurers use approximately the same illiquidity premium at the same point in time; and
- Further discussions with APRA which indicated preference for a formula-based approach which references one or more observable market parameters, with the parameters being calibrated using a range of market-based methodologies.

In addition to discussing methods for estimating an illiquidity premium, we have also considered the potential impact that any future change in the illiquidity premium might have on an insurer. If an illiquidity premium is used by an insurer, then under APRA's proposed capital principles the risk that such illiquidity premiums adversely change should be captured in determining that insurer's capital requirements.

Existing Approaches

In an insurance context studies of illiquidity premiums have been undertaken in Europe as part of the development of Solvency II. This paper draws on that experience.

More generally, most academic and practitioner research on estimating illiquidity premiums in asset markets has been carried out on US and European asset (primarily credit) markets. Relatively little published research exists specifically relating to estimation of illiquidity premiums in Australia. The Solvency II Quantitative Impact Study 5 (QIS5) specifications did set out a methodology to estimate illiquidity premiums for Australian liabilities; however we understand that this was extrapolated from proxy methods calibrated to overseas illiquidity premium estimates, and not to Australian markets.

In Europe, various industry and regulatory bodies have contributed to the debate on how illiquidity premiums might be estimated. The existence of an illiquidity premium has also been suggested by the CFO Forum, which suggests the risk free rate should be the swap rate (less a 10bp credit risk adjustment) plus an illiquidity premium, where appropriate. In responses[8] to a CEIOPS discussion paper on risk free rates[9], many market participants echoed the CFO Forum's sentiments.

[7] "*Response to submissions Review of capital standards for general insurers and life insurers*", APRA, March 2011 p30 http://www.apra.gov.au/CrossIndustry/Documents/GLI_RS_RCSGILI_032011_ex_r[1].pdf

[8] http://www.ceiops.eu/media/files/consultations/consultationpapers/CP40/CEIOPS-SEC-103-09-Comments-and-Resolutions-Template-on-CEIOPS-CP-40-09.pdf

In the most recent impact study on Solvency II, an illiquidity premium is permitted where liabilities meet certain criteria of illiquidity. The methodology used to estimate illiquidity premiums under Solvency II's QIS5 was based on a methodology proposed by the CFO and CRO forums[10], also discussed in the CEIOPS taskforce report on liquidity premiums[11].

Determining an Illiquidity Premium

The methodology used in this paper for determining an illiquidity premium is similar to that set out in the CEIOPS taskforce report on illiquidity premiums and subsequent Solvency II QIS5 proposals. The key steps are as follows:

Collate data and estimate historic illiquidity premiums in Australia

Historic illiquidity premiums in Australian asset markets can be estimated using a variety of methods (Bond-CDS spreads, Government Guaranteed bond spreads, semi-government bond spreads). These data provide a variety of time series of illiquidity premium estimates.

We have considered the available data in an endeavour to identify potentially significant limitations in methodology and resulting estimates.

Identify "Risk Factor" Proxies for Illiquidity Premium

Potential explanatory "risk factor" proxies can be identified which might be used as an explanatory variable in a simple formula used to estimate illiquidity premiums. These can be chosen to be consistent with APRA's requirements for any illiquidity premium estimate, namely that they:

- Are an intuitive explanatory factor for illiquidity premium (e.g. the measure increases as liquidity decreases);
- Are readily available in a timely manner;
- Are easily accessible by industry practitioners;
- Have a time series history available consistent with the illiquidity premium estimates; and
- Have characteristics which are relatively well aligned to the available illiquidity premium estimates (e.g. by duration, credit rating, currency, etc).

Fit a Proxy Formula to Historic Illiquidity Premium Estimates

The final step is to fit a simple functional form to the available data as a proxy to an illiquidity premium. It is intended that this functional form, and the resulting calibration, should be an appropriate proxy which can be used to estimate the illiquidity premium without any of the significant computational complexities which arise from the more detailed methods used to estimate historic illiquidity premiums.

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[9] http://www.ceiops.eu/media/files/consultations/consultationpapers/CP40/CEIOPS-CP-40-09-L2-Advice-TP-Risk-Free-Rate.pdf

[10] http://www.thecroforum.org/assets/files/publications/CFOF_CROF_QIS%205%20RFR%20calibration_FINAL.pdf

[11] https://eiopa.europa.eu/fileadmin/tx_dam/files/publications/submissionstotheec/20100303-CEIOPS-Task-Force-Report-on-the-liquidity-premium.pdf

As the available data for estimating illiquidity premiums in Australia are limited, particularly by maturity, any chosen method would be able to extend the formulaic estimate to provide an estimate of illiquidity premium across the entire term structure at any point in time.

5.0 Historic Estimates of Illiquidity Premium: Measurement Approaches

There is no market data available which provide a single precise decomposition of bond yields/returns into risk-free, credit risk and illiquidity premium components.

Therefore, Solvency II QIS5 and this paper consider a range of approaches available for estimating illiquidity premium.

The overseas literature and CFO Forum analysis have generally used three methods to estimate illiquidity premiums – CDS Negative Basis, Structural Models, and Covered Bond methods. These, and other potential methods, are described below.

The illiquidity premiums calculated through these methods provide estimates which arise in the respective markets taking into account the level of liquidity in those markets. In practice, all of the asset markets used to estimate illiquidity premiums are likely to exhibit some level of liquidity. As such, the illiquidity premiums calculated will tend to underestimate the illiquidity premiums that would be applicable to a highly illiquid insurance liability.

The CDS Negative Basis Method

Credit default swaps provide a mechanism for insuring against the default of a bond issuer. The CDS Negative Basis method compares the spread on a corporate bond with the interpolated spread of a Credit Default Swap for similar issuing entities, maturities and seniority.

Using arbitrage logic it can be shown that the spread of a corporate floating rate note (FRN) over a default free FRN should be equal to the CDS premium, plus any allowance for default of the CDS protection issuer. The arbitrage process involves buying the corporate FRN and buying protection against the bond's default through a CDS: the net rate earned, i.e. the bond yield less the CDS premium, can then be considered "risk free". Similar arbitrage logic can also be applied to ordinary fixed income coupon bonds as well, although here we discuss FRNs. Empirical results support this argument by showing a meaningful negative difference between the CDS premium and the bond spread. This difference is called the "negative basis" and provides evidence for the existence of other components priced in the corporate spread such as a market illiquidity risk premium for the underlying bond.

The key assumption of this approach is that the CDS spread measures the pure credit risk component of the corporate bond spread. In practice, the CDS spread may also price the counterparty risk that the protection seller will default. However, it should be noted that most CDS are captured under Credit Support Annexes, significantly mitigating the counterparty credit risk of a CDS. Furthermore globally, regulators, dealers and investors have moved to develop central counterparty clearing mechanisms for CDS contracts and greater standardisation of contracts. These initiatives are beginning to develop momentum, particularly in Europe with Eurex clearing a sample of CDS contracts from the end of July 2009. This is an important development for using the CDS basis as a measure of the illiquidity premium since it has the potential to effectively remove counterparty risk from the basis equation.

An illiquidity premium determined using this method might be expected to vary by the term and seniority of the issue, and the credit quality of the issuer. In practice, the amount of data available, particularly in the Australian credit market, does not facilitate the breakdown of such estimates into these categories.

The Guaranteed Bond Method

The guaranteed bond method involves choosing a pair of assets which, besides liquidity, are assumed to offer equivalent cash flows and equivalent credit risk. In overseas markets, covered bonds are used. In Australia, the prime examples are the spread between CGS bonds and corporate bonds which are guaranteed by the government, and between CGS bonds and semi-government bonds also guaranteed by the Commonwealth. Due to the guarantee, the corporate and semi-government bonds have the same credit risk as the government bonds. The illiquidity premium is estimated as the difference in yield between these two groups of bonds.
As noted above, government guaranteed corporate and semi-government bonds will likely have higher liquidity than insurance liabilities, so this method will underestimate the appropriate illiquidity premium for such liabilities.

Other Models

A number of other methods have been proposed or used for illiquidity premium estimation. Some of these are noted here for completeness. Overseas evidence suggests such methods produce similar results, and in some cases the methodologies are significantly more complex.

The Structural Model Method

The structural model method involves the use of option pricing techniques to calculate a theoretical credit spread which compensates only for credit risk, allowing for both default risk and any credit risk premium. The difference between the theoretical spread and the actual market spread is typically taken to be an illiquidity premium. This method was one of the methods used to estimate illiquidity premiums in the Solvency II QIS5 calibration.

This method compares the yield on an illiquid corporate bond portfolio with the cost/yield on a liquid position with otherwise equivalent risk characteristics constructed from risk free bonds and notional options on the value of the issuing entity, using the Merton model. Allowance can be made in such techniques for a variety of frictional costs associated with this construction, e.g. bankruptcy costs.
While this approach is appealing due to its intuitive explanation and theoretical foundations, the method is complex, model-dependent, and requires subjective estimates of parameters which may not be directly observable in markets.

The Replication Method

In a recent paper, Barrie and Hibbert[12] present a theoretical argument and a practical approach for estimating illiquidity premiums. The authors focused on a theoretical portfolio of replicating assets (not actual backing assets) to calculate the

[12] http://www.barrhibb.com/documents/downloads/Research_Note_Measure_of_Liquidity_of_Insurance_Liabilities_DP.pdf

illiquidity premium. The authors argue that if the liability cash flows can be matched exactly by a (hypothetical) portfolio of assets, then any illiquidity premium embedded in the asset valuation should be included in the valuation of the liabilities.

The Swap Spread

Given that many of the illiquid instruments used to determine illiquidity premiums are typically priced by market participants assuming swap rates represent a risk free rate, additional information about the size of illiquidity premiums is likely to be contained within swap spreads at any given time. As such, the swap spread has been considered as an additional factor used when fitting proxy formulae. This is discussed further later in this paper.

6.0 Illustrative Estimates of Illiquidity Premium

For the purposes of illustration, we discuss the application of three of the above methods to the Australian market.

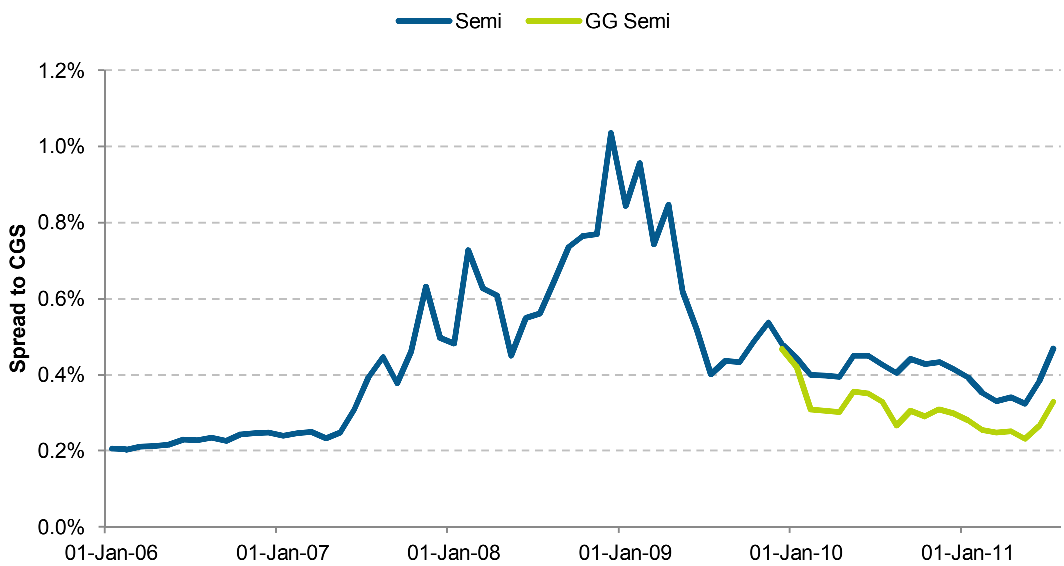
Semi-Government Bond

Many investors consider Australian semi-government bonds to be essentially risk free, carrying an implicit support from the federal government. This assumption was reinforced during the global financial crisis when the federal government moved to offer a blanket guarantee of all existing semi-government bonds in its effort to stabilise Australian financial markets. This offer was taken up by NSWTC and QTC and while other states did not take the offer up as they considered it ultimately unnecessary, the offer demonstrated the willingness of the federal government to provide explicit state support when required. As such, semi-government bonds can be considered to be an alternative risk free rate, differentiated from CGS by being relatively less liquid.

Chart 1 shows the time series of the illiquidity premium as measured by average semi-government and government guaranteed semi-government bonds spread to CGS curve. These can be considered to be an estimate of the illiquidity premium over time. Spreads have been calculated as the yield to maturity on each instrument less the CGS curve point that matches the duration of the corporate bond. The CDS curve is the linear interpolation of CGS bond duration and yield to maturity points. All yields are quoted as annually compounded spot rates.

Over the period, January 2006 to August 2011, the average duration is 3.4 and 5.0 years for semi-government bonds and government guaranteed semi-government bonds respectively. On average, there are 35 semi-government bonds and 13 government guaranteed semi-government bonds.

CHART 1 TIME SERIES SEMI GOVERNMENT BONDS SPREAD TO CGS CURVE



Source: CBA Spectrum

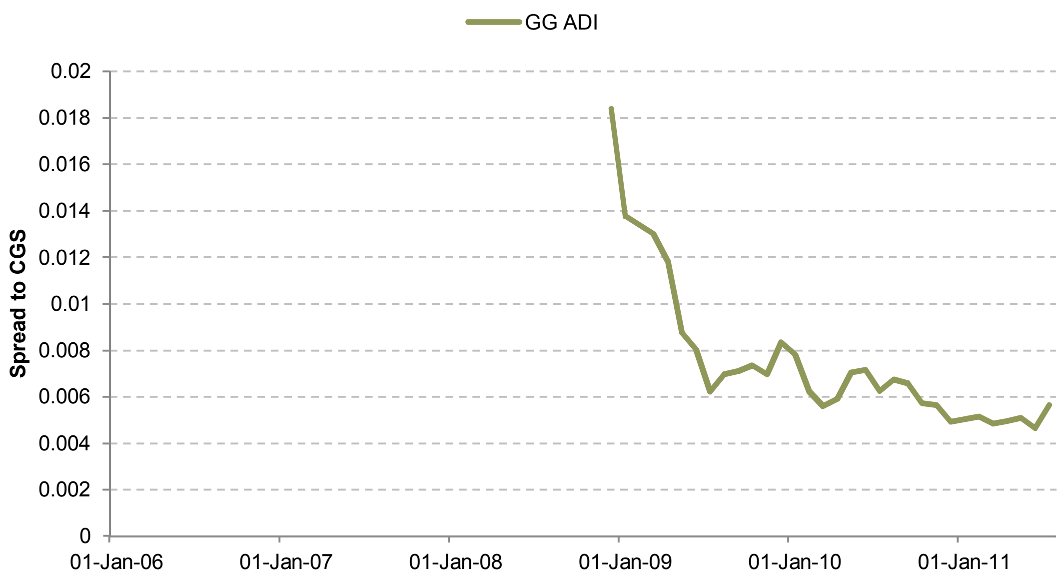
Chart 1 above illustrates that while Australian semi-government may be implicitly supported by the federal government, those bonds with an explicit guarantee trade at a premium. This may be due to either lower credit risk, higher liquidity, or both.

Government Guaranteed (GG) Corporate Bonds

In late 2008, the federal government introduced the Australian Government Guarantee (GG) scheme under which qualifying ADIs were able to issue bonds carrying the full guarantee of the Federal Government. All bonds issued under this guarantee can be considered to have the credit risk characteristics of the Australian Commonwealth Government. Subject to any settlement delays or disputes on the government's guarantee payments, or any potential shortening of duration of the GG bonds should the guarantee become payable, yield spreads between CGS and GG can therefore be considered to largely reflect liquidity differences between the bonds, and hence an illiquidity premium.

It should be noted that the Commonwealth guarantee scheme has only been in place since 2009, and closed to new issues in March 2010. Bonds up to a term of 5 years were permitted to obtain the guarantee. As such, GG bonds will only remain until 2015. The illiquidity premium implied are therefore a useful estimate of illiquidity premiums over this period, but will cease to be a meaningful indicator in future.
Chart 2 shows the time series of the illiquidity premium as measured by average government guaranteed corporate bond spread to CGS curve.

CHART 2 TIME SERIES OF GOVERNMENT GUARANTEED ADI BONDS SPREAD TO CGS CURVE



Source: CBA Spectrum

On average, there are 27 bonds in the GG ADI spread index in Chart 2. The average duration of these bonds is 2.7 years.

CDS Negative Basis

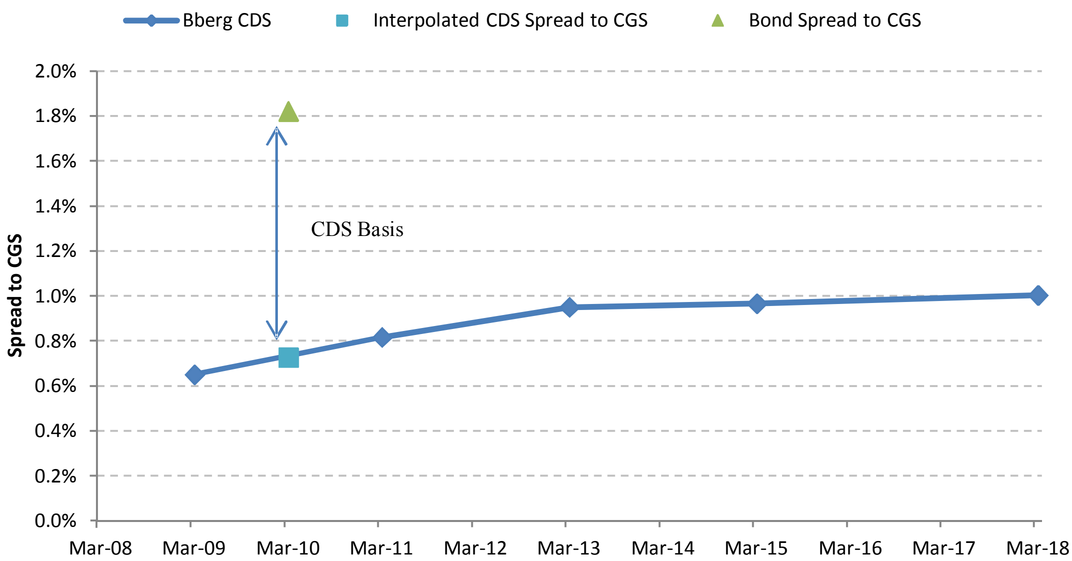
Similar to offshore markets, Australia has a relatively deep credit default swap (CDS) market for which multiple market participants provide pricing and liquidity.

The CDS Negative Basis method determines an illiquidity premium by subtracting the market cost of credit risk, represented by the CDS premium, from the overall bond yield spread (to a risk free rate).

Corporate bond spreads to the CGS curve data were obtained from UBS for a number of individual bond issues. Subordinated debt was excluded. CDS spreads to CGS curve data was obtained from Bloomberg. As CDS terms are generally at least one year, bonds with maturities of less than a year were excluded.

Chart 3 illustrates the CDS Negative Basis method. The available CDS nodes (for example 1, 3, 5, 7 and 10 year maturities might be available) are linearly interpolated to match the bond's maturity. The difference between this interpolated CDS spread and the bond spread is the CDS basis.

CHART 3 TERM STRUCTURE OF CDS BASIS



Source: UBS, Bloomberg. Bond ISIN: AU0000ANZHJ7, data as at 31-Mar-2008

In calculating the CDS Negative Basis, instances where the CDS spread was larger than the bond spread were omitted. This does not detract from the validity of the analysis; those bond-CDS pairs would simply not be invested in. Such occurrences may indicate issues with those data points, stale corporate bond prices or a less liquid CDS market than the underlying bond market.

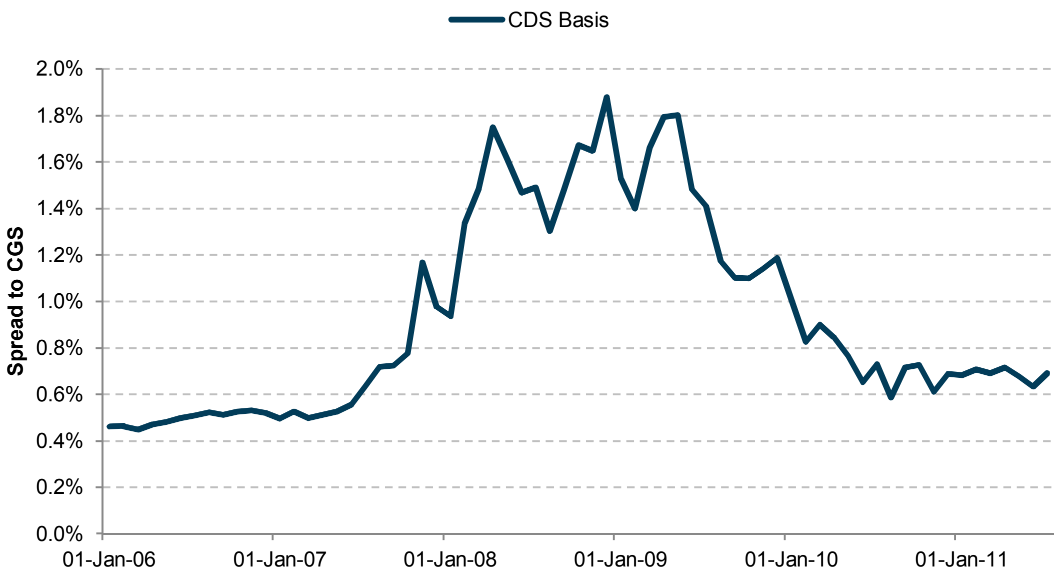
For the period, January 2006 to August 2011, there is an average of 68 matched corporate bond-CDS pairs with a positive CDS basis. The maximum is 83 pairs and the minimum is 55; i.e. there is a reasonable sample size. We note however that there is a less diverse spread of *issuers* than *issues*, consistent with the relatively concentrated number of issuers of investment grade corporate bonds in Australia.

Chart 4 exhibits the time series of the illiquidity premium as measured by the unweighted average CDS basis across the available bonds. Note that this provides an average across the range of bond maturities and credit ratings.

Over the period analysed in Chart 4, the bonds used in the CDS Basis have:

- an average rating of A and ranged between A- and A+; and
- an average duration of 2.9 years with a minimum of 2.5 and maximum of 3.3.

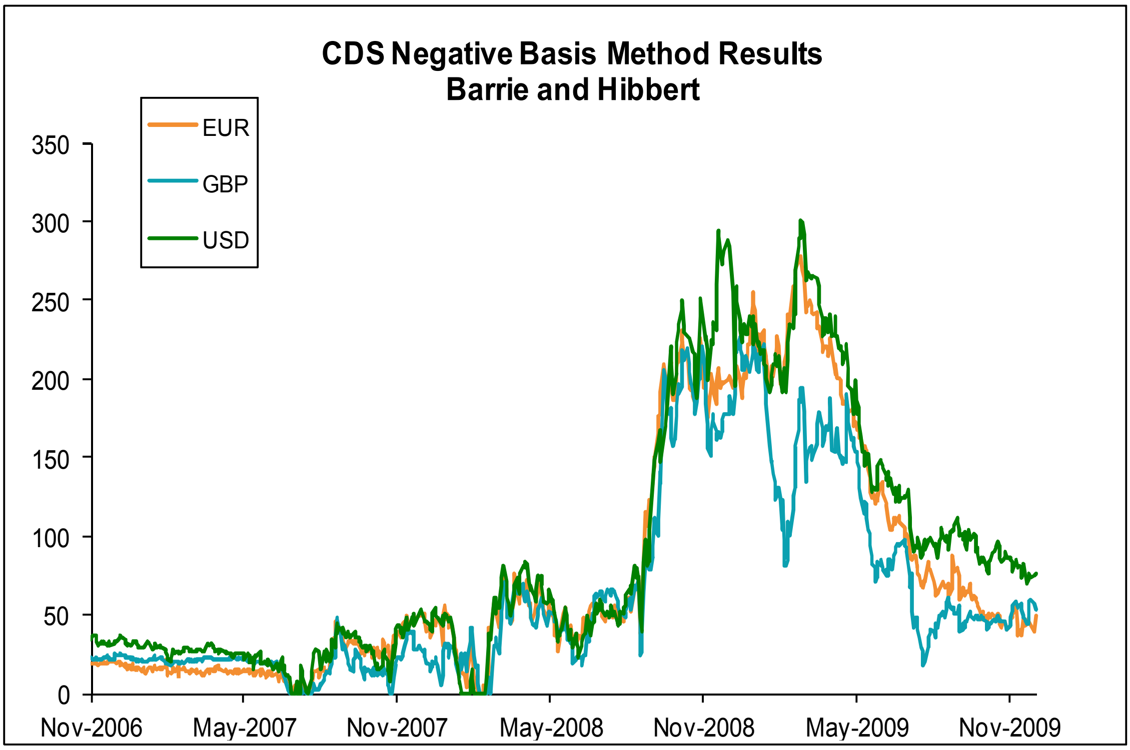
CHART 4 TIME SERIES OF CDS BASIS



Source: UBS, Bloomberg

This analysis indicates a similar overall pattern to the negative basis analysis conducted by Barrie and Hibbert for the US, European and UK, which is set out in Chart 5 below.

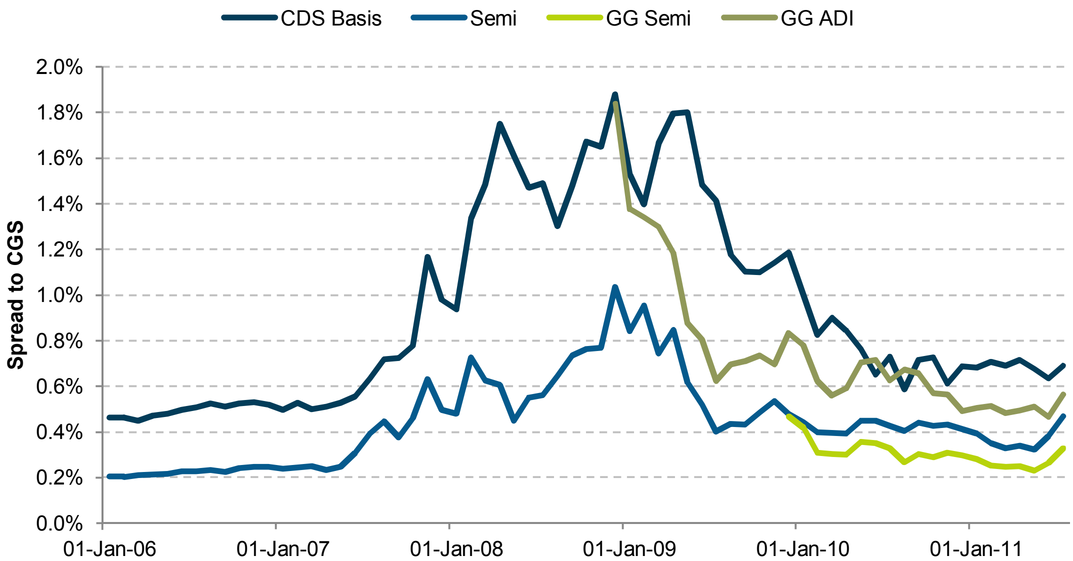
CHART 5 BARRIE AND HIBBERT ANALYSIS OF CDS BASIS



Historic Illiquidity Premium Series

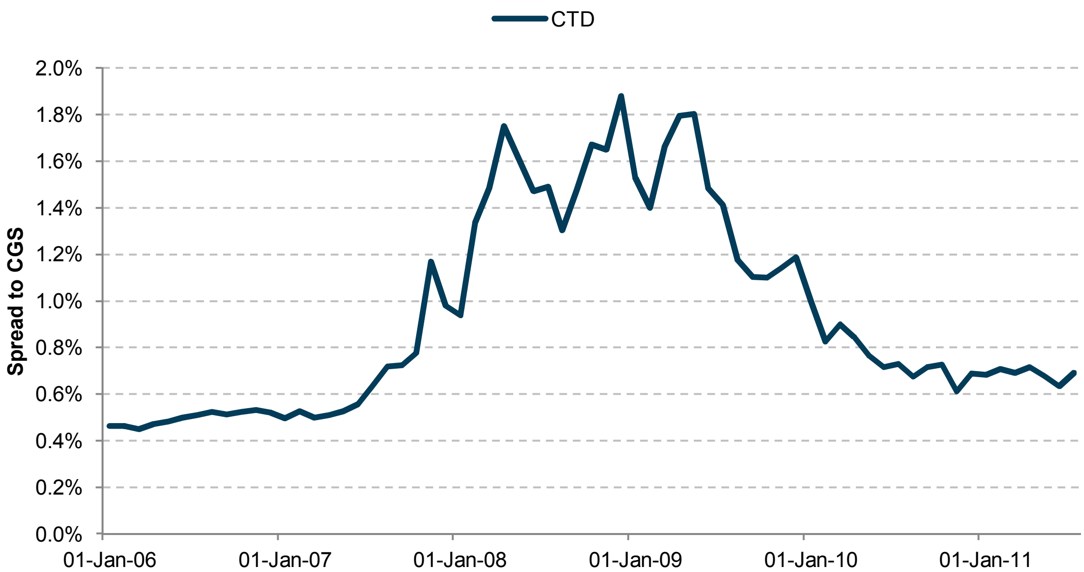
Chart 6 illustrates all illiquidity premium measures on one chart. Using the liquidity matching argument set out by APRA, a firm could match illiquid liabilities to risk free illiquid assets at any point in time by holding the lowest cost version of the universe of assets. A "cheapest to deliver" (CTD) series can be constructed by taking the maximum illiquidity premium at each date. The CTD series can be seen in Chart 7. We note that, in almost all time periods observed, the CDS basis method has produced the largest illiquidity premium measure. This is consistent with the view that the other measures represent more liquid markets, with higher levels of liquidity than expected with insurance liabilities.

CHART 6 AUSTRALIAN ILLIQUIDITY PREMIUM ESTIMATES



Source: UBS, Bloomberg

CHART 7 AUSTRALIAN CHEAPEST TO DELIVER ILLIQUIDITY PREMIUM ESTIMATE



7.0 Formulaic Proxies and Fitting Results

CFO Forum approach

The various methods described above for estimating illiquidity premiums provide a range of outcomes reflecting factors such as the approximations in the methodologies and the varying liquidity of the underlying reference markets. By making use of estimates derived from a number of different methods together it is possible to create a more robust overall estimate. Barrie and Hibbert[13] propose a simple and intuitive proxy method to 'sense check' the other models and to propose a model that is very easy to implement. Based on a simple transformation of the observed credit spread, the model proposes that the illiquidity premium is:

$$LP = max\{0, x(Spread - y)\},$$

where both LP and Spread are measured by reference to the swap curve, and x and y are variables defined below.

In their paper, Barrie and Hibbert suggest an interpretation of this formula. The corporate bond spread over swap is considered to be comprised of three components: an allowance for the cost of default; a risk premium to compensate bond holders for bearing credit risk and an illiquidity premium to compensate for the costs and associated uncertainty of trading illiquid bonds. Expected default costs over long horizons might be expected to be reasonably stable and one can interpret the deduction, *y*, as an allowance for expected losses. By setting the proportion, *x*, the remainder of the spread is split between the illiquidity premium and the credit risk premium.

Provided that the value of x is positive, this formula can provide illiquidity premium estimates which increase as credit spreads increase. Such behaviour is clearly evidenced in charts 1 to 2 and 4 to 7 above, which include periods of extreme spread movements during the global financial crisis.

The CFO Forum used this transformation to fit to US, UK and Euro markets to produce parameters of *x* = 50% and *y* = 40bps. This formula and parameterisation was adopted for the Solvency II QIS5 study.

Risk Factor Proxies

In order to set an illiquidity premium estimate, potential risk factor proxies for use in the simplified formula need to be determined. As noted above, these proxies should satisfy some basic requirements, namely:

- be readily available in a timely manner;
- be easily accessible by industry practitioners;
- have a time series history available consistent with the illiquidity premium estimates; and
- have characteristics which are relatively well aligned to the available illiquidity premium estimates (e.g. by duration, credit rating, currency, etc).

[13] http://www.barrhibb.com/documents/downloads/Simple_Proxy_Liquidity_Premium.pdf

In determining possible risk factor proxies, a number of alternatives are available. Given the use of credit data to estimate asset illiquidity premiums, measures of credit spreads are the obvious choice in this context. Commercially available spreads on bond indices provided by a number of market counterparties could also be used. However, these suffer from a potential lack of ready availability to all practitioners, potentially being available only to customers of the providers.

For illustration purposes, we show a proxy based on spreads for A-rated corporate bonds with 1-5 years maturity[14] published monthly by the RBA, using spreads over both bonds issued by the Australian Government and swap rates. These indices are available with daily data history, and are published for the previous month on the first day of each month. In our example, the 'A'-rated version has been used, as this provides a broad range of Australian credit-risky bonds generally consistent with the average data used to calibrate the historic CDS Negative Basis illiquidity premium estimates, and reflective of a typical insurance company credit portfolio.[15]

Formulaic proxy for Australian data

As noted above, the formula and parameterisation of illiquidity premium for the Solvency II QIS5 was based on determining an illiquidity premium which is added to the swap curve. In contrast, the illiquidity premium approach illustrated in this paper is to be added to a CGS curve. Given that many of the illiquid instruments used to determine illiquidity premiums are typically priced by market participants assuming swap rates represent a risk free rate, additional information about the size of illiquidity premiums is likely to be contained within swap spreads at any given time. As such, the swap spread has been considered as an additional factor used when fitting proxy formulae.

This gives the following proxy formula for the calculation of an illiquidity premium:

$$\begin{aligned} &\mathit{Simple\ Proxy\ LP} \\ &\qquad = \max\{0, x_1 \times \mathit{RBA\ Single\ A\ Index\ Spread\ to\ Bond} + x_2 \\ &\qquad \times \mathit{RBA\ Single\ A\ Index\ Spread\ to\ Swap} + y\} \end{aligned}$$

Spread data can be obtained from the F3 Capital Market Spread Non-government Instruments published monthly by the RBA. Using a least squares regression approach gives the following proxy formula.

$$\begin{aligned} &\mathit{Simple\ Proxy\ LP} \\ &\qquad = \max\{0, 90\% \times \mathit{RBA\ Single\ A\ Index\ Spread\ to\ Bond} - 60\% \\ &\qquad \times \mathit{RBA\ Single\ A\ Index\ Spread\ to\ Swap} + 2bps\} \end{aligned}$$

where:

[14] See http://www.rba.gov.au/statistics/tables/pdf/f03hist.pdf . This index is described by the RBA as follows: *"The data cover fixed-rate bonds issued in Australia by financial institutions and non-financial corporates (including public trading enterprises and credit-wrapped bonds). They exclude asset-backed bonds and bonds issued by non-residents. Yields and spreads are shown for bonds that are in the broad credit ratings (as determined by Standard and Poor's) AA, A, and BBB, and that have a remaining term to maturity of between 1 and 5 years. All senior bonds quoted by UBS that meet these criteria are included in the calculations. Monthly figures shown are for the last working day of the month."*

[15] AA and BBB versions are also published by the RBA. The former is dominated by Australian bank issued bonds, the latter contains fewer issues and is at the low end of the investment grade bond holdings typically held by insurance companies.

» *RBA Single A Index Spread to Bond* is the "Spread over bonds issued by the Australian Government" for A securities as set out in table *F3 Capital Market Yields and Spreads – Non-government Instruments*; and

» *RBA Single A Index Spread to Swap* is the "Spread over swap issued by the Australian Government" for A securities as set out in table *F3 Capital Market Yields and Spreads – Non-government Instruments.*

Chart 8 below compares the formulaic proxy calculated using the formula above with the illiquidity premium curve shown in Chart 7.

Chart 8 CTD Illiquidity Premium Estimate vs. Fitted Proxy

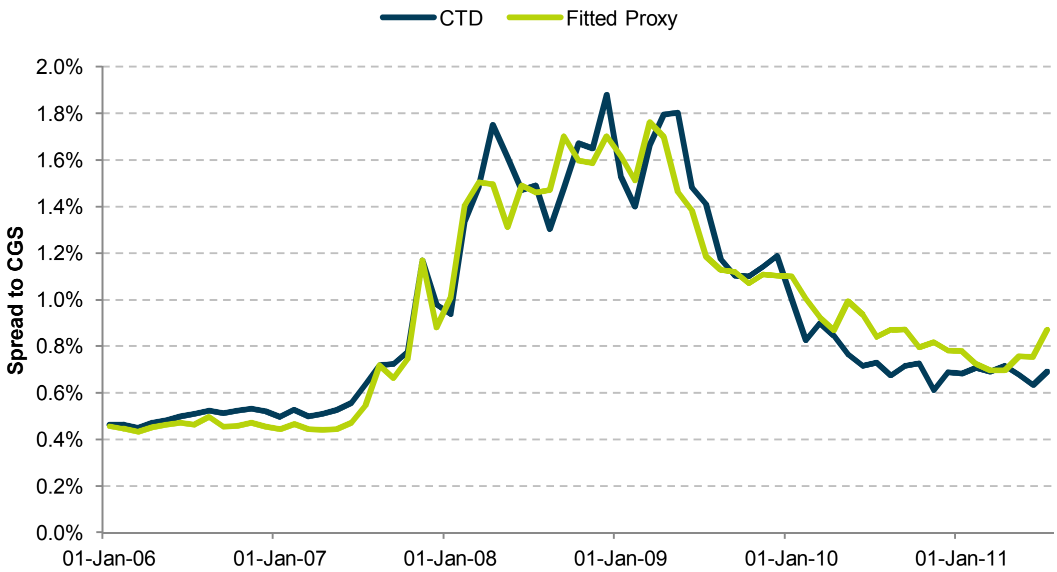
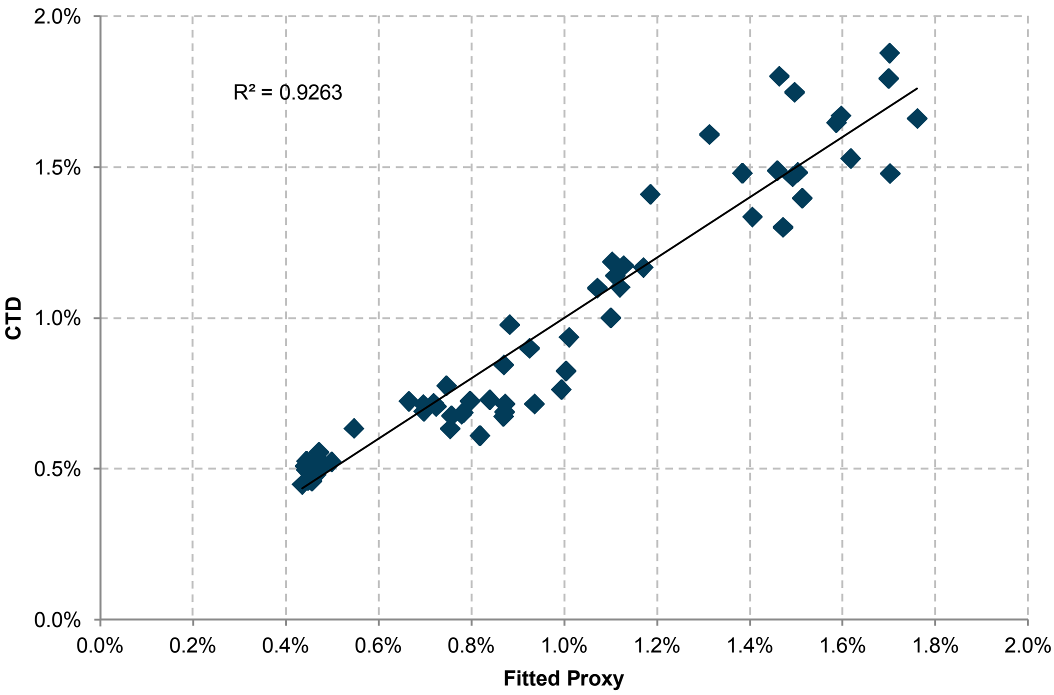


Chart 9 below shows a comparison of the calculated and fitted observations. This shows an R^2 of 0.93, with a correlation of 96%.

CHART 9 CHEAPEST TO DELIVER VS FITTED PROXY



We note the following:

» The regression fitting process has not been constrained in any way. The resulting parameters can therefore be considered the "best fit" statistical parameters for the proxy.

  As a result of this unconstrained approach, the choice of parameters means the formula no longer retains the same interpretation attributed by the CFO Forum. In particular, the value of the y parameter has turned out to be an addition to the formula rather than a deduction, so that an amount is added to spreads before scaling down by the x% factor. Given that the approach adopted is a "pure" statistical fitting exercise, this does not come as a major surprise. In part this difference in parameters (relative to the CFO Forum fit) can be attributed to the fact that we are fitting a liquidity premium relative to CGS yields rather than Swap rates as in the CFO Forum.

» Regardless of the choice of parameters, we note that the parameterisation provides a best fit to the historical estimates.

» As noted by the R^2 of 0.93 from the regression fit, the assumed linear behaviour with respect to the spread proxy is a very good fit.

Alternative approach

As an alternative to the above approach, for illustration purposes we have also fitted a curve based on the simplified proxy formula as put forward by Barrie and Hibbert, that is:

$$LP = max\{0, x(Spread - y)\}$$

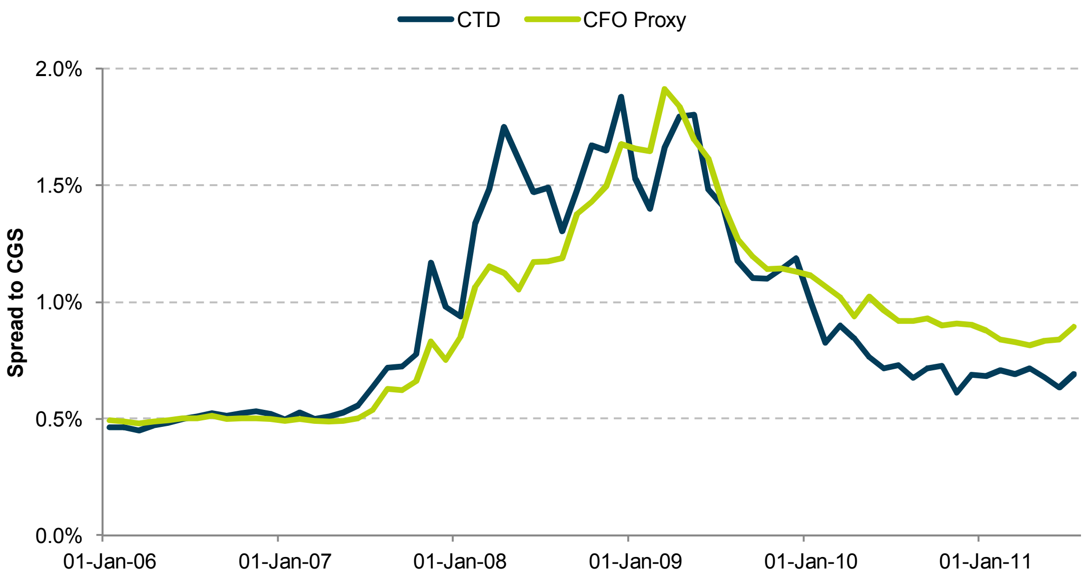
Using a least squares regression approach resulted in the following proxy formula.

$$Simple\ Proxy\ LP = \ max\{0{,}34\%(RBA\ Single\ A\ Index\ Spread + 83bps)\}$$

where RBA Single A Index Spread is the "Spread over bonds issued by the Australian Government" for A securities as set out in table *F3 Capital Market Yields and Spreads – Non-government Instruments*.

Chart 10 below compares the formulaic proxy calculated using the formula above with the illiquidity premium curve shown in Chart 7.

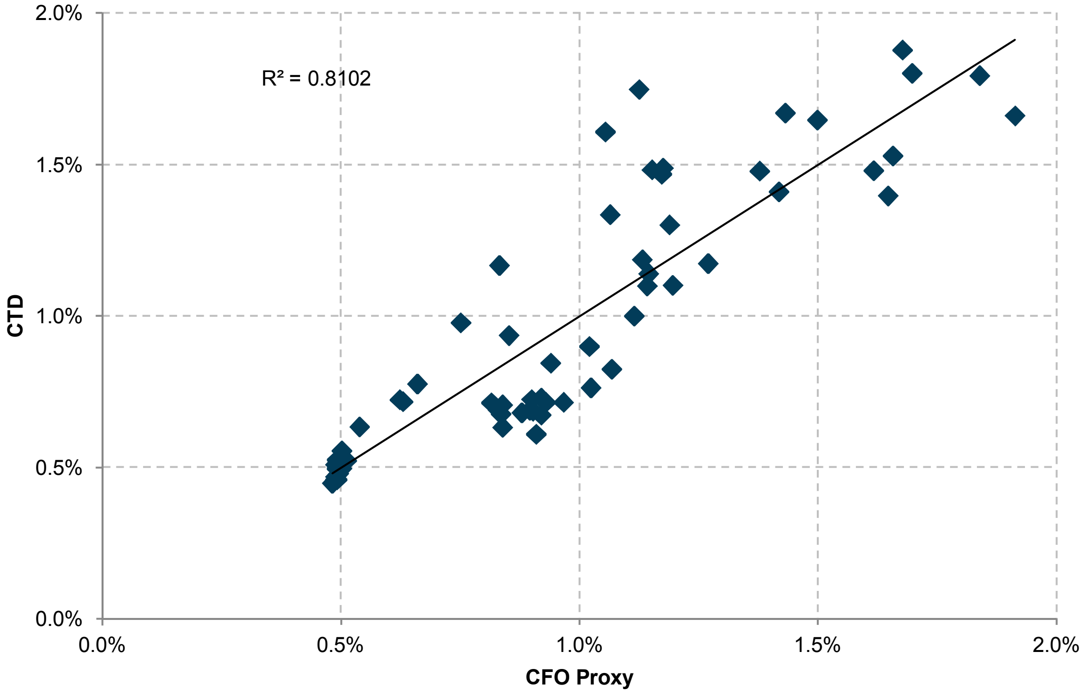
CHART 10 CHEAPEST TO DELIVER SIMPLE PROXY



Source: UBS, Bloomberg, RBA

Chart 11 below shows a comparison of the calculated and fitted observations. This shows an R^2 of 0.82, with the correlation being 91%.

CHART 11 CHEAPEST TO DELIVER VS RBA A INDEX SPREAD TO CGS CURVE



Source: UBS, Bloomberg

The use of the simpler formula provides a good fit, with R^2 of 0.81. However, the fit of the two-variable proxy is better, with R^2 of 0.91. This suggests that the swap spread contains information that can be used to explain the illiquidity premium.

The same approach used in the CFO Forum analysis was also tested, whereby the various measures of illiquidity premium are measured with respect to swap rates rather than CGS yields before fitting to a proxy formula. This results in a better fit of the proxy measure, with a correlation of 97% between the proxy measure and the CTD illiquidity premium estimates. The value of the y parameter in this case remains negative (meaning it is added to the spread), suggesting the interpretation assumed by the CFO Forum is simply not applicable to the Australian data.

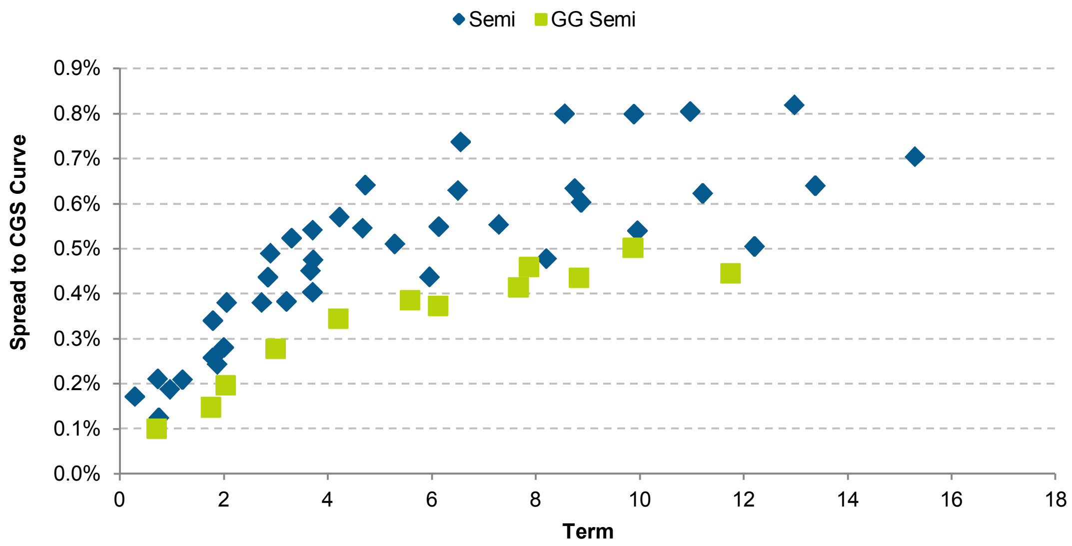
Term Structure of Illiquidity Premium

As previously discussed, illiquidity can be defined as occurring where an asset is not readily saleable due to uncertainty about its value or due to the lack of a market in which it is regularly traded. Where assets are illiquid, theory suggests that investors demand an additional premium as a reward for the risk of being unable to realise the asset as required, or for incurring additional transaction costs where the asset has to be sold. This additional premium leads to an increase in the implicit yield of the instrument, and thus a spread over and above the discount rate for an otherwise liquid asset.

All else being equal, for two illiquid assets the longer term asset exposes the holder to greater uncertainty, and hence a higher illiquidity premium should be demanded. The illiquidity premium curve is therefore expected to be upward sloping over time.
Chart 12 shows the term structure of the illiquidity premium as measured by semi-

government and government guaranteed semi-government bonds spread to CGS curve.

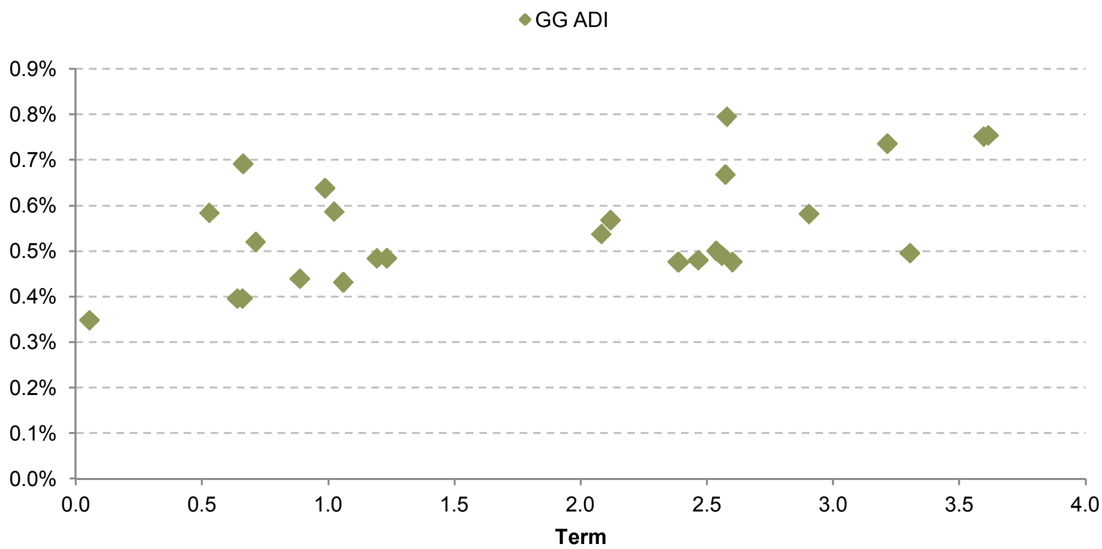
CHART 12 TERM STRUCTURE OF SEMI GOVERNMENT BONDS SPREAD TO CGS CURVE



Source: CBA Spectrum, data as at 3/8/2011

Chart 13 shows the term structure of the illiquidity premium as measured by the government guaranteed ADI bonds spread to CGS curve.

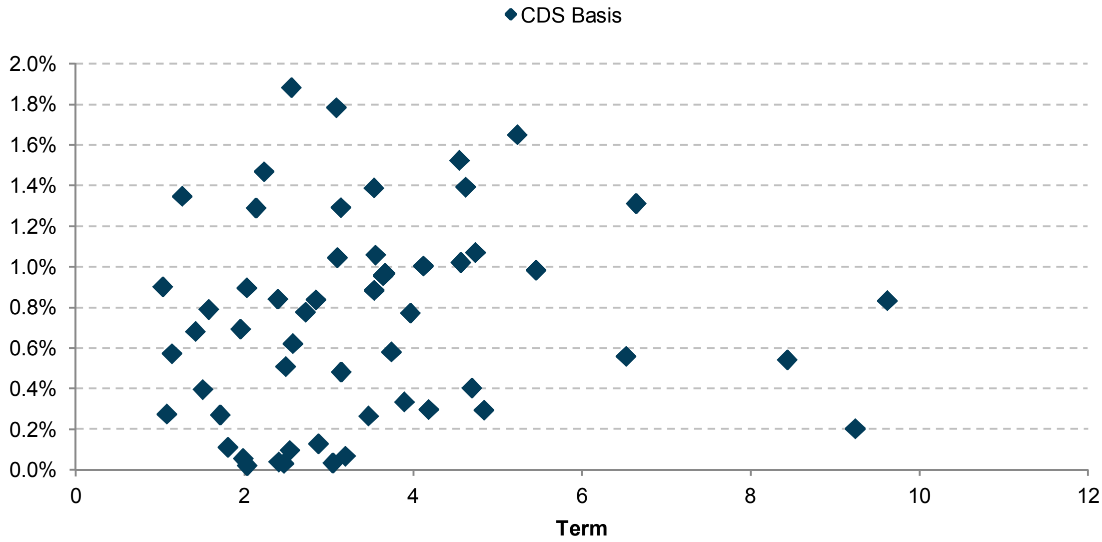
CHART 13 TERM STRUCTURE OF GOVERNMENT GUARANTEED ADI BONDS SPREAD TO CGS CURVE



Source: CBA Spectrum, data as at 29/7/2011

Chart 14 shows the term structure of the CDS basis using estimates produced from the basket of instruments as at 30 August 2011.

CHART 14 TERM STRUCTURE OF CDS BASIS



Source: UBS, Bloomberg, data as at 30-Aug-2011

Observable data are limited, but anecdotal evidence suggests the existence of longer-dated illiquidity premiums throughout all observable maturities. For example, Charts 12 and 13 above provide some evidence of an upward sloping liquidity premium estimate at certain points in time using semi-government and government guaranteed ADI respectively, although no such trend is apparent in the CDS basis data in Chart 14.

All the data used to estimate illiquidity premiums above are shorter dated than the insurance liabilities to which illiquidity premium estimates will typically be applied when determining statutory capital requirements. In particular, corporate bond, government guaranteed ADI bonds and available CDS typically have durations of no more than around five years.

As such, there is a very limited data set on which to make estimates of illiquidity premium for longer maturity liabilities. Due to duration effects, illiquidity premium estimates will have a larger effect on long-term liabilities than on short-term liabilities.

Further, the lack of significant volumes of longer term assets reduces the ability of a life insurer to match its longer term illiquid liabilities with similar term illiquid assets, and therefore to capture the illiquidity premium in such assets. That is, the life insurer faces a reinvestment risk on future movements in illiquidity premium because it is unable to lock the entire longer term illiquidity premium in through matching assets. The major longer term assets available are semi-government bonds, although as previously discussed these are less illiquid than insurance liabilities.

Taking these various factors into account, we have identified three potential approaches to the term structure of illiquidity premiums:

- the illiquidity premium can be upward sloping, in line with theory, using some function based on observed term structures;
- the illiquidity premium can be level over time, as a prudent version of the first option. That is, there are very little data on which to determine how much illiquidity premiums should go up over time, so a prudent approach is to assume that they do not; or
- the illiquidity premium can be level for a period of time, after which it can revert over time to an expected "long term" level of illiquidity premium.

Given the reinvestment risk that a life insurer faces if it is unable to capture long term illiquidity premiums, the third option above may be reasonable, that is holding the illiquidity premium constant for a period, and then having it revert over time to an expected "long term" level of illiquidity premium.

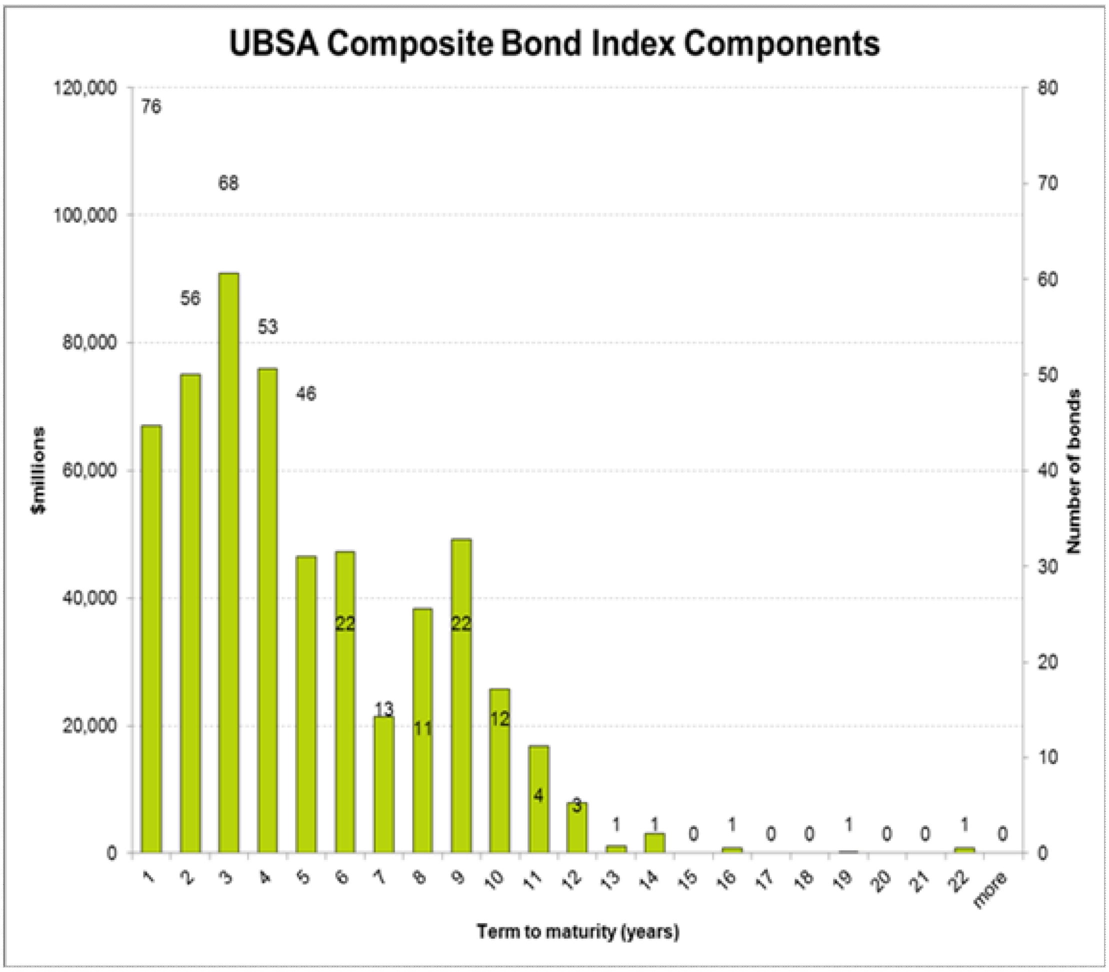
This approach requires a number of additional factors to be determined:

- the period for which illiquidity premium is kept constant;
- the period over which illiquidity premium revert to a "long term" level; and
- the long term level.

In order to illustrate a suitable period for which illiquidity is kept constant, we have examined the volumes of corporate and semi-government bonds available in the market, by term to maturity.

Chart 15 below shows that meaningful volumes of bonds exist out to ten years. The bars show the volumes of bonds on issue in $million, while the numbers show the number of bonds on issue.

Chart 15 Composition of Australian Bonds in UBS Composite Bond Index



Based on the data above, it seems reasonable for the illiquidity premium to be kept constant for maturities out to approximately seven years. This is consistent with the term proposed under Solvency II QIS5 for Australian dollar denominated assets.

Similarly, it seems reasonable for the illiquidity premium to revert to the assumed long term level over a period of approximately five years, which is in line with the approach in Solvency II QIS5. This is consistent with the decrease in available long-dated bonds as shown in chart 15.

In order to illustrate a longer term level to which illiquidity premium can revert, we have repeated the methodology of fitting a curve to historic illiquidity premiums but considered only the illiquidity premium implied by semi-government securities of greater than ten years.

The resulting formula is:

$$\begin{aligned} &Simple\ Proxy\ LP \\ &\qquad = max\{0, 7.5\% \times RBA\ Single\ A\ Index\ Spread\ to\ Bond + 9.3\% \\ &\qquad \times RBA\ Single\ A\ Index\ Spread\ to\ Swap + 24bps\} \end{aligned}$$

Chart 16 below compares the formulaic proxy calculated using the formula above with the base data.

CHART 16 SEMIS > 10 YEARS VS LT PROXY

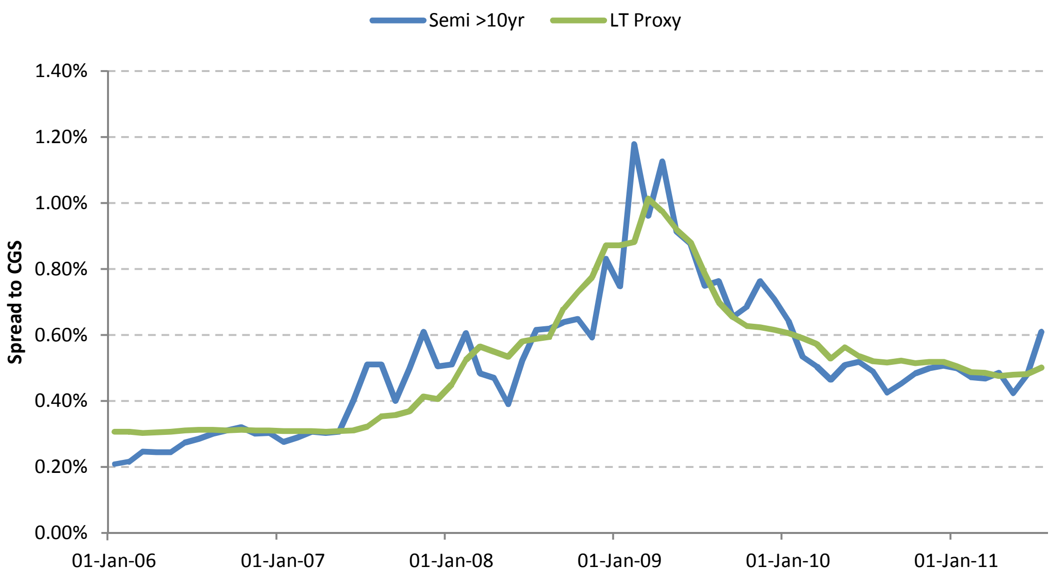
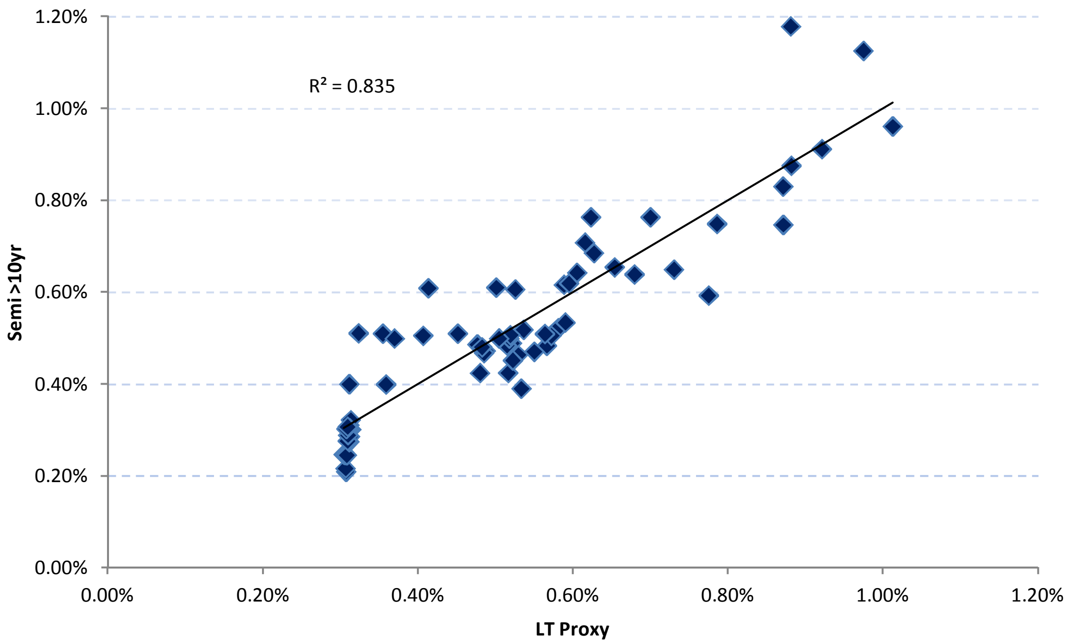


Chart 17 below shows a comparison of the calculated and fitted observations. This shows an R^2 of 0.83, with a correlation of 91%.

CHART 17 SEMIS > 10 YEARS VS LT PROXY



Allowing for Illiquidity Premium Risk in the PCA

We suggest that, in addition to determining an appropriate (proxy) formula for illiquidity premiums, APRA considers the risks that a life insurer faces with respect to movements in illiquidity premiums, and how these should be reflected in the PCA.

We make a number of observations:

- It appears that illiquidity premiums are highly correlated with credit spreads. Indeed, illiquidity premiums represent a component of credit spreads, albeit that they are not separately identified and must be determined by methods as discussed above. The proxy formulae above reflect this correlation between spreads and illiquidity premiums.
- The PCA calculation already includes a credit spreads module, which includes shocks to credit spreads. To the extent that these shocks have been calibrated to historic credit spread movements, a component of the shock actually represents a shock to illiquidity premiums.
- Depending on the particular structure of a life insurer's assets and liabilities, an adverse shock scenario may either be an increase in credit spreads (leading to a decrease in the value of assets), and therefore an increase in illiquidity premium (leading to a decrease in the value of liabilities), or a decrease in credit spreads (leading to an increase in the value of assets), and therefore a decrease in illiquidity premium (leading to an increase in the value of liabilities).
- An allowance for reinvestment risk has already been made in the proposed proxy formula through having the illiquidity premium revert to a long term level over time.

APRA may wish to consider that illiquidity premium risk be allowed for in the PCA through:

- applying the credit spread shocks to assets, and flowing the A bond shock through the illiquidity premium proxy formula by applying it to the RBA Single A Index Spreads with the updated illiquidity premium applied to the relevant liabilities;
- applying shocks both in an upward and downward direction;
- taking the most adverse of these two shocks; and
- using the amount determined as the result of the credit spread module for the purposes of the aggregation benefit using the correlation matrix.

We note that the existing credit spread shocks proposed by APRA have been calibrated to, and currently only apply to, an increase in spreads. APRA may wish to consider whether a separate calibration of spread shocks is required when applying as a decrease in spreads and hence illiquidity premiums.