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Absolute Bias in (Nominal) Commonwealth Government Securities

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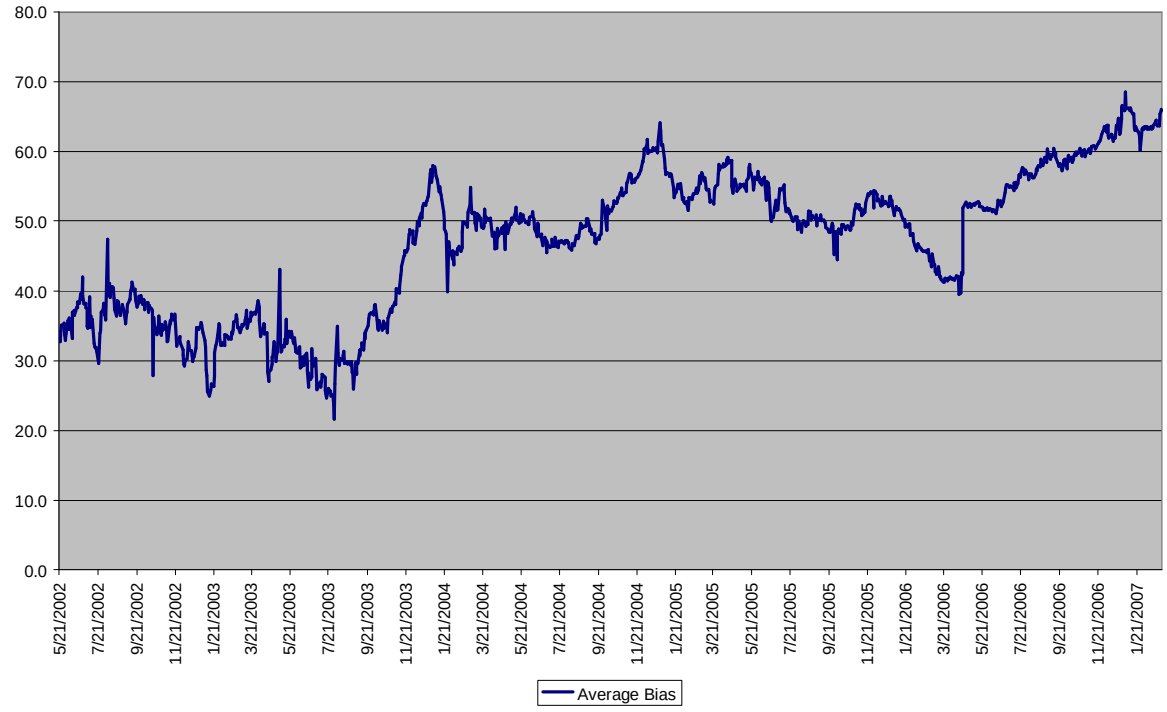
This report was foreshadowed in our March 2007 report. In that report we explained that the yield on government bonds was well understood in the finance literature, and by central banks including the RBA, to be a downward biased estimate of the true risk free rate. The focus of our March 2007 report was to establish the magnitude of the bias in indexed CGS relative to nominal CGS - which we estimated to be 20bp using market data.

We noted in that report that nominal CGS yields were also likely to be downward biased estimates of the CAPM risk free rate. This has become an accepted empirical fact in the finance literature since the rapid development since 2000 of a market for credit default swaps (effectively a market for insuring corporate debt against default). Using data from this market it is now possible to estimate the amount of the spread to government securities that can be explained by differences in risk and the remainder which reflects a premium paid for government debt above and beyond that justified by its lack of default risk. This has led to finance academics concluding, in the words of Blanco *et. al.*:

> *"…it is well known that government bonds are no longer an ideal proxy for the unobservable risk free rate"*[1]

Making use of Australian CDS data we have performed an analysis of the bias in nominal CGS for the longest period that data is available. Our results are summarised in the below graph.

Figure 0.1
Average Bias



[1] Blanco, Brennan, and Marsh, *An Empirical Analysis of the Dynamic Relation between Investment-Grade Bonds and Credit Default Swaps* The Journal Of Finance Vol. LX, no. 5 October 2005, p2261.

We estimate that the current bias in nominal CGS is around 66bp and that this bias has dramatically increased (more than doubled) since the first half of 2002/03. This phenomenon has been noted by the RBA who, in 2004, argued that an increase in corporate spreads to CGS could be explained by supply and demand conditions for CGS rather than an increased risk premium.

We tend to agree with this conclusion and note that, based on RBA data, the ratio of CGS relative to non-government bonds has fallen from a around 1.0 in 2000 to around 0.15 in 2007. This dramatic reduction in relative supply would appear to have, consistent with finance literature predictions, resulted in a dramatic increase in the bias of CGS as a proxy for the CAPM risk free rate.

Regulatory implications

The implication of our findings in both this and our previous report is that standard regulatory practice needs to be adapted to take account of the growing bias in CGS yields. Taking this into account will require regulators to:

- increase estimates of the real cost of debt by 20bp (to reflect the 20bp relative bias in indexed CGS yields); and

- increase estimates of the real cost of equity by 86bp (to reflect the 20bp relative bias in indexed CGS and the 66bp bias in nominal CGS).

There is no need to adjust the cost of debt for the bias in nominal CGS because this is effectively captured in the way that regulators estimate the debt premium for corporate debt. Specifically, regulators estimate this as the spread from corporate bonds to CGS - which includes compensation for both default risk and the bias in nominal CGS yields.

1. Existence of a Bias in (Nominal) CGS Bond Yields

In our paper "Bias in Indexed CGS Yields as a Proxy for the CAPM Risk Free Rate" we set out to test and quantify the RBA's belief that indexed CGS yields are downward biased *relative* to the yield on nominal CGS. We estimated this relative bias to be around 20bp.

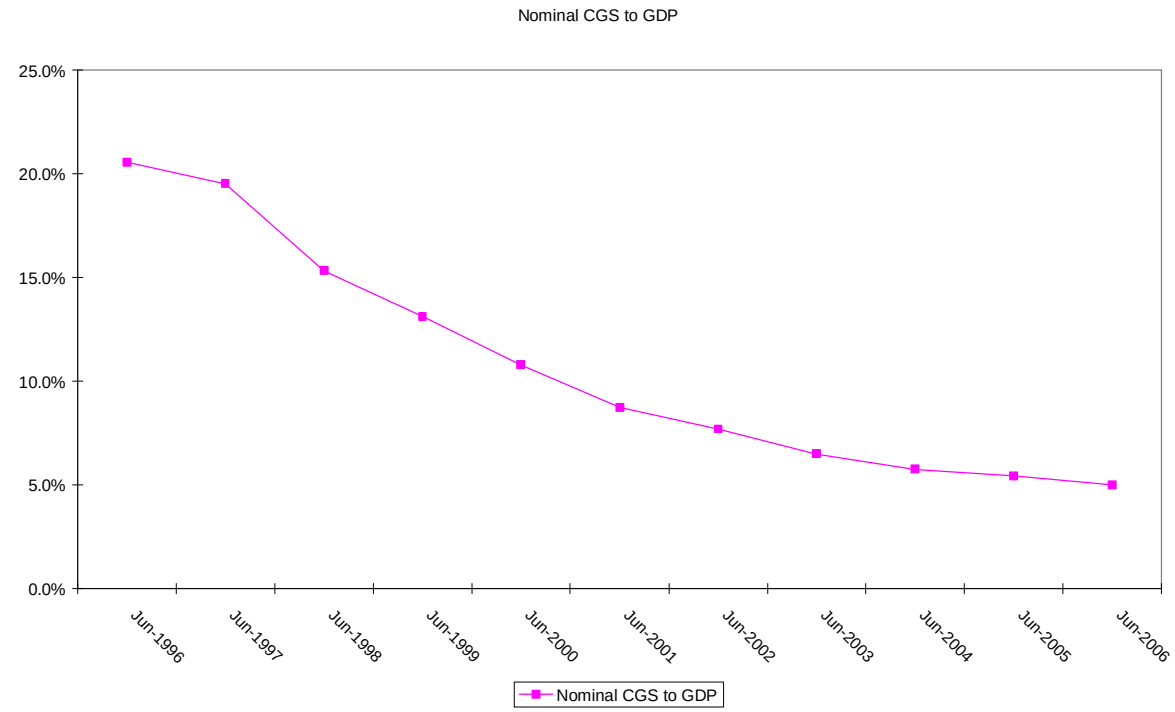
However, the RBA also made statements suggesting that both nominal and indexed CGS yields are biased down by a lack of supply. This means that the total bias in indexed bonds (relative to the true risk free rate) is made up of two components: 1) a bias *relative* to nominal bonds; 2) an 'absolute' bias in both nominal and indexed bonds. In our earlier report we used RBA data to arrive at a preliminary estimate of 42 to 44bp for the magnitude of this absolute bias. However, that estimate was qualified due to the potential shortfalls associated with the use of the RBA data in question. In this report we re-examine this issue with a better data source.

In the remainder of this section we repeat some of the more salient facts and commentary from our earlier report. In section 2 we undertake new empirical work to estimate the absolute bias. In section 3 we discuss our conclusions and the appropriate regulatory response to our work.

1.1. Shortage of supply relative to demand depressing nominal CGS Yields

Indeed, the reduction in the supply of indexed CGS relative to nominal CGS has been much smaller than the absolute reduction in supply of total CGS (nominal and indexed). The fall in the supply of nominal CGS over the last decade is illustrated in figure 1.1 below.

Figure 1.1
Nominal CGS as a % of GDP



Since reaching a local peak in 1996 the supply of nominal CGS has fallen from 20.6% of GDP to only 5% in 2006. This leaves nominal CGS at historically low levels of supply (half its previous (short lived) low of 11.7% in 1991). To the extent that demand for CGS has grown in line with the level of

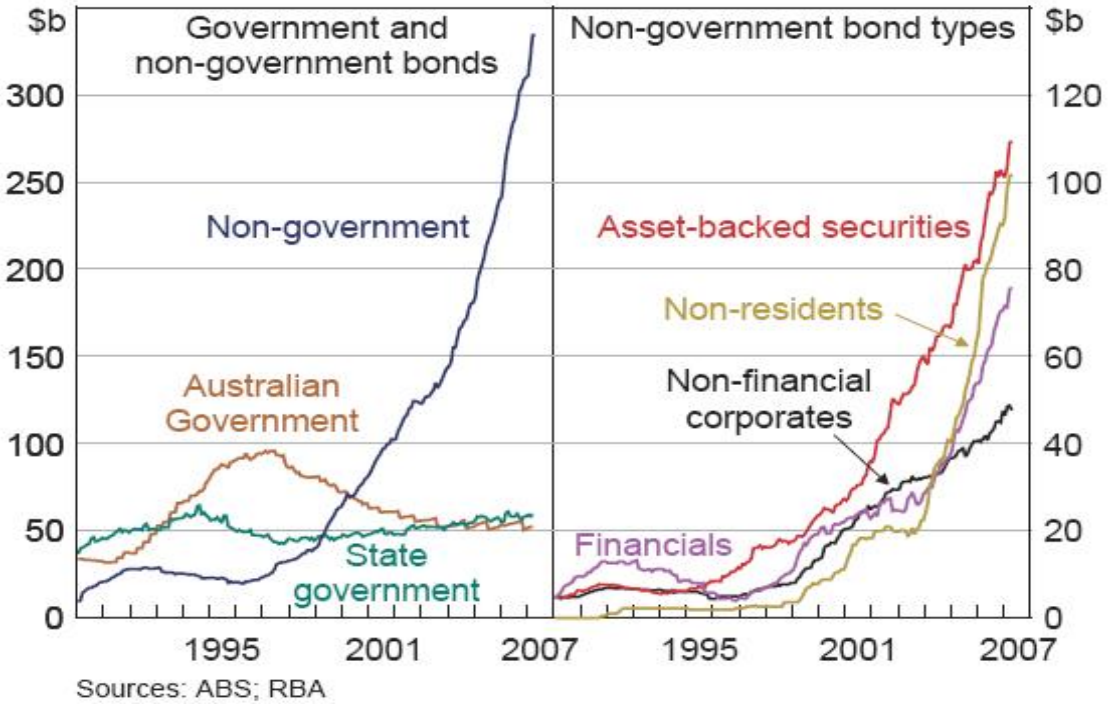
economic activity then, other things equal, one might expect this to result in a premium being paid for a nominal CGS security (and its yield being artificially depressed as a result). It should also be noted that this fall in supply has occurred at a time when funds under management have been increasing rapidly (eg, superannuation funds under management have increased by 130% since March 2000 according to the RBA.)

As described in the previous section, the RBA has expressed precisely this view in the relation to the *relative* level of indexed and nominal CGS yields. In its March 2004 Financial Stability Review the RBA *also* expressed the view that spreads between nominal corporate debt and nominal CGS overestimated default risk due to downward bias in nominal CGS yields.

> "*Premia for credit default swaps (CDS), which measure the cost of insurance against a specific company defaulting, have fallen sharply in the past year and spreads between corporate bond and swap rates have also fallen (Graph 21). In contrast, interest rate spreads between corporate bonds and Commonwealth Government securities (CGS) have risen over the past six months, although this appears to reflect strong demand for CGS, particularly from overseas investors, rather than a judgment about credit quality in the Australian corporate sector.*"[2]

When examined as a proportion of total bonds on offer, the reduction in the relative supply of CGS is even more stark. The graph below is reproduced from page 51 of the RBA's Statement on Monetary Policy May 2007. It shows that the supply of CGS has gone from representing around 100% of the total supply of non-government bonds on issue in Australia in 2000 to being around 15% in 2007 ($50bn divided by $340bn).

Figure 1.2
Bonds on Issue in Australia



[2] Page 15.

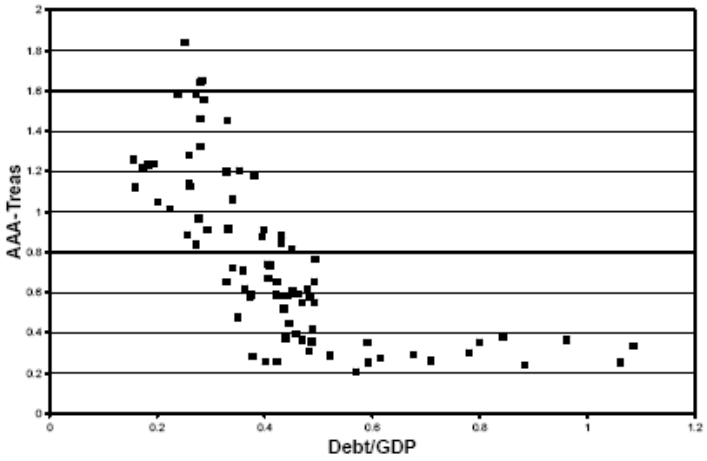
The above RBA graph highlights the radical reduction in the supply of CGS relative to other debt instruments. This is almost certainly an important explanation for the observed willingness of investors to pay an increasing premium for CGS relative to corporate debt - even when the riskiness of corporate debt has been falling. (This phenomenon has been observed by the RBA and is confirmed in our analysis in section 2 below where we show that the bias in CGS has more than doubled to 66bp since June 2003.)

Since the time of the above quote, the RBA appears to have completely disregarded spreads to CGS as an indicator of credit risk. In its place, the RBA has focused primarily on the CDS premium and secondarily on the spread to the BBSW.[3] For example, since March 2004 the RBA has produced the Financial Stability Review report biannually. In each issue of that report the CDS and the spread to BBSW have been the sole indicators of the price of credit default risk. The only mention of spread to CGS has been to discount its usefulness due to yields on CGS being depressed by a shortage of supply relative to demand.

The RBA's position is supported by empirical evidence from the US. The study by Krishnamurthy and Vissing-Jorgenson (KV) discussed in our previous report is particularly pertinent. KV shows that the spread from corporate to government bonds in the US (Treasuries) is strongly inversely related to the level of supply of government bonds. The lower the supply of Treasuries (measured as a percentage of GDP) the higher the spread - as per the below figure from that study.

Figure 1.3
Figure 1 from KV Study

Figure 1: Corporate Bond Spread and Government Debt



The corporate bond spread (y-axis) is graphed versus the $Debt/GDP$ ratio (x-axis) based on annual observations from 1925 to 2005. The bond spread is the difference between the percentage yield on Moody's AAA long maturity bond index and the percentage yield on long maturity Treasury bonds.

The authors' conclusion is that this inverse relationship is explained by the fact that when supply of Treasuries is low their prices are bid up and their yields depressed. However, the reference risk free

[3] Bank bill swap rate.

rate (i.e., that used in CAPM) remains unchanged so the yield on nominal corporate bonds is unaffected and, consequently, the spread on corporate bonds increases. When the supply of Treasuries is sufficiently high (around 60% of GDP in the above graph) the 'premium' on government bonds falls to zero and the spread on corporate bonds asymptotes to the true default risk premium (between 20 and 40bp in the above graph).

The UK central bank has also been grappling with why it is that long term interest rates have fallen to historically low levels. In doing so it has argued that the limited supply of long dated government securities and the willingness of some institutions to pay a premium for these bonds is an important explanation.

> *"As noted in the main text, demand for long-maturity gilts from institutional investors can at times become relatively price inelastic, and the value of outstanding nominal and index-linked gilts at long maturities is sometimes limited (Chart C).*
>
> *"The combination of price-inelastic demand and the relative scarcity of long maturity bonds may result in investors paying a high price for long-dated gilts. This premium would tend to reduce the yield on such instruments, pushing long-maturity forward rates below the rate that would hold in the absence of these factors."*[4]

2. Measuring the bias

2.1. RBA Data

The RBA began publishing CDS premiums in the RBA Bulletin publication in 2003. As discussed above, it now relies primarily on CDS premiums as the relevant measure of the price of credit default risk. Since 2003, the rise in the 'uniqueness' premium attached to nominal CGS can be measured from market data reported in the RBA Bulletin as described in the table below.

Table 2.1
Change in Nominal CGS Bias Since 2003

	A rated bonds			AA rated bonds			
	Spread to CGS**	**CDS***	**Difference**	**Spread to CGS****	**CDS***	**Difference**	**Implied CGS Bias**
Jun 2003	61	46	15	35	20	15	15bp
Feb 2007	65	18	47	50	6	44	44bp to 47bp

Source: RBA Bulletin: Table F3: Capital Market Yields and Spreads - Non Government Instruments:
**Corporate bonds used by the RBA to calculate spreads to CGS have a maturity of 1 to 5 years.*
*** CDS rates quoted by the RBA are 5-year credit default swap rates*

The above table shows that in June 2003 the average cost of insuring for default on an A rated bond was 46bp per annum. At the same time, the average spread to CGS for the same rated bonds (maturity 1 to 5 years) was 61bp suggesting that 15bp of that spread was not a default premium (ie, reflected a 'uniqueness' premium for CGS). This suggests that the nominal CGS yield was around 15bp below the CAPM risk free rate in June 2003.

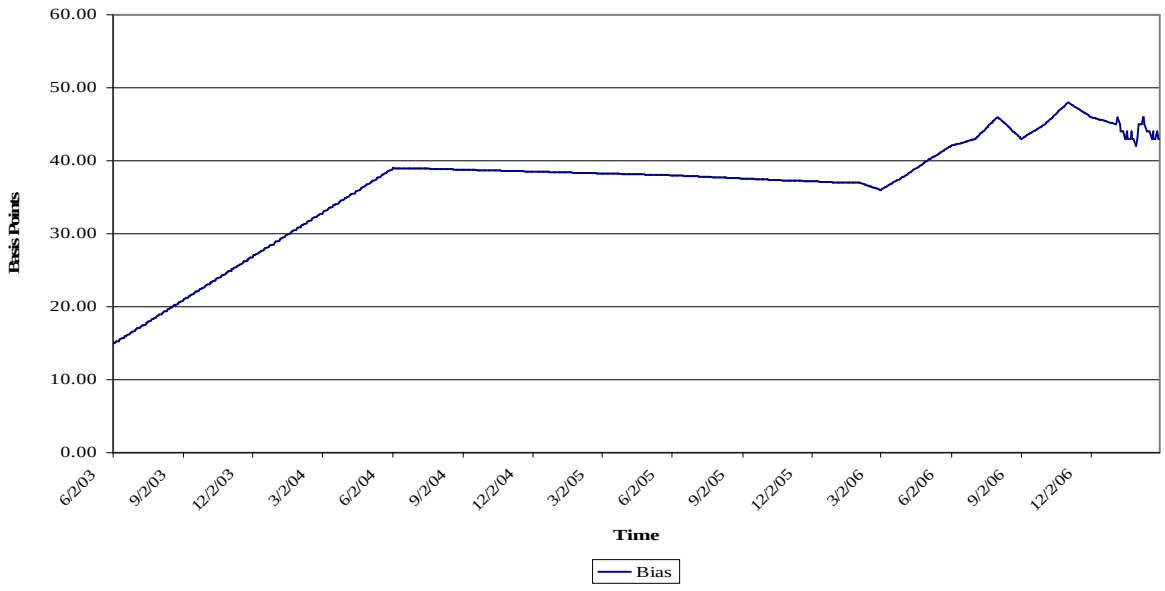
[4] Bank of England, Quarterly Bulletin, Winter 2005, page 419

The same analysis can be performed using RBA data on AA rated corporate bonds as a check on the above analysis. This should yield a similar result to using A rated bond data. As it turns out using AA rated bonds yields exactly the same result. While the spread on AA rated bonds to CGS is 26bp lower for AA rated bonds so is the CDS rate on AA rated bonds - leaving the implied bias unchanged. It could reasonably be concluded that the entirety of the additional spread to CGS on AA rated bonds versus A rated bonds is explained by higher credit risk attached to AA rated bonds (as one would expect). These two results together provide evidence for a 15bp estimate of bias in June 2003.

Performing the same analysis using the most recently available February 2007 RBA data suggests the magnitude of this bias is now around 44bp to 47bp. Since June 2003 the CDS rate on A rated bonds has fallen 28bp (from 46bp to 18bp) while the spread to CGS has risen by 4bp. The combination of these two effects suggests that the CGS uniqueness premium has risen by 32bp (from 15bp to 47bp). Performing the same analysis using AA rated bonds suggests that the uniqueness premium is now 44bp (ie, within 3bp of the result using A rated bonds).

Importantly, credit risk for both A rated and AA rated bonds as implied by the CDS rate has more than *halved* since 2003 (fallen from 46 to 18bp for A rated bonds). However, over the same period the spread to CGS has *increased* (from 61 to 65bp for A rated bonds). That is, the cost of insuring A rated bonds against default has more than halved at the same time that the spread to CGS has increased. This is precisely the same phenomenon (falling credit risk but rising spread to CGS) which the RBA has put down to demand and supply conditions peculiar to the CGS market.

Figure 2.1
Absolute Bias in 5 year CGS - RBA Data



In the above graph, the bias as calculated from the RBA data is plotted since June 2003. The plotted line represents the spread on an A rated corporate bond with a maturity ranging from 1-5 years over CGS with a maturity of 1-5 years, less the price of a 5 year credit default swap. Absent any bias in CGS then one would expect that the curve would be suspended around zero since the excess between a corporate bond and the risk free rate would simply be the required compensation for bearing default risk. However as is quite clear, this is not the case with the bias steadily growing since 2003 and, using RBA aggregate data, it now stands at an absolute level of 46bp.

2.2. Bias in nominal CGS appears to be at historic highs

Given that the supply of nominal CGS is at historically low levels then it is reasonable to expect that the 'uniqueness' premium paid for CGS may be at historically high levels (ie, the bias in CGS yields as a proxy for the CAPM risk-free rate is at historically high levels). This is precisely what the financial market data extracted from the RBA Bulletin suggest.

In the last five years the market in credit insurance for corporate bonds has matured. Credit default swaps (CDSs) are essentially an insurance policy to protect against the risk that a bond's issuer will suffer credit default event (including a downgrade to its credit status). In November 2006 the Financial Times described the growth in the CDS market as 'exponential'.

> *"The credit derivatives market has experienced a period of exponential growth over the last few years. Since their appearance in Europe around 10 years ago, credit default swaps have won wide acceptance from many quarters – banks, asset managers, insurance companies, hedge funds and pension funds. The attraction lies in their liquidity, flexibility, and diversity, qualities in which they outstrip the physical corporate bond market. Nevertheless, CDS are derivatives, and derivatives still make many investors nervous – and with some justification.*
>
> *"The British Bankers' Association in a survey in September this year estimated the total volume of global credit derivatives at $20,000bn (€15,639bn). This is more than double the $8000bn that was predicted for 2006 in the BBA's previous survey in 2004. The BBA estimates that by 2008 the market will have expanded a further 50 per cent to $33,000bn."*[5]

The development of the CDS market has made it simpler to estimate the degree of bias in CGS yields as a proxy for the risk free rate. Prior to the development of the CDS market it was not possible to rely on market data to split the corporate spread to CGS into: a) corporate default risk premium; and b) the uniqueness premium paid for CGS (the bias). However, this has been made easier since the development of the CDS market - with the uniqueness premium being equal to the corporate spread to CGS less the CDS price. [6]

2.3. Correcting possible mismatch errors in RBA data

A possible shortcoming of the data provided by the RBA is that the maturities of the financial instruments do not match. For example, all corporate bonds and spreads to CGS in table 2.1 are measured on bonds with maturities ranging from 1 to 5 years. However, the CDS index used by the RBA is based on CDS with a maturity of 5 years. On this basis, we would expect the RBA data to underestimate the bias to the extent that the spread to CGS at five years is higher than the spread to CGS for less than 5 years maturity.

It is also true that the CDS on issue are for a subset of all A and AA rated entities. This means that some of the bonds used to derive the average spread to CGS were issued by entities who did not have CDS pricing (and possibly vice versa). This may introduce 'mismatch' errors to the extent that entities with CDS pricing have a different risk profile to those with bonds in the sample used to derive the RBA's spread to CGS estimate.

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5 http://www.ftmandate.com/news/fullstory.php/aid/1274/Filling_the_supply_gap_sees_massive_ CDS_swell.html

6 That said, the CDS market is still not very deep for lower credit rated bonds (below A rated). It may be unreliable to attempt to rely on CDS for lower rated bonds as an indication of the average credit risk associated with that rating class. This is less of a problem for the A rated bond category where the CDS market is deepest.

In order to remove the potential for such errors we have extended our analysis by calculating the absolute bias in CGS when the maturities and issuance of all instruments are matched. For example, we compare the yield on 5 year CGS with the yield on 5 year AGL debt (sourced from CBA Spectrum) less the CDS rate for AGL (sourced from AFMA). The difference is our estimate of the bias in CGS when used as a proxy for the risk free rate. We then perform this task again using Woolworth yield and CDS data and so on.

2.3.1. Choice of Data

In the analysis that follows we have sourced pricing for all 5 year credit derivate swaps (CDS) from AFMA. The pricing of 5 year CDS starts from August 2001 or later for each reference entity, however, there is generally no bond pricing available for those reference entities until 2003 or later. We have also performed the analysis for 10 year bonds, however, there are much fewer observations for these bonds.

For those reference entities that have CDS pricing, we have searched both the CBASpectrum and Bloomberg databases for pricing (yields) of corresponding bonds issued by those entities. The CBA Spectrum database covers more bonds than did Bloomberg and, consequently, we have chosen to rely on CBASpectrum where pricing is available from both. In addition, we have used the Bloomberg database to obtain pricing for corporate bonds for those reference entities not listed on the CBA Spectrum database.

It is worth noting that NERA has previously critiqued the use of CBASpectrum *fair value* estimates as giving rise to biased estimates of true fair value yields. In this report we use CBASpectrum pricing for *individual* bonds rather than CBASpectrum's *fair value* curves. We have no reason to believe that CBASpectrum reported yields on individual bonds are in any way biased.

2.3.2. Methodology

The term to maturity for the CDS pricing is a rolling 5 year period which necessitates the creation of a matching estimate of the 5 year corporate bond yield for each reference entity. However, on any given date, most entities will not have a bond on issue that is exactly 5 years to maturity. This means we must estimate from those bonds that are on issue on that day the yield a 5 year bond would have had on that day.

All raw data has been collated and used by NERA following the below methodology:

- Identify those entities that have, on any given day, at least one bond on issue with a maturity that is within three years of five years (or ten years). That is, we have only used corporate bonds that have a time to maturity of 2 to 8 years (or 7 to 13 years) on each specific date.

- For the corporate bond issued that is, on a given day, closest to five/ten years maturity:
  - take the yield;
  - we have then assumed that the yield curve for that entity's debt follows the same shape as the Bloomberg Fair Value yield curve for the same S&P rating. For example, if the longest dated AGL debt is 3 years we have estimated a 5 year AGL yield as: a) the yield on the 3 year debt; plus b) the difference between the Bloomberg 3 and 5 year fair value curve for BBB rated corporate debt (because AGL's debt is BBB rated); [7]

[7] There are occasional gaps in Bloomberg fair value pricing for some maturities. Where these occur we have used CBASpectrum fair value curves for the same purpose.

– where the difference in time to maturity between the corporate bond and the fair value curve are not exact we have taken the nearest available fair value curve and applied the appropriate fraction;

Having constructed an estimate of the yield for a bond with five/ten years to maturity issued by a particular entity we then:

§ deduct the 5/10 year CGS yield on that day as reported by Bloomberg; and

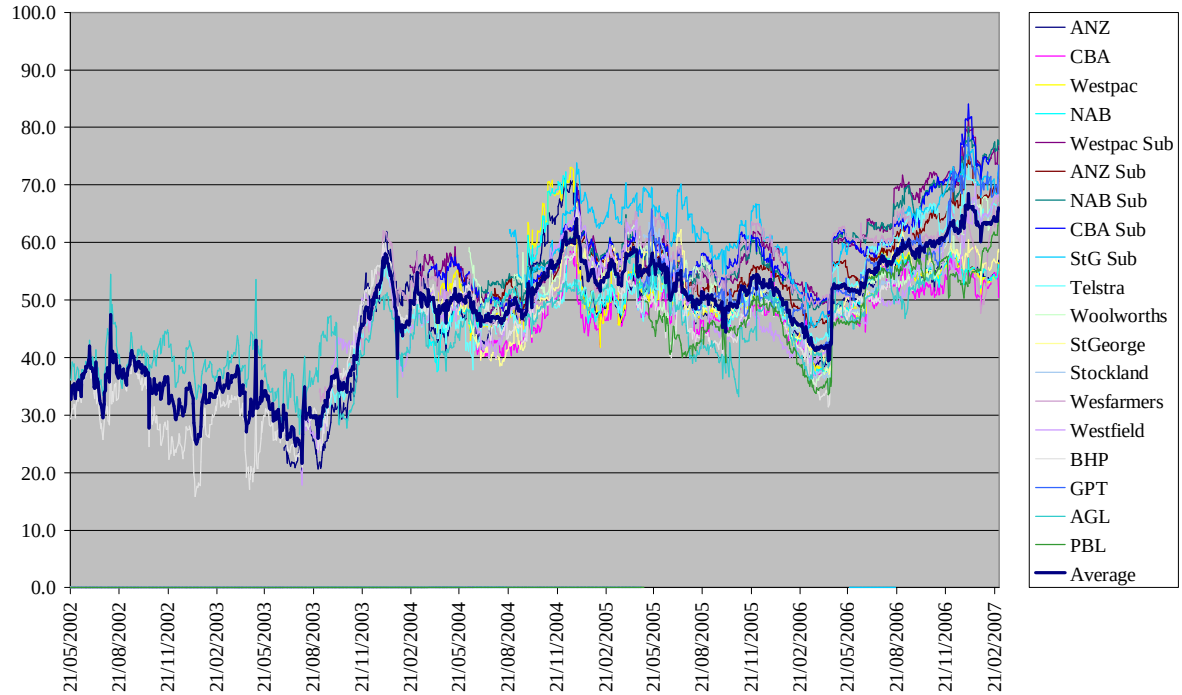
§ deduct the corresponding 5/10 year CDS.

The residue of this process is our estimate of the bias in the CGS instrument as a proxy for the true CAPM risk free rate. In estimating bias we rely on the mean of of observations of bias using pricing data from different entities (where there are more than one entity with data). The further back in time we go the fewer the entities who have pricing available. Before 1 September 2003 pricing data is only available for three reference entities. To prevent our results from being unduly influenced by a particular reference entity, we counsel focussing on data from 1 September onwards (i.e., from where there are at least six reference entities with the relevant pricing). This also has the advantage of focussing on periods where the CDS market is relatively more mature in Australia.

2.3.3. Results

The results of this analysis are summarised in the below figure.

Figure 2.2
Bias in 5 year CGS as a proxy for the risk free rate



These results clearly confirm the existence of a bias in CGS as a proxy for the risk free rate and a material increase in this bias in recent years. On the 1st of March 2007 the average bias was 66bp which is over 19bp higher than the estimate derived from RBA data. This is not surprising and

largely reflects the result of calculating spread to CGS at 5 years maturity (rather than between 1 and 5 years).

However, the change in bias since 2003 is similar to that derived using RBA data. In June 2003 the average bias was 30bp, however, this is based on AGL, BHP and ANZ data. By the 1st of September 2003 data is also available for Westfield, Wesfarmers and Telstra - with an average of 29 bp. Thus, the increase in bias since 2003 has been of the order of 36bp. By contrast, using RBA data the increase in bias from June 2003 to February 2007 was around 30bp.

These results are summarised below.

Table 2.2
Change in nominal 5 year CGS bias - matched entity and maturity pricing for corporate bonds and CDS

	Average Bias
Jun 2003	30
March 2007	66
Change	36

At ten years there are only 3 corporate bonds for which bond and CDS pricing is available and where the bonds had a maturity of greater than 7 years on 1 March 2007. These are bonds issued by Telstra, Santos and PBL and the longest pricing history for these bonds is two years (Telstra) and the shortest is one year (PBL - with pricing only from 4 March 2006). Consequently, it is not possible to perform the same time series analysis as was performed for five year maturities. Nonetheless, the average bias implied by these three observations on 1 March 2007 was 62.3bp. This compares with the average bias of 42.1bp on 4 March 2006 (the oldest date for which observations for each entity is available). These results are consistent with the more statistically reliable results derived from bonds and CDS with five year maturities.

2.4. Using averages instead of matched individual entity data

We have also constructed measures of the 'average' bias by comparing five year maturity Bloomberg Fair Value curves for A rated entities to the average CDS rate for A rated entities (using AFMA data). Relative to the above analysis this has the advantage that a proxy for bond pricing is always available (unlike individual corporate bond data, the time series for Bloomberg Fair Value A rated entities is uninterrupted). This allows us to use all of the CDS data for each entity because there is always a bond yield proxy to measure this against. However, the flip side to this advantage is that the average bond yield of A rated entities need not reflect the average bond yield for A rated entities for which we have CDS data.

For this reason, we have less confidence in the accuracy of this approach. However, for completeness the results are provided in the below table.

Table 2.3
Change in nominal 5 year CGS bias - Bloomberg Fair Value A rated bond yield & AFMA A rated CDS data

	Bias
Jun 2003	36
Feb 2007	78
Change	42

As can be seen by comparing table 2.2 and 2.3, using an average methodology results in a higher estimated bias and a higher estimated increase in bias. However, for the reasons already stated, we regard the results in table 2.2 to be more reliable. (more details on the approach to deriving the results in table 2.3 are provided in Appendix A.)

3. Conclusions

The two key conclusions of the analysis in section 2 are:

1. On 1 March 2007, the yield on five year nominal CGS underestimated the five year nominal risk free rate by around 66bp; and
2. This is 36bp higher than it was in mid 2003.

This means that using the yield on CGS as a proxy for the risk free rate in regulatory decisions will result in an underestimate of the cost of equity by 66bp (which is 36bp greater than the error that would have resulted using the same methodology in 2003).[8] The average 1 March 2007 estimated bias using matched 10 year corporate debt and matched 10 year CDS is consistent with this (although the sample consists of only three reference entities).

These empirical conclusions support the conclusions of the finance literature discussed in our March 2007 companion report that:

- the true CAPM risk free rate is likely to be higher than yield on CGS; and
- diminishing supply of these securities over the last ten years is likely to have resulted in CGS yields being an increasingly biased proxy for the true CAPM risk free rate.

On this basis, we believe that regulators must place less weight on CGS yields when determining the risk free rate in regulatory decisions. This is our primary conclusion. (Equivalently, if, as is required under the AEMC Transmission Rules, regulators determine the real risk free rate by deducting expected inflation from a nominal risk free rate, the estimate of expected inflation should not be mechanistically derived from the difference in indexed and nominal CGS yields.)

3.1. Potential Regulatory Responses

The implication of our findings in both this and our previous report is that standard regulatory practice needs to be adapted to take account of the growing bias in CGS yields. Other things equal, taking this into account will result in an:

- increase estimates of the real cost of debt by 20bp (to reflect the 20bp relative bias in indexed CGS yields identified in our March 2007 report); and
- increase estimates of the real cost of equity by 86bp (to reflect the 20bp relative bias in indexed CGS and the 66bp bias in nominal CGS).

There is no need to adjust the cost of debt for the bias in nominal CGS because this is effectively captured in the way that regulators estimate the debt premium for corporate debt. Specifically, regulators estimate this as the spread from corporate bonds to CGS - which includes compensation for both default risk and the 66bp bias in nominal CGS yields. This has the effect of including the bias in nominal CGS in the cost of corporate debt. Mathematically, current practice can be described as

Real regulatory cost of debt $= CGS_{indexed}$ + corporate debt premium

[8] Note that this absolute bias in nominal CGS is in addition to the 20bp relative bias in indexed CGS identified in out March 2007 report - such that the total bias in indexed CGS yields is 86bp relative to the true inflation adjusted risk free rate.

$$= CGS_{indexed} + (Corp_{nominal} - CGS_{nominal})$$

$$= CGS_{indexed} + \text{bias in } CGS_{nominal} + \text{compensation for default risk}$$

Consequently, the only adjustment required to this approach is an adjustment for the bias in indexed CGS relative to nominal CGS (as the nominal CGS bias has been implicitly captured in the debt premium).

However, the current approach to estimating the real cost of equity simply adds an equity premium to the indexed CGS yield - where that equity premium does not capture the prevailing bias in nominal CGS. For this reason, the real cost of equity must be increased by both the bias in nominal CGS and the bias in indexed CGS relative to nominal CGS.

3.1.1. Formalising a change in methodology

In our view, the best estimate of the nominal risk free rate is equal to the yield on corporate bonds less the cost of insuring those bonds against default (ie, less the CDS rate). In order to take this evidence into account regulators have broadly two options:

i. stop setting the regulatory nominal risk free rate equal to the yield on CGS and instead set it equal to an estimate of nominal corporate bond yields less matched CDS rates (as per section 2.3 above). That is, set the nominal risk free rate equal to the yield on corporate bonds less the cost of insuring those bonds against default. The real risk free rate can then be determined by deducing an estimate of expected inflation. If this estimate is to be derived from the difference in indexed and nominal CGS then it should take into account any bias in indexed CGS relative to nominal CGS; or

ii. continue to use the CGS yield to set the risk free rate but add an increment to this to reflect contemporaneous market evidence on the level of bias in CGS yields (and in recognition that this bias is not constant over time).

3.1.1.1. Option i

The first option would be a proper recognition of the state of the modern finance literature as described in our March 2007 report and embodied in the below quote:

> *"…it is well known that government bonds are no longer an ideal proxy for the unobservable risk free rate"*[9]

The first option recognises that the best estimate of the risk free rate is the yield on corporate bond less the expected cost of default on those bonds (ie, the cost of insuring them against default). Adopting this approach will involve a slightly more intensive use of market data than the current practice. In particular, the regulator would need to have regard to bond yields and CDS rates for 10 to 15 corporate entities rather than the current practice of simply using CGS yields as published on the RBA website. However, this is a relatively minor inconvenience given the size of the potential error from continuing with the current approach. It is also true that the proposed approach in i) relies solely on transparently available market data and is amenable to application of a relatively mechanistic approach.

[9] Blanco, Brennan, and Marsh, *An Empirical Analysis of the Dynamic Relation between Investment-Grade Bonds and Credit Default Swaps* The Journal Of Finance Vol. LX, no. 5 October 2005, p2261.

3.1.1.2. Option ii

The second option collapses to the first if the increment to the CGS yield is simply equal to the bias in CGS as estimated in section 2.3 above. However, the second option also encompasses a range of other approaches. For example, it might be argued that only the change in bias since 2003 should be adjusted for on the basis that, as discussed below, the historical MRP has been estimated relative to historic CGS yields. Alternatively, the regulator might have regard to a number of factors when setting the risk free rate - not restricted to the estimate of bias using CDS rates.

This is essentially the approach taken by UK regulators when setting the risk free rate where reliance has been placed on long run historical levels of government bond yields. For example, Ofcom states:

> *"the nominal rate for 5-year gilts has fallen over the last year and **mechanistically** applying a 3 month average of the most recent data would lead to a risk free rate of 4.5% or less. Such an estimate would, however, be low by historic standards, and Ofcom believes that some weight should be given to a longer-term perspective, suggesting that the use of a slightly higher risk free rate would be more appropriate."*…
>
> *"Taking account of both current and recent historical evidence, Ofcom's view is that it is appropriate to use a value of 4.6% for the nominal risk free rate. This is somewhat higher than the current rate of about 4.2% to 4.3% (which are lower than historic averages), but consistent with a longer term averages and a real risk free rate of 2.0% and a rate of inflation of 2.5%."*[10] (Emphasis added.)

The same reasoning has been adopted by Ofwat, Ofgem and the Commerce Commission in the UK - see section 3.1.2 of our March 2007 report. Having regard to long term averages can be justified by the finance literature and, in particular, the work of Lettau and Ludvigson who find strong empirical evidence that return on equity does *not* move mechanistically with government bond yields. (This work is discussed in section 4.5 of our March 2007 report.) Of course, one of the reasons for this is that the true CAPM risk free rate does not move mechanistically with government bond yields (as the 36bp increase in bias since 2003 suggests).

3.2. Is an adjustment to the MRP also required

Correcting for the bias in CGS yields as a proxy for the risk free rate may be argued to require a partially offsetting adjustment to the MRP. This is the case where the MRP has been set on the basis of long run historical data measuring the difference between equity returns and the return on CGS. In this case, the MRP measured will overestimate the true MRP by an amount equal to average long run historical bias in CGS yields.

However, the long run historical bias is likely to be substantially below the current bias. This conclusion is based on:

1. the fact that supply of government bonds is at historically low levels and the general agreement of central banks that low levels of supply increase the bias in yields of government securities (supported by the empirical conclusions in the finance literature such as by KV outlined earlier); and

2. our findings in section 2 of a 36bp increase in bias in the last 4 years.

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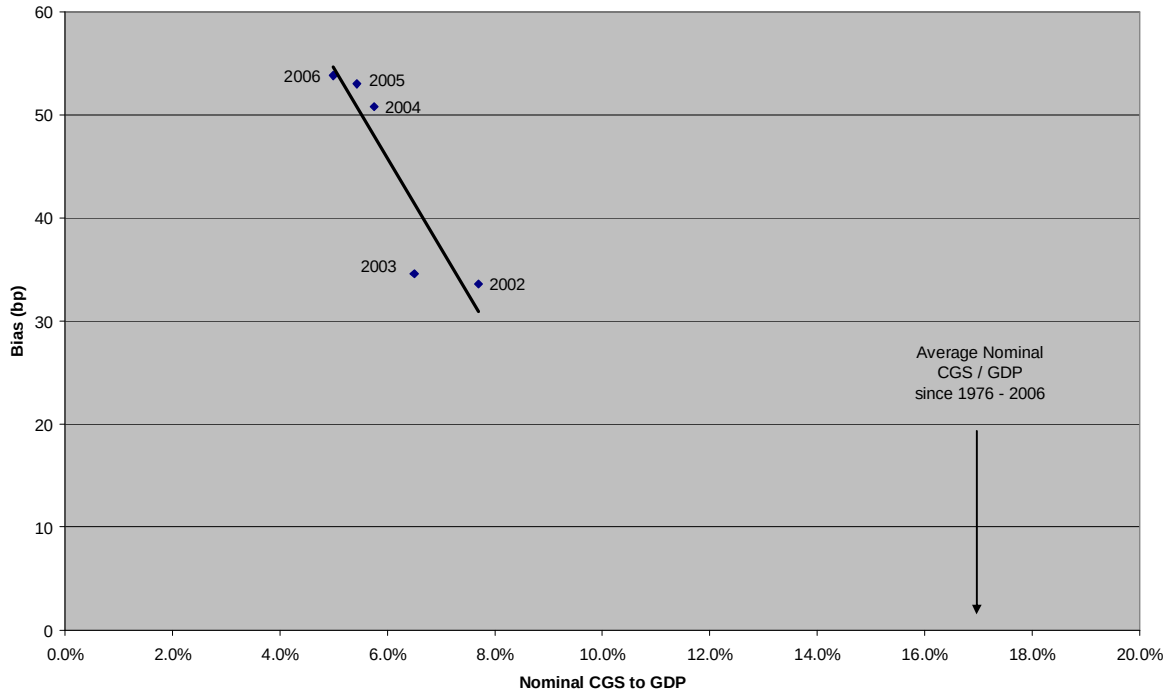
[10] Office of Communications, Ofcom's approach to risk in the assessment of the cost of capital, 23 June 2005, p 15.

On this basis, it appears unlikely that any such adjustment would be material, although, this can not be confirmed empirically using modern credit derivative data because that data simply is not available on a long run historical basis. However, it is possible to derive a rough, but nonetheless the best available, estimate of the average long run bias in CGS.

We do this by reference to the correlation between our estimate of the bias and observations we have for the corresponding supply of CGS. The below figure plots the average bias in each calendar year from 2002 to 2006 inclusive (as derived in section 2) against that supply of CGS to GDP at 30 June of that calendar year (as reported by the AOFM). Also illustrated is the line of best fit.

Figure 3.1
Supply of CGS to Bias - 2002 to 2006



In the last five years there has been a strong relationship between supply of CGS and the measured bias. If this relationship holds going back further in time then we can conclude that the long run historical bias in CGS would be close to zero. This reflects the fact that the average CGS to GDP ratio since 1974 was 17% - while, if the above relationship held, the bias would be eliminated at supply levels of 11% (ie, in all years prior to 2000).

Of course, the above analysis is not conclusive. We have only five observations and other factors, such as changes in investor preferences, are not captured by the above single variable regression. Nonetheless, on the basis of this data the best estimate of the long run average bias in CGS in Australia is close to zero.

This implies that the best estimate of the appropriate adjustment to the cost of equity for the bias in nominal CGS is 66bp (86bp factoring in the relative bias in indexed CGS). At a minimum, our work suggests that at least 36bp (56bp factoring in the relative bias in indexed CGS) should be added to the return on equity to reflect the increasing bias in nominal CGS yields since 2003.

Appendix A. Description of Index Methodology

A.1. Choice of data

In the analysis that follows we attempt to replicate the RBA findings using averages for particular ratings of bonds and CDS prices.

A.1.1. Post 2003 data

The RBA first discussed the use of CDS as a measure of default risk in their 2003 paper, *Credit Risk Transfer Markets: An Australian Perspective*. Following the publication of this paper, the RBA first started reporting on CDS in their Statement on Monetary Policy from August 2003. Additionally, the RBA only provide CDS data from June 2003 in their report "Capital Market Yields and Spreads".

Prior to 2003 the credit derivative market was still in its infancy and consequently there was very little market depth. This lack of depth can be illustrated using the AFMA database. In 2002/03 there were on average only seven five-year A rated CDS, however, in 2003/04 the number of recorded CDS increased to 20 (at March 2007 there were 23 A rated CDS with a maturity of 5 years). Where we are taking an average of CDS prices, it is not possible to reliably isolate the absolute bias in CGS with such a small sample - which also represents a small subset of the A rated entities used to set fair value yield curve for A rated bonds. Therefore we have followed the RBA's approach and have only used CDS data from June 2003 onwards[11].

A.1.2. Use of CDS data for A rated bonds

We have also investigated whether it is possible to obtain reliable pricing of CDS for different bond ratings. In our opinion, the most reliable CDS data is for A rated bonds. Again, this reflects the number of CDS for which pricing is available. Currently, there are 23 A rated 5 year CDS but only four AA rated CDS and 11 BBB rated CDS.[12]

A.1.3. Use of 5 year CDS data

We also focus primarily on 5 year CDS data because the pricing history available from AFMA for 10 year CDS only begins in 2005. However, we nonetheless analyse this available data. The number of reference entities for 10 year CDS is the same as for 5 year CDS.

A.1.4. Bloomberg vs CBA Spectrum Spreads to CGS

We have not used CBA Spectrum spread to CGS estimates in our analysis because these figures appear to be biased downwards relative to Bloomberg estimates of spread to CGS.

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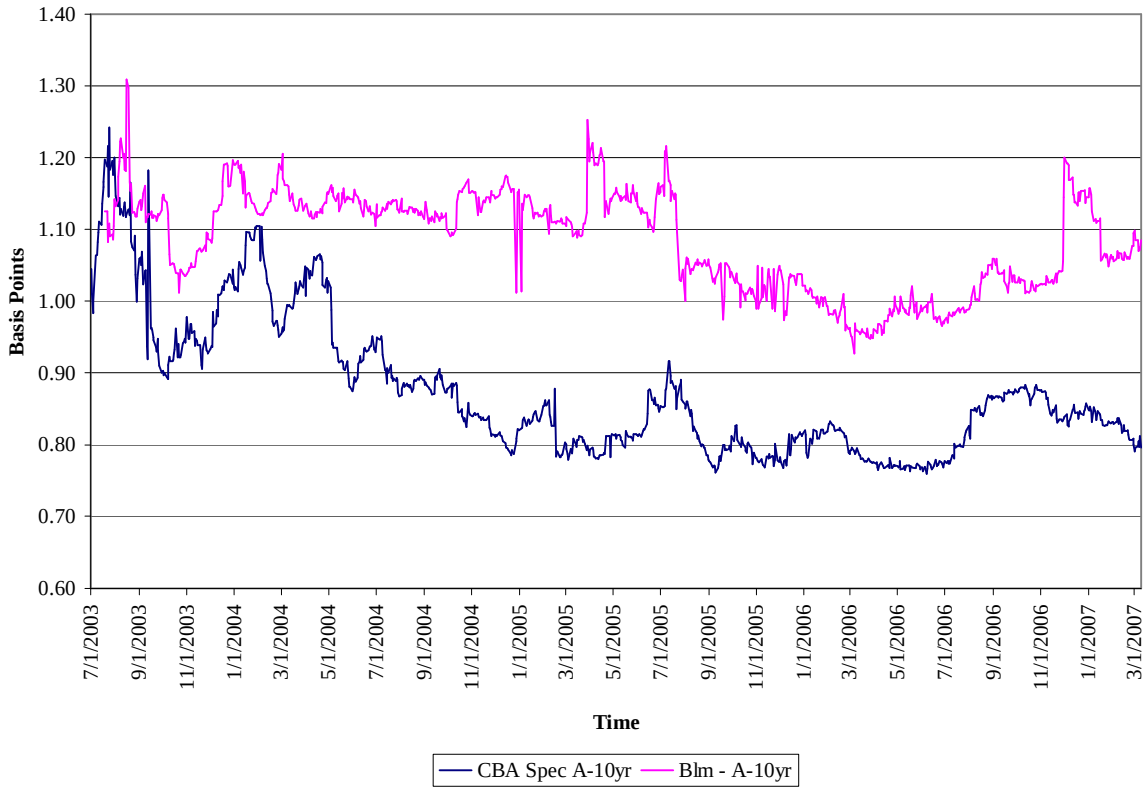
[11] The RBA first discussed the use of CDS as a measure of default risk in their 2003 paper, *Credit Risk Transfer Markets: An Australian Perspective.* Following the publication of this paper, the RBA started consistently reporting on CDS in their Statement on Monetary Policy from August 2003. Additionally, the RBA only provide CDS data from June 20003 in their report "Capital Market Yields and Spreads".

[12] Moreover the standard deviation of BBB rated CDS is a high 41.5bp with a maximum of 180bp (QANTAS) and a minimum of 26bp (PBL).

Figure A.1
Spread to CGS for 10 year A rated bonds - Bloomberg versus CBA Spectrum



As evident the spread on CBA Spectrum's 10 year A rated fair value curve is consistently below the Bloomberg equivalent. The only exception was in 2003 when the spreads were similar, implying that the problem with CBA Spectrum data may have become progressively worse.

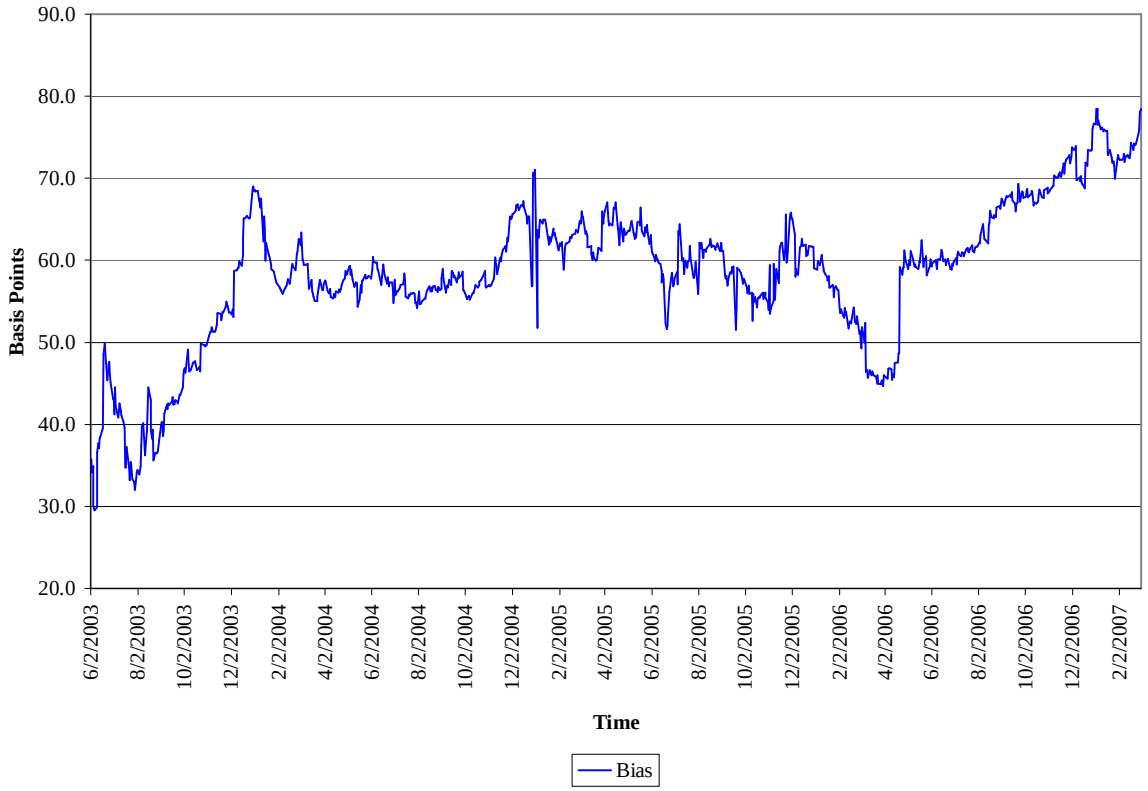
This is consistent with our 2005 report for the Energy Networks Association (ENA), the manner by which the fair value yield on long dated bonds is calculated understates the true yield around 25bp[13]. It was therefore our recommendation, which was adopted by most Australian regulators, that the yield on 10 year corporate bonds obtained from CBA spectrum be adjusted upwards.

A.2. Results

The figure below describes the trend in the bias in nominal CGS since 2003 using Bloomberg Fair Value yields for A rated debt and an index of CDS prices based on AFMA pricing of A rated entities.

[13] Hird and Grundy, Critique of Available Estimates of the Credit Spread on Corporate Bonds, 2005, p. 3.

Figure A.2
Absolute Bias in 5 year CGS - Bloomberg and AFMA Data



Adopting the methodology used to analyse Table 2.1, the uniqueness premium in CGS's, can be calculated using a combination of Bloomberg and AFMA data. The spread on corporate bonds relative to CGS is calculated using Bloomberg's 5 year A rated corporate bond fair value curve and their 5 year CGS fair value curve[14]. The 5 year CDS index is created by averaging the price for all A rated CDS that are on the AFMA reference entity list (this is the same method followed by the RBA[15]).

As illustrated in the above figure, the bias (the spread on corporate bonds relative to CGS less the price of an equivalent CDS) has risen from 36bp in June 2003 to 78bp in March 2007, an overall increase of 42bp. This translates into the nominal yield on CGS being 78bp below the risk free rate as at 1 March 2007.

[14] An A rated bond has been selected for this analysis due to a greater level of depth in the market in comparison to AA, AAA and BBB rated bonds.

[15] RBA Explanatory Notes, p. 25.

Table A.1
Change in Nominal CGS Bias (Bloomberg & AFMA data)

	A rated bonds		
	Spread to CGS	**CDS**	**Diff**
Jun 2003	73	37	36
Feb 2007	93	15	78
Change	20	-22	42

In the above table we have replicated the structure from Table A.1, however we have sourced the data directly from Bloomberg and AFMA.

The most striking difference between tables A1 and 2.1 is that the spreads to CGS in table 2.1 are higher than reported by the RBA and, consequently, the measured bias is higher in table 2.1. This result is to be expected given that the RBA spread to CGS is based on bonds with a maturity ranging from 1 to 5 years whereas, as discussed previously, the Bloomberg data is based on estimated spreads for bonds with a maturity of 5 years. Given spread to CGS tends to rise with maturity, matching maturity to 5 years can be expected to increase estimated spreads. The difference in the CDS rates arises due to the fact that the RBA averages the price of all the CDS for each month whereas we have taken the average at 1 June 2003 and 28 February 2007.

A.3. Summary

Table 1.3 below summarises our findings.

Table A.2 Summary Table – Nominal CGS Bias from different data sources

	5 Year A rated bond	
	RBA	Blm & AFMA
1-Jun-03	15	36
28-Feb-07	47	78
Bias growth	32	42

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