ESTIMATING THE COST OF DEBT OF THE BENCHMARK EFFICIENT REGULATED ENERGY NETWORK BUSINESS

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16 August 2013

The helpful comments and assistance of AER staff are gratefully appreciated. All opinions expressed are nevertheless those of the author.

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EXECUTIVE SUMMARY

This paper has sought to address a number of questions posed by the Australian Energy Regulator (AER), and relating to estimating the cost of debt of the efficient benchmark regulated energy network business, as follows.

The first question is whether the estimation method should use a single benchmark maturity or a range of maturities and what should these be. If the 'on-the-day' approach is adopted, the appropriate benchmarks are the risk free rate for a term corresponding to the regulatory cycle (because regulated firms generally enter hedging arrangements that have this effect and it is efficient to do so) and a DRP for a term corresponding to the average debt term of regulated businesses (because it is not feasible to vary this through hedging arrangements). Evidence presented by the JIA indicates that the latter term is about ten years. Furthermore, the costs of the hedging arrangements that convert the risk free rate component of the ten year cost of debt to the rate corresponding to the length of the regulatory cycle should be added to the allowed cost of debt. By contrast, if a trailing average approach is adopted, the benchmark debt term would require knowledge of the interest rate swap contracts that the regulated firms would have entered into sans regulation, in order to determine the effective risk free rate term on their debt sans regulation, and this is not observable. Thus, in respect of the risk free rate component of the cost of debt, the benchmark debt maturity under the trailing average approach (net of the effect of the swap contracts) is indeterminable. Finally, if the hybrid approach is adopted involving the on-the-day approach to the risk free rate component of the cost of debt and the trailing average approach to the DRP, then the benchmark debt maturity would be the regulatory term for the risk free rate and the ten year average of the ten year DRP. As we progress through the regulatory cycle this DRP figure may or may not be annually revised in the form of a moving average.

The second question is whether the AER should use a third-party source for estimating the cost of debt (if so, which) or develop its own method/dataset and, in the latter case, what should this be. In view of its serious limitations, I recommend that the AER abandon use of the BFVC. In this event the AER will need to develop its own estimate of the ten year DRP at its specified credit rating. The best bonds to provide this data will vary over time and the choice of bonds at the times at which estimates are required should be delegated to an expert panel. In using this data to estimate the ten-year DRP, the choice is between some form of averaging and curve fitting. Since one approach is not clearly superior, I recommend that results from both approaches be considered and that the resulting estimate be rounded to at least the nearest 0.25%. In addition, if the AER abandons use of the BFVC, it will be much more difficult for it to implement the trailing average or hybrid approaches due to the quantity of historical data that will be required.

The third question is whether the estimation method should use a single credit rating or a range of ratings and what the benchmark firm should be. In my view the appropriate benchmark regulated energy network business is a private-sector firm primarily engaged in such activities and without a foreign parent with a high credit rating. In addition, whatever the benchmark credit rating resulting from this definition is, there are likely to be few comparator bonds with the same rating and therefore comparator bonds should be drawn from a wider credit band centred on the benchmark credit rating. So, if the benchmark rating were BBB+ as at present, comparators should be selected from the BBB to A- range in order to provide sufficient observations to estimate the DRP of a BBB+ rated regulated energy network businesses.

The fourth question is which bond issuers should be considered in the estimation process, with the possibilities including but not limited to service providers and their parent groups, companies operating in the energy sector, regulated network companies (specified), and all Australian businesses that match other selection criteria (credit rating, maturity, etc). In my view the best set of firms is all Australian regulated energy network businesses, i.e., all regulated firms engaged primarily in electricity or gas transmission or generation. If this set of firms does not supply sufficient comparator bonds to estimate the DRP of a benchmark firm of this kind, I recommend inclusion of regulated network businesses in other industries, with similarly limited competition or exposure to the threat of new entry. The only clear example of this kind is water supply. The next set of possibilities would be other regulated firms with similarly limited competition or exposure to the threat of new entry, such as the DBCT. The last set of possibilities would be unregulated firms whose principal activities are monopolistic, and with similarly limited exposure to competition or the threat of new entry. The only clear example of this kind is airfield operations, which were subject to price regulation until 2002.

The last question is what types of debt instruments available to a business should be used and how should each be incorporated in the estimation process. Fixed rate bonds denominated in Australian currency are uncontroversial. Floating rate bonds denominated in Australian currency should also be used but after swapping into fixed rate bonds and the swap costs should be included. However foreign currency denominated bonds should be excluded because the primary market data will be too limited, the secondary market data may provide a poor estimate of the DRP of local bonds or even the foreign bonds, and raises contentious questions about the optimal weighting to be applied to such data in the event of using this data to better reflect the benchmark firm's cost of debt over a variety of sources. In addition, callable bonds (excluding make-whole callable bonds) should also be excluded because their DRPs are higher to compensate lenders for the call option, any impact on the equity beta does not offset this effect, and there is no universally accepted method for adjusting for the call option. In addition, subordinated bonds should also be excluded primarily because their DRPs are likely to overestimate the DRP of a benchmark firm of the same credit rating.

1. Introduction

The AER is currently considering whether to estimate the cost of debt of the efficient benchmark regulated energy network business using the 'on-the-day' approach or by using a trailing average or a hybrid approach (the 'on-the-day' approach for part of the cost and the trailing average for the remainder). For each of these approaches, the AER has posed a number of questions as follows and this paper seeks to address them.

Firstly, should the estimation method use a single benchmark maturity or a range of maturities and what should these be.

Secondly, should the AER use a third-party source for estimating the cost of debt (if so, which) or develop its own method/dataset and, in the latter case, what should this be.

Thirdly, should the estimation method use a single credit rating or a range of ratings and what the benchmark firm should be.

Fourthly, which bond issuers should be considered in the estimation process, with the possibilities including but not limited to service providers and their parent groups, companies operating in the energy sector, regulated network companies (specified), and all Australian businesses that match other selection criteria (credit rating, maturity, etc).

Lastly, what types of debt instruments available to a business should be used and how should each be incorporated in the estimation process.

The conclusions presented are generic to the industry subsector of interest unless otherwise specified.

2. The Choice of Maturity Benchmark

2.1 On-The-Day Approach

This approach is currently employed by the AER, and involves estimating the cost of debt by separately estimating the risk free rate (proxied by that on CGS) and the DRP relative to CGS over a short period prior to the regulatory period in question. The benchmarks currently employed by the AER are the ten year CGS and the debt risk premium on ten-year BBB+ bonds.

There is general agreement that parameter choices should satisfy the NPV = 0 requirement, i.e., the present value of expected cash flows should equal the initial investment by the regulated entity. As shown in Lally (2007), when a regulator resets the cost of debt every T years using prevailing rates and recontracting risk is absent, this can only be achieved through the regulator using the prevailing T year cost of debt and the firm aligning its borrowing with the regulatory cycle (either through physical borrowing or the use of hedging arrangements that are equivalent to this).[1] Furthermore, the firm will have a strong incentive to do this so as to eliminate the significant interest rate risk that would otherwise arise, i.e., an efficient benchmark firm would act in this way. However recontracting risk clearly exists and it *may* drive a firm to not only borrow for a longer period than the T year regulatory cycle (for N > T years) but to also stagger its borrowing so that approximately 1/Nth matures each year (see AER, 2009, pp. 150-152). In addition, it does not seem to be feasible for firms to fully correct for this misalignment between their physical borrowing and the regulatory cycle through the use of hedging arrangements. In particular, there are difficulties in using credit default swaps to deal with the debt risk premium. This implies that the NPV = 0 requirement cannot be satisfied and the second-best policy should then be pursued by the regulator.

One possible (widely-used approach) is for the regulator to grant the prevailing N year risk free rate and the prevailing N year debt risk premium on the grounds that this would provide appropriate compensation on average for regulated firms. However, at least some firms are able to align the risk free rate component of their cost of debt with the regulatory cycle through the use of interest rate swap contracts, they would have a strong incentive to do this so as to minimise interest rate risk (variation between the cost of debt allowed by the regulator and that actually incurred), and doing so appears to be general practice (see AER, 2009, pp. 152-153). The result would be that, in respect of the risk free rate component of the cost of debt, these firms would be compensated for the N year rate but would (net of the

[1] Recontracting risk is the risk that firms will either not be able to refinance debt at the roll-over point, because debt markets have frozen, or will face unduly high rates because all potential lenders understand that the firm has no alternative to refinancing its debt. This problem is greatest when the firm refinances all of its debt at the same time. By contrast, if (for example) only 10% of its debt is refinanced every year, then the firm has the option (in the event of debt market freezing or unduly high rates are demanded) of repaying this portion of its debt by reducing dividends, capex, and opex, in which case refinancing risk is absent.

effect of the swap contracts) only incur the T year rate and would therefore typically be better off because the term structure is typically upward sloping. For example, suppose the regulator allows the ten year risk free rate of 5%, the firm actually incurs the five year rate, and the five year rate is 4.8%. Furthermore the AER is well aware of this over compensation issue (AER, 2009, page 154).

An alternative approach (with a T year regulatory cycle) would be for the regulator to allow a cost of debt based upon the prevailing T year risk free rate plus the cost of the swap contracts that firms would require to convert the risk free rate component of their N year debt into T year debt plus the prevailing N year DRP. For those firms that could use these swap contracts, the result would be an allowed risk free rate that always matched that incurred by the firm and an allowed DRP that *on average* matched that incurred by the firm. For those firms that can use these swap contracts, this approach is the best available in the context of an on-the-day approach. To illustrate the DRP issue, suppose that the regulatory cycle is T = 1 year, firms issue N = 2 year debt with half just rolled over and the other half rolled over one year ago, the two-year DRP is currently 3%, and it was 1% one year ago. In this case, firms will receive a DRP allowance of 3% for the next year and this will correspond to the cost incurred on the debt that has just been rolled over. However, in respect of the debt rolled over one year ago, the DRP incurred on it over the next year will be 1%. Accordingly, over its debt in aggregate, the actual DRP incurred by the firm over the next year will be 2% and therefore the DRP allowed will be excessive. However the reverse situation is just as likely. Over time the average allowance will converge on the average cost incurred.

This approach has three possible drawbacks. The first is the risk to regulated firms associated with the discrepancies between the DRP allowed (the prevailing rate) and that incurred (the historical average rate). However, over a series of regulatory cycles, the average discrepancy tends to zero and the short-term effects will simply be for dividends to be more volatile than otherwise or for the firm to borrow when the discrepancy is negative and repay when it is positive. These consequences do not seem to be very significant. Furthermore, in the course of the GFC during which the DRP rose, firms will have so far received more DRP compensation than the DRP incurred, with the expectation of a reversal in the coming years.

The second possible drawback is resulting greater volatility in prices to consumers. However, since both the risk free rate and DRP components of the cost of debt are determined in accordance with the on-the-day approach, there is some dampening in price volatility because the risk free rate and the DRP are negatively correlated. In addition, even this total cost of debt would be only part of the total price paid by consumers. Thus this issue would not seem to be substantial.

The third possible drawback relates to firms that cannot use swap contracts to align the risk free rate component of their cost of debt with the regulatory cycle because the size of the required contracts over the usual 40 day period in which the prevailing risk free rate is estimated would be too large to be accommodated by the market. Both SFG (2012, pp. 23-25) and the ACCC (2013, pp. 24-25) refer to this problem and assert its existence but neither provides any evidence in support of their claim. By contrast, the AER (2009, pp. 152-153) quotes a number of treasurers for privately-owned NSPs who clearly deny the presence of any such difficulty. Furthermore, these Treasurers include those for both Envestra and SP AusNet, whose debt levels are substantial: approximately $2b and $3.7b respectively (AER, 2009, page 158). The QTC (2012, Attachment 1, pp. 27-29) also acknowledges the ability of privately-owned regulated businesses to utilise these swap contracts but claims that the state-owned NSPs are too large to be able to replicate this strategy within the narrow window in which regulatory averaging is usually done. However, even if this is true, the use of a longer window by the regulator would presumably deal with the problem and the QTC specifically nominates a period of six months (QTC, ibid, page 42). Furthermore, even if the regulator's window was not widened, the regulated firm could still address the problem by undertaking its swap contracts over a wider period and the consequential risk from doing so would presumably be small.[2]

The only remaining issue is that of the average debt term for regulated businesses. The AER (2009, page 158) notes evidence from the JIA indicating a figure of about ten years, and raises the question of whether floating rate debt maturing in ten years should be treated differently to fixed rate debt maturing in ten years before deciding that there was no persuasive evidence to depart from the ten-year term. The relevant issue here is the term for

[2] If the swap contracts are undertaken over (say) a six month period rather than two months, then the risk free rate component of the regulated entity's effective cost of debt would reflect prevailing rates over that six month period rather than the two month period, whereas the regulatory allowance would still be based upon the two month period. Thus, if average interest rates over these two periods differ, then the risk free rate component of the regulated entity's effective cost of debt would differ from that allowed by the regulator.

which the DRP is fixed and the DRPs on these two types of debt would be similar.[3] Thus, for the present purposes, floating rate debt maturing in 10 years should be treated identically to fixed rate debt maturing in 10 years.

In conclusion, when adopting an 'on-the-day' approach, the appropriate benchmarks are the risk free rate for a term corresponding to the regulatory cycle (because regulated businesses generally enter hedging arrangements that have this effect and it is efficient to do so) and a DRP for a term corresponding to the average debt term of regulated businesses (because it is not feasible to vary this through hedging arrangements). Furthermore, evidence presented by the JIA indicates that the latter term is about ten years. Finally, the costs of the hedging arrangements that convert the risk free rate component of the ten year cost of debt to the rate corresponding to the length of the regulatory cycle should be added to the allowed cost of debt.

2.2 Trailing Average Approach

This involves estimating the cost of debt at the beginning of the regulatory cycle by reference to the average cost of debt prevailing over a historical period corresponding to the average debt term for benchmark entities. As discussed in the previous section, this average debt term is about ten years. This suggests that the benchmark debt maturity at the beginning of the regulatory cycle should be the ten year average of the ten year cost of debt. As we progress through the regulatory cycle this figure may or may not be annually revised in the form of a moving average.[4]

With annual revision, and application of the resulting rate only to firms that have been involved in the same operations in question for at least ten years, such an approach is entirely consistent with the NPV = 0 principle, i.e., following such an approach, equity holders are

[3] The rate paid on floating rate debt maturing in ten years would be the BB rate (reset at some high frequency such as three monthly) plus a margin (*m*) that would remain fixed over the ten years. Upon swapping into fixed-rate debt, the cost would become the ten year swap rate plus *m*. Relative to CGS, the ten year DRP would be the ten year swap rate plus *m* less the ten year CGS.

[4] The ACCC (2013) favours no annual adjustment and claims that the resulting errors are self-correcting over a series of regulatory cycles. However, there is no certainty of this. For example, suppose that the regulatory cycle is three years, firms borrow for three years (in a staggered fashion), the three year rate is 8% up to and at the beginning of the current regulatory cycle and is 6% thereafter. With no annual adjustment the firm will be allowed 8% by the regulator over the current regulatory cycle but actually incur an average rate between 6% and 8%. At the beginning of all subsequent regulatory cycles, the regulator will allow 6% and the firm will also incur 6%. Thus there is no correction of the initial error.

compensated for efficient debt costs and therefore the present value of their revenues net of their costs (including the cost of debt) will (subject to other conditions) match their initial equity investment. However there is a fundamental problem in applying such an approach, as follows.

It is implicit in such an approach that the efficient (unregulated) firm borrows but does not then enter into swap contracts to shorten the effective life of its debt, at least in respect of the risk free rate component. However, it is unlikely that efficient unregulated firms would act in this way because debt is progressively more expensive as its term increases. It is more likely that an efficient unregulated firm would choose both its debt term and interest rate swap contracts to optimally trade off the reduction in renegotiation risk from longer term debt, the increase in the risk free rate with the effective debt term, the transactions costs of the swap contracts, and the increased interest rate risk arising from a shorter effective debt term. Consequently a firm might borrow for ten years but couple this with interest rate swap contracts in order to convert the risk free rate component of the cost of debt to (say) three years, thereby reducing the risk free rate component to the three year rate. In this event the benchmark cost of debt should be the three year average of the three year risk free rate plus the ten year average of the ten year DRP plus the cost of the swap contracts. So the regulator would need to observe not merely the average term for which firms borrow but the average *reduction* in that term resulting from the swap contracts. Furthermore, the relevant firms to observe for these purposes are the firms that it regulates sans regulation, which is impossible. Observation of the swap contract behaviour of the firms in the presence of regulation will not be a satisfactory substitute because this swap contract behaviour will be influenced by the nature of the regulation. For example, if the regulatory cycle is five years, regulated firms can be expected to convert the risk free rate component of their cost of debt into five year debt and the evidence presented (AER, 2009, pp. 152-153) indicates that they do this. This tells us nothing about how they would behave if they were not regulated.

In summary, a benchmark debt term under a trailing average approach requires knowledge of the interest rate swap contracts that the regulated firms would have entered into sans regulation, in order to determine the effective risk free rate term on their debt sans regulation, and this is not observable. Thus, in respect of the risk free rate component of the cost of debt, the benchmark debt maturity under the trailing average approach is indeterminable.

2.3 Hybrid Approach

This approach uses the on-the-day approach to the risk free rate component of the cost of debt and the trailing average approach to the DRP. Thus, if this average debt term is N years and the regulatory cycle is T years, then the cost of debt allowed at the beginning of the regulatory cycle would be the prevailing T year risk free rate and the N year average of the N year DRP. As we progress through the regulatory cycle this DRP figure may or may not be annually revised in the form of a moving average.

Such an approach is free of the problem to which the trailing average approach is subject.

3. The Use of Third Party Sources

3.1 Problems with the BVFC

The AER's current practice is to use the BBB BFVC. This BFVC includes all BBB-, BBB and BBB+ fixed-rate bonds issued by Australian companies, including callable and subordinated bonds but excluding those that are denominated in a foreign currency (CEG, 2012, page 21 and page 72).[5] However this source has a number of significant disadvantages, as follows.

Firstly, if the benchmark credit rating is BBB+ (as at present), there is no BFVC for such debt with the nearest approximation being the BBB curve (ACCC, 2013, page 43). However CEG (2012, section 5.2) model the term structure using the Nelson-Siegel (1987) approach. Their two largest data sets (223 and 297 bonds) are shown in Figure 11 and Figure 13 respectively, and both reveal that the BBB curve exceeds the BBB+ curve by about 0.70% throughout the term to maturity range. On this basis the BBB BFVC would not be a satisfactory proxy for BBB+ bonds. By contrast, in respect of two of the smaller data sets examined by CEG and shown in Figure 10 and Figure 12, there is no distinction in the curves for BBB and BBB+ bonds but this is presumably a reflection on the much smaller sample sizes.

Secondly, even if the BFVC for BBB bonds is considered to be an adequate substitute for BBB+ bonds, the curve does not currently extend to the desired ten year term with the current

[5] All references to the BBB BFVC in this paper therefore refer to Bloomberg's curve that pools these BBB-, BBB, and BBB+ bonds. By contrast, reference to BBB bonds means BBB strictly and does not include BBB- and BBB+ bonds.

limit being seven years (ACCC, 2013, page 42). Thus some form of extrapolation is required, with its attendant risk of error. Currently the AER uses the seven year BFVC figure coupled with the use of paired bonds (with seven and ten year terms to maturity on the same company and with the same credit rating) to extrapolate the BFVC figure for seven years out to ten years (AER, 2012, section 10.3.3).

Thirdly, the process by which Bloomberg select and weight data in forming the BFVC is proprietary (AER, 2011b, page 243). In particular, the weightings given to individual bonds vary according to how recently they have traded. Given that this involves judgement and Bloomberg's judgement might be presumed to be good, this could be considered to be an advantage (CEG, 2012, page 8). However the exercise of judgement should not be confused with lack of transparency. By way of analogy, if Bloomberg offered an estimate of the MRP based upon results from differing methodologies but did not disclose the weights that it placed upon these various results, one would not expect any regulator to defer to this estimate as opposed to forming its own.

Fourthly, there is considerable variation in DRP estimates for third-party providers, all of whom could be reasonably presumed to be well-acquainted with Australian debt markets. For example, from the commencement of the GFC in September 2008 until CBASpectrum ceased publishing its DRP estimates, the DRP estimates of Bloomberg and CBASpectrum for ten-year BBB bonds diverged by as much as 3.3% (AER, 2011a, Figure A.6). Coupled with the lack of transparency of the processes underlying these estimates, such variation damages the credibility of all such estimates.

Fifthly, there are widespread concerns about its reliability. For example, the ACT (2012, page 44) has recently stated that "there appears to be increasing doubt as to its reliability". In addition, Credit Suisse (2011, pp. 1-3, Figure 12) has recently expressed the view that the DRP allowances are currently excessive (by about 1.0%), implicitly attributes this error to the AER's reliance upon the BVFC, and advises its clients to expect a reduction in the allowed DRP upon the AER abandoning the use of the BFVC.

Sixthly, the ITRAXX CDS index (which equally weights the five-year CDS contracts on the 25 most liquid investment grade Australian bonds) exhibits a considerable rise during 2008 and 2009 followed by significant subsequent subsidence whilst the BBB five-year BFVC curve shows no such subsequent subsidence (AER, 2011b, Figure 9.6). Naturally, the problem (if there is one) could lie with the ITRAXX index rather than the BFVC. However the ITRAXX index has the dual advantages of both liquidity and transparency. Furthermore, in commenting on this discrepancy in behaviour, CEG (2012, pp. 74-75) observes that the cause might lie in the BFVC under reacting in the 2008-2009 period rather than being too high subsequently. This is entirely possible. However, any acknowledgement of deficiency in the BFVC during 2008-2009 must also damage its credibility in the post 2009 period, particularly from such a staunch defender of the BFVC as CEG and absent any explanation for why the problem would have been confined to only 2008-2009.

Seventhly, there are considerable variations in the DRPs for the bonds included in the BFVC, when holding rating class and term to maturity fixed. For example, CEG (2012, Figure 1) shows a spread in the Bloomberg DRPs on two-year BBB+ bonds from 1.6% to 3.4%. In addition, CEG (2012, Figure 2) shows a spread in the Bloomberg DRPs on six-year A- bonds from 2.8% to 5.2%.[6] Nor is this variation limited to data underlying the BFVC. For example, CEG (ibid, Figure 2) shows a spread in the UBS DRPs on one-year A- bonds from 1% to 4%, on six-year A- bonds from 2% to 4%, and on fifteen-year A- bonds from 3.3% to 5.8%. Even more spectacularly, CEG (Figure 11) shows a spread in the DRPs on pooled UBS and Bloomberg data on ten-year BBB bonds issued by Australian firms from 7% to 14.5%. Chairmont Consulting (2012, Graph 1) provides another dramatic example of this kind, in the form of yields on 18.11.2011 for a range of AAA rated public-sector entities that issued debt in the Australian market; the yields range from 3% to 7% at a five year term to maturity. Thus, in using any curve that is fitted to data of a particular credit rating and at a particular term to maturity, one is averaging over huge variation in DRPs.

Many of the sources of this variation are quite well understood; current DRPs depend not simply on credit rating (an estimate of default risk based upon past information) and term to maturity but a host of other factors that affect the DRP but not the current credit rating. One of these is liquidity, which lowers a bond's yield but does not affect its credit rating. Another is callability, which raises a bond's yield to compensate the bondholder for the bond issuer's right to call the bond but may not affect its credit rating. Another is the expected recovery

[6] The terms to maturity of these bonds range from 5.5 to 7.5 years with the DRP monotonically decreasing whilst the BFVC is upward sloping. Consequently, if the terms to maturity had matched more closely, the DRP range would have been even greater.

rate in the event of default, which lowers a bond's yield in compensation but does not affect its credit rating (Chairmont Consulting, 2012, page 10). Another is mere differences in opinion between the market and the rating agencies about the risk of default, and this can extend to entire industries. Lastly, markets react more quickly to new developments than rating agencies and therefore bonds may have unusually high or low DRPs relative to other bonds of the same rating until the rating is changed. Chairmont Consulting (2012, Graph 2) again provides a particularly pointed example of this point, involving GE Capital whose DRP rose from 0.8% to 5.0% over the two year period preceding a rating downgrade in March 2009.

The implications of all this for regulated firms is clear. If their liquidity, incidence of call options, or expected recovery rates are not typical of other firms with the same credit ratings, their DRPs will diverge from that of other firms with the same credit rating. Plausibly, regulated businesses have higher than normal expected recovery rates because their activities necessarily include regulated activities, whose viability will survive any default occasioned by imprudence or bad luck in respect of their unregulated activities. Thus, using the BBB BFVC to estimate the ten-year DRP for BBB regulated businesses would in principle be akin to estimating the average weight of a jockey from the average weight of all adults, and using the BBB BFVC to estimate the ten-year DRP for BBB+ regulated businesses would in principle be akin to estimating the average weight of a naked jockey from the average weight of all heavily attired adults. In respect of differences of opinion between investors and rating agencies, intra-industry differences of opinion will tend to wash out in the present process. However the same is not true of industry-level differences of opinion. In particular, if rating agencies believe the default probability for regulated energy network businesses is higher than investors believe it to be, the DRPs for such businesses will be low relative to other bonds with the same credit rating. Consequently the BFVC for BBB bonds will overestimate the DRP for BBB regulated energy network businesses.

The impact of call options is particularly interesting and is revealed by the report prepared by Oakvale Capital (2011). They examine 31 callable bonds and find that the DRP impact of the call option ranges from zero to 2.0% (ibid, Appendix F and para 50). CEG (2012, Figure 2) apply the same methodology, with their Figure 2 showing results without adjustments for the call options and Figure 4 showing results with the adjustments. One of these bonds experiences an estimated reduction in its DRP of about 1.5% (Suncorp with a 12 year term to maturity). The effect of industry is also particularly interesting, with CEG (ibid, pp. 16-17) commenting that the BBB bonds in their Figure 3 with maturities from 7-13 years are inconsistent with the wider population of BBB bonds and, in particular, have a lower average DRP than the BBB bonds with maturities of 4-7 years. The conclusion CEG draw from this is that a curve designed to fit all bonds might not fit a subset corresponding to a particular maturity range and this does not reflect adversely on the curve. However, given that these 7-13 year BBB bonds are dominated by BBB regulated firms, one could reasonably suspect that regulated firms have unusually low DRPs relative to BBB bonds in general and therefore that the BFVC BBB curve is unsuitable for estimating the DRP of a regulated BBB firm.

On the other hand, some of the variation in DRP estimates around the BFVC is also due to DRP estimates that are not current because the bonds have not recently traded and the DRP estimates have not been updated by the entity providing the estimates (QTC, 2012, page 23; Chairmont Consulting, 2012, pp. 47-48). The BFVC may account for this by placing low weighting on such bonds and therefore the apparent variation in DRPs around the BFVC is to some extent illusory (as argued by CEG, 2012, pp. 8-9). However, since Bloomberg's analysis is proprietary, the extent to which this point is valid is indeterminable.

In view of these overwhelming limitations of the BFVC, I consider that the AER should seek to develop its own estimate of the ten year DRP at its specified credit rating. The fact that Bloomberg has ceased attempting to do this for BBB bonds in general, presumably because it has judged the data to be inadequate, might suggest that any attempt by the AER would be doomed (as argued by the QTC, 2012, Attachment 1, page 23). However, the BFVC for a particular credit class is concerned with bonds in general whereas the AER is concerned only with regulated energy network businesses. Thus, if the bonds of regulated energy network businesses are well represented amongst the available data, this data might be sufficient for the AER's purpose even if it were not for Bloomberg's purpose.

3.2 Alternatives to the BFVC

If the AER ceases using the BFVC then two possible approaches are available to them: to collect a set of DRP estimates on suitable bonds with residual terms to maturity of approximately ten years, followed by averaging over these estimates, or to collect estimates on suitable bonds over a wider range followed by the fitting of a curve to the data. The extent of data that is available will be a factor in this choice. For example, if there were minimal observations in the 8-12 year term then curve fitting would be required. Otherwise the choice exists. Averaging suffers from the problem of ignoring useful information outside the averaging band. CEG (2012, pp. 50-52) also argue that it suffers from the fact that the yield curve is concave and therefore averaging over the yields of a set of bonds with an average term to maturity of (say) ten years will induce downward bias in the DRP estimate for a ten year bond. However, it is also true that firms issue bonds with a wide range in their lives[7] and the appropriate DRP would average over them but general practice is instead to estimate the DRP at the average term; this bias is upward rather than downward and is likely to be more significant than the downward bias identified by CEG.

To illustrate this point, suppose that firms issue bonds with maturities of 5, 10, and 15 years, with DRPs of 2%, 3% and 3.3%. Suppose also that a regulator seeks only to estimate the DRP of ten year bonds and uses data on three bonds, with terms to maturity of 7.5, 10, and 12.5 years and DRPs of 2.67%, 3%, and 3.2%. The resulting DRP estimate would average over the last three numbers, yielding 2.96% rather than the 3% for ten year bonds and the shortfall of 0.04% is CEG's downward bias. However, had the regulator averaged over the DRPs of 5, 10, and 15 year bonds, so as to properly reflect the spread in a single firm's bond lives, the result would have been 2.77%. Thus the net effect of these two biases is upward, by 0.20%. So, if regulators do define the DRP of the benchmark firm to be that associated with a single term (such as ten years), it would be desirable for them in estimating this DRP to average over the DRPs of various bonds with a wide range of terms to maturity around the ten year average, so as to reverse out the upward bias arising from their definition of the DRP of the benchmark firm.

Turning now to curve fitting, this suffers from the need to choose amongst competing curve-fitting functions. CEG (2012, section 5) presents results from applying the Nelson-Siegel model to both the yield-to-maturity and to spot rates. The largest data set is 110 AUD denominated bonds, with ratings from BBB- to A, and the results are shown in CEG's Figure 12 and Figure 16 respectively. For BBB+ bonds with ten years till maturity, the estimated yields are 7.67% and 8.10% respectively, i.e., a difference of over 0.40%, which is not trivial. Alternative models are those of Svensson (1994), which adds extra parameters to the Nelson-

[7] I understand that the principal sources of debt for Australian corporate are bank loans, Australian public debt issues, and foreign bonds (public debt issues or private placements). I also understand that the term for bank loans typically does not exceed five years whilst the term for foreign bonds is typically at least ten years.

Siegel model to allow for the possibility of a second ‘hump’, and ‘spline’ approaches in which the yield curve is a series of segments rather than a single function. Amongst the world’s central banks, all three approaches have their supporters and this implies that there is no professional consensus on the best approach (BIS, 2005, Table 1).

Curve fitting also suffers from the need to obtain high quality DRP data over a wider range of maturities. Given the need for a wider range of maturities, the temptation to loosen standards (by admitting lower quality data) will be strong and the result of this is likely to be a biased estimate of the DRP of concern. Since one approach is not manifestly superior and there is no necessity to favour one over the other, I recommend that results from both approaches be considered. In the same way, a better estimate of the MRP arises by considering estimates from a range of methodologies.

I also recommend that the AER desist from its current practice of estimating the DRP to the nearest basis point. This practice, which is very common, may reflect a belief that the MRP is not observable whilst the DRP is, and therefore the principle of approximation is accepted for the former but not the latter. However, the current controversy over the appropriate estimate for the DRP of the benchmark entity clearly demonstrates that this DRP is not observable and therefore some level of approximation should be accepted. Whatever this level of approximation might be (0.25% or 0.5%), it is less likely than otherwise that the choice of averaging versus curve fitting would produce a different result.

On the question of choosing particular bonds, I do not propose to do so here because any such selection is likely to be out of date before being first applied to a particular regulatory case. Furthermore, I do not consider that I have the requisite expertise. I therefore recommend that the AER appoint a panel of advisers on this matter, and draw upon the panel’s advice at the particular times that it is required. Such a panel should contain both industry practitioners, with a particular familiarity with the Australian debt market, and others with a more academic orientation. However the following sections offer some broader recommendations and caveats in this area.

These issues have differing implications for the trailing average and on-the-day approaches. If the BFVC is retained, errors from its use are less significant under a trailing average or hybrid approach than under an on-the-day approach due to averaging across BFVC values at various points in time (ACCC, 2013, pp. 43-44). However, if the BFVC systematically overestimates the DRP for regulated businesses, averaging of this kind will not mitigate the error. Alternatively, if the BFVC is abandoned and replaced by an expert panel, the estimation process for the DRP will be more difficult for the hybrid or trailing average approaches (in which a ten-year average of the ten year DRP will be required) than for the on-the-day approach (in which only the prevailing ten year DRP will be required) for two reasons. Firstly, unlike the BFVC for which a historical series already exists, an expert panel starts afresh and would have to create a historical series as well as a current estimate. Panellists chosen because of their familiarity with the current state of the Australian debt market would not necessarily have an adequate familiarity with the market ten years earlier. The second difficulty in using an expert panel in conjunction with a trailing average or hybrid approach is the sheer volume of historical DRP estimates that would be required and this problem would be aggravated if annual adjustment were also done (as noted by the QTC, 2012, Attachment 2, page 7).

Both of these difficulties would be mitigated if the Expert Panel used the BFVC values up to the GFC and conducted their own analysis from that point. However, many of the problems with the BFVC that have been described above are not limited to the period since the commencement of the GFC and therefore use of the BFVC up to the GFC would not be satisfactory.

Both of these difficulties would evaporate if the transitional process from the current regime to the trailing average did not utilise historical data. Consistent with this, the ACCC (2013, section 7) argues that regulated businesses could be presumed to have organised their debt issues so as to reflect the current regime, which would involve debt being perfectly aligned with the regulatory cycle. Consequently, under the new regime (with for example a five year regulatory cycle), the regulated firm would undertake a set of borrowing arrangements with maturities in one, two, three, four, and five years, and upon maturity replace each of them by five year debt. Consistent with this, the regulator would assign equal weight to each of these arrangements in the first year of the new regime and this would not require knowledge of historical DRPs. However the ACCC's belief that, under the current regime, regulated firms would have aligned their debt issues with the regulatory cycle is contradicted by the evidence from corporate treasurers presented by the AER (2009, pp. 151-154). Instead firms appear to have engaged in staggered borrowing and to have used interest rate swap contracts to align the risk free rate component of the cost of debt with the regulatory cycle. Consequently the DRPs currently paid by these firms will reflect the historical rates prevailing over the last ten years.

In summary, if the BFVC is abandoned, the AER will need to develop its own estimate of the ten year DRP at its specified credit rating. The best bonds to provide this data will vary over time and the choice of bonds at the times at which estimates are required should be delegated to an expert panel. In using this data to estimate the ten-year DRP, the choice is between some form of averaging and curve fitting. Since one approach is not clearly superior, I recommend that results from both approaches be considered and that the resulting estimate be rounded to at least the nearest 0.25%. In addition, if the AER abandons use of the BFVC, it will be much more difficult for it to implement the trailing average or hybrid approaches due to the quantity of historical data that will be required.

4. The Choice of Credit Rating

The benchmark regulated energy network business should be a private sector firm engaged only in such activities, and therefore the relevant credit rating is that of a firm of this type. Private-sector firms engaged in additional activities are not satisfactory because their credit ratings will at least partly reflect the riskiness of these other activities. Government-owned regulated energy networks are not satisfactory because their credit ratings would reflect the possibility of government support.[8] Similarly, private-sector regulated energy networks with parents are not satisfactory because their credit ratings are likely to be affected by the possibility of parental support.

It might be argued that it is efficient for a private-sector regulated energy network to be part of a larger business, either through having unregulated activities or having a parent likely to support it, and the definition of a benchmark should reflect that efficiency opportunity. Such a benefit comes from less than perfect correlation between the cash flows of the regulated business and these other associated activities (risk pooling), yielding a lower cost of debt for the aggregate entity than for the average of the stand-alone businesses. However, it is not

[8] This position matches that of the AEMC (2012, section 7.4.3) and ensures competitive neutrality between the two sectors. Appendix 1 examines this issue in detail.

apparent what the optimal degree of risk pooling of this type is; increasingly diversified conglomerates experience greater risk pooling but at the expense of various disadvantages. Furthermore, risk pooling arrangements of this kind involve not just a free-lunch in the form of a lower average cost of debt but cross-subsidisation of high-risk activities by low-risk activities. For example, suppose that a stand-alone regulated business would have a cost of debt of 6%, an unrelated stand-alone unregulated business of similar risk would also have a cost of debt of 6%, and the aggregate business would have a cost of debt of 5.5%. In this case, both activities would benefit from aggregation of the businesses. However, suppose instead that the unregulated business was of higher risk and would incur a cost of debt of 8% if it were a stand-alone business. In this case, the aggregate business is likely to have a cost of debt in excess of that of the stand-alone regulated business. So, if this figure were 6.5%, then the regulated business would be subsidising the cost of debt of the unregulated business by at least 0.50%.

Returning to the tests specified above, no firm meets all of these tests and therefore at least some of these requirements must be relaxed. One such candidate is firms with other activities, because this is a matter of degree and the degree may not be great. Another candidate is privately-owned firms with parental relationships other than very strong ones, with a strong parent being defined to be foreign, holding at least a 50% stake, and with a high credit rating.[9] The result is that the benchmark firm is privately-owned and without a very strong parent. Even with this relaxation in the definition, the number of admissible firms is likely to be small. For example, using the set of Australian network utility firms with S&P credit ratings as of November 2012 (S&P, 2012), there seem to be only six firms that are both privately owned and without very strong parents: APT, DUET, Electranet, Envestra, ETSA, and United Energy.[10]

Having selected a benchmark credit rating by recourse to the average credit rating of the firms selected in this way, the next issue is whether comparator bonds should have the same

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[9] Ceterus parebus, foreign parents are stronger than local ones because many economic shocks are country or region specific. Thus, if a regulated energy network business suffers an economic shock, a foreign parent is less likely to be also affected and therefore more able to support the subsidiary.

[10] The firms deleted due to having a strong parent were ATCO Australia (owned by ATCO Group with an A rating), Powercor (majority owned by CKI with an A rating), SP Ausnet Group (majority owned by SPI with an AA rating), SPI Australia (owned by SPI), and Citipower (majority owned by CKI). In addition, DUET wholly owns Energy Partnership and is the 80% owner of DBNGP, and all three firms have the same credit rating. So, only DUET is recorded.

rating or whether a wider band would be acceptable. If a wider band is not used this will severely limit the number of high-quality observations. For example, suppose the benchmark credit rating were BBB+ as at present. The AER (2011b, pp. 249-251) was only able to find two BBB+ cases within a 7-13 year term to maturity band and only four cases by widening the term to maturity band to 5-15 years. Augmenting this with BBB and A- cases would increase the sample size from four to 13 cases with a 5-15 year term to maturity band (AER, 2011b, pp. 249-251). However the inclusion of data from the two adjoining credit bands presumes that the DRP differential between BBB and BBB+ is comparable to that between BBB+ and A-.

Evidence on the question of DRP differentials between adjoining rating categories is presented in CEG (2012, section 5.2), who model the term structure using the Nelson and Siegel (1987) approach. Their two largest data sets (223 and 297 bonds) are shown in Figure 11 and Figure 13 respectively, and both reveal that the BBB curve exceeds the BBB+ curve by about 80% of the amount by which the BBB+ curve exceeds the A- curve at the ten-year term to maturity. I therefore recommend that the differentials be treated as if they are equal, for the purposes described above.

In summary, the appropriate benchmark regulated energy network business is a private-sector firm primarily engaged in such activities and without a foreign parent with a high credit rating. In addition, whatever the benchmark credit rating resulting from this definition is, there are likely to be few comparator bonds with the same rating and therefore comparator bonds should be drawn from a wider credit band centred on the benchmark credit rating. So, if the benchmark rating were BBB+ as at present, comparators should be selected from the BBB to A- range in order to provide sufficient observations to estimate the DRP of a BBB+ rated regulated energy network businesses.

5. **The Choice of Debt Issuers**

The analysis in section 3.1 suggests that there are considerable variations in DRPs for a given credit rating and term to maturity and also that the bonds of regulated businesses may have lower DRPs than other bonds with the same credit rating. One might also suspect that there were variations across different kinds of regulated businesses. This suggests that the choice of debt issuers should be limited to firms whose regulated activities represent the dominant part of their activities and match the benchmark entity of concern. Thus, in respect of electricity transmission, the comparator firms should be primarily involved in electricity transmission (and similarly for electricity distribution, gas transmission, and gas distribution). However the resulting set of firms is likely to be far too small to provide a set of bonds suitable for estimating the DRP of the benchmark entity of concern. In addition, if primary market bond data is used and as noted by the AER (2013, page 119), regulated firms may be incentivised to issue expensive debt.

In view of this, the set of debt issuers should be expanded until a sufficiently large set of comparators is obtained. The minimum set should include all regulated energy network businesses, i.e., all regulated firms engaged primarily in electricity or gas transmission or generation. If this set of firms does not supply sufficient comparator bonds, I recommend inclusion of regulated network businesses in other industries, with similarly limited competition or exposure to the threat of new entry. The only clear example of this kind is water supply. The next set of possibilities would be other regulated firms with similarly limited competition or exposure to the threat of new entry, such as the DBCT. The last set of possibilities would be unregulated firms whose principal activities are monopolistic, and with similarly limited exposure to competition or the threat of new entry. The only clear example of this kind is airfield operations, which were subject to price regulation until 2002 and are now subject to price monitoring.

6. The Choice of Debt Instruments

6.1 General Issues

The AER's current practice is to use the BFVC and therefore the choice of debt instruments is effectively delegated to Bloomberg, who base their analysis upon fixed-term bonds denominated in AUD. Thus, if the BFVC is abandoned and replaced by a panel of expert advisers, the choice would lie with that panel. Obviously the bonds would have to be issued by suitable Australian entities (as discussed in section 5) and fixed-term bonds denominated in AUD would be clearly admissible. The more contentious questions relate to floating-rate bonds denominated in AUD, bonds denominated in foreign currency, callable bonds, and subordinated bonds.

For meaningful comparison with the yield to maturity on fixed-term AUD-denominated bonds, the AUD-denominated floating-rate bonds would have to be coupled with a suitable interest rate swap and the foreign currency denominated bonds would have to be coupled with suitable currency swaps. Accordingly, the costs of such swap contracts would be added to the cost of such borrowing arrangements.[11]

6.2 Foreign Currency Denominated Bonds

The inclusion of foreign currency denominated bonds in a DRP estimate is problematic on a number of grounds. Firstly, the QTC (2012, Attachment 1, page 25) argues that the principal US holders of such bonds typically hold till maturity and therefore these bonds are not very liquid. Consequently they argue that only data from bonds issued during the period in which the DRP estimate is sought should be used, i.e., only primary market data should be used. However, since the set of comparator debt issuers will be small (as discussed in section 5), it would be unusual for any of them to have issued foreign denominated bonds within the designated 40 day DRP estimation window. In short, primary market data would be rare and secondary market based estimates (from Bloomberg, etc) would have low quality due to the low liquidity of the market.

Secondly, in respect of primary market data, I understand that the rate differential between local bonds and otherwise identical foreign denominated bonds fluctuates considerably over time, with the differential typically up to 1%.[12] Since the DRP comprises allowances for expected default losses, the illiquidity of the bonds relative to government bonds, and systematic risk[13], the DRPs paid by a given Australian borrower may differ between local and foreign borrowing because local and foreign lender perceptions of the default risk of Australian firms may be different, premiums for the relative illiquidity of the bonds may differ across markets, and the premiums for systematic risk are likely to be different (as noted by Davis, 2011, pp. 7-9).[14] This raises the question of why such foreign denominated bond

[11] These swap costs are not large. Even for currency swaps, I understand that the bid-offer spread is up to five basis points plus a similar amount for credit risk providing suitable collateral arrangements are in place.

[12] Foreign denominated borrowing would likely be more prevalent when it is cheaper but other considerations are involved, including the desire by firms to diversify their sources of finance and the inability to obtain very long-term borrowing locally. Thus, even if foreign currency denominated borrowing were more expensive, some level of it would still be observed.

[13] Elton et al (2001) conclude that most of the DRP is compensation for systematic risk whilst Dick-Nielsen et al (2012, Table 5) conclude that about 25% of the DRP on A to BBB bonds was due to illiquidity in the period 2007-2009.

[14] In respect of systematic risk, financial institutions in (say) the US who lend to Australian rather than US companies are akin to US investors who buy Australian rather than US equities. In both cases, with imperfect

data might be used by a regulator. If it were being used merely to assist in estimating the DRP of a local currency bond, it may therefore provide a poor estimate. Alternatively, if it were being used to better reflect the actual costs of a firm's debt finance, then this would raise contentious questions about whether to also include the cost of bank debt (the third primary source of debt finance), the weights to be placed upon such sources of debt, and the issue of whether to apply the same weights to firms who may not have access to foreign borrowing (due to their limited size and/or the lack of a credit rating).[15] Furthermore, the optimal weights for local and foreign borrowing will fluctuate through time (inversely with relative costs), and therefore the optimal weights at the current time will be unknown (using the relative current levels of the various types of debt will be unsatisfactory because these current levels will reflect the relative attractiveness of the different types of debt at various points in the past).

Thirdly, in respect of secondary market data, the buyers of such bonds come from a variety of markets.[16] If they are from the same market as the lender, the DRP estimated from secondary market data would tend to be similar to that based upon primary market data (absent any new information). However, if buyers are from another market, the DRP estimated from secondary market data could be quite different and this will aggravate the problems outlined in the previous paragraph. In particular, if the data is being used merely to assist in estimating the DRP of a local currency bond, it may therefore provide a poor estimate. Alternatively, if it were being used to better reflect the actual costs of a firm's debt finance (in the primary market), then it may provide a very poor estimate in addition to raising

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integration of markets, the imperfect correlation between the Australian and US markets implies that the Australian investments exert a lower impact than further US investments upon the risk of the assets currently held by these US investors. Furthermore, in respect of lending, one would expect the benefits to be shared with the borrowers in the form of a lower DRP than they would pay on local borrowing so as to encourage borrowers to seek foreign loans. These effects may or may not persist after the issue date because the interest rate data is then from the secondary market and secondary market buyers may or may not be from the same market.

[15] Some regulated energy network businesses do not have credit ratings and I understand that this would exclude them from most foreign bond markets. In addition, due to the fixed costs of foreign borrowing and minimum bond issue sizes imposed by the market itself, smaller businesses would also be excluded. For example, I understand that the minimum transaction size in the US public debt market is about US$500m. Thus, a firm with even a maximum rollover proportion of 20% per year would have to have total debt of at least US$2500m. With leverage of 60%, this implies assets of at least US$4b. Even in the US private placement market, I understand that the minimum transaction size is US$100m, and therefore is limited to regulated firms with assets of at least US$800m.

[16] This is apparent from examining the ownership composition of some of these foreign currency denominated bonds, as provided by Bloomberg.

contentious questions about whether to also include bank debt, the weights to be placed upon such sources of debt and the application of those weights to firms who do not have access to foreign borrowing.

To illustrate this point, suppose Company X borrows in $US at 7.5% (after swapping into AUD), could borrow locally at 7.0%, and secondary market transactions on the foreign borrowing shortly after issue of the bonds were at 7.5%. In this case the primary market data would overestimate the cost of local borrowing but accurately estimate the cost of foreign borrowing, whilst the secondary market data would do likewise. By contrast, if the secondary market transactions were at 7.0%, then this data would correctly estimate the cost of local borrowing but underestimate the cost of foreign borrowing.

In respect of secondary market transactions and DRP estimates based upon this, Bloomberg data presented by CEG (2012) reveals a significant difference between the costs of local and foreign borrowing. CEG's Figure 7 shows the BFVC for BBB bonds and the yields (after the currency swaps) from 19 foreign currency denominated BBB bonds. The vast majority of these bond yields are above the curve and the average margin above it is 1.55%.[17] By contrast, CEG's Figure 3 shows the DRPs on local currency BBB bonds and the BFVC for BBB bonds, with data drawn from the same period as with Figure 7 (and similarly excluding callables other than make-whole callables). In this case the average DRP on the BBB bonds relative to the BFVC is very close to zero (-0.04%). It follows that the average DRPs on the foreign currency denominated bonds exceed those on local currency bonds by about 1.6%. In addition CEG show Bloomberg and UBS data on AUD denominated bonds (Figure 12) and both AUD and foreign-currency denominated bonds in Figure 13, and then fits Nelson-Siegel curves to this data for BBB, BBB+ and A- bonds. In respect of Figure 12, the simple average of the three curves at the ten-year maturity is 7.38% and the corresponding result for Figure 13 is 7.93%. Furthermore, in moving from Figure 12 to Figure 13, the data set increases from 110 bonds to 297 bonds (CEG, ibid, pp. 36-37). It follows that 187 of the total set of bonds are foreign currency denominated and they represent 63% of the total. The average ten-year yield on the foreign currency denominated bonds must then be x satisfying the following equation:

[17] Remarkably, in spite of this, CEG (2012, page 26) claims that the BFVC fits the data well. Presumably the data referred to is all data on the figure but the average credit rating of this data is above BBB and therefore not comparable with the BBB curve.

$$x(0.63) + 7.38\%(0.37) = 7.93\%$$

It follows that x = 8.25%. Thus the average yield on the ten-year foreign currency denominated bonds is 0.87% larger than on AUD bonds (8.25% v 7.38%). Both this difference and the 1.6% referred to above are substantial. If the cause of the difference lies only in data quality, such as estimates that have not been updated, then this reinforces the need to select only high quality data. Alternatively, if the difference is genuine and the foreign currency denominated bonds are included, then (as noted above) it raises potentially contentious questions about whether to also include the cost of bank debt, the weights to be placed upon such data, and the issue of whether to apply the same weights to firms who may not have access to foreign borrowing.

In view of these concerns, I recommend that foreign currency denominated bonds be excluded.

6.3 Floating Rate Bonds

In respect of floating rate bonds, the second and third difficulties with foreign-currency denominated bonds as discussed above do not appear to be relevant. Accordingly, the inclusion of floating-rate bonds is recommended but subject to the usual requirements relating to liquidity. In searching for suitable comparators, the AER (2011b, pp. 249-251) was only able to locate five fixed-rate bonds within a 7-13 year term to maturity band, and therefore (reasonably) elected to augment these with a further four floating rate cases. However, the five fixed rate bonds had an average term to maturity of 9 years and an average DRP of 2.6% whilst the corresponding figures for the floating rate bonds were 10.6 years and 3.8% respectively.[18] The DRP discrepancy seems large relative to the term difference and discrepancies of this magnitude would warrant investigation.

To convert a floating rate (which would typically be the BB rate plus a margin) on (say) ten year debt into a fixed rate (for ten years), the floating rate bond would be coupled with an interest rate swap contract to pay the ten-year swap rate for that company and receive BB. The resulting fixed rate cost of debt would then be the margin plus the excess of the ten year

[18] The figures for the floating rate bonds were deduced from the information presented in AER (2011b, Table 9.10).

swap rate for that company over BB. Thus, if the floating rate is BB plus 2% for ten years, the current ten-year swap rate for that company is 4%, the resulting fixed rate would be 2% + 4% = 6%. Deduction of the ten year CGS then yields the DRP.

All of this presumes that the DRP on a floating-rate bond is the same as that on a fixed-rate bond of the same term. However if interest rates are expected to rise and therefore for the BB to rise, a floating-rate borrower faces a set of coupon payments that are expected to rise over time whilst those for a fixed-rate bond are necessarily fixed over the life of the bond. Accordingly, the default risk on a floating-rate bond is likely to be higher than on a fixed rate bond and therefore the DRP must be higher in compensation. However Duffie and Liu (2001) show that the effect is minor.

6.4 Callable Bonds

Callable bonds (excluding make-whole callable bonds) have higher DRPs than otherwise identical non-callable bonds because the firm's call right is disadvantageous to lenders and the higher DRP is compensation to them. This suggests that they should be excluded or adjusted. CEG (2012, 2012, section 3.3.1) argues that they should be included *without* adjustment because callable bonds lower the estimated equity beta of a regulated firm and therefore inclusion of these bonds (with a consequential increase in the estimated DRP) is compensation for the lower estimated equity beta. However this line of argument assumes that the firms used to estimate the DRP are identical to those used to estimate the equity beta, and also that the net impact of the call feature of a bond on WACC is zero (the upward DRP effect perfectly offsets the downward equity beta effect). Clearly the first assumption is wrong. So too is the second because the DRP rises to compensate debt holders for the expected value losses arising from this bond feature, the DRP also changes to reflect the impact of the call feature on the systematic risk of the bonds, and the equity beta also changes to reflect the impact of the call feature on the systematic risk of equity. Only the last two of these effects offset, and therefore the WACC impact of including callable bonds in the DRP estimation process will be upward. Of course, the expected adverse impact of the call on debt holders is perfectly offset by the expected favourable impact of the call on equity holders, but this is not incorporated in the CAPM. Thus, because the cost of debt incorporates a feature that has no impact on capital suppliers in aggregate and there is no adjustment for this in the cost of equity, the estimated WACC will rise (improperly). Accordingly, the inclusion of callable bonds in the DRP estimation process is undesirable.

To illustrate the latter point, consider a one-period two-state world, i.e., the only two points in time are now and some future time, and there are only two possible (equally-probable) states that could prevail at this future time. The assets of the firm are currently worth \$100m and will evolve to either \$130m (state 1) or \$90m (state 2), with market rates of return over this period of 30% (state 1) or -10% (state 2). To simplify the example, I assume no corporate taxes. The firm borrows \$60m, at some promised interest rate, and there is no call feature. The risk free rate is 5%. In this situation the promised rate on the firm's debt would match the risk free rate of 5%, i.e., the DRP would be zero. Thus the debt would pay out \$63m in either state. In addition, the equity value of the firm is currently \$40m (\$100m - \$60m) and will evolve to either \$67m (\$130m - \$63m) or \$27m (\$90m - \$63m). Thus the actual rate of return on the firm's equity will be 67.5% (state 1) or -32.5% (state 2). The equity beta is then 2.5. In addition, since the expected rate of return on the market portfolio is 10% (equal probability on 30% and -10%) and the risk free rate is 5%, then the MRP is also 5%. Following the CAPM the expected rate of return on the equity is then 17.5% as follows:

$$E(R_e) = .05 + .05(2.5) = .175$$

The firm's WACC is then 10% as follows:

$$WACC = .175(.40) + .05(.60) = .10$$

Now suppose the firm's debt contains a call feature. I start with the simplest possible case, in which the debt would be called in both states, and the effect would be to reduce the debt payoff by \$2m in both states. The promised interest rate would then have to rise by 3.33% to compensate for this, in which case the DRP would be 3.33%. However the equity payoffs would remain unchanged (the higher interest rate on debt perfectly offset by the call benefit), the equity beta would remain 2.5, and therefore the cost of equity would remain 17.5%. Accordingly the estimated WACC would rise to 12% as follows:

$$WACC = .175(.40) + .0833(.60) = .12$$

This WACC increase is due to the DRP increase that compensates for the expected adverse effect of the call on bond payoffs ($2m/$100m). There is no effect on the betas of debt or equity.

Turning now to a case in which the bond is called only in one state (state 1), suppose that the effect of the call is to reduce the debt payoff by $2m only in this state. In this case the promised interest rate must rise to reflect the expected impact of the call ($1m) but is mitigated by the fact that the bond now pays off less in state 1 than state 2 and therefore has a negative beta. To ensure that the value of the bond is still $60m, the promised interest rate must be 6.26% and therefore the DRP is 1.26%.[19] The resulting payoffs to equity holders are then as follows:

State 1: $130m - $60m(1.0626) + $2m = $68.24m

State 2: $90m - $60m(1.0626) = $26.24m

The value of equity remains $40m but the possible rates of return on equity are now .706 (state 1) and .344 (state 2), and therefore the equity beta rises to 2.62. Accordingly, the cost of equity rises to 18.1%, and therefore the estimated WACC is 11% as follows:

$$WACC = .181(.40) + .0626(.60) = .11$$

So, relative to the situation with no call feature, the introduction of the call raises the WACC by 1%, because the DRP increases to compensate debt holders for the expected adverse effect of the call ($2m*.50/$100m). In addition, the call lowers the beta of debt and raises the beta of equity, with offsetting WACC effects.

Finally, I consider a case in which the call is exercised only in state 2, and the effect is to reduce the debt payoff by $2m only in this state. Following the process just described the

[19] To facilitate determining this compensatory increase in the promised yield on debt, the certainty-equivalent form of the CAPM is used to determine the prices now of the two "pure" securities, with one paying $1 in state 1 and nothing in state 2, and the other paying $1 in state 2 and nothing in state 1 (Copeland and Weston, 1992, Ch. 12, section B). These prices are $0.357 and $0.595 respectively. Application of these prices to the state 1 and state 2 payoffs of the bond, followed by summing, yields the value now of the bond, which is $60m by virtue of the promised yield on the bond compensating for the call feature.

promised interest rate is 7.08% (DRP = 2.08%) and the equity beta is 2.38 (with a resulting cost of equity of 16.9%). Accordingly, the WACC is as follows:

$$WACC = .169(.40) + .0708(.60) = .11$$

So, relative to the situation with no call feature, the introduction of the call raises the WACC by 1%, because the DRP increases to compensate debt holders for the expected adverse effect of the call ($2m*.50/$100m). In addition, the call raises the beta of debt and lowers the beta of equity, with offsetting WACC effects.

In conclusion, the belief that the upward impact on the DRP estimate from including callable bonds in the DRP estimation process is offset by the fall in the equity beta is not correct. The call is a zero-sum game across debt and equity holders but it will raise the estimated WACC because the DRP rise to compensate debt holders for the expected adverse effect of the call is not offset by any adjustment to the cost of equity. I therefore recommend that callable bonds be excluded from the DRP estimation process. Ideally, they should also be excluded from the equity beta estimation process. However, even if this is not possible, there are no strong grounds to believe that the effect on the equity beta is downward.

An alternative to ignoring bonds with calls would be to reduce the DRP to remove the effect of the call option. However Chairmont Consulting (2012, section 3.3) argues that this is not possible for two reasons. Firstly, using call valuation models of the Black and Scholes (1973) type assume that the option is tradable whereas the call options embedded in bonds are not tradable. Secondly, attempting to assess the DRP effect of the call option by reference to otherwise identical bonds with no such calls is complicated by the lack of otherwise identical bonds. Furthermore, if such otherwise identical bonds existed, their yields would be used and the callable bonds would then be redundant for the present purposes. Chairmont's concerns about the tradability of the call option are unwarranted; so long as the bond itself is tradable, and the bond issuer is assumed to act rationally in deciding whether to call or not and the transactions costs of calling can be quantified, it is possible to determine the interest rate reduction that yields the same value for a callable bond as an otherwise identical non-callable bond. However, to do so, it is necessary to model the stochastic evolution of interest rates and there are a variety of possible models that could be used to do this. In a report for the

AER, Oakvale Capital (2011) uses Bloomberg results based upon the Hull and White (1990) model but there are many alternatives to this model (see Hull, 1997, Ch. 17). Furthermore, any characterisation of a bond issuer's exercise strategy cannot incorporate issuer-specific considerations, such as the issuer calling the bond in order to change its financing.

In view of these points I consider that bonds with call options should in general be excluded. However, an Expert Panel might make an exception in a particular case (where the likelihood of the bond being called was very low) and Chairmont Consulting (2012, page 32) presents an example of this type.

6.5 Subordinated Bonds

Subordinated bonds have higher default risk than senior bonds over the same company. However, if credit ratings fully reflect all information relevant to bond pricing, then the DRP of a subordinated bond of a company that has a BBB+ rating is comparable with the DRP of a senior bond of another company with the same BBB+ credit rating (as argued by CEG, 2012 page 49). However, as discussed in section 3, the very wide spread in DRPs on BBB bonds around the BBB BFVC reveals that credit ratings do not fully reflect all information relevant to bond pricing. In particular, credit ratings do not reflect the expected recovery rate on bonds in the event of default (Chairmont Consulting, page 10) but DRPs do and subordinated bonds have unusually low recovery rates by virtue of being subordinated. In addition, subordinated bonds are relatively illiquid (Chairmont Consulting, 2012, pp. 12-13). Thus, subordinated bonds with a BBB+ credit rating could be expected to have unusually high DRPs for that rating category and therefore their DRPs would overestimate the overall DRP of a firm with a BBB+ credit rating.

In addition, subordinated debt generally attracts a credit rating one class below that of the senior debt of the same company (Chairmont Consulting, page 36). However the relative default risk of subordinated debt depends upon the relative levels of the two debt classes and therefore the general practice of assigning a one class rating differential to subordinated bonds suggests that these ratings are not the product of very careful consideration. To illustrate this point, consider a one-period world. A firm with promised payments at the period end of \$8m in senior bonds and \$2m in subordinated bonds has a period end value (V_1) that is normally distributed with a mean of \$20m and a standard deviation of \$7m. The probability of default on the subordinated bonds is then the probability that the period end value of the firm is less than \$10m. Letting Z denote the standard normal random variable, this probability is 7.6% as follows:

$$\Pr ob(V_1 \leq \$10m) = \Pr ob(\$20m + \$7mZ \leq \$10m) = \Pr ob(Z \leq -1.43) = .076$$

By contrast, the probability of default on the senior bonds is the probability that the period end value of the firm is less than \$8m, which is 4.4%. Now suppose instead that the senior bonds have a promised payment of \$2m and the subordinated bonds \$8m. Following the same process, the default probabilities would then be 0.5% for the senior bond and remain at 7.6% for the subordinated bond. Thus, if the proportion of debt that is senior falls from 80% to 20%, the default probability on the senior debt falls from 4.4% to 0.5% whilst that for subordinated debt is unchanged. So, depending upon the relative levels of the two bond classes, the relative default probabilities can differ significantly.

In view of all of these points, I consider that subordinated bonds should be excluded.

7. Conclusions

This paper has sought to address a number of questions posed by the AER, and the conclusions are as follows.

The first question is whether the estimation method should use a single benchmark maturity or a range of maturities and what should these be. If the 'on-the-day' approach is adopted, the appropriate benchmarks are the risk free rate for a term corresponding to the regulatory cycle (because regulated firms generally enter hedging arrangements that have this effect and it is efficient to do so) and a DRP for a term corresponding to the average debt term of regulated businesses (because it is not feasible to vary this through hedging arrangements). Evidence presented by the JIA indicates that the latter term is about ten years. Furthermore, the costs of the hedging arrangements that convert the risk free rate component of the ten year cost of debt to the rate corresponding to the length of the regulatory cycle should be added to the allowed cost of debt. By contrast, if a trailing average approach is adopted, the benchmark debt term would require knowledge of the interest rate swap contracts that the regulated firms would have entered into sans regulation, in order to determine the effective risk free rate term on their debt sans regulation, and this is not observable. Thus, in respect of the risk free rate component of the cost of debt, the benchmark debt maturity under the trailing average approach (net of the effect of the swap contracts) is indeterminable. Finally, if the hybrid approach is adopted involving the on-the-day approach to the risk free rate component of the cost of debt and the trailing average approach to the DRP, then the benchmark debt maturity would be the regulatory term for the risk free rate and the ten year average of the ten year DRP. As we progress through the regulatory cycle this DRP figure may or may not be annually revised in the form of a moving average.

The second question is whether the AER should use a third-party source for estimating the cost of debt (if so, which) or develop its own method/dataset and, in the latter case, what should this be. In view of its serious limitations, I recommend that the AER abandon use of the BFVC. In this event the AER will need to develop its own estimate of the ten year DRP at its specified credit rating. The best bonds to provide this data will vary over time and the choice of bonds at the times at which estimates are required should be delegated to an expert panel. In using this data to estimate the ten-year DRP, the choice is between some form of averaging and curve fitting. Since one approach is not clearly superior, I recommend that results from both approaches be considered and that the resulting estimate be rounded to at least the nearest 0.25%. In addition, if the AER abandons use of the BFVC, it will be much more difficult for it to implement the trailing average or hybrid approaches due to the quantity of historical data that will be required.

The third question is whether the estimation method should use a single credit rating or a range of ratings and what the benchmark firm should be. In my view the appropriate benchmark regulated energy network business is a private-sector firm primarily engaged in such activities and without a foreign parent with a high credit rating. In addition, whatever the benchmark credit rating resulting from this definition is, there are likely to be few comparator bonds with the same rating and therefore comparator bonds should be drawn from a wider credit band centred on the benchmark credit rating. So, if the benchmark rating were BBB+ as at present, comparators should be selected from the BBB to A- range in order to provide sufficient observations to estimate the DRP of a BBB+ rated regulated energy network businesses.

The fourth question is which bond issuers should be considered in the estimation process, with the possibilities including but not limited to service providers and their parent groups, companies operating in the energy sector, regulated network companies (specified), and all Australian businesses that match other selection criteria (credit rating, maturity, etc). In my view the best set of firms is all Australian regulated energy network businesses, i.e., all regulated firms engaged primarily in electricity or gas transmission or generation. If this set of firms does not supply sufficient comparator bonds to estimate the DRP of a benchmark firm of this kind, I recommend inclusion of regulated network businesses in other industries, with similarly limited competition or exposure to the threat of new entry. The only clear example of this kind is water supply. The next set of possibilities would be other regulated firms with similarly limited competition or exposure to the threat of new entry, such as the DBCT. The last set of possibilities would be unregulated firms whose principal activities are monopolistic, and with similarly limited exposure to competition or the threat of new entry. The only clear example of this kind is airfield operations, which were subject to price regulation until 2002.

The last question is what types of debt instruments available to a business should be used and how should each be incorporated in the estimation process. Fixed rate bonds denominated in Australian currency are uncontroversial. Floating rate bonds denominated in Australian currency should also be used but after swapping into fixed rate bonds and the swap costs should be included. However foreign currency denominated bonds should be excluded because the primary market data will be too limited, the secondary market data may provide a poor estimate of the DRP of local bonds or even the foreign bonds, and raises contentious questions about the optimal weighting to be applied to such data in the event of using this data to better reflect the benchmark firm's cost of debt over a variety of sources. In addition, callable bonds (excluding make-whole callable bonds) should also be excluded because their DRPs are higher to compensate lenders for the call option, any impact on the equity beta does not offset this effect, and there is no universally accepted method for adjusting for the call option. In addition, subordinated bonds should also be excluded primarily because their DRPs are likely to overestimate the DRP of a benchmark firm of the same credit rating.

APPENDIX: Government Ownership and Credit Ratings

This Appendix examines the relevance of the credit ratings for government-owned NSPs to the assessment of the appropriate credit rating for the industry. Publicly-owned NSPs appear to have higher credit ratings than otherwise identical privately owned entities, and the reason is clear: publicly-owned entities have a lower risk of default because their owners are more likely to rescue the entity in the event of financial difficulties.

To explore this issue, consider the following highly simplified example. A set of NSPs is characterised by two types of firms. Type A firms are publicly owned, have no risk of default and can therefore borrow at the government stock rate of 4%. In addition, such firms are fully debt funded so that their cost of capital is 4%. All such firms have assets of $1,000m and no other costs. So, an appropriate level of revenues would appear to be <u>$40m</u> per year for each firm. Type B firms are identical except in being privately owned, and therefore at some risk of default. The probability of default is 2% and losses suffered by debt holders in that event would be the full $1,000m invested. Accordingly, the cost of debt for such firms is 6% per year, with the additional 2% (i.e., $20m per year) compensating debt holders for the expected default loss of $20m per year. Since type B firms are also fully debt funded, their cost of capital is 6% per year, and therefore the appropriate revenues are $60m per year for each firm.

Given this scenario, the controversial question is then as follows. For the purpose of setting the cost of debt of these firms, and therefore their regulated revenues, which of the following policies should be adopted?

(1) Average over their costs of debt to yield a rate of something between 4% and 6% for all firms (the average will depend upon the relative numbers of firms in each category), or

(2) Apply different rates depending upon ownership (4% for publicly owned firms of this type and 6% for privately owned ones), or

(3) Apply the private sector rate of 6% for all such firms.

Policy (1) is not in my view viable, because it will apply a rate that is too low to private sector firms. For example, if the average rate is 5%, then the revenues obtained from customers will be only $50m per year whereas their interest costs are $60 per year. The firms will therefore be rapidly driven into bankruptcy, i.e., the revenues in even the first year will be insufficient to meet the interest payments required by debt holders. It will be of no comfort to these debt holders to be told that revenues of $50m reflect the industry average situation, because such debt holders are not in the industry average situation; they are fully exposed to the possibility of default and require interest payments of $60m to compensate them for it. Furthermore, if more of the firms in this industry become publicly owned, the average cost of debt will decline and thereby aggravate the problem here.

Since policy (1) is not viable, this leaves either policy (2) or policy (3). To examine this matter more closely, suppose that a publicly-owned firm faces a distress situation, i.e., the business suffers a shock that reduces the value of its assets by $1,000m and the taxpayer owners inject this sum to restore the business to its former condition. The owners may or may not seek to recover this $1,000m by raising the firm's output prices. If they do seek recovery in this way, then the cost of debt that should be used to determine the firm's output price is no longer 4%. It is instead 4% in tranquil times and something considerably larger in the event of financial distress. To set the output price initially on the basis of a 4% cost of debt, but with the possibility of a subsequent substantial increase under certain conditions, raises significant problems of inter-generational equity. To avoid such difficulties, the appropriate course of action would be to act as if the publicly owned firms were privately owned and therefore faced the private sector cost of debt of 6%. This is policy (3).

On the other hand, if the owners of a publicly owned firm would not seek to recover the $1,000m through higher prices in the event of financial distress, then the inter-generational equity problem still exists but is instead suffered by the taxpayer owners of the firm rather than its customers, i.e., taxpayers who live through a period without financial distress will not be required to contribute to the $1,000m whereas those who do live through it will be required to do so. In view of this, the appropriate course of action would still be to avoid the inter-generational equity problem, and this can only be done through setting output prices to incorporate the future possibility of financial distress, i.e., to act as if the publicly-owned firms were privately owned and therefore faced the private sector cost of debt of 6%. Again, this is policy (3).

In summary, three possible methods for setting the cost of debt for NSPs exist. The first option will undermine the financial viability of privately-owned firms through an insufficiently high cost of debt. The second option induces inter-generational equity problems for either the customers or the owners of the publicly-owned firms. The third option is free of both problems, and is therefore recommended, i.e., apply the private sector cost of debt to all firms in the industry. Consequently the relevant firms for assessing the credit rating of the benchmark firm are the privately-owned ones.

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