The Debt Maturity Issue in Access Pricing

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Abstract:

There has been substantial debate and disagreement over the appropriate debt maturity used in determining the cost of debt for use in access pricing decisions in Australia. Some regulators have used a debt maturity corresponding to the length of the regulatory reset period (typically five years). Others have used a longer maturity based on the argument that the assets being financed are long lived. In this paper it is demonstrated that under the current Australian approach, in order to meet the objectives of access pricing, the assumed debt maturity should be set equal to the term of the regulatory reset period. Whether practical debt management difficulties for access providers suggest that an alternative approach, placing more emphasis on their actual debt costs (as occurs in some other jurisdictions) should be considered, is also discussed.

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Access pricing involves a regulator setting a maximum price or revenue stream for an owner of a network asset who has some degree of monopoly power. The objective is to ensure that prices are set to generate output (usage of the service) consistent with economic efficiency and provide the owner with a "fair" expected return from investment in the asset over the life of the asset, thus inducing efficient investment.[2] Typically access pricing decision making occurs at regular discrete intervals[3] (hereafter assumed to be five years, which is common in Australia) when the allowable prices and expected revenue stream for the forthcoming regulatory period of five years is determined based on current economic and financial data and projections of demand, operating costs and other relevant variables. Generally, the asset in question has a substantially longer life than the regulatory horizon of five years.

The divergence between the five year regulatory reset period and the much longer asset life has led to debate in Australia over the financial data which should be used in the regulatory determinations. The specific aspect of that debate addressed in this paper is whether the cost of five year debt (corresponding to the regulatory reset period) or cost of much longer term debt (perhaps corresponding to the asset's expected life) should be used in estimating the access provider's cost of capital. Typically this is posed as a choice between using five or ten year debt. (Even though the asset life is generally much greater, in practice there is virtually no corporate debt issuance in Australia beyond a ten year maturity).

This significance of this question arises from the particular approach to determination of cost of debt adopted by Australian regulatory authorities, which prescribes a particular debt maturity for estimating debt costs based on market data at the regulatory reset date, independent of the actual debt maturity policy adopted by the access provider. This contrasts with approaches found in a number of overseas jurisdictions where an estimate of the expected cost of debt arising from the debt

[2] A fair return includes both the return on capital invested as well as return of capital. Schmalansee (1989) shows that if net revenues (after operating costs) over the life of the asset provide (a) a full return of capital and (b) the required rate of return each period on the remaining capital at the start of the period, the investment has a zero net present value.

[3] Alternatively, as is more common in the US regulatory setting, reset dates may be determined by the timing of the access provider's application for a rate (price) increase.

maturity policy of the access provider is incorporated into regulatory determinations. Despite that difference, the results of this paper have relevance for those overseas approaches in that they also provide insights into the optimal debt maturity policy for firms subject to access regulation.

Under the Australian approach to access pricing the analysis of this paper shows that, given the objectives of access pricing regulators, the assumed debt maturity should correspond to the regulatory reset period (typically five years). Compared to use of a longer debt maturity assumption, lower access prices result on average from lower debt financing costs. Moreover, if access providers "mimic" the assumed debt portfolio structure they do not incur debt-financing cost risks of long-lived assets, which are passed on to consumers via access price changes. However, practical debt management considerations may make such "mimicking" unattainable and introduce additional risks for access providers.[4] Reflecting this, some international regulators have placed more emphasis on the actual debt maturity of the access provider in assessing allowable debt finance costs. While that approach removes debt-finance cost risks for the access provider, the analysis of this paper suggests that actual debt maturity structures longer than the regulatory reset period generally imply higher debt financing costs and thus access prices. Whether resulting lower risk to consumers of access price variability adequately offsets the price level effect is an important consideration in choosing between such approaches in the optimal design of access pricing arrangements.

The following section briefly reviews the Australian regulatory debate and prior literature on this topic and considers its relevance to access pricing approaches found overseas. Then, in section 2, the model used to derive the conclusions of the paper regarding debt maturity is outlined, while section 3 provides further intuition for the result by way of analogy of cash flows from access pricing decisions with those of a floating rate bond. Section 4 discusses a number of practical complications associated

[4] As discussed later, financial engineering makes maturity *per se* less of an issue than the *repricing* period of debt. For example, a ten year maturity bond could be issued with an interest rate which is reset in line with market interest rates after five years. For ease of exposition, the analysis in the text focuses upon maturity, with the implications of financial engineering options taken up in a later section.

with access providers implementing an optimal debt maturity policy implied by the access pricing approach and risk sharing implications. Section 5 concludes.

1. Approaches to Debt Maturity in Access Pricing Regulation

Access pricing regulation in Australia is undertaken at the Federal level by the Australian Energy Regulator (AER) and the Australian Consumer and Competition Commission (ACCC) and by various State regulators such as IPART (in NSW), QCA (in Queensland), and the ERA (in WA).[5] A "building block" approach is generally used in which access prices for the coming period are determined at the start of the regulatory reset period (typically five years) by reference to projected operating costs, capital employed (the regulatory asset base) and the required rate of return on capital employed. That last component involves estimating the cost of equity and cost of debt capital prevailing at the regulatory reset date for an assumed level of gearing. A specific debt maturity period is chosen, independent of the actual debt maturity policy of the access provider, to estimate the cost of debt for the current regulatory reset period. Implicit in that approach is an assumption (discussed later) that the goals of access pricing are better achieved than by accepting the actual debt maturity chosen by the access provider.

Regulatory attitudes on the appropriate debt maturity to be used have varied across regulators and over time, with the focus being upon whether to use a five year maturity (equal to the length of the regulatory reset period) or a longer maturity closer to the expected life of the assets under regulation. That latter option has involved use of a ten year maturity which, although well short of expected asset life, is the longest maturity for which reliable figures for costs of Australian corporate debt can be found.[6]

Recently, for example, the Australian Energy Regulator (2009) undertook a review of the WACC parameters for electricity transmission and distribution services. In its draft decision it had proposed use of a five year bond rate for the cost of debt (consistent with the regulatory period), but in the final decision opted for a 10 year

[5] Another relevant participant in the process is the Australian Competition Tribunal which hears appeals against decisions of the ACCC and AER.
[6] Even at the ten year maturity, the available data is very sparse.

bond rate. Ten years had previously been the debt maturity used by the Australian Energy Regulator and also by the Australian Consumer and Competition Commission. IPART (2011), the regulator for access pricing in the State of NSW, decided to shift from a ten to five year bond rate in its determination of WACC. The Queensland Competition Authority has also assumed a five year maturity (see, for example, QCA, 2010).[7]

The academic literature on this topic is relatively sparse. Lally (2007a) addresses the appropriate debt maturity assumption in access pricing in the context of a two period model, but assumes that the only source of risk is interest rate risk. (See also the response by Hall, 2007, and rejoinder by Lally, 2007b). While he allows for variation in the credit risk premium faced by the access provider, as well as in the risk free rate, he does not consider the effect of the regulator regularly re-setting the allowed credit risk premium (as is done) as well as the risk free rate. The results of this paper confirm those of Lally, but within a more general framework which allows explicitly for other types of risk additional to market interest rate risk.

The importance of providing a more robust proof of the proposition are evident from the ongoing debate over choice of appropriate debt maturity found in submissions to access pricing regulators in Australia, such as by Grundy (2011), Lally (2010) and the summary of such arguments in QCA (2011, Chapter 2). In the broader context of whether the assumed maturity approach favoured by Australian regulators is preferable to alternatives that may better reflect actual debt maturity policies, Chairmont Consulting (2013) provides an overview of submissions made on that topic to the ERA by industry participants.

The approach adopted by Australian regulators towards debt costs is somewhat different to that found in a number of international jurisdictions, where more emphasis has been placed on actual debt costs associated with the debt maturity policy of the regulated industry. In Canada, for example, the Ontario Energy Board (2009, p51) notes that “the total estimated cost of debt should be a close proxy for the

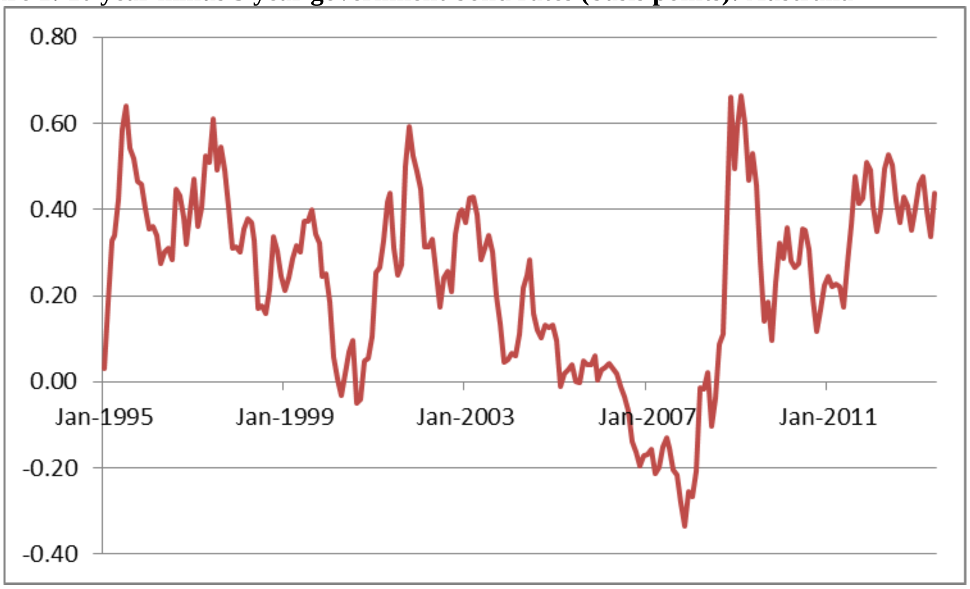
[7] See also the discussion, and alternate views expressed in section 16 of the Franks, Lally and Myers (2008) report to the New Zealand Commerce Commission.

actual long-term debt cost incurred by the natural gas utility in the rate year" which it estimates using the cost of embedded debt and forecasts of future debt issue costs. US regulators such as the Federal Energy Regulatory Commission (FERC) and state based commissions tend to use a similar actual cost of embedded debt approach, although as Littlechild (2012) points out a large proportion of rate cases involve negotiated settlements between interested parties, with the implication that assumed debt costs do not come to prominence as an individual item. Oxera (2013) discusses how regulators in the UK, such as Ofcom and Ofgem, use aspects of both an actual (embedded) cost and a current market cost of debt in regulatory determinations.

Use of actual debt cost rather than an assumed maturity debt cost changes the relevance of the Australian debt maturity debate for such approaches. If actual debt costs are passed on in access prices to consumers, they, rather than the access providers, bear the debt-financing cost risks of long-lived infrastructure. Whether access providers then have adequate incentives to choose a debt structure which minimizes the cost of debt financing is open to question. The results derived in this paper imply that regulatory setting of an assumed debt maturity equal to the term of the regulatory reset period involves the same risk allocation if access providers choose to adopt the same actual debt maturity. In comparing the merits of the two approaches, it is thus necessary to compare potential savings in average debt costs and access prices from regulators specifying a shorter debt maturity than might otherwise be chosen, with any additional costs and risk which may arise from practical difficulties for the access provider in achieving a conforming debt management strategy.

It might also be asked whether the issue of assumed debt maturity (5 years versus 10 years) being addressed here is one of economic significance. To consider that, note that the difference in debt costs comprises two components, the difference in risk free rates for 5 and 10 years (r_5 and r_{10} respectively) and the difference in credit spreads for 5 and 10 year corporate bond issues (s_5 and s_{10} respectively). The difference in total assumed borrowing costs ($r_{10}+s_{10} – r_5-s_5$) applied to the assumed debt amount of the access provider indicates the difference in annual revenue. Figure 1 shows the difference between 10 and 5 year government bond yields since 1995. There is considerable variability over time, but the average difference over the period shown is 24 basis points.

Figure 1: 10 year minus 5 year government bond rates (basis points): Australia

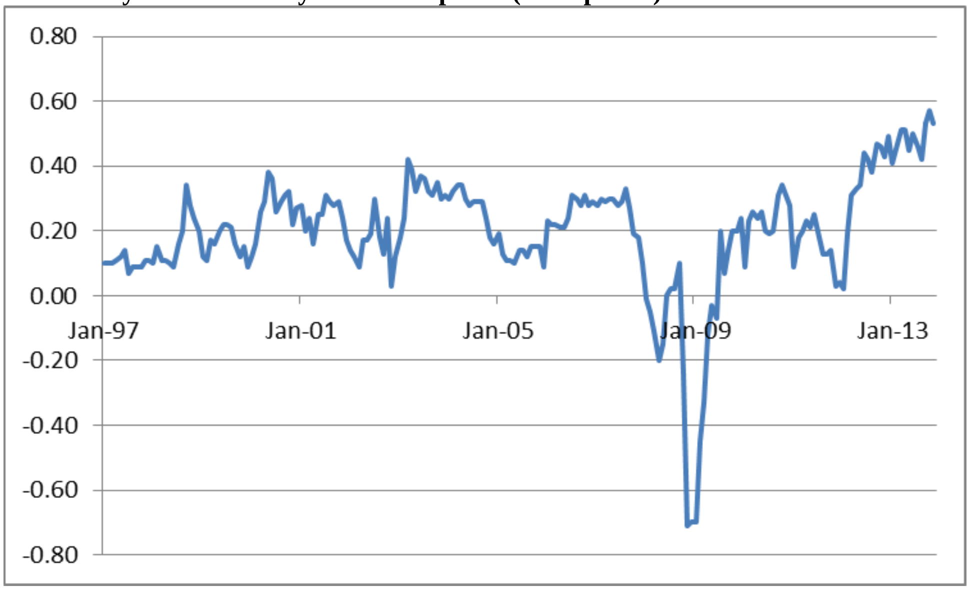


Source: RBA Statistical Tables F2

Unfortunately there are no reliable longer term time series of 5 and 10 year credit spreads for Australian corporate debt. Hence, to provide an indicative figure, Figure 2 shows the difference in credit spreads for US A rated corporate debt of 7-10 year maturities and 2-5 year maturities. Again there is considerable time series variability, but the average difference is 20 basis points.

These differences imply that using 10 year rates rather than 5 year rates involves higher cash flows to access providers of 0.44 per cent of the assumed debt amount. To illustrate the magnitudes involved, in the 2003 AER decision regarding Electranet with assumed gearing of 60 per cent on a regulatory asset base (RAB) of $824 million, the assumed debt level is $494 million, implying higher revenues of $2.2 million p.a. For the AER Citipower decision in 2011, with an initial RAB of $1.4 billion and 60 per cent gearing the annual revenue difference is $3.7 million, which is around 1.8 per cent of the allowed revenue requirement for 2011 of $208 million.

Figure 2: 7-10 year minus 2-5 year credit spread (basis points): US A rated bonds



Source: http://research.stlouisfed.org/fred2, series BAMLC2A0C35Y and BAMLC4A0C710Y

2. The Model

The model used in this section assumes an asset with a life of two periods and each period (when a regulatory reset occurs) comprising only one year. The argument can be generalized to a five year reset period or longer asset life – but at the cost of algebraic complexity. The argument is also made clearer by focusing upon the return to equity (by subtracting the debt cash flows from allowable cash flows) rather than using the weighted average cost of capital approach commonly found in the access pricing "building block" model.[8] This involves a simple algebraic rearrangement of the "building block" model. Again the argument could be expressed using the weighted average cost of capital approach, but at the cost of algebraic complexity.

While the analysis focuses upon a single asset with a fixed life, it should be borne in mind that access providers have a portfolio of assets of different vintages and remaining lives. The approach adopted by Australian regulators is to combine all assets at depreciated values into a single regulatory asset base (RAB) and apply a

[8] The "building block" approach is specified in legislation for use by some regulators. See for example, AEMC (2012, Section 6.4.3) and Davis (2006). The Brattle Group (2000, Appendix 6) provides an overview of alternative variants of the "building block" approach..

single cost of capital across the RAB for the current regulatory reset period. In the context of this analysis that approach implies that a two period regulatory rate of return could be applied to an asset with only a single period of life remaining. (An alternative of using a rate of return maturity based on the remaining life of the asset would require the regulator to calculate asset vintage-specific rates of return).

Assume that an access provider has, at date 0, purchased an asset with a life of two periods for a price of $\$K_0$, which it intends to finance with $\$wK_0$ of equity and $\$(1-w)K_0$ of debt. Expected net cash flow (after operating costs), c_1, for date 1 will be set by the regulator at date 0 as:

$$c_1 = r_e^0 wK_0 + r_d^0(1-w)K_0 + D_1$$

where r_e^0 and r_d^0 are the cost of equity and debt assumed by the regulator respectively at date 0 and D_1 is the return of capital (depreciation) provided at date 1. Note that no assumption is made at this stage about whether the regulatory cost of debt is for a maturity of one or two periods. It is also assumed that the regulator's allowed cost of equity is the true cost of equity.

It is assumed that $D_1 = zK_0$ is the return of capital at date 1 (and $D_2 = (1-z)K_0$ is the return of capital at date 2).[9] Hence:

$$c_1 = r_e^0 wK_0 + r_d^0(1-w)K_0 + zK_0$$

Because the regulatory asset base at date 1 is now $(1-z)K_0$, expected net cash flow (after operating costs), c_2, for date 2 will be set by the regulator at date 1 as:

$$c_2 = r_e^1 w(1-z)K_0 + r_d^1(1-w)(1-z)K_0 + (1-z)K_0$$

Here, r_e^1 and r_d^1 are the cost of equity and debt respectively assumed by the regulator at date 1 and $(1-z)K_0$ is the return of capital (depreciation) provided at date 2. Taking the debt cash flows to the LHS of the equations (including the debt share of return of capital (to keep leverage constant) we can derive allowable expected cash flows to equity (e_1 and e_2). If the regulator's allowed cost of debt equals the actual cost it is possible to show that the expected return on equity matches the required rate

[9] Davis (2004) shows that the choice of depreciation schedule does not affect the validity of the building block model.

of return, or equivalently that the NPV of the equity investment is zero. To see this, note that:

$e_1 = c_1 - r_d^0(1\text{-}w)K_0 - z(1\text{-}w)K_0 = r_e^0\, wK_0 + wzK_0$

and

$e_2 = c_2 - r_d^1(1\text{-}w)(1\text{-}z)K_0 \text{ -}(1\text{-} z)(1\text{-}w)K_0 = r_e^1\, w(1\text{-}z)K_0 + w(1\text{-} z)K_0$

The present value at time 1 of expected future equity cash flows (e_2), using the discount rate r_e^1 is $w(1\text{-}z)K_0$ (which is the equity financed portion of the asset remaining at date 1). Thus, substituting $w(1\text{-}z)K_0$ as the present value at date 1 for expected date 2 equity cash flows, the present value at time 0 of expected future equity cash flows (e_1 and e_2) is given by:

$PV_0 = (r_e^0\, wK_0 + w\, zK_0 + w(1\text{-}z)K_0)/(1 + r_e^0) = wK_0$

which is the amount of equity funding contributed, giving an NPV of zero.

If the actual debt cost of the firm differs from that assumed by the regulator (r_d^0, r_d^1), then expected return to equity will differ from the required rate of return. We now examine how that may happen by considering alternative borrowing strategies by the firm in conjunction with alternative regulatory approaches to determining allowable borrowing costs.

For simplicity, we focus only on two possible regulatory approaches and two borrowing strategies of the firm. These are where the regulator uses either the current one period or two period cost of debt at the reset dates (date 0 and date 1), and where the firm borrows for either one or two periods to finance the asset. In the first case, the firm will reissue one period debt at date 1. In the second case, the two period debt is assumed to be amortizing with a principal repayment at date 1 equal to the regulatory return of capital attributable to debt financing at that date.[10]

[10] There are several other possibilities for both the regulatory approach and firm debt strategies. The regulator could, for example, set the cost of debt at date 0 for the life of the asset, or use the residual life of the asset at the reset date. The firm could also issue two period floating rate debt (fixing its credit spread but being exposed to market interest rates) or issue one period debt and enter a two period interest rate swap as the fixed rate payer, thus effectively having an exposure to changes in its credit spread but no exposure to market interest rates. These (and other cases) were included in an earlier version of this paper, but did not affect the conclusions as derived in this paper.

Consider the situation facing the regulator and the regulated firm at date 0. Assume that the regulator and firm agree on the appropriate cost of equity r_e^0. The two debt financing choices available for the firm considered here are illustrated in Table 1, where r_{ij} is the risk free rate prevailing at date i for maturity j, and s_{ij} is the credit spread faced by the firm at date i for maturity j. The total borrowing cost is the sum of the risk free rate and the credit spread ($r_{ij}+ s_{ij}$). Option 1 involves financing by a succession of one-year borrowings, while option 2 involves financing by issue of two year (amortizing) fixed debt. These alternatives involve different combinations of exposures of the firm to changes in the risk free rate and in credit spreads.

TABLE 1: Alternative Borrowing Strategies

Strategy		Debt Cashflows	
		Date 1	Date 2
1. Short term debt	Date 0: Borrow $(1\text{-}w)K_0$ for one period at $r_{01}+s_{01}$ Date 1: Borrow $(1\text{-}w)(1\text{-}z)K_0$ for one period at $r_{12}+s_{12}$	$-(1+ r_{01+}s_{01})(1-w)K_0)$ $+(1-w)(1-)z)K_0$ $=- (r_{01}-s_{01})(1-w)K_0+(1-w)zK_0$	 $-(1- r_{12}-s_{12})(1-w)(1-z)K_0$ $=- (r_{12}-s_{12})(1-w)(1-z)K_0+(1-w)(1-z)K_0$
2. Long term fixed rate debt	Date 0: Borrow for two periods (amortising principal) at $r_{02}+s_{02}$	$-(r_{02}+s_{02})(1+w)K_0-(1-w)zK_0$	$-(1-w)(1-z)K_0(1+-r_{02}+s_{02})$ $=-(r_{02}+s_{02})(1+w)(1-z)K_0-(1-w)(1-z)K_0$

Note that option 1 is also the allowable debt cash flows determined by the regulator if a one period debt maturity is chosen (because the regulatory cost of debt is $r_{01}+s_{01}$ at date 0 and reset at date 1 as $r_{12}+s_{12}$). However, if the regulator uses a two period debt maturity the allowable debt cash flows differ from those given in option 2. The reason is that while the allowable cost of debt for period 1 is $r_{02}+s_{02}$ (set at date 0) at date 1 the allowable cost of debt will be reset using the two period rates, $r_{13}+s_{13}$, prevailing at date 1.

We now consider the implications of the alternative regulatory and borrowing strategy choices. The four cases are shown in Table 2 which combines the information on cash flows from alternative strategies in Table 1 with allowable debt cash flows from the different regulatory approaches. It shows the divergence in interest costs – which will be reflected in deviations of the expected cash flows to equity (e_1, e_2) from the required returns. Note that the return of capital component of cash flows is the same in all circumstances, and consequently the RAB to which the cost of debt is applied at date 1 is also unaffected by corporate borrowing strategies. Consequently, to simplify the presentation, only the differences in the cost of debt are shown.

TABLE 2: Debt Strategies and Cash Flows:			
regulatory use of short term cost of debt Regulator allows $r_d^0 = r_{01}+s_{01}$ at date 0 and $r_d^1 = r_{12}+s_{12}$ at date 1.		Interest cost difference	
Corporate Strategy	Company actual debt interest costs	Date 1	Date 2
1, Short term debt	Date 1: $r_{01}+ s_{01}$ Date 2: $r_{12} + s_{12}$	*0*	*0*
2. Long term fixed rate debt	Date 1: $r_{02} + s_{02}$ Date 2: $r_{02} + s_{02}$	$r_{01}+s_{01} - r_{02}-s_{02}$	$r_{12}+s_{12} - r_{02}-s_{02}$
regulatory use of long term cost of debt Regulator allows $r_d^0 = r_{02}+s_{02}$ at date 0 and $r_d^1 = r_{13}+s_{13}$ at date 1.			
Corporate Strategy	Company actual debt cash flows	Date 1	Date 2
3. Short term debt	Date 1: r_{01}-+s_{01} Date 2: $r_{12} + s_{12}$	$r_{02}+s_{02} - r_{01}- s_{01}$	$r_{13}+s_{13} - r_{12} - s_{12}$
4. Long term fixed rate debt	Date 1: $r_{02} + s_{02}$ Date 2: $r_{02} + s_{02}$	*0*	$r_{13}+s_{13} - r_{02}-s_{02}$

Consider first the case where the regulator consistently uses a one period cost of debt. What is immediately apparent from Table 2 is that by borrowing for one period (strategy 1), matching the regulatory approach, the access supplier does not assume any additional risk and has an expected return on equity equal to its required return. Adopting strategy 2 (borrowing long when the regulator uses a short term maturity) involves the firm in assuming both market interest rate risk and credit spread risk (because r_{12} and s_{12} are not known at date 0).

Consequently, if the regulator chooses a one period cost of borrowing: (a) the firm's expected return on equity equals the required return if one period borrowing is undertaken; (b) the firm can adopt a different borrowing strategy based on its interest rate view which may lead to a higher expected return on equity, but involves interest rate risk.

Consider now the situation if the regulator uses the two period cost of debt observed at date 0 and date 1 in determining allowable expected cash flows. What is immediately apparent from the lower panel of Table 2 is that there is no debt strategy which gives an expected return to equity equal to the required return without taking on market interest rate risk and credit spread risk. While strategy 4 (borrowing for two periods) gives a first period expected return to equity equal to the required return, the company is exposed to interest rate risk in period 2 (due to changes in the risk free rate or credit spreads at date 1). Strategy 3 (borrowing short term) involves taking on risk, but provides potential for expected equity returns above the required return if there is a pervasive term premium in market interest rates and/or credit spreads (such as was shown in Figures 1 and 2).

The equity cash flows for strategy 3 provide a clue as to why access providers generally argue for use of the longer term cost of borrowing in the setting of allowable cost of capital by regulators. Generally, the term structure of both risk free rates and credit spreads is upwards sloping, reflecting the pervasive existence of a term premium in interest rates (in addition to the effects of expectations of future interest rates). Thus if the regulator uses longer term rates (two periods in the preceding analysis) to set allowable cash flows, but the company borrows on a shorter term basis (one period in the preceding analysis), it stands to make an abnormal return on equity (albeit one involving some risk). For date one, the expected return on equity exceeds the required return by the difference between long and short term borrowing costs at date 0. For date two, the expected return on equity will exceed the required return if long term borrowing rates remain above short term rates.

3. Implications and Intuition

The implication of the preceding analysis is that the debt maturity used in cost of debt capital estimation in access pricing should correspond to the regulatory reset period. This argument is based on the following premises. First, allowable expected cash flows should be set such that after making allowance for required debt repayments, the expected return to equity should equal its required return. Second, the allowable debt repayments should be the minimum possible the access provider can achieve without creating additional risk for itself beyond that which is allowed for in the regulatory determination. (This is to ensure lowest cost pricing of access services, and avoid the possibility that abnormal profits accrue to the access provider from arbitraging any gap between allowed debt repayments and the minimum accessible). Because cash flows are reset each five years for the subsequent five year period taking into account both risk free interest rates and credit spreads prevailing at that time, it is only when the cost of five year debt is used by the regulator that these two conditions are met.

The intuition behind this argument can be explained by noting the similarity (albeit with an important difference discussed in the next paragraph) between determination of allowable cash flows on an access asset and cash flows on a floating rate bond. The latter involves coupon cash flows being reset in line with movements in some market indicator rate at regular intervals until maturity. Consider a floating rate bond which has the coupon reset at a fixed margin over the market indicator rate each period. If such a floating rate bond is purchased, and the fixed margin remains appropriate for the issuer credit risk at the next reset, funding it by successive issuance of one period bonds with the same coupon rate is a perfect hedge (and a zero net present value position). The reason is that the floating rate bond price will be equal to its par value at the next reset date. However, if the margin is no longer appropriate for the credit risk, the market price will no longer equal par value at the reset date, and the hedging strategy fails.

In access pricing the expected net cash flows (after operating costs) of the asset can be logically divided into one part to compensate the cost of equity finance and a second to compensate the cost of debt finance.[11] Focusing solely on the debt financed component, the principal difference with the floating rate note is that cash flows are reset at regular dates by the regulator in line with movements in both risk free interest rates and the credit spread facing the asset owner-borrower.[12] Then, by issuing debt of the same maturity as the reset period with the same coupon as applied by the access regulator, the asset owner will have financed and perfectly hedged the debt cost component of current period cash flows. Moreover, at the next reset date, the asset owner will be able to reissue one period debt at par with the same coupon rate as that reset for the debt financed component of the asset by the regulator. Thus, if the regulator resets asset cash flows in line with the one period cost of borrowing (using the one period risk free rate and one period credit spread) the asset owner is able to meet debt financing costs and be perfectly hedged against debt financing cost risk by a succession of one period borrowings.

4. Caveats and Complications

The preceding analysis has demonstrated that under the Australian regulatory approach to determining the cost of debt, setting the assumed maturity of debt equal to the regulatory reset period (rather than a longer maturity) implies a generally lower cost of debt which the access provider can achieve without incurring additional interest rate risks. The lower cost reflects the empirical evidence that there are generally positive term premiums in the risk free interest rate and in credit spreads. The avoidance of additional risk arises from the assumption that the access provider can structure its debt portfolio to have characteristics that match those assumed by the regulator.

In practice, there are two risk-related issues which also need to be considered. The first is how the assumed choice of debt maturity affects the sharing of interest rate risk of financing long term assets between access providers and customers. The

[11] For simplicity, tax cash flows have been ignored.

[12] Another potential difference lies in the fact that floating rate notes generally involve full repayment of principal only at maturity whereas access pricing involves return of principal over the life of the asset. This difference does not affect the logic of the argument, since it simply requires the succession of one period debts issued to decline in size in line with the amount of capital returned in asset cash flows.

second is whether access providers may be unable to match their debt portfolios to the regulatory assumptions and thus incur additional costs and/or risks.

The risk sharing consequences of the assumed choice of debt maturity might be expected to result from greater volatility of 5 year interest rates relative to longer term rates. Using 5 year rates would then see greater variation in the cost of debt at each reset date and thus greater variation in access prices from one five year period to the next. However, there are two factors which suggest that this effect is likely to be of minor importance. First, variability and size of other building block components (operating costs, return of capital, cost of equity) suggest that the effect of relative variability in five versus ten year interest rate costs on access price variability is likely to be relatively small. Second, the building block approach used in Australia involves a “smoothing” of access price paths such that changes in costs are not reflected in discrete jumps in access prices at regulatory reset dates but in changes in the nominal growth rate of access prices over the regulatory reset period.

A more substantial issue is the risk faced by access providers if they cannot mimic the debt portfolio characteristics assumed by regulators of debt repricing only on the regulatory reset date and at the assumed interest rate.

The approach taken by Australian regulators of using a market determined cost of debt as at the reset date implicitly assumes that the access provider can issue (or rollover) debt of the required amount at the assumed maturity at that cost on the reset date. Naturally, practical complications arise, including the feasibility and optimality of the access provider rolling over its entire stock of debt at that date. Reflecting this complication, regulators have used an average of market rates over a window (such as 20 or 40 days) prior to the reset dates.

More generally, though, interest rate risk management can be separated to some degree from debt maturity choice and rollover risk, by use of interest rate swaps and other derivative products. Such products can enable access providers to adopt different maturity structures and spread debt rollover periods to hedge market interest rate fluctuations.[13] However, ability to hedge credit spread risk as effectively is less apparent despite the growth of credit default swap markets.[14] Consequently, access providers may bear some additional risks due to inability to perfectly mimic debt portfolio characteristics assumed by the regulator. Whether any such risks are systematic or diversifiable, and thus whether they have any implications for the required return on equity for access providers is an empirical question beyond the scope of this paper.

A further complication is that in practice the regulatory period involves cash flows during the regulatory period including some return of capital. In that case, it would seem appropriate in principle for the debt maturity to match the duration of the allowable cash flows over the period – where the end of period regulatory asset base is included as a cash flow in the duration calculation. Thus, with a five year regulatory period, a debt maturity somewhat less than five years might be appropriate.

A third complication is the argument advanced by some that use of a 10 year bond rate as the risk free rate in determining the regulatory cost of equity via the CAPM (or other asset pricing model) implies use of a 10 year cost of debt on ground of consistency. Because the historical market risk premium used in CAPM cost of equity determination is calculated as a premium over the 10 year bond rate, it is appropriate to use that rate in that specific context. However, it should be noted that the historical premium is calculated using the average of the difference between observed one year returns to equity and the 10 year bond yield to maturity. Thus, the expected return to equity so calculated refers, in the absence of further assumptions, to a one year required return (which is then assumed to be applicable for the five year regulatory reset period). Despite ongoing debate, this question remains contentious, but

[13] For example, in the context of the model used in section 2, the access provider could issue two period floating rate debt which involves the interest rate being reset at date one in line with the change in the market interest rate (although the fixed credit spread involved in such borrowings leaves the issuer exposed to any change in market credit spreads at date one which the regulator would incorporate in allowable period two cash flows).

[14] Regulatory decisions involve credit spreads for a hypothetical borrower of a specified credit rating rather than for the specific access provider. There is likely to be less impediment to hedging such market wide movements in credit spreads but exposure to deviations of the issuer-specific credit spread from the market average would remain as a source of risk.

justifications for a cost of debt based on a 10 year maturity on grounds of "consistency" with cost of equity determination are, at least, open to question.

5. *Conclusion*

Use of a debt maturity equal to the regulatory horizon involved in resetting of allowable expected cash flows is the only approach consistent with achieving the goals of access pricing regulation as it has been practiced under the "building block" approach generally adopted in Australia. This is a result of regulators using an assumed cost of debt for a specific debt portfolio maturity structure, rather than the actual or expected cost of debt associated with the access provider's actual debt portfolio strategy.

There are, undoubtedly, debt management complications posed for access providers from the discrete resetting of regulatory cost of debt allowances, prompting the question of whether alternative approaches might be preferable. One alternative would be for the regulator to set the allowable cost of capital component of cash flows over the entire life of the asset at the time of its purchase using a debt maturity equal to the asset life, and never resetting the cost of capital component of allowable cash flows. Such an approach, of setting the regulatory reset period for the cost of capital component equal to the underlying asset life, would also achieve access pricing goals. It would involve access providers bearing any debt financing cost risks over the life of the asset if they adopted debt financing of shorter duration. An alternative approach based on using the remaining expected life of access assets at reset dates to determine debt financing costs would also achieve regulatory goals, but would transfer interest rate risk to consumers. In both cases estimating economic life is problematic (albeit necessary anyway for determining the return of capital component of cash flows) and would require access price decisions at the time of each significant asset purchase, in contrast to the current approach which enables one regular price determination process to apply across all assets regardless of the time of purchase.

Another alternative would be to move closer to approaches found overseas where the actual (and forecast) cost of debt of the access provider plays a larger role. The difficulty with such approaches is that automatic pass-through of borrowing costs to consumers via access prices may reduce incentives for debt management efficiency aimed at minimizing the cost of debt. Ultimately, some regulatory judgement on acceptable debt portfolios and borrowing costs of regulated entities for determining access prices seems inevitable – although whether the Australian approach of using solely the costs of a specific assumed debt maturity is optimal is worthy of further debate.

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