THE TRAILING AVERAGE COST OF DEBT

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19 March 2014

The helpful comments of John Fallon, Michael Blake, and Darren Page of the QCA are gratefully acknowledged. However, all views expressed here are those of the author.

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EXECUTIVE SUMMARY

This paper has sought to address a number of issues raised by the QCA relevant to the conceptual framework for the regulatory cost of debt, and the conclusions are as follows.

Firstly, there are only two combinations of a viable debt policy (feasible and not so inefficient that firms would avoid it) and a regulatory policy that satisfy the NPV = 0 principle. One involves the regulator using a trailing average regime for the entire cost of debt whilst firms borrow long-term and stagger the borrowing to ensure that only a small proportion of the debt would mature in any one year (thereby reducing refinancing risk to a minimal level). The other combination involves the regulator setting the risk free rate component of the cost of debt in accordance with the rate prevailing at the beginning of the regulatory cycle and the DRP in accordance with a trailing average regime whilst firms borrow long-term, stagger the borrowing to ensure that only a small proportion of the debt would mature in any one year, and use interest rate swap contracts to align the risk-free rate component of their cost of debt to that allowed by the regulator. However there is no viable debt policy in combination with the present regulatory policy, in which the regulator sets the entire cost of debt in accordance with the rate prevailing at the beginning of the regulatory cycle, that can satisfy the NPV = 0 principle.

Secondly, if the regulator uses a trailing average regime for the DRP and favours its own estimates of the DRP over those from a third-party source such as the BFVC and does not use a transitional regime that avoids the use of historical data, it will be much more difficult to implement the DRP trailing average regime than the current regime due to the sheer quantity of historical DRP data that will be required. Thus, if a regulator uses a trailing average regime, a transitional regime that avoids the use of historical DRP data is desirable. In addition, although the use of a trailing average regime by a regulator may better reflect the cost incurred by a firm than the present regime (and will do so for the DRP), it does not guarantee that the allowed cost of debt (or the allowed DRP if the trailing average regime is limited to the DRP) will correspond to the cost incurred by every firm or even any firm.

Thirdly, there is no inconsistency in using the prevailing risk free rate for setting the allowed cost of equity and using a trailing average regime for setting the allowed cost of debt or the DRP. The NPV = 0 principle requires the use of the prevailing risk free rate for setting the

allowed cost of equity but it does not require use of the prevailing cost of debt. Any feasible debt policy coupled with a matching regulatory policy for setting the allowed cost of debt will satisfy the NPV = 0 principle.

Fourthly, if a trailing average regime is adopted for either the DRP or the entire cost of debt, application of the trailing average to both new debt to support capex and new debt arising from new entrants to an industry as well as existing debt has the disadvantage of discouraging capex and new entrants when the prevailing cost of debt is above the trailing average and improperly encouraging them when the prevailing cost of debt is below the trailing average. These problems can be eliminated by applying the prevailing rate to both new debt arising from capex and new entrants, and then gradually adjusting the rate towards the trailing average in the manner proposed by the QTC, but this adds to the complexity of the trailing average regime.

Fifthly, under the current regime, the allowed DRP may significantly differ from that incurred by a firm thereby raising the risk of bankruptcy. Changes in the net cash flow of regulated businesses are therefore examined under this regime over the period 2007 to 2013 relative to the 2007 value. The most adverse outcome involved businesses whose regulatory reset was during 2007, for whom net cash flows declined in the period 2007-2011 (but only by 11%) because the trailing average DRP paid by these businesses rose but the allowed DRP did not rise until 2012, after which the increase in the allowed DRP outweighed the fall in the allowed cost of equity and the net cash flow then rose. Thus the current regulatory regime has not given rise to any material bankruptcy risk for regulated businesses.

Sixthly, the variation over time in output prices has been assessed under the current regime, application of a trailing average regime to the DRP, and application of a trailing average regime to the entire cost of debt. Using data from 2003 to 2013, output prices would have exhibited moderately less variation if a trailing average were applied to the DRP compared to the current regime, and substantially less if a trailing average were applied to the entire cost of debt.

Seventhly, the regulator's choice of the prevailing rate or a trailing average regime for the risk-free rate component of the cost of debt should not affect the risk faced by equity holders because firms could be expected to act so that their cost incurred matches that allowed by the regulator (by using interest rate swap contracts if the regulator uses the prevailing rate, and not otherwise). However the regulator's choice of the prevailing rate or a trailing average regime

for the DRP may affect the firm's equity beta, and therefore its cost of equity. Although it is not possible to ascertain the impact, because all of the returns data that is available to estimate beta is drawn from firms subject to the present regime in which revenues or prices are set using the prevailing DRP, the fact that market prices are forward-looking and that the regulator's choice won't affect the average net cash flow outcome imply that any impact from the regulator's choice of regime on market prices and hence beta should be minimal.

Eighthly, using the swap rate rather than the CGS rate as the base rate in setting the allowed cost of debt produces a closer match between the allowed cost of debt and that actually incurred by the firm. However, the effect is small in absolute terms, and small relative to the use of a trailing average regime for the DRP rather than the prevailing DRP. Consequently there is a not a strong argument for change and I therefore favour continued use of the government bond rate as the base rate.

Ninthly, if a regulator does adopt a trailing average regime for the cost of debt or the DRP, the results from fixing that value at the beginning of the regulatory cycle or engaging in annual updating (either formally or via an 'unders and overs' account) can be significantly different. Furthermore, the use of a trailing average regime is premised on the need to better match the allowed cost to that actually incurred. Since the cost actually incurred better corresponds to the trailing average with annual updating, this suggests that annual updating should be used if a trailing average regime is adopted.

Tenthly, I do not favour allowing firms to choose between alternative regimes because it is more likely to result in firms choosing the regime that maximises their (short-term) revenues rather than the one that best reflects their preferred debt management policy. In addition, I do not favour a regulator assigning different regimes to different firms because it is likely to induce a substantial amount of 'litigation' from firms seeking to improve their (short-term) revenues.

Eleventhly, if a regulator adopts a trailing average regime for the DRP or the entire cost of debt, a transitional regime may be adopted and it has two possible purposes: to mirror the transitional process that the regulated entity would go through (if it does do so) and to initiate the switch to the new regulatory regime without the need to collect historical data. Both the ACCC and the QTC have proposed transitional processes. In respect of the risk free rate component of the cost of debt, the ACCC's proposal achieves both objectives whilst the QTC's

proposal only avoids the need to collect historical data and does not mirror the transitional process that the entity would go through; the ACCC's proposal is then superior. In respect of the DRP component of the cost of debt, both proposals serve only to initiate the switch to the new regulatory regime without recourse to historical data and mirroring the behaviour of regulated entities is irrelevant because such entities would not change their behaviour in response to the regulator's use of a trailing average DRP. However, during the transitional period, the ACCC's proposal would involve the use of DRPs for terms shorter than that actually used by firms whilst the QTC's proposal would not have this undesirable feature; the QTC's approach is then superior for the DRP. So, if a regulator adopts a trailing average for only the DRP, the QTC's transitional process is superior. By contrast, if a regulator adopts a trailing average regime for the entire cost of debt, the QTC's transitional proposal fails to mirror the transitional process that a firm would actually go through in respect of the risk-free rate component of the cost of debt while the ACCC's transitional proposal would involve the use of DRPs for terms shorter than that used by businesses, and therefore both proposals have disadvantages.

Twelfthly, the DRP spike arising from the GFC temporarily boosted the allowed revenues of regulated businesses relative to the costs actually incurred by them and this effect is gradually being reversed over time. Thus, having benefited from this highly unusual event, businesses would at some point benefit from a switch to a trailing average DRP or entire cost of debt regime without a transitional process so as to lock-in the maximum accumulated GFC benefit. By contrast, if a transitional process were adopted, then the accumulated profits from the GFC would be trivial, even if switching commenced from the end of 2013. This strengthens the argument for a regulator adopting a transitional regime, if they do switch to a trailing average for the DRP or the entire cost of debt.

Finally, and in respect of the appropriate regulatory policy, three regulatory options are considered here, corresponding to the present regime, a hybrid regime involving the risk free rate prevailing at the beginning of the regulatory cycle coupled with a ten-year trailing average for the DRP, and a ten-year trailing average for the entire cost of debt. Relative to the second option, the third option has lower variation over time in output prices but it has greater incentive problems for capex and new entrants (or greater complexity if these problems are addressed), requires a transitional regime that will embody some drawback regardless of the choice of transitional regime (the QTC's transitional proposal fails to mirror the transitional process that

a firm would adopt in respect of the risk-free rate component of the cost of debt while the ACCC's transitional proposal would involve the use of DRPs for terms shorter than that used by businesses), and it would allow too high a cost of debt by failing to mirror the behavior of otherwise similar unregulated firms (by copying the average debt term of such firms whilst ignoring the interest rate swap contracts that such firms would likely engage in and which have the effect of reducing the risk-free rate component of their cost of debt). This suggests that the second option is superior to the third. In comparing the first and second options, the first option suffers from the disadvantage that there is no viable debt strategy that can be combined with it to satisfy the NPV = 0 principle, it gives rise to greater bankruptcy risk, and it also gives rise to greater output price variation. However it is easier to implement, and has lesser incentive problems for capex and new entrants (or lesser complexity if these incentive problems are addressed). Furthermore the increased bankruptcy risk was minor during the GFC, the increased price variation was minor over the 2003-2013 period, and the violations of the NPV = 0 principle are not a major issue. In addition the CDS market is likely to continue to develop and may reach the point at which the DRP risk under the present regime can be better hedged by regulated businesses, in which case these concerns would be further ameliorated. Accordingly, whilst there is a case for changing policy, I do not think that there is a strong case for doing so and I therefore favour continued use of the present regime.

1. Introduction

The QCA's current approach to the cost of debt is to estimate it using the risk free rate plus the debt risk premium (DRP) prevailing at the beginning of each regulatory cycle, and this is the usual practice amongst Australian regulators. However, recently, the AEMC (2012, Chapter 7) allows regulators to use a trailing average for either or both of the risk free rate and the DRP, and to use the swap rate rather than the CGS rate as the base rate. The AEMC also allows regulators to apply these different approaches to different firms. In response to this, the QCA has raised the following issues with me:

- To assess the current regime and the trailing average regime in terms of satisfying the NPV = 0 test, being capable of implementation, consistency with the use of the current rate in assessing the cost of equity, and any other relevant criteria; and
- To recommend whether the swap rate should be used as the base rate rather than the CGS rate; and
- To recommend whether a trailing average regime should be adopted for the entire cost of debt or the DRP; and
- To recommend whether a trailing average regime should be subject to annual updating or fixed for the regulatory cycle; and
- To assess whether the choice of regime would affect the regulated firm's cost of equity and its incentives to undertake capex; and
- To assess the pros and cons of a regulator adopting different regimes across its regulated firms and of allowing regulated firms to choose the regime; and
- To critique the QTC's (2013a) submission to the AER on these issues.

2. Preliminary Questions

2.1 The NPV Principle

The NPV = 0 principle is that regulatory practices should give rise to price or revenue caps such that the present value of the future net cash flows of the regulated entity are equal to the initial investment. Implicit in this statement is a presumption that the actions of a regulator do not change the behavior of regulated entities, i.e., the regulator chooses a policy that reduces the prices of a firm and thereby reduces the NPV of the business to zero. In respect of debt policy this is not the case; there are a range of policies that a firm might pursue and the regulator's choice of policy might lead the firm to change its policy, leading to a further change

in regulatory action, and so on. Under such conditions, the NPV = 0 principle should be viewed not simply as a regulatory policy that gives rise to NPV = 0 but a compatible combination of regulatory policy and firm actions that satisfies the NPV = 0 principle; this compatible combination must involve a course of action by an unregulated firm that is feasible sans regulation and a regulatory policy whose imposition would not cause the firm to change this behavior ("matching" regulatory policy). Naturally there may be more than one combination that satisfies this definition.

To illustrate this point, consider the following scenario: fixed assets are purchased now for $100m with a life of three years, revenues arise at the end of each year, there is no opex or tax, financing is 60% debt and 40% equity, regulatory depreciation is 33.3% per year (and therefore 33.3% of the debt is repaid each year), the equity risk premium *P* (the product of the MRP and beta) does not change over time, and there is no differential personal tax treatment across different sources of investment income.

I start by supposing that the firm's debt policy is to borrow for a one-year term and roll it over at maturity. No derivative contracts are used to modify this. This debt policy is feasible. The cost of debt incurred each year is then the sum of the one year risk free rate and the DRP prevailing at the beginning of the year. The "matching" regulatory policy would be to reset the price or revenue cap at the beginning of each year in accordance with these one-year rates, with consequent effect upon the revenues received one year later, so that the expected revenues in one year would be equal to the regulatory depreciation plus the cost of capital using these rates. For the first year, with a one-year risk free rate at year beginning of R_{f01} and a one-year debt risk premium at year beginning of DRP_{01}, the expected revenues would be as follows (with the expectation formed now over a realisation at the year end):

$$E_0(REV_1) = \$33.3m + \$100m[.4(R_{f01} + P) + .6(R_{f01} + DRP_{01})] \quad (1)$$

In one year the process would be repeated using the prevailing one-year risk free rate (R_{f12}) and debt risk premium (DRP_{12}) to yield the following expected revenues (with the expectation formed in one year over a realisation one year later):

$$E_1(REV_2) = \$33.3m + \$66.7m[.4(R_{f12} + P) + .6(R_{f12} + DRP_{12})] \quad (2)$$

One year later the process is repeated:

$$E_2(REV_3) = \$33.3m + \$33.3m[.4(R_{f23} + P) + .6(R_{f23} + DRP_{23})] \quad (3)$$

In two years' time, the value then of the equity would be the expectation then of the revenues arising one year later as shown in equation (3), net of the year end payment of interest and repayment of principal (on borrowing of 60% of the book value of assets prevailing at the beginning of this third year), discounted at the one-year cost of equity at the beginning of the year, as follows:

$$S_2 = \frac{E_2(REV_3) - \$33.3m(0.6)[1 + R_{f23} + DRP_{23}]}{1 + R_{f23} + P} \quad (4)$$

Substituting equation (3) into (4) yields the following:

$$S_2 = \frac{\$33.3m(.4)[1 + R_{f12} + P] + \$33.3m(.6)[1 + R_{f12} + DRP_{12}] - \$33.3m(0.6)[1 + R_{f12} + DRP_{12}]}{1 + R_{f12} + P}$$

$$= \$13.3m \quad (5)$$

This corresponds to the book value of the equity in two years' time, being 40% of the asset book value of \$33.3m. In one year the value of equity would be the expectation then of the revenues arising one year later, net of the year end payment of principal and interest plus S_2, discounted at the one-year cost of equity at the beginning of the year, as follows:

$$S_1 = \frac{E_1(REV_2) - \$66.7m(.6)[R_{f12} + DRP_{12}] - \$33.3m(.6) + S_2}{1 + R_{f12} + P} \quad (6)$$

Substituting equations (2) and (5) into (6) yields the following:

$$S_1 = \frac{\$33.4m(.4) + \$66.7m(.40)[1 + R_{f12} + P] + \$33.3m(.4)}{1 + R_{f12} + P} = \$66.7m(.4)$$

Again, the value of equity matches its contemporaneous book value, being 40% of the asset book value of \$66.7m. Repeating the process once more at the current time yields a market value for equity of \$40m, corresponding to its book value at that point:

$$S_0 = \$100m(.4) = \$40m$$

Since the market value of the firm now is the sum of the equity and debt values, and the latter equals its book value so long as the interest rate paid corresponds to the market rate, it follows that the value now of the firm equals the initial investment of \$100m:

$$V_0 = S_0 + B_0 = \$40m + \$60m = \$100m$$

So, the NPV = 0 principle is satisfied.

We now consider an alternative debt policy, in which firms borrow for two years, stagger the repayments so that no more than 50% of the outstanding debt becomes repayable at any point, and do not use derivative contracts (to effectively convert such borrowing into successive one year borrowing arrangements). Again, this debt policy is feasible. In this case, the firm would initially borrow \$30m for two years and \$30m for one year. Upon the maturity of the second borrowing arrangement the firm would replace it with two year debt (but only \$10m so as to achieve a total debt level of \$40m, being 60% of the contemporaneous asset book value of \$66.7m). Finally, upon the maturity of the first borrowing arrangement, the firm would replace it with one year debt (but only \$10m so as to achieve a total debt level of \$20m, being 60% of the contemporaneous asset book value of \$33.3m).

The effect of this is that the cost of debt incurred over the first year will be an equal weighting over the current costs of one and two year debt, whilst the cost incurred over the second year will have 75% weight on the initial two-year cost of debt and 25% on the new two-year cost of debt, and the cost incurred in the third year will involve equal weight on the two-year cost of debt set one year earlier and the new on-year cost of debt:

$$Cost_{01} = .5(R_{f01} + DRP_{01}) + .5(R_{f02} + DRP_{02})$$

$$Cost_{12} = .75(R_{f02} + DRP_{02}) + .25(R_{f13} + DRP_{13})$$

$$Cost_{23} = .5(R_{f13} + DRP_{13}) + .5(R_{f23} + DRP_{23})$$

This debt policy implies that the cost of debt incurred in any year is a "trailing average" of the current and historic rates (apart from the first year). The "matching" regulatory policy would be for the regulator to set the price or revenue cap at the beginning of each year using such a trailing average. Accordingly the expected revenues at the end of year 3, and previously shown in equation (3), would now have to be as follows:

$$E_2(REV_3) = \$33.3m + \$33.3m[.4(R_{f23} + P) + .3(R_{f13} + DRP_{13}) + .3(R_{f23} + DRP_{23}] \quad (7)$$

In two years' time, the value then of the equity would be these expected revenues, net of the contemporaneous payment of interest and repayment of principal, discounted at the prevailing one-year cost of equity, as follows:

$$S_2 = \frac{E_2(REV_3) - \$33.3m(0.6)[1 + .5(R_{f13} + DRP_{13}) + .5(R_{f23} + DRP_{23})]}{1 + R_{f23} + P} \quad (8)$$

Substituting equation (7) into (8) yields the following:

$$S_2 = \frac{\$33.3m(.4)[1 + R_{f12} + P]}{1 + R_{f12} + P} = \$33.3m(.4) = \$20m$$

This corresponds to the book value of the equity in two years, being 40% of the asset book value of \$33.3m. By continuing this recursive process back to time 0, as before, it follows that the value now of the firm equals the initial investment of \$100m. So, the NPV = 0 principle is again satisfied.

In summary, since a regulator's policy in respect of the allowed cost of debt may induce a regulated business to change its behavior, the NPV = 0 principle should be viewed not simply as a regulatory policy that gives rise to NPV = 0 but a compatible combination of regulatory policy and firm actions that satisfies the NPV = 0 principle; this compatible combination must

involve a course of action by an unregulated firm that is feasible and a regulatory policy whose imposition would not cause that firm to change its behavior. Naturally there may be more than one combination that satisfies this definition.

2.2 Possible Debt Strategies

We now consider the possible debt policies that a firm could pursue. Some may not be feasible and therefore could not in conjunction with a matching regulatory policy satisfy the NPV = 0 principle as presented in the previous section. Even if they are feasible, some policies may be so inefficient that they would be shunned by most firms (i.e., unviable) and such policies should be identified as such. Furthermore, even if a debt policy is viable, and therefore feasible, there may be no regulatory policy in conjunction with it that satisfies the NPV = 0 test.[1]

The first debt policy considered is to roll over all debt at the same point, and this might be done to align the firm's borrowing with the regulatory cycle. Although the policy is feasible, the resulting refinancing risk would be unacceptably high and therefore this strategy is not viable. The AER (2009, pp. 151-154) and SFG (2012, page 24) make the same point.

A second possible debt policy would be to borrow long-term (say ten years) and stagger the borrowing so that only a small proportion of the debt matured in any one year. This would reduce the refinancing risk to a low level. This strategy is viable and generally employed (AER, 2009, pp. 151-154).

A third possible debt policy would involve borrowing long-term (say ten years), staggering the borrowing so that only a small proportion matured each year, and entering interest-rate and credit-default swap contracts to change the effective term of the debt. The first two parts of this arrangement would reduce the refinancing risk to a minimal level. The last part (the swap contracts) has two possible uses. For an unregulated firm, they could be used to optimally trade-off the (typically) lower cost of shorter term debt with the higher volatility in rates. For a firm that is regulated using the current regime, these swap contracts could be used to align the cost of debt with the rate allowed by a regulator and thereby eliminate interest rate risk to the business. This strategy is not feasible (and therefore not viable) because credit-default swap

[1] This approach could be further pursued to identify optimal debt policies, but this matter is too subjective to admit clear conclusions. Consequently, judgements about the optimality of a debt policy are avoided.

contracts are in general either not available on the desired bonds or in sufficient quantities for many of the regulated businesses in question.

A fourth possible debt policy would involve borrowing long-term (say ten years), staggering the borrowing so that only a small proportion matured each year, and entering interest-rate swap contracts to change the effective term of the risk-free rate component of the cost of debt, i.e., the third possibility subject to removal of the credit-default swap contracts. The interest-rate swap contracts have two possible uses. For an unregulated firm, and in respect of the risk-free rate component of the cost of debt, they could be used to optimally trade-off the (typically) lower cost of shorter term risk-free debt with the higher volatility in rates. For a firm that is regulated using the current regime, these swap contracts could be used to align the risk-free rate component of the cost of debt with the rate allowed by a regulator and thereby eliminate this source of interest rate risk to the business. This strategy is viable so long as interest rate swap contracts are available in the require volumes. SFG (2012, page 25) claims that the swaps market lacks the depth to accommodate businesses with large debt levels. However it is not clear whether SFG are referring to government entities, and private-sector entities are the regulatory benchmark. The QTC (2013a, page 8) also argues that the swap contracts would have to be entered into over the same short period (about one month) used by regulators in setting the risk-free rate at the beginning of the regulatory cycle (in order to fully hedge the risk) and doing so exposes the regulated entity to "opportunistic pricing by other market participants". However, if this were true, the regulated entity could simply increase the window over which the swap contracts were entered into. The result would be to generate some interest rate risk from the imperfect match in timing, but this would be trivial relative to the aggregate risks of the business. The AER (2009, pp. 152-154) summarises submissions from private-sector entities and these entities raise no concerns about the depth of the swaps market or opportunistic pricing. It follows that this strategy is viable.

In summary, only two possible debt strategies for a business are viable. The first involves borrowing long-term and staggering the borrowing to ensure that only a small proportion of the debt would mature in any one year; this reduces refinancing risk to a minimal level. The second additionally involves the use of interest rate swap contracts (relating to the risk-free rate component of the cost of debt). Each of them has a matching regulatory policy. For the first, the matching regulatory policy would be for the allowed cost of debt to be set in accordance with the trailing average cost, and this combination of corporate debt policy and regulatory

policy would therefore satisfy the NPV = 0 principle. In respect of the second debt policy, additionally involving the use of interest-rate swap contracts, the matching regulatory policy would be for the allowed risk free rate within the cost of debt to be set in accordance with the rate prevailing at the beginning of the regulatory cycle whilst the DRP would be set in accordance with the trailing average. This combination of corporate debt policy and regulatory policy would therefore also satisfy the NPV = 0 principle. By contrast the current regulatory regime involves setting the allowed cost of debt in accordance with the rate prevailing at the beginning of the regulatory cycle. In combination with a debt policy of borrowing at the beginning of the regulatory cycle for the term of the regulatory cycle, and rolling it over at maturity, this would satisfy the NPV = 0 principle. However, the refinancing risk associated with this debt policy makes it unviable, and there is no viable debt strategy that could be coupled with the current regulatory regime to satisfy the NPV = 0 principle. Faced with the current regulatory regime, businesses have borrowed long-term, with staggering, to deal with refinancing risk and used interest-rate swap contracts to align the risk-free rate component of their cost of debt with the regulatory cycle. Since the regulator allows a DRP that reflects the rate prevailing at the beginning of each regulatory cycle, and the firm pays the trailing average DRP, this combination of firm and regulatory policy does not satisfy the NPV = 0 principle.

2.3 Implementation Issues

Regardless of whether a regulator uses the prevailing regime or a trailing average regime, the regulator requires an estimate of the cost of debt, comprising the base rate and the DRP. Of these two components, the principal difficulties lie with the DRP and these arise for two reasons. The first of these difficulties is the issue of what credit rating is appropriate for the regulated businesses. The second is how to estimate the prevailing DRP for a specific credit rating and term to maturity. Unlike the base rate, an estimate of this DRP does not arise from a single highly liquid bond. Instead, it arises by either selecting an index compiled by a third party (such as the Bloomberg Fair Value Curve, i.e., BFVC) or selecting a suitable set of bonds followed by some type of curve fitting exercise, i.e., the regulator defers to the decisions of a third party over bond choice and curve fitting or makes such decisions themselves. If the preferred approach involves a third party index, all of the potentially difficult questions (over the choice of bonds and the curve fitting) are avoided and mere observation of the value of the index on the appropriate date is required. However, as discussed in Lally (2013, section 3.1), the BFVC is subject to such significant problems that a regulator should not defer to it.

Consequently, difficult questions relating to the choice of bonds and curve fitting must be faced. For such a task, I recommend the appointment of an 'expert panel'.

Turning now to the regulator's choice of the prevailing regime or a trailing average regime, a trailing average regime requires costs at the current time and at various historical points. For example, if the trailing average were for ten years, then cost of debt estimates would be required at the present time and for each of the last nine years. Again, the principal difficulties are with the DRP. If a third party index such as the BFVC were chosen, only observation of the historical values of the index would be required. However, if the BFVC were rejected in favour of an expert panel, the estimation process for the DRP will be more difficult for the trailing average regime (in which a ten-year average of the ten year DRP will be required) than for the current regime (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 regime is the sheer volume of historical DRP estimates that would be required and this problem would be aggravated if annual adjustment of the trailing average were also done (as noted by the QTC, 2012a, Attachment 2, page 7).

These difficulties arising from the use of historical data 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 described in Lally (2013, section 3.1) 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. In addition these difficulties arising from the use of historical data would evaporate if the transitional process from the current regime to the trailing average regime did not utilise historical data (and will be discussed further in section 6).

A further implementation issue relating to a trailing average regime is the implicit assumption that all borrowing by all firms is for N years if the average borrowing term across firms and terms is found to be N years. For example, suppose 25% of firms have exclusively five year debt, 25% have exclusively 15 year debt, and the other 50% have an equal mix of five and 15 year debt. The average over all terms and firms is then ten years. So, in implementing a trailing

average regime, one would assume that all firms borrow for ten years. The assumption would be wrong for all firms. Consequently, a regulator's use of a trailing average regime does not guarantee that the cost of debt allowed (or the DRP if the trailing average is limited to the DRP) will correspond to the cost incurred by every firm or even any firm. Nevertheless, at least in respect of the DRP, it will still better reflect the actual cost incurred by firms than the use of the cost prevailing at the beginning of the regulatory cycle.

In summary, if the regulator uses a DRP trailing average regime and favours its own estimates of the DRP over those from a third-party source such as the BFVC and does not use a transitional regime that avoids the use of historical data, it will be much more difficult to implement the DRP trailing average approach than the current regime due to the sheer quantity of historical DRP data that will be required. Thus, if a regulator uses a DRP trailing average regime, a transitional regime that avoids the use of historical DRP data is desirable. In addition, although the use of a trailing average regime may better reflect the cost incurred by a firm than the present policy (and will do so for the DRP), the use of a trailing average regime does not guarantee that the allowed cost of debt (or the allowed DRP if the trailing average is limited to the DRP) will correspond to the cost incurred by every firm or even any firm.

2.4 Consistency with the Cost of Equity

The analysis in section 2.1 shows that, regardless of whether the current regime or a trailing average regime is used, the appropriate cost of equity to be used by the regulator to set the price or revenue cap must be the current cost (for the regulatory cycle). Thus, if a trailing average regime is used for the cost of debt, this raises the question of whether an inconsistency arises. Clearly, if a trailing average cost of debt is used, it would be different to the use of a current cost of equity. However, the word "inconsistency" implies that the difference is in some way necessarily wrong. This is not the case. So long as it is feasible for firms to engage in borrowing arrangements in which the effective cost of debt or the DRP is a trailing average, regulatory use of a trailing average regime for the cost of debt or DRP will in conjunction with this debt policy satisfy the NPV = 0 principle. The same NPV = 0 principle also warrants the use of the current cost of equity.

In summary, there is no inconsistency in using the prevailing risk free rate for setting the allowed cost of equity and using a trailing average regime in setting the allowed cost of debt or the DRP. The NPV = 0 principle requires the use of the prevailing risk free rate for setting

the allowed cost of equity but it does not require use of the prevailing cost of debt. Any feasible debt policy coupled with a matching regulatory policy for setting the allowed cost of debt will satisfy the NPV = 0 principle.

2.5 Implications for CAPEX and New Entrants

The current practice of setting the cost of debt in accordance with the cost prevailing at the beginning of the regulatory cycle involves extrapolating the same cost of debt to that undertaken during the regulatory cycle for the purpose of financing capex. However, during the interval between the beginning of the regulatory cycle and the subsequent borrowing, the cost of debt may change. Assuming (reasonably) that the capex timing is predictable, the risk free rate component of this risk can be hedged with a forward-rate contract (as noted by SFG, 2012, page 28). However, the risk of movement in the DRP cannot be hedged. Thus, if the DRP rises over this period, the firm may delay the capex until the beginning of the next regulatory cycle (at which point the allowed DRP would match that actually incurred). In addition, if the DRP falls over this period, capex that is NPV negative may be undertaken because the allowed DRP exceeds that actually incurred.

Such problems would be even more severe under a pure trailing average regime for the DRP (in which the trailing average is applied to new debt to finance capex as well as existing debt), for three reasons. Firstly, the DRP allowed in respect of the intra-cycle capex in likely to be even further from the DRP prevailing at that time and this in turn because the trailing average at any point reflects the DRP five years ago (on average) whereas the time interval under the current approach would average 2.5 years (the average time from the beginning of a regulatory cycle till the incurrence of capex during the five year cycle). Secondly, if the allowed DRP is too low, the difference between the allowed DRP and that actually incurred resulting from the capex cannot be eliminated by simply delaying the capex until the beginning of the next regulatory cycle because the allowed DRP may still be inadequate at that point. Thirdly, the DRP shortfall or excess might continue for a protracted period of time. All three problems would be magnified if a trailing average regime were also applied to the risk free rate component of the cost of debt. Both SFG (2012, pp. 47-48) and the QTC (2013a, page 19) refer to the last two concerns.

To illustrate these points, suppose that the trailing average is applied to the entire cost of debt, the cost of debt is 6% at the beginning of the current regulatory cycle, has gradually risen over

the last ten years at 0.3% per year and continues to rise at that rate during the current regulatory cycle. Accordingly, under the current approach, the average shortfall between the borrowing rate at the time of the intra-cycle capex and the rate allowed would be 0.75% (0.3% per year for 2.5 years). In addition, the shortfall would be eliminated if capex were deferred till the beginning of the next regulatory cycle, at which point the allowed and actual cost of debt would both be 7.5%. By contrast, under the trailing average regime, the average shortfall would be 1.50% for intra-cycle capex (0.3% per year for five years) and the shortfall would remain 1.5% even if capex were deferred till the beginning of the next regulatory cycle. Furthermore, if the cost of debt continued to grow, the total shortfall over the life of the capex would be even greater than the 1.5%

A further and related issue is that of new entrants to a regulated sector, who would presumably borrow at that time and therefore incur the current cost of debt. However, if the historical average determined under a trailing average regime were below the current level, the new entrant would be subject to a price or revenue cap that did not compensate for their costs. Furthermore, the shortfall might persist for several regulatory cycles. Thus, at such times, new entrants would be discouraged. Similarly, if the trailing average rate exceeded the current rate, new entrants would be encouraged for the wrong reasons. The ACCC (2013, section 5.3) refers to this problem.

These problems with a pure trailing average regime could be addressed by applying the prevailing rate to new debt arising from both capex and new entrants, and then gradually adjusting the rate towards the trailing average. Furthermore, the QTC (2013b, section 2) demonstrates how this might be undertaken. This adds to the complexity of the regime, and therefore to the ease with which it can be understood.

In summary, if a trailing average regime is adopted, application of the trailing average to both new debt to support capex and new debt arising from new entrants to an industry as well as existing debt has the disadvantage of discouraging capex and new entrants when the prevailing cost of debt is above the trailing average and improperly encouraging them when the prevailing cost of debt is below the trailing average. These problems can be eliminated by applying the prevailing rate to both new debt arising from capex and new entrants, and then gradually adjusting the rate towards the trailing average, in the manner explained by the QTC, but this adds to the complexity of the trailing average regime.

2.6 The Risk of Financial Distress

Under the current regime, in which the allowed revenues are based upon the DRP prevailing at the beginning of the regulatory cycle whilst the firm actually pays a trailing average DRP, this mis-match may raise the risk that the regulated entity would be unable to meet its debt obligations and therefore face bankruptcy risk.[2] However, in assessing bankruptcy risk, it is necessary to consider the other cash flows of the firm, most particularly the cash flows arising from the allowed cost of equity because they may mitigate the problem arising from the use of the prevailing DRP. Accordingly, the overall impact of changes in the DRP and the risk-free rate on bankruptcy risk, under the current regulatory regime, is examined as follows.

Letting *S* denote the book value of equity, *B* the book value of debt, k_e the cost of equity, k_d the cost of debt, superscript *A* denote that allowed by the regulator, superscript *P* that actually paid by the firm, and *X* denote all other cash flow components, then the net cash flows of the business are as follows:

$$NCF = Sk_e^A + Bk_d^A - Bk_d^P + X$$

Under the current regime, the allowed cost of equity is the sum of the risk free rate prevailing at the beginning of the regulatory cycle (R_f^c) and an allowed MRP (MRP^A) whilst the allowed cost of debt is the sum of the risk-free rate prevailing at the beginning of the regulatory cycle (R_f^c) and the DRP at the same point (DRP^c). In addition, firms engage in interest rate swaps to ensure that the risk-free rate component within the cost of debt paid by them matches that allowed under the current regime (R_f^c). Finally, the DRP component of the cost of debt that businesses pay would be similar to the benchmark trailing average (denoted with the superscript *TA*). So, the last equation becomes:

[2] The issue does not arise in respect of the risk free rate component of the cost of debt because the rate allowed is that prevailing at the beginning of the regulatory cycle and the same rate is effectively paid by businesses due to using interest rate swap contracts to align their borrowing terms to the regulatory cycle. In addition, the issue does not arise if the regulator uses a trailing average regime for the DRP because this will lead to a firm's incurred DRP closely corresponding to that allowed by the regulator. In addition, the issue does not arise if the regulator also uses a trailing average regime for the risk-free rate component of the cost of debt, because regulated firms could then be expected to desist from interest rate swap contracts and thereby incur a cost of debt that closely corresponded to that allowed by the regulator.

$$NCF = S(R_f^c + MRP^A) + B(R_f^c + DRP^c) - B(R_f^c + DRP^{TA}) + X$$

$$= S(R_f^c + MRP^A) + B(DRP^c - DRP^{TA}) + X$$

To limit the scope of the analysis, the additional cash flows *X* are deleted from the analysis. In addition, the MRP allowed by the QCA has always been 6%. In addition, the typical leverage ratio is 60%. So, per $100 of asset book value, the last equation becomes

$$NCF = \$40(R_f^c + .06) + \$60(DRP^c - DRP^{TA}) \quad (9)$$

To assess the variation in this net cash flow from the beginning of 2007 (before the GFC commenced) to the end of 2013, I have drawn upon the Bloomberg BBB ten-year series from 2005-2011 (AER, 2011, Figure A.6) supplemented with data for regulated utilities provided by the QCA for the period 2000-2013.[3] Collectively this data indicates that the DRP was stable at about 1.3% until the beginning of 2007, rose to about 4.5% at the beginning of 2010 and declined to about 3.2% at the beginning of 2013. This is shown in the first two columns of Table 1. In addition, I assume that the average debt term is 10 years, in which case the DRP paid in each year is the ten-year trailing average, as shown in the third column of Table 1.

Table 1: The Variation in Net Cash Flow under the Current Regime

Year	DRP	DRP^{TA}	DRP^c	R_f^c	*NCF*
2007	1.3	1.3	1.3	5.88	$4.75
2008	2.0	1.37	1.3	5.88	$4.71
2009	3.0	1.54	1.3	5.88	$4.61
2010	4.5	1.86	1.3	5.88	$4.41
2011	4.0	2.13	1.3	5.88	$4.25
2012	3.6	2.36	3.6	3.80	$4.66
2013	3.2	2.55	3.6	3.80	$4.55

TA = Trailing Average; C = Current; NCF = Net Cash Flow

[3] The DRP and risk free rates in the years before 2007 were quite stable and therefore are not examined here.

I start by considering businesses for which a (five year) regulatory cycle begins in 2007. In this case the DRP allowed under the current regime is shown in the fourth column of Table 1, i.e., 1.3% for 2007-2011 (because this was the prevailing rate at the beginning of 2007), followed by 3.6% for 2012-2016 (because this was the prevailing rate at the beginning of 2012). The fifth column of Table 1 shows the allowed risk free rate, being 5.88% for 2007-2011 (corresponding to the average ten year rate in January 2007) and 3.80% for 2012-2016 (corresponding to the average ten year rate in January 2012). The last column of Table 1 then shows the results for equation (9) in dollars per $100 of regulatory asset book value. As shown there, there is very little variation in this NCF: it falls by up to 11% during the first five years (because the trailing average DRP that is paid by businesses is rising whilst the allowed DRP remained fixed) and rises moderately thereafter (because the allowed DRP rises sharply at that point but this effect is largely offset by the concurrent fall in the allowed risk free rate).

These calculations assume that the commencement year for the regulatory cycle includes 2007. However the commencement year might instead be any of 2008-2011. Calculations of the type shown in Table 1 are therefore performed for each of those years, and the results are shown in Table 2. For each of these cases there is a decline over time in NCF until the first post GFC resetting of the allowed rates occurs. However, even for the first of these cases (in the first row), for which the delay before the post GFC resetting is longest (not until 2012), the decline in the NCF relative to that in 2007 is only 11%. Across all five rows, the average decline is only 6%. This suggests that the current regulatory regime has not given rise to any material bankruptcy risk for regulated businesses.

Table 2: The NCF Time Series for Various Regulatory Cycles under the Current Regime

Cycle	2007	2008	2009	2010	2011	2012	2013
2007-2011	4.75	4.71	4.61	4.41	4.25	4.66	4.55
2008-2012	4.51	5.21	5.11	4.91	4.75	4.61	4.15
2009-2013	4.68	4.64	4.91	4.72	4.56	4.42	4.31
2010-2014	4.54	4.50	4.40	6.20	6.04	5.90	5.79
2011-2015	4.48	4.44	4.34	4.14	5.73	5.59	5.48

SFG (2013, pp. 56-68) also examines bankruptcy risks arising from the current regulatory regime and various alternatives, reflected in the interest cover ratio calculated by them. However, their analysis shown in their Table 6 sets the EBIT equal across all three economic states examined by them, and therefore does not recognise that the current regulatory regime would induce variation in EBIT arising from variation in the allowed cost of equity. By contrast, their analysis shown in their Table 8 does appear to allow EBIT to vary over economic states and they also consider a number of possible scenarios. Since the purpose of the exercise is to examine various possible regulatory policies relating to the allowed cost of debt, it would be important for the allowed cost of equity to correspond to that currently used, which involves the prevailing risk free rate and an allowed MRP that is stable over time. However none of the seven possible combinations of debt policy and regulatory policy examined by them (and shown in their Table 7) involves an allowed cost of equity of this kind. Instead, SFG's assumption about the allowed cost of equity is that both components are the prevailing rate or both are a trailing average. Thus, no valid conclusions about the appropriate regulatory policy for the cost of debt can be drawn from their analysis.

In summary, under the current regime, the allowed DRP may significantly differ from that incurred by a firm thereby raising the risk of bankruptcy. Changes in the net cash flow of regulated businesses are therefore examined under this regime over the period 2007 to 2013 relative to the 2007 value. The most adverse outcome involved businesses whose regulatory reset was during 2007, for whom net cash flows declined in the period 2007-2011 (but only by 11%) because the trailing average DRP paid by these businesses rose but the allowed DRP did not rise until 2012, after which the increase in the allowed DRP outweighed the fall in the allowed cost of equity and the net cash flow then rose. Thus the current regulatory regime has not given rise to any material bankruptcy risk for regulated businesses.

2.7 Value Hedging

SFG (2013, pp. 44-45) argues that the present regime, in which the DRP allowed by the regulator is equal to the prevailing rate whilst the firm actually pays the trailing average rate, gives rise to volatility in the firm's net cash flows to shareholders but the discount rate applied to these cash flows is negatively correlated with the cash flows, and this dampens volatility in the value of equity. SFG (2013, pp. 58-68) go on to conduct a detailed analysis of this issue, involving various combinations of regulatory policy and firm debt policy, and conclude that switching from use of the prevailing DRP to a trailing average by a regulator causes the

volatility of equity returns to slightly increase (ibid, para 278). However, as discussed in the previous section, none of the seven scenarios examined by SFG (and shown in Table 7 of their report) reflects the fact that the allowed cost of equity under the current regime is the prevailing risk free rate coupled with an estimate of the MRP that is relatively stable over time. Instead, SFG's assumption about the allowed cost of equity is that both components are the prevailing rate or a trailing average. Thus, no valid conclusions about the appropriate regulatory policy for the cost of debt can be drawn from this analysis.

2.8 Variation over Time in Output Prices

The AER (2013, page 84) argues that, in setting the allowed DRP, the use of the prevailing DRP rather than a trailing average of the DRP induces greater volatility in output prices because the prevailing DRP is more volatile than its trailing average. However the word "volatility" implies unexpected variation in prices over very short periods whilst unexpected price changes under the current regime typically occur only five-yearly. So, a better phrase would be "variation over time". Furthermore, the impact of the risk free rate on the business's output prices may exert a dampening effect upon the use of the prevailing DRP. Accordingly, the overall impact of changes in the DRP and the risk-free rate on output prices, under a variety of possible regulatory regimes, is examined, as follows.

Letting S denote the book value of equity, B the book value of debt, k_e the cost of equity, k_d the cost of debt, superscript A denote that allowed by the regulator, superscript P that actually paid by the firm, and Y denote all other revenue components, then the revenues of the business are as follows:

$$REV = Sk_e^A + Bk_d^A + Y$$

Under the current regime, the allowed cost of equity is the sum of the risk free rate prevailing at the beginning of the regulatory cycle (R_f^c) and an allowed MRP (MRP^A) whilst the allowed cost of debt is the sum of the risk-free rate prevailing at the beginning of the regulatory cycle (R_f^c) and the DRP at the same point (DRP^c). So, the last equation becomes:

$$REV = S(R_f^c + MRP^A) + B(R_f^c + DRP^c) + Y$$

To limit the scope of the analysis, the additional revenues *Y* are deleted from the analysis. In addition, the MRP allowed by the QCA has always been 6%. In addition, the typical leverage ratio is 60%. So, per $100 of asset book value, the last equation becomes

$$REV = \$40(R_f^c + .06) + \$60(R_f^c + DRP^c) \tag{10}$$

Since output variations are reflected in *Y*, this formula will reflect variation over time in output prices due to variation in the allowed cost of capital. To assess this variation from before the beginning of the GFC (in 2007) to the end of 2013, I have drawn upon the DRP data shown in Table 1 along with risk free rate data from the RBA (averaged over January for the relevant year). So, for businesses with regulatory cycles beginning in 2007 and 2012, I determine the results from equation (10) for the regulatory cycles commencing at the beginning of 2007 (before the GFC) and at the beginning of 2012. These results are as follows:

$$REV(2007) = \$40(.059 + .06) + \$60(.059 + .013) = \$9.06$$
$$REV(2012) = \$40(.038 + .06) + \$60(.038 + .036) = \$8.36$$

By contrast, had a trailing average regime for the DRP been used, the DRP of .036 prevailing at the beginning of 2012 would have been replaced by the contemporaneous ten-year trailing average of .0236 (see Table 1) and the results would have been as follows:

$$REV(2007) = \$40(.059 + .06) + \$60(.059 + .013) = \$9.06$$
$$REV(2012) = \$40(.038 + .06) + \$60(.038 + .0236) = \$7.61$$

By contrast, had a trailing average regime for both the DRP and the risk-free rate been used in setting the allowed cost of debt, the risk-free rates of 0.059 and 0.038 prevailing at the beginning of 2007 and 2012 respectively would have been replaced by the contemporaneous ten-year trailing averages of 0.0568 and 0.0524 respectively and the results would have been as follows:[4]

$$REV(2007) = \$40(.059 + .06) + \$60(.0568 + .013) = \$8.94$$

[4] The trailing averages used for both the DRP and the risk-free rate are averages over the prevailing month (January) and the previous nine Januaries. Other averaging schemes are possible (involving the past ten years) but the volatility results are likely to be very similar under alternative such schemes.

$$REV(2012) = \$40(.038 + .06) + \$60(.0524 + .0236) = \$8.48$$

These results along with those for regulatory cycles with different start dates are shown in Table 3 below.

Table 3: Variation over Time in Output Prices for Various Regulatory Cycles

Cycle	First REV	Second REV	Third REV
2007-2011 (no TA)	\$9.06 (2007)	\$8.36 (2012)	
2007-2011 (TA: DRP)	\$9.06 (2007)	\$7.61 (2012)	
2007-2011 (TA)	\$8.94 (2007)	\$8.48 (2012)	
2008-2012 (no TA)	\$8.46 (2003)	\$9.68 (2008)	\$7.72 (2013)
2008-2012 (TA: DRP)	\$8.46 (2003)	\$9.30 (2008)	\$7.33 (2013)
2008-2012 (TA)	\$9.31 (2003)	\$9.08 (2008)	\$8.33 (2013)
2009-2013 (no TA)	\$8.88 (2004)	\$8.29 (2009)	
2009-2013 (TA: DRP)	\$8.88 (2004)	\$7.41 (2009)	
2009-2013 (TA)	\$9.44 (2004)	\$8.32 (2009)	
2010-2014 (no TA)	\$8.53 (2005)	\$10.66 (2010)	
2010-2014 (TA: DRP)	\$8.53 (2005)	\$9.08 (2010)	
2010-2014 (TA)	\$9.00 (2005)	\$9.00 (2010)	
2011-2015 (no TA)	\$8.38 (2006)	\$10.32 (2011)	
2011-2015 (TA: DRP)	\$8.38 (2006)	\$9.20 (2011)	
2011-2015 (TA)	\$8.76 (2006)	\$9.16 (2011)	

TA = Trailing Average for the Cost of Debt; TA:DRP = Trailing Average for only the DRP

For each of these three regulatory regimes, there are six changes in the revenues of the regulated business, from which the standard deviation (as a measure of variation) can be estimated. For the existing regime, this standard deviation is \$1.65. If a trailing average is used for the DRP, it falls moderately to \$1.30. If a trailing average is also used for the risk-free rate component of the cost of debt, it falls further to \$0.54. Thus, across these three possible regulatory regimes, output prices would exhibit the most variation under the existing regime, moderately less if a trailing average were applied to the DRP, and substantially less if a trailing average were also applied to the risk-free rate component of the cost of debt.

In summary, the variation over time in output prices has been assessed under the current regime, application of a trailing average to the DRP, and application of a trailing average to both the DRP and the risk-free rate component of the cost of debt. Using data from 2003 to 2013, output prices would have exhibited moderately less variation if a trailing average were applied to the DRP compared to the current regime and substantially less if a trailing average were also applied to the risk-free rate component of the cost of debt.

2.9 Implications for the Cost of Equity

The cost of equity is determined using the Officer (1994) version of the CAPM, which involves the risk parameter beta, and this parameter might be sensitive to the regulator's choice of a trailing average or current rate for the cost of debt. In respect of the risk-free rate component of the cost of debt, the regulator's choice of a prevailing rate or a trailing average could be expected to induce firms to mirror the regulator's behavior, i.e., use interest rate swaps to produce a cost that matched that allowed by the regulator, if the regulator adopts the prevailing rate, and not use them if the regulator adopts a trailing average regime. So the regulator's choice of a prevailing risk-free rate or the trailing average would not affect the risk faced by equity holders. Accordingly, I will focus upon the regulator's choice of a trailing average or current rate for the DRP. As discussed in section 2.7, SFG concludes that a regulator's use of the prevailing DRP causes the volatility of equity returns to slightly decrease relative to use of a trailing average. However, as discussed in section 2.7, no valid conclusions can be drawn from SFG's analysis because none of the seven scenarios examined by SFG (and shown in Table 7 of their report) reflects the fact that the allowed cost of equity under the current regime is the prevailing risk free rate coupled with an estimate of the MRP that is relatively stable over time. Instead, SFG's assumption about the allowed cost of equity is that both components are the prevailing rate or a trailing average.

All that can be deduced from SFG's analysis is that the choice of a trailing average regime or the prevailing DRP *may* affect the variability in the firm's net cash flows and therefore affect its beta (because the variability in question is over economic states that would be correlated with market returns). Furthermore, whatever the direction and extent of the effect on beta is from a regulator switching to a trailing average, it would not seem to be possible to estimate this change because beta estimation is an empirical exercise and all of the returns data that is available to estimate beta is drawn from firms subject to the present regime in which revenues

or prices are determined using the prevailing DRP. However, the regulator's choice of the prevailing DRP or a trailing average regime will not affect the *average* net cash flow outcome over time and market prices are forward-looking. So, any impact of the regulator's choice on market prices (and hence beta) should be minimal.

In summary, the regulator's choice of the prevailing rate or a trailing average regime for the risk-free rate component of the cost of debt should not affect the risk faced by equity holders because firms could be expected to act so that their cost incurred matches that allowed by the regulator (by using interest rate swap contracts if the regulator uses the prevailing rate, and not otherwise). However the regulator's choice of the prevailing rate or a trailing average regime for the DRP *may* affect the firm's equity beta, and therefore its cost of equity. Although it is not possible to ascertain the impact, because all of the returns data that is available to estimate beta is drawn from firms subject to the present regime in which revenues or prices are set using the prevailing DRP, the fact that market prices are forward-looking and that the regulator's choice won't affect the average net cash flow outcome imply that any impact from the regulator's choice of regime on market prices and hence beta should be minimal.

3. The Choice of Base Rate

The base rate for the allowed cost of debt that is currently used by the QCA is the government bond rate. However, for a firm that engages in interest rate swaps, the base rate that is effectively paid is the swap rate. Consequently, there will be variation between the rate allowed by the regulator and the cost incurred by the firm. This variation is prima facie undesirable and could be eliminated by the regulator using the swap rate as the base rate. However, the importance of this issue depends upon the degree of variation, and I therefore consider the work of SFG (2012) on this matter.

SFG (2012, pp. 35-41) focus on the variation rather than the average difference, because the latter is likely to be close to zero. They examine the standard deviation of the difference between the cost of debt allowed by the regulator and that actually incurred by the firm:

$$SD(r_{reg} - r_{actual}) \tag{11}$$

A number of different procedures for regulatory setting the allowed rate, and debt policies pursued by firms, are considered by SFG. However, all of them (reasonably) involve the firm incurring a DRP that reflects a trailing average. I will limit my consideration to the three cases considered by SFG in which the firm is assumed to undertake swap contracts in order to align the base rate in its cost of debt with the base rate allowed by the regulator, because the empirical evidence is that firms have acted in this way (AER, 2009, pp. 151-154). Thus, the cost of debt incurred by the firm involves the current swap rate plus the trailing average DRP defined relative to the swap rate. The variation across the three cases is then purely in the policy adopted by the regulator, and these cases are as follows:

(a) The regulator uses the current swap rate plus the trailing average DRP defined against the swap rate. The resulting standard deviation shown in equation (11) is 0.20%.
(b) The regulator uses the current government bond rate plus the trailing average DRP defined against the government bond rate. The resulting standard deviation is 0.54%.
(c) The regulator uses the current government bond rate plus the current DRP defined against the government bond rate. The resulting standard deviation is 2.20%.

The current regime corresponds to (c). The effect of replacing the prevailing DRP by the trailing average DRP (defined relative to the government bond rate) is to reduce the standard deviation of the error from 2.20% to 0.54%, with a further reduction to 0.20% if the DRP is defined relative to the swap rate. Thus, of the potential reduction in standard deviation from 2.20% to 0.20%, 82% comes from using the trailing average DRP and the remaining 18% from using the swap rate. So, the use of the swap rate is a much less important issue than the use of a trailing average. In addition, as shown in section 2.6 and 2.8 respectively, the use of a trailing average DRP regime rather than the current regime slightly reduces bankruptcy risk and slightly reduces variation over time in output prices. The additional use of the swap rate will further reduce bankruptcy risk and may further reduce variation over time in output prices. However, since the reduction in standard deviation from the use of a swap rate in addition to a DRP trailing average regime is small relative to the use of the DRP trailing average regime, the benefits from use of the swap rate in terms of lower bankruptcy risk and variation over time in output prices are likely to be trivial. So there is not a strong argument for change and I therefore recommend against it.

In summary, using the swap rate rather than the CGS rate as the base rate in setting the allowed cost of debt produces a closer match between the allowed cost of debt and that actually incurred

by the firm. However, the effect is small in absolute terms, and small relative to the use of a trailing average DRP rather than the prevailing DRP. Consequently there is a not a strong argument for change and I therefore favour continued use of the government bond rate as the base rate.

4. Annual Updating of the Trailing Average

If a regulator does adopt a trailing average for the cost of debt or the DRP, the value may be fixed at the beginning of the regulatory cycle for the entire cycle or it may be subject to annual updating (either formally or via the use of an 'unders and overs' account). The ACCC (2013, pp. 30-35) argues that fixing the value at the beginning of the regulatory cycle produces very similar results to that of annual updating and therefore favours the former option. However they do not present an example of the difference in outcomes and the difference can be quite substantial and not reversed over time.

For example, suppose that the prevailing cost of debt is 8% per year up to and including the beginning of the first year of the current regulatory cycle, after which it immediately drops to 6% and remains at that level, as shown in the first two columns of Table 4. In addition the average debt term is five years and therefore the trailing average is for five years. Using a trailing average without annual updating, the allowed cost of debt will be 8% at the beginning of the current regulatory cycle (fixed for five years) and 6% at the beginning of the next regulatory cycle (fixed for five years) as shown in the third column of Table 4.

By contrast, under a trailing average regime with annual updating, the allowed cost will decline from 8% at the beginning of the current regulatory cycle to 6% at the end of that cycle and then remain at that level, as shown in the fourth column of Table 4. The difference in outcomes under these two regulatory regimes is shown in the last column of the table. As shown there, the difference is as much as 1.6% of the debt level of the business and there is no reversal over time of the difference. Thus, assuming a trailing average regime for the cost of debt and the illustrative cost of debt time series underlying Table 4, the regulated businesses will temporarily receive a higher allowance when the trailing average is not annually updated compared to annual updating and this effect is not subsequently reversed.

Table 4: Allowed Costs of Debt with and without Annual Updating

Year	Cost of Debt	No Updating	Updating	Difference
-4	8%			
-3	8%			
-2	8%			
-1	8%			
1	8%	8%	8%	0%
2	6%	8%	7.6%	0.4%
3	6%	8%	7.2%	0.8%
4	6%	8%	6.8%	1.2%
5	6%	8%	6.4%	1.6%
6	6%	6%	6%	0%

In summary, if a regulator does adopt a trailing average regime for the cost of debt or the DRP, the results from fixing that value at the beginning of the regulatory cycle or engaging in annual updating (either formally or via an 'unders and overs' account) can be significantly different. Furthermore, the use of a trailing average regime is premised on the need to better match the allowed cost to that actually incurred. Since the cost actually incurred better corresponds to the trailing average with annual updating, this suggests that annual updating should be used if a trailing average regime is adopted.

5. The Use of Different Regimes for Different Firms

The AEMC (2012, pp. 79-80) raises the possibility of allowing regulated businesses or a regulator to choose the cost of debt regime that best reflects the individual circumstances of that business, and the QTC (2013a, pp. 9-10) recommends this. For example, allowing firms to choose between the current regime and a trailing average regime in respect of the risk free rate component would allow firms who are able to readily match this component of the cost of debt to the regulatory cycle to choose the current regime and the others would then choose the trailing average. However, faced with a choice between regimes, one could reasonably predict that firms will oscillate between regimes so as to maximise their revenues rather than to best reflect their preferred debt management policy. I do not think that it is possible to eliminate

such gaming by appropriate switching rules. For example, the QTC (2013a, page 22) properly notes that switching would have to be done prospectively (rather than retrospectively) but this would not suffice to eliminate gaming because DRPs and risk free rates are mean-reverting processes, and therefore can be predicted to a significant degree. Even if such gaming could be eliminated by appropriate rules regarding switching, this would add to the complexity of the regime. Accordingly I do not favour choice being permitted. The ACCC (2013, section 5.6) shares this view.

Such gaming would be eliminated if the regulator rather than the regulated business exercised the choice of regime. However, whenever a firm is assigned a regime that will produce lower revenues in the short-term than an alternative benchmark, it would be reasonable to expect that the firm would argue for the suitability of the alternative regime. The result will be endless 'litigation' over the assignment decisions of the regulator. Furthermore, when a single regime is applied to all firms, all firms have an incentive to adopt the most efficient debt policy. For example, if the trailing average regime is applied to firms who are (in the opinion of the regulator) not able to readily match the risk free rate component of their cost of debt to the regulatory cycle, such firms will lack the incentive to find ways to achieve this matching. Accordingly I do not favour the regulator using different regimes for different firms.

In summary, I do not favour allowing firms to choose between alternative regimes because it is more likely to result in firms choosing the regime that maximises their (short-term) revenues rather than the one that best reflects their preferred debt management policy. In addition, I do not favour the regulator assigning different regimes for different firms because it is likely to induce a substantial amount of 'litigation' from firms seeking to improve their (short-term) revenues.

6. Transitional Issues

If a regulator adopts a trailing average regime for the cost of debt or the DRP, the question of a transitional process arises. Such a process has two possible purposes: to mirror the transitional process that the regulated entity would go through and to initiate the switch to the new regulatory regime without the need to collect historical data.

One possible transitional process has been proposed by the ACCC (2013, section 7), commencing at the beginning of a regulatory cycle. The ACCC 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 and therefore all maturing at the end of the current regulatory cycle. Consequently, if a trailing average regime were adopted at the beginning of the next regulatory cycle and the average debt term were five years, the regulated firm would be rolling over all debt at that point and therefore could be presumed to react to the introduction of a trailing average regime by undertaking 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 ACCC's transitional process involves assigning equal weight to each of these arrangements in the first year of the new regime, replace the weighting on one year debt by that on five year debt in the second year of the new regime, and so on; this would not require recourse to historical data. This transitional process could be applied to the total cost of debt (as favoured by the ACCC) or just the DRP. However the ACCC's belief that, under the current regime, regulated firms would have aligned their debt issues with the regulatory cycle is true only in respect of the risk free rate component of the cost of debt, i.e., the empirical evidence reveals that firms have engaged in staggered borrowing and have used interest rate swap contracts to align the risk free rate component of the cost of debt (but not the DRP) with the regulatory cycle (AER, 2009, pp. 151-154). Consequently the DRPs currently paid by these firms will reflect the historical rates. Thus, in respect of the risk free rate component of the cost of debt, the ACCC's transitional proposal would perfectly mirror the transitional process that firms would need to go through and would also initiate the switch to the new regime without recourse to historical data. By contrast, in respect of the DRP component of the cost of debt, the ACCC's transitional process would not mirror the behaviour of regulated entities (because such entities would not change their behaviour in response to the regulator's use of a trailing average) and the sole justification here for the ACCC's transitional process would be to initiate the switch to the new regime without recourse to historical data.

An alternative transitional regime is that proposed by the QTC (2012b, page 2), and also commencing at the beginning of a regulatory cycle. For the first year, the allowed cost of debt would be the prevailing (ten-year) cost of debt at the beginning of that year, i.e., the cost of debt over a narrow window just before the commencement of the regulatory cycle. For the second year, the allowed rate would be 90% of the rate prevailing at the beginning of the first

year plus 10% of the rate prevailing at the beginning of the second year. For the third year, the allowed rate would be 80% of the rate prevailing at the beginning of the first year plus 10% of the rate prevailing at the beginning of the second year plus 10% of the rate prevailing at the beginning of the third year, etc. The process would take ten years to complete the transition. Thus, for the tenth year and thereafter, the allowed rate would be 10% of each of the ten-year rates prevailing at the beginning of each of the previous ten years. This transitional process could be applied to the total cost of debt (as favoured by the QTC) or just the DRP. This transitional process would not serve to mirror any transitional process that the firm engaged in and would merely serve to initiate the switch to the new regulatory regime without recourse to historical data.

In comparing these two transitional regimes, and given the empirical evidence that firms do engage in staggered borrowing, the ACCC's proposal is superior in respect of the risk free rate component of the cost of debt because it achieves both objectives described above whilst the QTC's proposal achieves only one of them. In respect of the DRP component of the cost of debt, both proposals serve only to initiate the switch to the new regulatory regime without recourse to historical data. So, prima facie, they are equally good. However, during the transitional period, the ACCC's proposal would involve use of DRPs for terms shorter than that actually used by firms whilst the QTC's proposal would not have this feature. For example, and assuming that firms borrow for ten years on average, the ACCC's proposal would place equal weight on the DRPs for one through ten year bonds during the first year whilst firms are actually paying a ten-year DRP. Accordingly, the QTC's approach is superior in respect of the DRP component of the cost of debt.

In summary, if a regulator adopts a trailing average for the DRP or the entire cost of debt, a transitional regime may be adopted and it has two possible purposes: to mirror the transitional process that the regulated entity would go through (if it does do so) and to initiate the switch to the new regulatory regime without the need to collect historical data. Both the ACCC and the QTC have proposed transitional processes. In respect of the risk free rate component of the cost of debt, the ACCC's proposal achieves both objectives whilst the QTC's proposal only avoids the need to collect historical data and does not mirror the transitional process that the regulated entities would actually go through; the ACCC's proposal is then superior. In respect of the DRP component of the cost of debt, both proposals serve only to initiate the switch to the new regulatory regime without recourse to historical data and mirroring the behaviour of

regulated entities is irrelevant because such entities would not change their behaviour in response to the regulator's use of a trailing average DRP. However, during the transitional period, the ACCC's proposal would involve use of DRPs for terms shorter than that actually used by firms whilst the QTC's proposal would not have this undesirable feature; the QTC's approach is then superior for the DRP. So, if a regulator adopts a trailing average for only the DRP, the QTC's transitional process is superior. By contrast, if a regulator adopts a trailing average regime for the entire cost of debt, the QTC's transitional proposal fails to mirror the transitional process that a firm would adopt in respect of the risk-free rate component of the cost of debt while the ACCC's transitional proposal would involve the use of DRPs for terms shorter than that used by businesses, and therefore both proposals have disadvantages.

7. The Timing of Switching

Even if the use of a trailing average DRP regime were considered superior to the use of the rate prevailing at the beginning of the regulatory cycle, and it were considered desirable to switch to the trailing average regime, the timing of the switch is a potentially important issue because the DRP rise arising from the GFC temporarily boosted the allowed revenues of the businesses relative to the costs actually incurred by them and this effect is gradually being reversed over time as the DRP reverts to its earlier level. In particular, once the DRP commenced its rapid rise and a regulated business subsequently had its allowed DRP reset at the new higher level, its allowed DRP will have exceeded the DRP that it paid because the latter will be a ten-year trailing average and therefore will not have risen as fast as the allowed DRP. However, once the DRP started to decline and the business subsequently had its allowed DRP reset at the new lower level, its allowed DRP will have been less than the DRP that it paid because the latter will be a ten-year trailing average and therefore will not have fallen as fast as the allowed DRP. Thus, having initially benefited from this highly unusual event, businesses would at some point prefer to switch to a trailing average regime so as to lock-in the accumulated GFC benefit before the reversal can take effect. [5] Similarly, if a business's revenues reflected the current price level in an economy but its costs reflected a ten-year trailing average of the price level in

[5] This DRP issue applies equally to a trailing average regime for both the DRP and the entire cost of debt. In respect of the risk-free rate component of the cost of debt, there have also been significant downward movements in the risk free rate over approximately the same period. However this reduction has equally affected both the rate allowed by the regulator and the rate incurred by the firm because firms use interest-rate swap contracts to match the risk free rate component of their cost of debt to the regulatory cycle. In addition, in respect of the risk free rate component of the cost of equity, this reduction has equally affected both the rate allowed by the regulator and the discount rate used by the market.

the economy, any temporary upsurge in the price level would initially boost the business's profits followed by a reversal as the increase in its costs gradually took effect.

To investigate this issue, I have drawn upon the Bloomberg BBB ten-year series from 2005-2011 (AER, 2011, Figure A.6) supplemented with data for regulated utilities provided by the QCA for the period 2000-2013. Collectively this data indicates that the DRP was stable at about 1.3% until the beginning of 2007, rose to about 4.5% at the beginning of 2010 and declined to about 3.2% at the beginning of 2013. This DRP spike is shown in the first two columns of Table 5. I have assumed reversion to the earlier level of 1.3% over the period 2014-2016. In addition, suppose that the average debt term is 10 years. Assuming (consistent with the empirical evidence) that firms use a staggered approach to borrowing, the DRP paid in each year would then be the ten-year trailing average, as shown in the third column of Table 5. Finally, I suppose that the regulatory cycle is five years.

I commence by assuming that any switch from the current regime to a trailing average (which must occur at the beginning of a regulatory cycle) does not involve any transitional process and therefore requires DRP data from the ten years preceding the switch point. I also commence by looking at regulated businesses for which 2007 is the beginning of a regulatory cycle. In this case the DRP allowed under the current regime is shown in the fourth column of Table 5, i.e., 1.3% prior to 2007 followed by 1.3% for 2007-2011 (because this was the prevailing rate at the beginning of 2007), followed by 3.6% for 2012-2016 (because this was the prevailing rate at the beginning of 2012), and then 1.3% for 2017-2021 (because this is the rate assumed to be prevailing at the beginning of 2017), and finally 1.3% for 2022-2026 (because this is the rate assumed to be prevailing at the beginning of 2022). The 'profit' from the current regime (the rate allowed by the regulator less the rate paid by the regulated entity) is then shown in the fifth column of Table 5, and the accumulated profit is shown in the last column. If the switch to a ten-year trailing average occurred at the end of 2011, after which the rate allowed would match that paid, the accumulated profit up to that point would be -1.70%. Furthermore, since the switch does not involve any transitional period, then the DRP allowed will match that paid from the time of the switch and therefore accumulated profits at the switch point are never subsequently changed. On the other hand, if the switch did not occur until the next possible opportunity at the end of 2016, the accumulated profit up to that point would be 3.21%. Similarly, if the switch did not occur until the next possible opportunity at the end of 2021, the accumulated profit up to that point would be -2.34%. The accumulated profit eventually

stabilises at -3.0% from 2025 onwards. Thus, a business subject to regulatory cycles that begin in 2007, 2012, 2017 etc would prefer the switch to a trailing average to occur at the end of 2016 because the accumulated profit up to that point would be greatest and it would not be subsequently eroded away by virtue of switching to a trailing average regime without any transitional period.

Table 5: The Effects of Switching with no Transitional Process

Year	Prevailing	Paid	Allowed	Profit (Allowed – Paid)	Accumulated Profit
2006	1.3	1.3	1.3	0	0
2007	1.3	1.3	1.3	0	0
2008	2.0	1.37	1.3	-0.07	-0.07
2009	3.0	1.54	1.3	-0.24	-0.31
2010	4.5	1.86	1.3	-0.56	-0.87
2011	4.0	2.13	1.3	-0.83	-1.70
2012	3.6	2.36	3.6	1.24	-0.46
2013	3.2	2.55	3.6	1.05	0.59
2014	2.6	2.68	3.6	0.93	1.51
2015	2.0	2.75	3.6	0.85	2.36
2016	1.3	2.75	3.6	0.85	3.21
2017	1.3	2.75	1.3	-1.45	1.76
2018	1.3	2.68	1.3	-1.38	0.38
2019	1.3	2.51	1.3	-1.21	-0.83
2020	1.3	2.19	1.3	-0.89	-1.72
2021	1.3	1.92	1.3	-0.62	-2.34
2022	1.3	1.69	1.3	-0.39	-2.73
2023	1.3	1.50	1.3	-0.20	-2.93
2024	1.3	1.37	1.3	-0.07	-3.00
2025	1.3	1.3	1.3	0	-3.00

These calculations assume that the commencement year for the regulatory cycle includes 2007. However the commencement year might be any of 2008, 2009, 2010, or 2011. Calculations of

the type shown in Table 5 are therefore performed for each of those situations, and these are used to determine the consequences of switching from the current regime to a ten-year trailing average at various points in time. For example, suppose the switch commenced at the end of 2011. This would allow an immediate switch for businesses subject to a 2007-2011 cycle, with accumulated profits up to that point of -1.70% as discussed in the previous paragraph. However, businesses subject to a 2008-2012 cycle could only be switched one year later at the end of 2012 (with accumulated profits of 0.74% to that point), businesses subject to a 2009-2013 cycle could only be switched two years later (with accumulated profits of 4.49% to that point), businesses subject to a 2010-2014 cycle could only be switched in three years (with accumulated profits of 10.61% to that point), and businesses subject to a 2011-2015 cycle could only be switched in four years (with accumulated profits of 6.66% to that point). All of these results are shown in the fourth column of Table 6 because they represent the consequences of a regulator commencing switching at the end of 2011 even if the actual switch for most businesses must be delayed. Since a regulator regulates many businesses, and the commencement years for the cycles vary, I have assumed that the commencement year is equally likely to be anywhere in this band from 2007-2011, and have therefore averaged over the results in the fourth column of Table 6, yielding 4.16%. So, if a regulator chooses to commence switching at the end of 2011, the aggregate effect on businesses will be to lock-in accumulated profits from the GFC of 4.16% of their aggregate debt level.

Table 6: Accumulated Profits for Various Switching Times with no Transitional Process

Cycle	2009	2010	2011	2012	2013	2014	2015
2007-2011	-1.70	-1.70	-1.70	3.21	3.21	3.21	3.21
2008-2012	0.74	0.74	0.74	0.74	3.26	3.26	3.26
2009-2013	4.49	4.49	4.49	4.49	4.49	3.88	3.88
2010-2014	-0.31	10.61	10.61	10.61	10.61	10.61	7.17
2011-2015	-0.87	-0.87	6.66	6.66	6.66	6.66	6.66
Average	0.47	2.65	4.16	5.14	5.65	5.52	4.84

If this process is repeated for a switch commencing at the end of other possible years, from 2009 till 2015, the results are shown in the other columns of Table 6. Starting with 2009, as the earliest switch date moves further into the future, the average profit initially rises to a peak

of 5.65% for switching commencing at the end of 2013 and then declines from there down to zero in 2021.

This analysis presumes that any switch from the current regime to a trailing average regime occurs without any transitional process and would therefore require DRP data for the ten years preceding the switch time. As noted in section 2.3, this would present considerable implementation difficulties unless the regulator was prepared to use DRP data such as the BFVC. Accordingly, I now consider the consequences of adopting a transitional process so as to avoid the need for historical data at the switch time. I therefore reconstruct Table 6 but instead assume that the QTC's transitional regime operates once the switch is made.[6] Given that the current time is January 2014, I consider only switch times at the ends of 2013, 2014 and 2015. The situation is now quite different because switching does not immediately give rise to an allowed DRP equal to the ten-year trailing average and therefore the accumulated profits may continue to change rather than being frozen at the switching point.

For example, suppose the regulator begins switching from the end of 2013. In respect of businesses with regulatory cycles that commence in 2007, 2012, 2017, etc, the first opportunity to switch these businesses will be at the end of 2016. As shown in the second column of Table 5, the DRP is 1.3% from 2017 onwards. So, using the QTC's transitional scheme, such businesses would receive a DRP allowance of 1.3% in each year from 2017 onwards. Coincidentally, this is the same as currently shown in the fourth column of Table 5 (which corresponds to the present regime) because the prevailing DRP is 1.3% from 2017 onwards. However these businesses would be paying the trailing average DRP shown in the third column of Table 5, which exceeds the DRP allowance until 2025 at which point their accumulated profits stabilise at -3.0% as shown in the last row of the last column of Table 5. So, if a regulator commences switching from the end of 2013, businesses with regulatory cycles that commence in 2007, 2012, 2017, etc will experience accumulated profits from the GFC of -3.0%. If the regulator commences switching from the end of 2014 or even 2015, the result will be the same for these businesses. These results are shown in Table 7 along with those for businesses with different start dates for their regulatory cycles. By contrast with Table 6, commencement of the switch from the end of 2013 yields only trivial accumulated profits from the GFC and these dwindle to zero if switching commences from the end of 2015.

[6] The results from using the ACCC's proposed transitional regime are similar.

I understand that the aggregate asset values of the businesses that are regulated by the QCA is about $26b. Assuming leverage of 60%, the aggregate debt level would be about $16b. Consequently, if the QCA switched to a trailing average DRP from the end of 2013 (without a transitional regime), the cumulative profits of the businesses resulting from the GFC spike in the DRP would be about 5.65% of $16b (see Table 6), which is about $900m. This is a substantial sum of money. Even if the switch commenced from the end of 2015, these accumulated profits would still be 4.84% of $16b, which is $770m. By contrast, if the transitional process proposed by the QTC were adopted, then the accumulated profits from the GFC would be trivial: for switching commencing at the end of 2013, these are 0.34% of $16b ($50m) declining to zero if switching commences from the end of 2015 (see Table 7). This strengthens the argument for a regulator adopting a transitional regime, if they do switch to a trailing average for the allowed DRP. In addition, without a transitional regime, the results in Table 6 would also explain why (and when) some regulated businesses would be keen to switch to a trailing average. In particular, Table 6 indicates that businesses on a 2009-2013 cycle would want to switch at the end of that cycle, those on a 2010-2014 cycle would want to switch at the end of this cycle, and so on. Unsurprisingly, both Aurizon and the DBCT (who are both on 2010-2015 cycles) have not petitioned the QCA to switch (but might be expected to do so as they approach the next regulatory cycle).

Table 7: Accumulated Profits for Various Switching Times with the QTC Transition Process

Cycle	End of 2013	End of 2014	End of 2015
2007-2011	-3.00	-3.00	-3.00
2008-2012	-1.50	-1.50	-1.50
2009-2013	1.85	0.50	0.50
2010-2014	5.35	5.35	5.00
2011-2015	-1.00	-1.00	-1.00
Average	0.34	0.07	0

In summary, the DRP spike arising from the GFC temporarily boosted the allowed revenues of regulated businesses relative to the costs actually incurred by them and this effect is gradually being reversed over time. Thus, having benefited from this highly unusual event, businesses

would at some point benefit from a switch to a trailing average DRP or entire cost of debt regime without a transitional process so as to lock-in the maximum accumulated GFC benefit. By contrast, if a transitional process were adopted, then the accumulated profits from the GFC would be trivial, even if switching commenced from the end of 2013. This strengthens the argument for a regulator adopting a transitional regime, if they do switch to a trailing average for the DRP or the entire cost of debt.

8. The Choice of Current Rate Versus Trailing Average

Three regulatory options are considered here, corresponding to the present regime, a hybrid regime involving the risk free rate prevailing at the beginning of the regulatory cycle coupled with a ten-year trailing average regime for the DRP, and a ten-year trailing average regime for the entire cost of debt.

I start with the current regime, in which the regulator sets the allowed cost of debt in accordance with the risk free rate and the DRP prevailing at the beginning of each regulatory cycle. Although there is a feasible debt strategy that in conjunction with the current regime satisfies the NPV = 0 principle, involving borrowing to match the regulatory cycle, this debt strategy is unviable because of the firm's significant exposure to refinancing risk. Faced with the current regulatory regime, businesses have reacted by borrowing long-term, with staggering, to deal with refinancing risk and using interest-rate swap contracts to align the risk-free rate component of their cost of debt with the regulatory cycle. Consequently, although the regulator allows a DRP that reflects the rate prevailing at the beginning of each regulatory cycle, the firm pays the trailing average DRP. This combination of firm and regulatory policy does not satisfy the NPV = 0 principle and it also gives rise to very moderate bankruptcy risk. However there are a number of desirable features of this regulatory regime. Firstly, it is easily implemented because it requires knowledge of only the DRP and the risk-free rate prevailing at the beginning of the regulatory cycle. Secondly, relative to a pure trailing average regime in which the trailing average is applied to all debt, it minimises the incentive problems for capex and new entrants during a regulatory cycle because it allows a DRP equal to that prevailing at the beginning of that regulatory cycle (which is more relevant to capex and a new entrant that a trailing average rate). Alternatively, relative to a trailing average in which new debt for capex and new entrants receives the current rate and is then gradually adjusted to the trailing average, the current regime avoids the complexity of that dual system.

The second option is the hybrid regime, which involves the regulator setting the risk-free rate component of the cost of debt in accordance with that prevailing at the beginning of the regulatory cycle and using a trailing average regime for the DRP. There is a feasible debt strategy that in conjunction with this regulatory regime satisfies the NPV = 0 principle, and is also viable: borrow long-term (staggered) coupled with interest-rate swap contracts that align the risk-free rate component of the firm's cost of debt with the regulatory cycle. In addition, output prices are moderately less variable over time than under the first option. A further advantage alleged by QTC (2012a, pp. 36-37) and the AER (2013, page 84) is that the DRP is inevitably estimated with error and a trailing average will give rise to a lower variance in the estimation error than the present regime; this is akin to a larger sample size reducing the variance in estimation errors in a conventional statistical estimation exercise. However, re-estimation of the DRP on a five-yearly basis in accordance with the present regime will give rise to a large set of estimates over the life of the asset and a regulated business typically has many such assets. So, even with the present regime, the 'sample size' is still very large and therefore the incremental benefit from the regulatory use of a trailing average will not be great. Notwithstanding these advantages, the hybrid regime has a number of undesirable features. Firstly, unless a transitional process is adopted that circumvents the need for historical DRP data, it requires knowledge of the DRP for each of the last ten years and this will be problematic if the regulator rejects the BFVC. Secondly, there are incentive problems for capex and new entrants because it allows a DRP that reflects the trailing average DRP whilst the capex or new entrant will incur the prevailing DRP. This incentive problem for capex and new entrants can be addressed but only at the expense of adding to the complexity of the regime.

The third option involves the regulator using a trailing average regime for the entire cost of debt. There is a feasible debt strategy that in conjunction with this regulatory regime satisfies the NPV = 0 principle, and is also viable: borrow long-term (staggered) and without interest-rate swap contracts. In addition, output prices are significantly less variable over time than under the first and second options. However it has a number of undesirable features. Firstly, unless a transitional process is adopted that circumvents the need for historical DRP data, it requires knowledge of the DRP for each of the last ten years and this will be problematic if the regulator rejects the BFVC. This problem is identical to that of the second option. Secondly, there are incentive problems for capex and new entrants because it allows a cost of debt that reflects the trailing average cost of debt whilst the capex or new entrant will incur the prevailing

cost of debt. These problems are even graver than for the second option because the total allowed cost of debt rather than just the DRP is based upon a trailing average. As discussed above, this incentive problem for capex and new entrants can be addressed but only at the expense of adding to the complexity of the regime. Thirdly, if transitional arrangements are adopted, each of the two transitional schemes that have been proposed has a significant drawback: as discussed in section 6, the QTC's transitional proposal fails to mirror the transitional process that a firm would adopt in respect of the risk-free rate component of the cost of debt while the ACCC's transitional proposal would involve the use of DRPs for terms shorter than that used by businesses.

Fourthly, this approach involves observing the behavior of benchmark firms (ideally, efficient unregulated firms that are otherwise similar to the firms in question) and mirroring that behavior in the regulatory regime. Thus, upon observing that efficient unregulated firms have an average debt term of (say) ten years, the regulatory regime then involves a ten-year trailing average cost of debt. It is implicit in such an approach that the benchmark firms borrow but do not then enter into swap contracts to shorten the effective life of their debt, in respect of the risk free rate or DRP components. However, it is unlikely that efficient unregulated firms would act in this way because debt is (in general) 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 refinancing 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 volatility arising from a shorter effective debt term. Consequently an efficient unregulated 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 cost of debt for firms that are regulated with a trailing average 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 a regulator who set the allowed cost of debt in accordance with the ten-year trailing average of the ten-year cost of debt would in general be providing an excessive allowance (because the ten-year risk free rate is typically larger than the three-year risk free rate).[7] Even if the regulator sought to overcome this problem

[7] This issue does not arise in respect of the risk free rate under the current regime because the choice of risk free rate under the current regime is based purely upon the length of the regulatory cycle rather than any attempt to mirror the actual behavior of firms. The same point applies to the risk free rate under the hybrid regime.

by allowing the ten-year DRP and (say) the three-year risk free rate, 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 interest rate 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 regulated firms 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 regime is the present one and the regulatory cycle is five years, regulated firms could be expected to convert the risk free rate component of their cost of debt into five year debt and the evidence presented indicates that they do this (AER, 2009, pp. 152-153). This tells us nothing about how they would behave if they were not regulated.

To illustrate this point, suppose that otherwise similar unregulated firms have ten-year debt, use interest rate swap contracts to convert the risk free rate component of their cost of debt to the three-year rate, the average ten-year DRP is 2%, the average ten-year risk-free rate is 6%, the average three-year risk-free rate is 5%, and the transactions costs of the swap contracts are 0.20%. The average cost of debt of these firms is then 7.2%, comprising the average three-year risk-free rate of 5%, the ten-year DRP of 2%, and the transactions costs of the swap contracts. However, a regulator who merely observed their average debt term of ten years and ignored their interest-rate swap contracts would allow a ten-year cost of debt, with an average rate of 8%. The allowed cost of debt would then be too high by 0.8%.[8]

Relative to the second option, the third option has lower variation over time in output prices but it has three disadvantages: greater incentive problems for capex and new entrants (unless these problems are addressed), the need for a transitional regime that will embody some drawback regardless of the choice of transitional regime (the QTC's transitional proposal fails to mirror the transitional process that a firm would adopt in respect of the risk-free rate component of the cost of debt while the ACCC's transitional proposal would involve the use

[8] This does not involve a violation of the NPV = 0 principle because it is feasible for unregulated firms to borrow for ten years and not use interest rate swap contracts, imposition of the trailing average regime for the entire cost of debt would not be expected to change the behaviour of firms acting in this way, and this combination of firm and regulatory behaviour would satisfy the NPV = 0 principle. It could not even be argued that such behaviour by firms was unviable. However, given the widespread use of interest rate swap contracts by unregulated firms, it is unlikely that unregulated firms would act in this fashion. Consequently, any regulator who adopts the trailing average regime described here would probably not be mirroring the behaviour of such firms and would therefore fail to satisfy its own objective of mirroring the behaviour of unregulated firms.

of DRPs for terms shorter than that used by businesses), and it would allow too high a cost of debt by failing to mirror the behavior of otherwise similar unregulated firms (by copying the average debt term of such firms whilst ignoring the interest rate swap contracts that such firms would likely engage in and which have the effect of reducing the risk-free rate component of their cost of debt). This suggests that the second option is superior to the third. In comparing the first and second options, the first option suffers from the disadvantage that there is no viable debt strategy that can be combined with it to satisfy the NPV = 0 principle, it raises bankruptcy risk, and it also gives rise to greater output price variation over time. However it is easier to implement, and has lesser incentive problems for capex and new entrants (or less complexity if these incentive problems are addressed). Thus, the choice will be affected by the extent of the increased bankruptcy risk, the increased price variation, and the importance of the violation of the NPV = 0 principle. In respect of the greater bankruptcy risk, this issue was examined in section 2.6 using data from the GFC period and the increase was not substantial. In respect of the greater price variation, this issue was examined in section 2.8 using data from 2003-2013 and the increase was not substantial. In respect of violations of the NPV = 0 principle, Lally (2010, Appendix 1) analyses this issue and finds that the violations are not substantial. Furthermore, the CDS market is likely to continue to develop and may reach the point at which the DRP risk under the present regime can be better hedged by regulated businesses, in which case these three concerns would be further ameliorated. Accordingly, whilst there is a case for changing policy, I do not think that there is a strong case for doing so and I therefore favour continued use of the present regime.

In summary three regulatory options are considered here, corresponding to the present regime, a hybrid regime involving the risk free rate prevailing at the beginning of the regulatory cycle coupled with a ten-year benchmark trailing average for the DRP, and a ten-year trailing average for the entire cost of debt. Relative to the second option, the third option has lower variation over time in output prices but it has greater incentive problems for capex and new entrants (unless these problems are addressed), requires a transitional regime that will embody some drawback regardless of the choice of transitional regime (the QTC's transitional proposal fails to mirror the transitional process that a firm would adopt in respect of the risk-free rate component of the cost of debt while the ACCC's transitional proposal would involve the use of DRPs for terms shorter than that used by businesses), and it would allow too high a cost of debt by failing to mirror the behavior of otherwise similar unregulated firms (by copying the average debt term of such firms whilst ignoring the interest rate swap contracts that such firms

would likely engage in and which have the effect of reducing the risk-free rate component of their cost of debt). This suggests that the second option is superior to the third. In comparing the first and second options, the first option suffers from the disadvantage that there is no viable debt strategy that can be combined with it to satisfy the NPV = 0 principle, it raises bankruptcy risk, and it also gives rise to greater output price variation. However it is easier to implement, and has lesser incentive problems for capex and new entrants (or lesser complexity if these incentive problems are addressed). Furthermore the increased bankruptcy risk was minor during the GFC, the increased price variation was minor over the 2003-2013 period, and the violations of the NPV = 0 principle are not a major issue. In addition the CDS market is likely to continue to develop and may reach the point at which the DRP risk under the present regime can be better hedged by regulated businesses, in which case these concerns would be further ameliorated. Accordingly, whilst there is a case for changing policy, I do not think that there is a strong case for doing so and I therefore favour continued use of the present regime.

9. Review of the QTC's Submission

The QTC (2013a, pp. 9-10) favours potentially allowing different regimes for different firms. The difficulties with this have been outlined in section 5.

The QTC (2013a, page 17) argues that use of the prevailing regime exposes consumers to potentially large price changes at the end of a regulatory period. This issue has been examined in section 2.8, using data from 2003-2013. This examination revealed that, relative to the current regime, the use of a trailing average DRP would have moderately reduced output variation over time and use of a trailing average for the entire cost of debt would have significantly reduced output price variation.

The QTC (2013a, page 19) argues that, whilst interest rates are mean reverting, they can depart from the mean for protracted periods and therefore high interest rates do not necessarily imply a rapid fall back towards the mean. Consequently, high interest rates do not induce firms whose allowed cost of debt is based upon a trailing average to delay investment in the expectation that interest rates will quickly fall. The QTC seems to believe that firms exposed to such a situation would invest without delay. A more reasonable conclusion is that they would delay until it was profitable for them to invest, even if the delay was protracted. Furthermore, the key issue is not that firms would delay until interest rates reverted to the mean level (as the QTC seems

to believe) but that they would delay until the trailing average caught up with the prevailing rate. For example, suppose the mean interest rate is 8%, the trailing average is also 8% and the prevailing rate is 10%. As time passes, the prevailing rate may not revert to 8% and may even remain at 10% but the trailing average will converge on the prevailing figure. At that point, firms will have the incentive to invest but the time lag may be substantial. However, if the QTC's (2013b, section 2) proposal for dealing with new debt arising from capex and new entrants is adopted, these issues evaporate.

10. Conclusions

My principal conclusions are as follows. Firstly, there are only two combinations of a viable debt policy (feasible and not so inefficient that firms would avoid it) and a regulatory policy that satisfy the NPV = 0 principle. One involves the regulator using a trailing average regime for the entire cost of debt whilst firms borrow long-term and stagger the borrowing to ensure that only a small proportion of the debt would mature in any one year (thereby reducing refinancing risk to a minimal level). The other combination involves the regulator setting the risk free rate component of the cost of debt in accordance with the rate prevailing at the beginning of the regulatory cycle and the DRP in accordance with a trailing average regime whilst firms borrow long-term, stagger the borrowing to ensure that only a small proportion of the debt would mature in any one year, and use interest rate swap contracts to align the risk-free rate component of their cost of debt to that allowed by the regulator. However there is no viable debt policy in combination with the present regulatory policy, in which the regulator sets the entire cost of debt in accordance with the rate prevailing at the beginning of the regulatory cycle, that can satisfy the NPV = 0 principle.

Secondly, if the regulator uses a trailing average regime for the DRP and favours its own estimates of the DRP over those from a third-party source such as the BFVC and does not use a transitional regime that avoids the use of historical data, it will be much more difficult to implement the DRP trailing average regime than the current regime due to the sheer quantity of historical DRP data that will be required. Thus, if a regulator uses a trailing average regime, a transitional regime that avoids the use of historical DRP data is desirable. In addition, although the use of a trailing average regime by a regulator may better reflect the cost incurred by a firm than the present regime (and will do so for the DRP), it does not guarantee that the

allowed cost of debt (or the allowed DRP if the trailing average regime is limited to the DRP) will correspond to the cost incurred by every firm or even any firm.

Thirdly, there is no inconsistency in using the prevailing risk free rate for setting the allowed cost of equity and using a trailing average regime for setting the allowed cost of debt or the DRP. The NPV = 0 principle requires the use of the prevailing risk free rate for setting the allowed cost of equity but it does not require use of the prevailing cost of debt. Any feasible debt policy coupled with a matching regulatory policy for setting the allowed cost of debt will satisfy the NPV = 0 principle.

Fourthly, if a trailing average regime is adopted for either the DRP or the entire cost of debt, application of the trailing average to both new debt to support capex and new debt arising from new entrants to an industry as well as existing debt has the disadvantage of discouraging capex and new entrants when the prevailing cost of debt is above the trailing average and improperly encouraging them when the prevailing cost of debt is below the trailing average. These problems can be eliminated by applying the prevailing rate to both new debt arising from capex and new entrants, and then gradually adjusting the rate towards the trailing average in the manner proposed by the QTC, but this adds to the complexity of the trailing average regime.

Fifthly, under the current regime, the allowed DRP may significantly differ from that incurred by a firm thereby raising the risk of bankruptcy. Changes in the net cash flow of regulated businesses are therefore examined under this regime over the period 2007 to 2013 relative to the 2007 value. The most adverse outcome involved businesses whose regulatory reset was during 2007, for whom net cash flows declined in the period 2007-2011 (but only by 11%) because the trailing average DRP paid by these businesses rose but the allowed DRP did not rise until 2012, after which the increase in the allowed DRP outweighed the fall in the allowed cost of equity and the net cash flow then rose. Thus the current regulatory regime has not given rise to any material bankruptcy risk for regulated businesses.

Sixthly, the variation over time in output prices has been assessed under the current regime, application of a trailing average regime to the DRP, and application of a trailing average regime to the entire cost of debt. Using data from 2003 to 2013, output prices would have exhibited moderately less variation if a trailing average were applied to the DRP compared to the current regime, and substantially less if a trailing average were applied to the entire cost of debt.

Seventhly, the regulator's choice of the prevailing rate or a trailing average regime for the risk-free rate component of the cost of debt should not affect the risk faced by equity holders because firms could be expected to act so that their cost incurred matches that allowed by the regulator (by using interest rate swap contracts if the regulator uses the prevailing rate, and not otherwise). However the regulator's choice of the prevailing rate or a trailing average regime for the DRP may affect the firm's equity beta, and therefore its cost of equity. Although it is not possible to ascertain the impact, because all of the returns data that is available to estimate beta is drawn from firms subject to the present regime in which revenues or prices are set using the prevailing DRP, the fact that market prices are forward-looking and that the regulator's choice won't affect the average net cash flow outcome imply that any impact from the regulator's choice of regime on market prices and hence beta should be minimal.

Eighthly, using the swap rate rather than the CGS rate as the base rate in setting the allowed cost of debt produces a closer match between the allowed cost of debt and that actually incurred by the firm. However, the effect is small in absolute terms, and small relative to the use of a trailing average regime for the DRP rather than the prevailing DRP. Consequently there is a not a strong argument for change and I therefore favour continued use of the government bond rate as the base rate.

Ninthly, if a regulator does adopt a trailing average regime for the cost of debt or the DRP, the results from fixing that value at the beginning of the regulatory cycle or engaging in annual updating (either formally or via an 'unders and overs' account) can be significantly different. Furthermore, the use of a trailing average regime is premised on the need to better match the allowed cost to that actually incurred. Since the cost actually incurred better corresponds to the trailing average with annual updating, this suggests that annual updating should be used if a trailing average regime is adopted.

Tenthly, I do not favour allowing firms to choose between alternative regimes because it is more likely to result in firms choosing the regime that maximises their (short-term) revenues rather than the one that best reflects their preferred debt management policy. In addition, I do not favour a regulator assigning different regimes to different firms because it is likely to induce a substantial amount of 'litigation' from firms seeking to improve their (short-term) revenues.

Eleventhly, if a regulator adopts a trailing average regime for the DRP or the entire cost of debt, a transitional regime may be adopted and it has two possible purposes: to mirror the transitional process that the regulated entity would go through (if it does do so) and to initiate the switch to the new regulatory regime without the need to collect historical data. Both the ACCC and the QTC have proposed transitional processes. In respect of the risk free rate component of the cost of debt, the ACCC's proposal achieves both objectives whilst the QTC's proposal only avoids the need to collect historical data and does not mirror the transitional process that the entity would go through; the ACCC's proposal is then superior. In respect of the DRP component of the cost of debt, both proposals serve only to initiate the switch to the new regulatory regime without recourse to historical data and mirroring the behaviour of regulated entities is irrelevant because such entities would not change their behaviour in response to the regulator's use of a trailing average DRP. However, during the transitional period, the ACCC's proposal would involve the use of DRPs for terms shorter than that actually used by firms whilst the QTC's proposal would not have this undesirable feature; the QTC's approach is then superior for the DRP. So, if a regulator adopts a trailing average for only the DRP, the QTC's transitional process is superior. By contrast, if a regulator adopts a trailing average regime for the entire cost of debt, the QTC's transitional proposal fails to mirror the transitional process that a firm would actually go through in respect of the risk-free rate component of the cost of debt while the ACCC's transitional proposal would involve the use of DRPs for terms shorter than that used by businesses, and therefore both proposals have disadvantages.

Twelfthly, the DRP spike arising from the GFC temporarily boosted the allowed revenues of regulated businesses relative to the costs actually incurred by them and this effect is gradually being reversed over time. Thus, having benefited from this highly unusual event, businesses would at some point benefit from a switch to a trailing average DRP or entire cost of debt regime without a transitional process so as to lock-in the maximum accumulated GFC benefit. By contrast, if a transitional process were adopted, then the accumulated profits from the GFC would be trivial, even if switching commenced from the end of 2013. This strengthens the argument for a regulator adopting a transitional regime, if they do switch to a trailing average for the DRP or the entire cost of debt.

Finally, and in respect of the appropriate regulatory policy, three regulatory options are considered here, corresponding to the present regime, a hybrid regime involving the risk free

rate prevailing at the beginning of the regulatory cycle coupled with a ten-year trailing average for the DRP, and a ten-year trailing average for the entire cost of debt. Relative to the second option, the third option has lower variation over time in output prices but it has greater incentive problems for capex and new entrants (unless these problems are addressed), requires a transitional regime that will embody some drawback regardless of the choice of transitional regime (the QTC's transitional proposal fails to mirror the transitional process that a firm would adopt in respect of the risk-free rate component of the cost of debt while the ACCC's transitional proposal would involve the use of DRPs for terms shorter than that used by businesses), and it would allow too high a cost of debt by failing to mirror the behavior of otherwise similar unregulated firms (by copying the average debt term of such firms whilst ignoring the interest rate swap contracts that such firms would likely engage in and which have the effect of reducing the risk-free rate component of their cost of debt). This suggests that the second option is superior to the third. In comparing the first and second options, the first option suffers from the disadvantage that there is no viable debt strategy that can be combined with it to satisfy the NPV = 0 principle, it gives rise to greater bankruptcy risk, and it also gives rise to greater output price variation. However it is easier to implement, and has lesser incentive problems for capex and new entrants (or lesser complexity if these incentive problems are addressed). Furthermore the increased bankruptcy risk was minor during the GFC, the increased price variation was minor over the 2003-2013 period, and the violations of the NPV = 0 principle are not a major issue. In addition the CDS market is likely to continue to develop and may reach the point at which the DRP risk under the present regime can be better hedged by regulated businesses, in which case these concerns would be further ameliorated. Accordingly, whilst there is a case for changing policy, I do not think that there is a strong case for doing so and I therefore favour continued use of the present regime.

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