Rule change proposals relating to the debt component of the regulated rate of return

Report for AEMC

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1. Executive summary

Background and context

1. SFG Consulting (**SFG**) has been engaged by the Australian Energy Market Commission (**AEMC**) to provide advice in relation to proposals to vary the National Electricity Rules (**NER**) and the National Gas Rules (**NGR**). The proposals have been made by the Australian Energy Regulator (**AER**) and the Energy Users Rule Change Committee (**EURCC**).

2. The AEMC is required to consider these proposals within the context of the National Electricity Law (**NEL**) and the National Gas Law (**NGL**). Specifically, the AEMC is required to have regard to the National Electricity Objective (**NEO**) and the National Gas Objective (**NGO**) and whether any rule change would contribute to the achievement of the relevant objective. The AEMC must also take into account the Revenue and Pricing Principles (**RPP**) that are set out in the NEL and NGL respectively.

Potential rule changes

3. The options in relation to the return on debt that are examined in this report are:

   a) **Status quo** – based on an estimate of the "cost of debt" at the time of each regulatory determination under the current NER and NGR. Under both sets of rules, the allowed return on debt is determined as the sum of the risk-free rate and debt risk premium (DRP), both of which are estimated as the average over a rate-setting period that is usually 20-40 days some time shortly before the determination date. Current regulatory practice (not codified into the Rules) is to estimate the risk-free rate with reference to the yield on government bonds (AER uses 10-year term and ERA uses 5-year term), and to estimate DRP with reference to the estimated yield on Australian corporate bonds with benchmark term and credit rating (AER currently uses Bloomberg fair value curve and Economic Regulatory Authority of Western Australia [**ERA**] performs its own calculations from raw bond yield data);

   b) **EURCC Proposal** – based on a five-year rolling average of the yield on five-year bonds, codified in the Rules, annual updates during each regulatory period, and with no transition arrangements;

   c) **QTC Submission to the AEMC rule change process** – based on a ten-year rolling average of the yield on ten-year bonds (or whatever the benchmark term of debt is determined to be), annual updates, detailed transition arrangements, and capital expenditure during each regulatory period being able to earn a return commensurate with the rate at the time of investment rather than the historical average;

   d) **ETSA/Citipower/Powercor submission to the AEMC rule change process** – based on a ten year rolling average of the debt risk premium on ten-year corporate bonds added to the five-year swap rate at the time of the determination.

Effect of proposed rule changes

4. There are two key differences between the current approach and the proposed averaging approaches:

a) For a given benchmark (in particular, the assumed credit rating and term to maturity), whether the regulatory allowance is based on the spot rate or an average of that spot rate over time, the average cost of debt will be the same over the long run. That is, changing to an averaging approach will not, in itself, systematically reduce the allowed return on debt; and

b) Averaging approaches will, by definition, result in smoother estimates of the allowed return on debt over time. But smoothing the allowed return of debt is not the primary objective, otherwise this could be achieved by simply specifying a constant allowed return on debt in the Rules.

The link between the Rules and debt management practices

5. There is clear evidence that regulated businesses will seek to align their debt management practices with the way the allowed return on debt is estimated under the Rules. Any approach for determining the regulatory allowance for the return on debt that is specified in the Rules will be based on an implicit debt management practice. Regulated businesses seek to align their debt management practices with the approach that is implicit in the Rules. Doing this results in a match between the firm's actual debt service payments and the allowed return on debt. Any mis-match between the cash inflows and cash outflows in relation to the return on debt will flow through to the equity holders. In summary, if the firm is able to implement the debt management approach that is implicit in the Rules, the result is a reduction in the volatility of cash flows to equity holders. There is a commensurate reduction in the volatility of prices for consumers.

6. Different firms have a different range of debt management practices that are open to them, depending upon their characteristics. For example:

a) It is infeasible for all but very small firms to issue all of their required debt at the time of each determination;

b) Very large firms do not have access to the interest rate swaps market at the time of each determination because the market is not deep enough to meet their requirements; and

c) Single network businesses cannot rely on diversification across their portfolios.

7. The debt management practice that is implicit in the current Rules cannot be implemented in practice. This inevitably results in a difference between the cost of servicing debt and the allowed return on debt. However, it is important to note that this differential is symmetric over time. Under some market conditions the allowed return on debt will exceed present debt service costs, and under other conditions the reverse will occur.

8. The potential Rule changes set out above each imply a particular debt management strategy, with different strategies being more appropriate for different types of businesses. For example:

a) The ETSA/Citipower/PowerCor approach assumes a strategy whereby a base interest rate is locked in using swaps. QTC submits that this would be infeasible for them to implement on behalf of their clients due to the size of their clients relative to the depth of the swaps market; and

b) The QTC approach assumes a strategy of regular fixed rate debt issuances. ETSA/Citipower/PowerCor submit that this approach would result in additional costs to them for no additional benefit relative to their own proposal.

9. This has led to a number of proposals to allow each business to select the method for determining the regulatory allowance for debt that best matches the debt management approach that is appropriate for the particular business. In particular, a number of business and industry groups have proposed that each business should be allowed to select between:

a) The current approach;

b) The QTC approach; and

c) The ETSA/Citipower/PowerCor approach.

10. In this report, we demonstrate that matching the debt management approach that is implied by the Rules with an actual debt management approach that can be implemented in practice results in businesses recovering their actual debt service costs. This in turn materially reduces the volatility of cash flows to equity and the variability of price changes for customers.

Key issues

11. The key issues when considering the rule change proposals that have been made in relation to the allowed return on debt include:

a) Given a particular benchmark for the cost of debt, the long-run average regulatory allowance for the cost of debt will be the same regardless of which method is adopted in the Rules. This means that, over time, consumers will pay the same amount to provide a return to debt holders regardless of which approach is adopted in the Rules;

b) Every specification that might be inserted into the Rules implies a particular debt management strategy. Whether a business is able to implement a particular debt management strategy depends on its characteristics. Not every business will be able to implement a particular strategy, which has led to submissions proposing that each business should be allowed to select a strategy (and consequently a Rule specification) that is appropriate for its circumstances;

c) Matching the debt management approach that is implied by the Rules with an actual debt management approach that can be implemented in practice results in businesses recovering their actual debt service costs. This in turn materially reduces the volatility of cash flows to equity and the variability of price changes for customers;

d) It is *not* the case that there is a fixed amount of volatility and the only question is how that should be distributed between shareholders and customers. Rather, shareholders and customers are on opposite sides of the same risk. If there is a mis-match between the cost of servicing debt and the regulatory allowance, then in some cases shareholders receive excess returns and customers pay relatively too much. But the reverse also occurs just as frequently. This means that shareholders and customers both wear the same risk – they are simply on opposite sides of it. If the regulatory allowance can be made to match the cost of serving debt, the risk is eliminated for both shareholders *and* customers;

e) The volatility of cash flows is not the only relevant consideration. The method for determining the allowed return on debt also affects asset values and incentives in relation to capital expenditure. These complex effects are examined in the context of a simulation analysis in this report; and

f) Allowing businesses to select from a number of methods for determining the allowed return on debt might be combined with a mechanism to ensure that there is no incentive to game that selection. This can be achieved by ensuring that the business must make its selection before it knows which approach is likely to produce a higher allowed return. The QTC transition arrangements ensure that this is the case, as would ensuring that the election of the method occurs in advance of the determination date.

Conclusions

12. Our primary conclusions are that:

a) Different businesses employ different debt management strategies according to their circumstances. For example, some techniques that are available to small businesses cannot be implemented by large businesses due to lack of depth in the market, and techniques that are appropriate for a diversified business are not employed by single-asset network businesses;

b) If there is a "match" between the actual debt management strategy employed by the business and the method used to compute the allowed return on debt, the business is compensated for its actual payments to service debt. This means that customers do not pay more, or less, than the actual cost of servicing debt, and that cash flows to equity are not affected by a differential between actual debt service payments and the regulatory allowance;

c) Many businesses would only consider a switch to a different method if appropriate transition arrangements could be put in place. For example, a business cannot today go back and borrow at a rate that applied ten years ago. If the regulatory allowance was set on this basis (by not allowing an appropriate transition arrangement), the result will be either a potentially material benefit or loss to the business – and conversely a potentially material loss or benefit for customers. Moreover, an appropriate transition arrangement effectively destroys any incentive or ability for a business to seek to "game" the regulatory allowance by proposing whichever method might result in the highest allowance; and

d) The historical average return can be more than 3% higher or lower than the prevailing rate at a particular point in time. If new capital expenditure earns a return that is materially different from the prevailing rate, there are obvious incentive problems.

13. In summary:

a) There are potentially positive benefits between having a "match" between the actual debt management strategy employed by a business and the allowed return on debt;

b) Appropriate transition arrangements must be put in place; and

c) Capital expenditure during the regulatory period must earn the prevailing rate.

2. Consultation

14. In preparing this report, we have had regard to:

    a) The rule change proposal of the EURRC, including supporting reports and references;

    b) The rule change proposal of the AER insofar as it relates to the estimation of debt risk premium;

    c) The submissions received prior to the issuance of the AEMC's Directions Paper, insofar as they relate to the estimation of the allowed return on debt;

    d) The submissions received subsequent to the issuance of the AEMC's Directions Paper, insofar as they relate to the estimation of the allowed return on debt;

    e) The supplementary submission from Queensland Treasury Corporation (**QTC proposal**); and

    f) The submissions received in response to the QTC proposal.

15. Through the AEMC, we have also met with a range of stakeholders in a series of meetings designed to assist us in:

    a) Understanding the perspectives of different stakeholders; and

    b) Identifying the key issues that require consideration from the AEMC.

16. A summary of those stakeholder meetings is set out in Table 1 below.

Table 1. Stakeholder meetings

Stakeholder	Date	Location
QTC	19-Apr	Brisbane
DBP	26-Apr	Teleconference (Perth)
AER	3-May	Brisbane + Teleconference (Melbourne, Canberra)
TransGrid	4-May	Sydney
APA Group	4-May	Sydney
ENA (with consultants PWC and NERA)	7-May	Melbourne
EURCC (Consultant Bruce Mountain	7-May	Melbourne
CitiPower, Powercor, ETSA Utilities	7-May	Melbourne
ERA (WA)	11-May	Teleconference (Perth)
QTC	6-Jun	Brisbane

17. We also assisted the AEMC in organising two forums for stakeholders to discuss a wide range of issues relating to the rule change proposals. Those forums were held in Sydney on 18 May and 13 July 2012.

3. Summary of proposals and submissions and comparison with past decisions

18. In this section, we summarise the key features of the main proposals that have been received in relation to the estimation of the return on debt component of the regulated rate of return. We also compare the allowed return on debt under the proposed methods with the actual regulatory allowance using the current regulatory approach under the existing Rules.

Status Quo

19. Some submissions, including those from APIA and APA Group, have proposed that no changes are required to the current Rules in relation to the regulatory allowance for the return on debt. Under the current Rules, the regulatory allowance for the return on debt is computed as the sum of (a) the risk-free rate of interest and (b) the debt risk premium appropriate for the assumed credit rating. Both components are measured at the time of the regulatory determination (usually averaged over a 20-40 day rate-setting period).

20. The key features of the current benchmark, as implemented by the AER, are a 10-year term to maturity and a BBB+ credit rating. The risk-free rate component is estimated as the yield to maturity on 10-year Commonwealth Government bonds and the DRP requires an estimate of the yield on Australian 10-year BBB+ corporate bonds. The AER has proposed a range of methods to estimate the yield on Australian 10-year BBB+ corporate bonds and most recently has adopted an estimate obtained by extrapolating the Bloomberg BBB fair value curve.

21. The ERA implements the current rules by estimating the risk-free rate as the yield on 5-year government bonds and by using a bond yield approach to estimate the yield on Australian corporate bonds. The bond yield approach involves estimating the yield on all Australian corporate bonds with a BBB or BBB+ credit rating and with more than two years to maturity and taking an average (four different averaging methods are examined).

EURCC Proposal – Historical average of cost of debt

22. The EURCC proposal is that the regulatory allowance for the return on debt should be estimated as an historical average over a period of five years. Specifically, the yield on benchmark debt would be estimated periodically (e.g., at the end of every month) over the five years prior to the date of the determination, and a simple average of all observations would be taken. That average value would then be used as the allowed return on debt over the ensuing year. This method does not require the allowed return on debt to be disaggregated between risk-free rate and DRP components.

23. The EURCC also proposes that the allowed return on debt would be updated annually within each regulatory period. In particular, every year the estimate of the "cost of debt" would be updated, based on a rolling five-year historical average.

24. The EURCC proposal also specifies that the benchmark debt should be considered to be 5-year corporate bonds rated between BBB- and A+, in which case the regulatory allowance would be:

> calculated as the simple average yield to maturity of A and broad BBB fair market value estimates of corporate bonds issued in Australia over the five year period ending on December 31st of [the year preceding the estimate].[1]

25. We note that the characteristics of the benchmark (i.e., 5-year or 10-year debt etc.) and the method of estimation (i.e., the rate at the time of the determination or a longer-term historical average) are separate issues. Whatever benchmark is chosen, it can be observed at the time of the determination or averaged over a longer period. We focus first on the method of estimation (average or not) and then subsequently consider the characteristics of the appropriate benchmark.

QTC submission – Historical average of cost of debt, transition arrangements, new debt at current rate

26. The Queensland Treasury Corporation (**QTC**) has proposed an approach that, like the EURCC proposal, is based on an historical average of the yield on benchmark debt. The QTC proposal contains detailed recommendations about how the approach would be implemented and what transition arrangements would be required. The key features of the QTC proposal are:

    a) The historical averaging period would match the assumed tenor of benchmark debt, which is currently ten years;

    b) The yield on benchmark debt would be estimated at the end of each quarter (i.e., for a ten-year tenor, the average would be taken over 40 observations);

    c) The regulatory allowance for the "cost of debt" would be updated annually based on the most recent ten-year period;

    d) To reflect the fact that most regulated businesses have already locked in debt funding costs at the time of their most recent determinations (having been incentivised to do this under the current Rules), QTC propose a set of transition arrangements. These transition arrangements are designed to ensure that a regulated business does not receive a gain or loss stemming from the differential between current and historical yields. The proposed transition arrangements are that:

        i) In Year 1 of the first regulatory control period, the allowed return on debt would be based on the estimate of the current yield on benchmark debt, as under the current Rules;

        ii) In Year 2, the allowed return on debt would be based on 90% weighting on the current yield and 10% weighting on the average yield over the previous year;

        iii) In Year 3, the allowed return on debt would be based on 80% weighting on the current yield, 10% weighting on the average yield over the previous year, and 10% weighting on the average yield over the year prior to that; and

[1] EURCC Proposal, p. 51. We assume that the EURCC means to say "on issue" rather than "issued" and that they intend that either five-year fair value estimates from independent data suppliers should be used or that the sample should be restricted to bonds with approximately five years to maturity.

iv) This procedure continues for ten years, at which time the allowed return on debt each year is the average over the previous ten years.

e) To create the appropriate incentives for new capital expenditure, QTC propose that benchmark debt[2] related to capital expenditure would enter the averaging procedure based on the estimated benchmark yield at the time the expenditure was made. That is, if a business had no new capital expenditure, the average would be computed by placing 10% weight on each of the prior ten years. If, however, capital expenditure was incurred in a particular year, that year would receive proportionately more weight in the rolling average.

ETSA/CitiPower/Powercor submission – Historical average of DRP only, referenced to swap rates

27. ETSA Utilities, CitiPower and Powercor have proposed a variation of the historical averaging approach with the following features:

a) The allowed return on debt would be the sum of a base rate of interest and an estimate of the DRP;

b) The base rate of interest would be the five-year swap rate[3], estimated as the average over a 20-40 day rate-setting period at the time of the determination;

c) The DRP would be estimated as the average, over the ten-year period prior to the determination, of the difference between the estimated yield on benchmark debt and the ten-year swap rate;[4] and

d) The resulting estimate of the "cost of debt" could either:

i) be updated annually during the regulatory control period; or

ii) be set as some combination of the historical average and a forward-looking estimate.

Summary of past decisions

28. Table 2 below presents a summary of the AER's regulatory determinations in relation to debt risk premium since the last WACC review in 2009.

29. In a number of determinations, the AER sought to rely exclusively on the CBA Spectrum fair value curve at a time when that curve produced estimates that were materially lower than those obtained from the Bloomberg fair value curve. In the ActewAGL merits review, the Tribunal found that the AER had erred in that there was no reasonable basis for selecting the CBA Spectrum curve over the Bloomberg curve, and ordered that an estimate based on the average of the two should be used. In the Jemena merits review, the Tribunal found that there was a statistical basis for preferring the Bloomberg curve to the CBA Spectrum curve and ruled that DRP should be estimated with reference to the more reliable Bloomberg curve only.

[2] The calculation would be based on the assumed benchmark efficient financing structure (e.g., 60% debt) and not on the actual amount of debt finance employed by the business.
[3] Or more precisely, the swap rate that matches the length of the regulatory control period.
[4] Or more precisely, the term would be set to match the term selected for benchmark debt.

30. Subsequently, CBA Spectrum ceased publishing fair value estimates and the AER began to use an approach that applied some weight to the Bloomberg curve and some weight to the estimated yield of a single bond – the APT bond. The weight applied to the APT bond began at 25%, increased to 50% and the AER proposed to increase it further to 75%, but never did so in a determination. In the APT Allgas/Envestra merits review, the Tribunal ruled that the AER had erred in placing material weight on a single bond without proper justification and ordered that DRP be estimated with reference to the Bloomberg curve only.

31. The most recent AER determinations have been based on the Bloomberg fair value curve only.

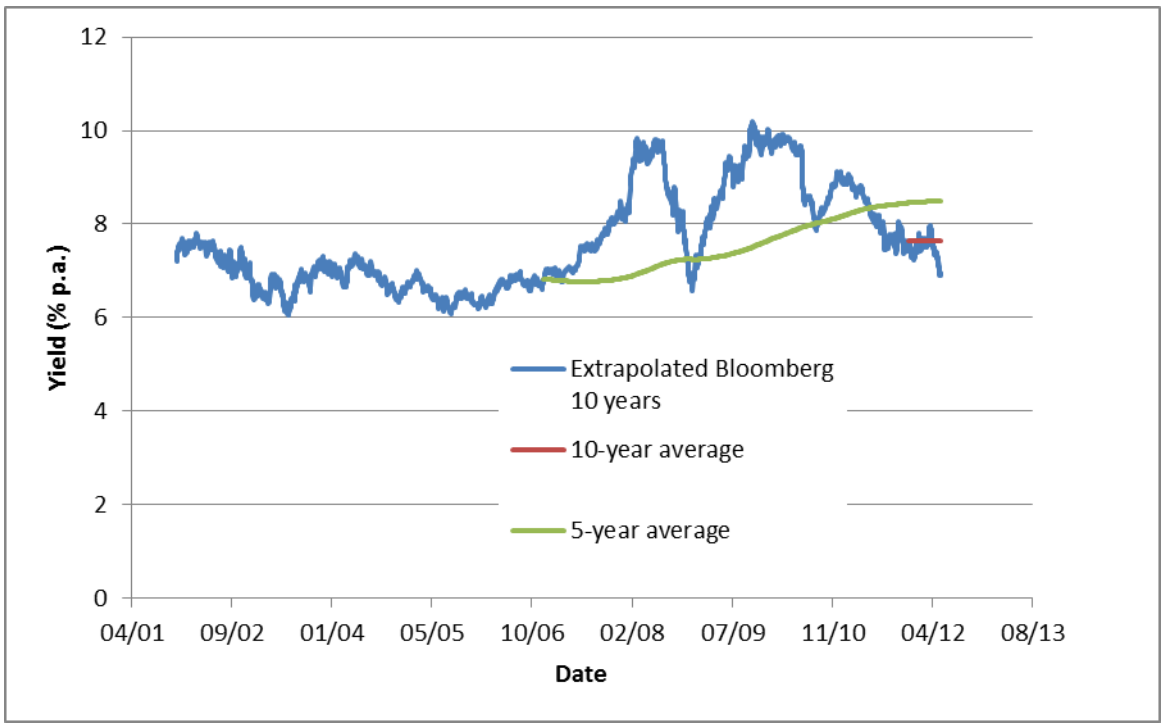
Table 2. Summary of past regulatory decisions in relation to DRP

Business	Sector	Date	Data source	DRP (basis points)
ACTEW/AGL	Gas distribution	Mar-10	CBA Spectrum	335
Country Energy	Gas distribution	Mar-10	CBA Spectrum	336
ETSA	Electricity distribution	May-10	CBA Spectrum	298
Queensland DBs	Electricity distribution	Jun-10	CBA Spectrum	333
Jemena Gas NSW	Gas distribution	Jun-10	CBA Spectrum	293
ActewAGL	[2010] ACompT 4	Sep-10	Average of extrapolated Bloomberg and CBA Spectrum fair value curves	
Victorian DBs	Electricity distribution	Oct-10	75% extrapolated Bloomberg 25% APT bond	370-405
Jemena	[2011] ACompT 10	Jun-11	Extrapolated Bloomberg, CBA Spectrum less reliable	
Envestra QLD, SA	Gas distribution	Jun-11	50% extrapolated Bloomberg 50% APT bond	381
APT Allgas	Gas distribution	Jun-11	50% extrapolated Bloomberg 50% APT bond	364
Amadeus gas pipeline	Gas pipeline	Jul-11	50% extrapolated Bloomberg 50% APT bond	380
APT Allgas, Envestra	[2012] ACompT 3,4,5	Jan-12	Extrapolated Bloomberg, no basis for over-weighting a single bond	
Aurora	Electricity distribution	Apr-12	Extrapolated Bloomberg	411
Powerlink	Electricity transmission	Apr-12	Extrapolated Bloomberg	393

Comparison of past decisions and proposed approaches

32. Given that the most recent decisions of the AER have estimated DRP with reference to the extrapolated Bloomberg fair value curve, we take the ten-year Bloomberg BBB yield estimate to be the current regulatory approach. We then compare the current regulatory approach with approaches that are based on longer-term averages of the extrapolated Bloomberg estimate, as set out in Figure 1, which shows that the five-year average of the extrapolated Bloomberg yield estimate is currently higher than the present yield estimate. This is because the five-year average includes the peak of the global financial crisis (**GFC**) period where yields rose sharply. By contrast, the ten-year average is close to the present yield estimate. This is because the ten-year average includes the peak GFC period as well as the pre-GFC period where yields were more modest. We note that the ten-year average is only available for a short period as ten years of the sample is required for averaging purposes.

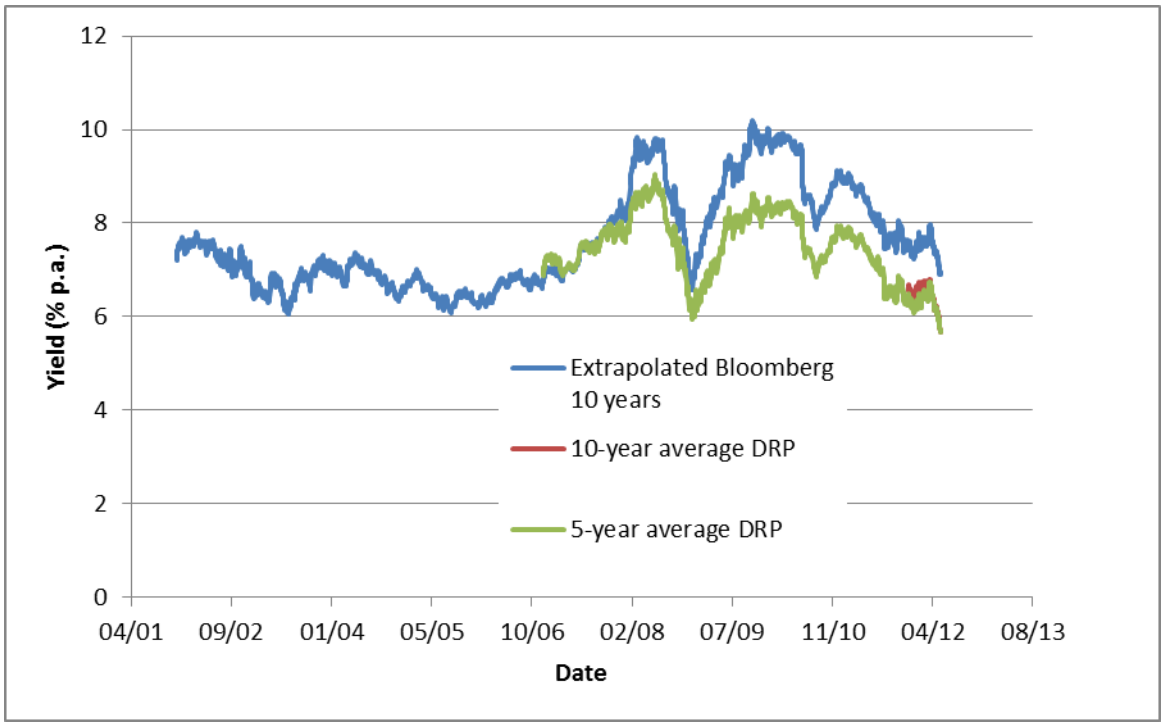
Figure 1: Extrapolated Bloomberg 10-year BBB yield estimates and long-term averages



Source: Bloomberg, SFG calculations

33. We also compare the ten-year Bloomberg BBB yield estimate to estimates that are constructed as the sum of the contemporaneous risk free rate and the longer-term historical average of the DRP. We examine two such approaches, based on five- and ten-year averages of the DRP, respectively. These estimates are displayed in Figure 2 below, which shows that the estimates based on the historical average DRP are currently below the present Bloomberg estimate. This is because risk premiums in financial markets are currently at elevated levels, resulting in a flight-to-quality that pushes down the yields on government bonds, increasing the DRP. At present, government bond yields are at historical lows and risk premiums are very high. Consequently, the long-term average DRP estimate is below the contemporaneous estimate.

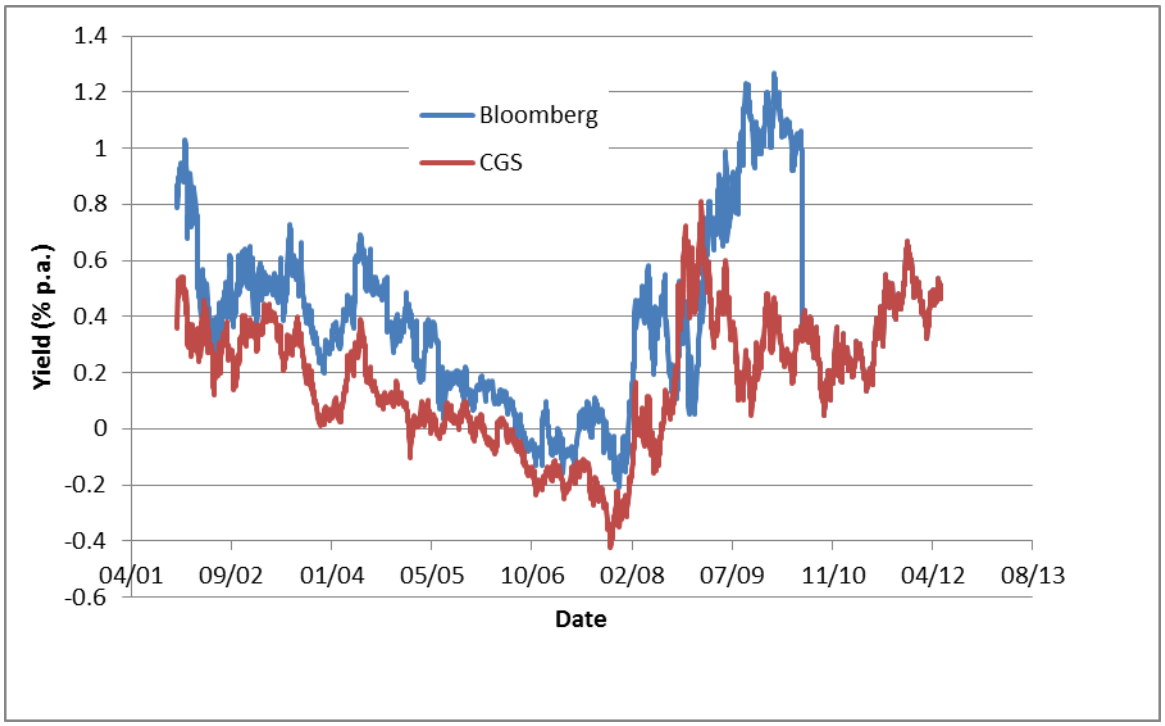
Figure 2: Extrapolated Bloomberg 10-year BBB yield estimates and estimates based on long-term averages of debt risk premium



Source: Bloomberg, SFG calculations

34. We note that, for a given benchmark, any form of historical averaging has the effect of reducing volatility in the regulatory allowance for the return on debt – averaging has the effect of smoothing the regulatory estimate of the "cost of debt." Averaging does not systematically increase or decrease the allowed cost of debt. Indeed, by definition, the contemporaneous value will sometimes be above the historical average and sometimes below it – on average, the two will be the same. Systematic increases or decreases to the allowed return on debt can only stem from changes to the benchmark. To examine this effect, we compare the Bloomberg BBB 10-year and 5-year fair value estimates over time. We also examine the 10-year/5-year yield differential for Commonwealth Government bonds. These differentials are shown in Figure 3 below. The Bloomberg 10-year yield is above the 5-year yield for all of the last 12 years, but for a period in 2007 when the term structure was slightly inverted. On average, the 10-year yield is approximately 40 basis points above the 5-year yield. Consequently, if the benchmark term were to be re-defined from ten years to five years, the allowed return on debt would fall by 40 basis points on average.

Figure 3: Difference between 10-year and 5-year yields on the Bloomberg BBB estimate and Commonwealth Government securities



4. Issues for consideration

35. In this section, we summarise the key issues for consideration by the AEMC.

Separate consideration of benchmark and averaging issues

36. Under the current Rules, the DRP must be estimated with reference to a particular benchmark. The issues that must be decided when specifying the benchmark are:

    a) Credit rating – should DRP be estimated for debt with a BBB or BBB+ or A- credit rating or some combination, or something else?;

    b) Tenor – should DRP be estimated for debt with a maturity of 5 years, or 10 years, or something else?; and

    c) Reference point – should DRP be estimated with reference to the yield on government bonds or with reference to the swap rate, or something else?

37. Having determined the characteristics of the benchmark, the regulator must then consider the data sources that are required to estimate the yield for the benchmark. A number of questions arise. Should the DRP be estimated with reference to commercial fair value curves or from a portfolio of individual bonds? If fair value curves are to be used, which one(s)? If some extrapolation is required, how should that be performed? If a portfolio of bonds is to be used, how should that portfolio be selected, and how should it be used to provide an estimate?

38. Under the current rules, the DRP is estimated over the same (usually 20- to 40-day) rate-setting period as is used to estimate the risk-free rate. These are estimates of the risk-free rate and DRP prevailing at a particular point in time. Taking an average is purely to minimise the noise associated with unusual fluctuations in the day to day bond yields which may not represent the true DRP at that point in time. Whatever choices might be made about the specification of the benchmark, that specification can either be observed over the rate-setting period or over a longer historical averaging period. That is, considerations of the specification of the benchmark can be separated from considerations of whether or not an historical average should be used.

39. In our view, the first issue to be settled is the choice of an appropriate benchmark. This choice can be made without consideration of whether observations of that benchmark are to be averaged over a long period or simply observed at the time of the determination. The question of whether or not to take an historical average of the benchmark is a separate, but related question. For example, there may be reasons to link the averaging period to the assumed tenor of the debt.

40. The first part of this report is from the perspective of the benchmark having been settled, with a focus only on whether that given benchmark should be averaged or simply observed at the time of the determination.

What should be averaged?

41. A number of different proposals have been made in relation to the specification of precisely what should be averaged. To consider these proposals, we first note that under the existing Rules, the allowed return on debt is estimated as the sum of the risk-free rate of interest and the estimate of DRP:

$$r_d = r_f + DRP.$$

42. A number of proposals have been received in relation to precisely what should be averaged, including the following examples:

    a) The EURCC Proposal is that the estimate of the yield on the relevant debt (r_d) should be averaged;

    b) CitiPower, Powercor and ETSA Utilities have submitted that only the DRP component should be averaged over an historical period and that the base interest rate component should be estimated over a rate-setting period as under the current Rules;

    c) Queensland Treasury Corporation has submitted that the entire yield should be averaged (consistent with the EURCC Proposal) and that, for consistency, the historical average of the risk-free rate should be used when estimating the required return on equity; and

    d) APIA and APA Group have submitted that neither the risk-free rate nor the DRP should be averaged over a long historical period. The current rules do not require nor allow such a long-term average to be used and the current regulatory practice is to estimate the risk-free rate and DRP over a rate setting period of 20-40 days. APIA and APA group submit that no changes are required to the current Rules or the current regulatory practice in this regard.

How should the average be computed?

43. If an average is to be applied, the key issues for consideration are:

    a) Over what period should the historical average be taken – 5 years, 10 years, or something different?;

    b) Should the averaging period be linked to the assumed tenor of the benchmark debt (i.e., if 10-year debt is used for the benchmark, does this imply that the averaging period should also be set at 10 years)?; and

    c) When computing the average, should observations be collected daily or weekly or monthly, or with some other frequency?

Should there be updates during the regulatory period?

44. If an historical average of some sort is to be computed, one possibility is that the average value is adopted at the time of the determination and then remains fixed for the regulatory period. Under this approach, observations that are currently taken over the (20- to 40-day) rate-setting period, would simply be replaced by the longer-term historical average values. No other changes would need to be made to the current regulatory approach.

45. An alternative approach is that the average value could be re-set each year during the regulatory period. Under this approach, the re-setting would apply to whatever had been averaged – if the historical average applied only to the DRP, the estimate of DRP would be updated each year during the regulatory period, following a moving average approach. It is likely that this would

work in a manner similar to the annual update for realised inflation under some regulatory approaches. If the entire yield was to be averaged (rather than just the DRP component) it is the entire yield that would be updated on a yearly basis under this approach.

46. A third approach would be to apply the historical average figure to debt in relation to the regulated asset base (**RAB**), holding this figure fixed for the regulatory period, but to apply the rate at the time of the determination (computed with reference to the usual 20- to 40-day rate-setting period) to debt in relation to capital expenditure (**CAPEX**) over the regulatory period.

47. Another important consideration in relation to the possibility of annual updating is whether or not such updates would amount to a "determination" and therefore be subject to merits review.

How would the trailing average be given effect?

48. The EURCC Proposal is for the mechanics of the averaging approach to be prescribed in the Rules. This would substantially remove discretion from the regulator and the regulated businesses.

49. The AER has submitted that the Rules should allow the regulator to estimate the required return on debt using whatever approach it deems to be most appropriate in the circumstances. This could involve the use of some form of historical average, either exclusively, or in combination with other information. The AER's submission does not specify any details of what sorts of averaging approaches it might consider, nor does it outline any principles that it would apply to determine whether or not averaging was appropriate in a particular case.

50. QTC has proposed that each regulated business should be given the option of selecting whether or not to use an historical averaging approach. This gives rise to a number of considerations including when the election would have to be made, and whether (and in what circumstances) the business would be permitted to switch between approaches.

Are transition arrangements required?

51. A number of regulated businesses have submitted that they routinely adopt risk management practices to ensure as close a match as possible between the allowed return on debt and the firm's debt service payments. These practices involve trading in interest rate swap contracts and/or other securities.

52. Many businesses have current positions in these securities that they entered as a means of managing risk under the current Rules. If a change to the Rules were to be made, it is likely that these firms would change their risk management practices – to be consistent with the new Rules. However, it may not be possible for firms to easily exit existing positions. For this reason, a number of businesses have proposed that consideration should be given to the transition between one set of Rules and the next. In particular, this may involve an announcement of the specifics of the Rule change, followed by a transition period to give businesses the chance to re-align their risk management positions prior to the new Rules talking effect. The QTC Proposal sets out a detailed description of how transition arrangements would work under its proposal and how businesses would implement hedges over the transition period so that there would not be any windfall gain or loss from the change to the way the regulatory allowance for the return on debt is estimated.

53. The alternative approach is to have no transition period or arrangements and simply treat the Rule change as a business risk that the regulated businesses will have to deal with. An important

consideration here is whether such an approach might be viewed by the market for funds as a signal that a higher degree of regulatory risk should be priced into their provision of funds, and whether that outcome would be in the long term interest of any stakeholders.

How are regulated businesses likely to respond to particular rule changes?

54. One of the key issues for the AEMC to consider is the effect that a change to the Rules in relation to the estimation of the allowed return on debt would have on regulated businesses in terms of:

    a) The risks borne by the shareholders of the regulated businesses, which could cause a change to the returns required by shareholders; and

    b) The incentives of the regulated businesses in relation to capital expenditure.

55. The AEMC is required to consider rule change proposals in the context of the NEO, NGO and RPP. It is impossible to determine whether a particular rule change is more consistent with the NEO, NGO and RPP without considering how regulated businesses are likely to respond to it. It is for this reason that we examine how different regulated businesses are likely to respond to particular rule change proposals – to provide information that will assist the AEMC in its consideration of whether the particular rule change is likely to be more consistent with the NEO, NGO and RPP. Moreover, from a consumer perspective, it is impossible to determine whether a proposed rule change is likely to benefit customers without considering how regulated businesses are likely to alter their debt management practices in relation to the rule change.

5. Overview of current practices

Overview

56. In this section, we summarise the current debt management practices of different types of regulated businesses. Debt management practices tend to differ according to:

    a) The size of the business: small to medium sized businesses can make use of interest rate swap contracts, whereas the swap market may not have sufficient depth to accommodate the requirements of very large businesses;

    b) The asset base of the business: one-asset businesses (businesses that own a single regulated network) tend to actively hedge interest rate risk at the time of each determination whereas portfolio businesses (businesses that derive revenues from a number of different assets) are more likely to be able to use a portfolio approach which involves accessing debt markets from time to time when conditions are considered to be favourable, and not seeking to actively hedge interest rate risk at the time of each determination; and

    c) The ownership structure of the business: Private sector businesses borrow directly from capital markets, whereas government-owned businesses tend to borrow through state government authorities such as QTC and New South Wales Treasury Corporation (**TCorp**).

57. The fact that different regulated businesses use different debt management practices is one issue that the AEMC must consider. It is likely that different businesses, depending on their particular circumstances, will favour a set of rules that makes it easiest for them to manage risks associated with their debt funding. The AEMC will need to determine:

    a) The extent to which the ability of a business to manage risks associated with its debt financing is relevant to the NEO, NGO and RPP; and

    b) Whether:

        i) A particular type of business should be considered to be the benchmark business, in which case it is only the debt management practices of that type of business that will be relevant; or

        ii) The debt management practices of regulated businesses in general are considered to be relevant.

58. If the AEMC is to specify the characteristics of "the benchmark" business and to base its specification of the regulatory allowance for debt on the debt management practices that would be appropriate for a business with exactly those characteristics, other things equal, businesses that are a closer match to the assumed benchmark will be better off. Moreover, their customers are also likely to be better off in that the business will be better able to reduce risk. In this respect, the Rules can have an unintended effect on the way the industry structures itself. Ideally, it would be factors other than administrative rule-making that determines the size and ownership structure of firms and the mix of assets they hold.

Regulatory revenue allowance

59. We begin with a simple scenario that is based on parameter estimates from prior to the beginning of the Global Financial Crisis (**GFC**) in 2008. We consider a regulated business with RAB of $5 billion and current debt of $3 billion (representing 60% gearing). We consider the following parameter values (where "current" refers to the value obtained over the 20- to 40-day rate-setting period, under the current Rules):

    a) Current risk-free rate: $r_f = 6\%$;

    b) Current debt risk premium: $DRP = 1\%$; and

    c) Current required return on debt: $r_d = 6\% + 1\% = 7\%$.

60. In this case, the annual revenue allowance to provide for the return on debt is

$$7\% \times \$3\,\text{billion} = \$210\,\text{million}.$$

61. That is, the regulated business will be able to include $210 million in its revenue allowance to enable it to pay a 7% return on its $3 billion of debt funds.[5]

Why do regulated firms hedge risks relating to the cost of servicing debt?

62. Consider a firm that operates a single regulated network. For such a business, any difference between the costs of servicing its debt and the allowed return on debt will flow through to (or from) equity holders. This is because the firm must pay its debt holders exactly what it has promised them, irrespective of whether the regulatory allowance is more or less than what is to be paid. Any surplus or deficit will then flow to (or from) the equity holders as the residual claimants. Consequently, if a regulated firm is able to match its debt servicing costs to the regulatory revenue allowance, it will remove this source of cash flow volatility to equity holders. It is for this reason that many regulated businesses seek to create the best possible match between their borrowing costs and the regulatory revenue allowance in relation to those borrowing costs.

63. To see why this issue is important to many regulated businesses, suppose the regulated firm had borrowed at a fixed rate of 9% p.a. some time before the regulatory determination. In this case, the business would be making annual payments of

$$9\% \times \$3\,\text{billion} = \$270\,\text{million}$$

    to its debt holders while receiving an annual revenue allowance of only $210 million. This would leave an annual shortfall of $60 million. It is the shareholders of the regulated business (as the residual claimants) who would bear this shortfall.

[5] The intention of this section is to establish, via some simple examples, the importance of the relationship between the allowed return on debt and the debt service costs of a business under different debt management strategies. For this reason, we consider cash flows prior to the effects of taxes in these examples.

64. Moreover, a $60 million shortfall in the cash flow available to equity is substantial. If the allowed return on equity is 10%, the business in question receives a regulatory allowance in relation to return on equity of:

$$10\% \times 2\,billion = 200\,million$$

in which case the $60 million shortfall represents 30% of the cash flow to equity holders.

65. Of course, if the business had borrowed at a rate that was *lower* than the rate at the time of the determination, the revenue allowance would be greater than the firm's debt service payments and the shareholders would benefit.

66. In summary, not matching the cash inflows and outflows in relation to debt service costs results in potentially material cash flow volatility for the shareholders of the regulated business. Later in this report we quantify this cash flow volatility in a large-scale simulation. We show that, for a single-asset firm, it is highly unlikely that the firm would elect not to attempt to match its debt service costs with the allowed return on debt.

How do regulated firms hedge risks relating to the cost of servicing debt?

Issue debt at the time of each determination

67. For very small firms it may be possible to physically issue fixed rate debt at the time of each determination. If the firm borrows at current rates, and if the regulatory allowance is also based on current rates, there will be a match between the cash inflows and outflows relating to the business's debt. But even in this case, there will not be an exact matching of inflows and outflows for a number of reasons:

    a) The regulator estimates the cost of debt for an efficient benchmark business. For many reasons, the particular business may differ in some respects from the regulatory benchmark;[6]

    b) The regulatory rate is set as the average over a 20- to 40-day rate-setting period. A business may not be able to lock in this average rate – for example, it is unlikely that a business could physically raise 5% of its required debt every day over a 20-day period; and

    c) This approach requires the business to issue debt for a term that matches the regulatory period, which currently differs from the debt tenor that is assumed (i.e., cash inflows would be based on the cost of 10-year debt whereas cash outflows would be based on the cost of 5-year debt).

68. There are two reasons why this form of hedging is not commonly used:

    a) It is infeasible for any but the smallest regulated businesses to issue all of their debt requirements at one time; and

[6] We note that this point applies to every method for estimating the regulatory allowance. We include it in our list, which seeks to set out all of the reasons why the regulatory allowance may differ from the firm's cost of servicing its debt. We also note that under incentive-based regulation, this potential differential should always exist – firms benefit from beating the benchmark and are penalised for falling short of it.

b) It leaves the firm exposed to material refinancing risk – there is a risk that conditions in debt markets at a particular point in time would not permit the issuance of debt for even small companies. A business that was unable to refinance the entirety of its debt (that was maturing at one time) would immediately become financially distressed.

69. Because it is infeasible for many regulated businesses to issue all of their debt financing requirements at the time of each determination, and because it is unlikely that such a debt management practice would be considered to be efficient from the perspective of a stand-alone private sector business, we do not consider this approach further in our analysis below.

Use swaps to lock in the base interest rate

70. One debt management approach that is commonly used by small to medium sized regulated businesses is to "lock in" the base interest rate at the time of the determination using the interest rate swaps market as follows:

a) The regulated business issues floating rate debt well prior to the determination;[7]

b) During the determination's rate-setting period, the regulated business enters interest rate swap contracts. Under these contracts, the business receives the relevant risk-free rate of interest from the counterparty and pays to the counterparty a fixed rate of interest that is set at the time the contract is entered into. The term of the swap will be set to match the length of the regulatory period (usually five years). The regulated business will enter an appropriate amount of swap contracts each day during the rate-setting period (e.g., for a 20-day rate-setting period, 5% of the total debt would be "fixed" each day);

c) The floating rate will then vary over time, but the business is hedged against those variations – it receives a floating rate payment from the swap counterparty and it pays that same amount to its floating rate lenders. This leaves the business paying only the fixed rate under the swap contract.

71. This does not create a perfect hedge for three reasons:

a) The regulator estimates the cost of debt for an efficient benchmark business. For many reasons, the particular business may differ in some respects from the regulatory benchmark;

b) The DRP component of the business's debt service cost cannot be hedged with the swaps market. For example, there is no swaps market for BBB+ debt, only a single swaps market based on an interest rate that is appropriate for one large bank lending to another. For this reason, it is only the base interest rate and not the DRP that can be hedged; and

c) Even the base interest rate cannot be perfectly hedged as the swap rate is not identical to the risk-free rate as proxied by the yield on government bonds and because the term of the swap may differ from the benchmark term of debt.

[7] An alternative to issuing floating rate debt is for the firm to issue fixed rate debt and to immediately enter into a swap that matches the term of the debt, in order to effectively convert that debt into floating rate debt.

72. Consider the following stylized example:

    a) Well before the determination, a regulated business issues $3 billion of 10-year floating rate BBB+ debt at 100 basis points. This creates an obligation for the business to pay interest at a rate of 100 basis points above the swap rate;

    b) During the rate-setting period, the yield on 10-year government bonds is 6%, the 10-year swap rate is 6.2%, and the regulator's estimate of the 10-year BBB+ DRP is 110 basis points;

    c) The business enters into an interest rate swap, under which it pays the fixed rate of 6.2% and receives the floating rate (whatever that might be from time to time);

    d) The regulatory revenue allowance in relation to the return on debt will be determined as the sum of the risk-free rate and DRP multiplied by the amount of debt finance:

$$(6.0\% + 1.1\%) \times \$3\,\text{billion} = \$213\,\text{million};$$

    e) The amount the firm will pay to service debt is determined as the sum of the swap rate and the margin over the swap rate when the firm issued its debt, multiplied by the amount of debt finance:

$$(6.2\% + 1.0\%) \times \$3\,\text{billion} = \$216\,\text{million}.$$

73. In this case, there is not a perfect hedge because:

    a) The swap rate and risk-free rate differ by 20 basis points; and

    b) The business is paying a debt margin that was set when it issued the debt (100 bp to swap) whereas the regulatory allowance is set at the time of the determination (110bp to risk-free rate).

Use physical securities to lock in the base interest rate

74. A number of submissions have indicated that some businesses are simply too large to lock in interest rates using swap contracts – the swaps market does not have sufficient depth to accommodate the volume that would be required by businesses with large amounts of debt funding. Moreover, since each determination generally applies to a number of businesses, having multiple businesses seeking to access the swap market over the same (or very similar) short period acts to exacerbate the potential inadequacy of the swap market.

75. Under the current Rules, these businesses use a number of different techniques to match their debt service cash flows with the regulatory revenue allowance, including:

    a) Locking in base interest rates in the swaps market over a much longer time period (e.g., 6 to 12 months) rather than seeking to do this during the 20- to 40-day averaging period, and simply accepting the inevitable mis-match between interest payments and the regulatory allowance; and

b) Issuing fixed rate bonds well before the determination and "parking" the proceeds until the determination – for government-owned businesses who raise their finance through treasury corporations.

76. The following simplified example illustrates how the "parking" approach works:

a) The business issues 10-year fixed rate debt of $100 at 7% a year before the determination and uses the proceeds to buy $100 of some other 7% bond that is on issue in the marketplace;

b) Over the next year, whatever is received from the bonds that are owned is paid to the holders of the bonds that were issued, so there is no net cash flow;

c) Suppose that a year later, at the time of the determination, interest rates have fallen and the yield on the bond that was purchased is now 6%. The business then sells those bonds for $106.80:

$$Present\ value = \$7 \times \frac{[1-1.06^{-9}]}{0.06} + \frac{\$100}{1.06^{9}} = \$47.61 + \$59.19 = \$106.80;$$

d) The first $100 of the bond sale proceeds is used to finance the firm's debt requirements over the next regulatory period. The remaining $6.80 is exactly equal to the present value of a stream of cash flows of $1 a year for next 9 years. That is, it can be used to reduce the debt service payments from $7 per year to $6 per year – effectively locking in the 6% rate that applied at the time of the determination. For example, the $6.80 could be used to purchase a 9-year annuity of $1 per year;

e) If interest rates had instead risen prior to the determination, the converse would apply and the firm would effectively lock in the higher rate that applied at the time of the determination.

77. There are a number of reasons why this approach does not produce a perfect hedge:

a) The regulator has estimated a spread for an efficient benchmark business. For many reasons, the particular business may differ in some respects from the regulatory benchmark; and

b) The bonds in which the funds are "parked" may differ from the bonds that were issued (e.g., different yield or different timing of coupon payments) so that the cash flows in and out do not perfectly offset each other during the parking period.

78. The issue-early-and-park approach is not feasible for private sector businesses. This is because the private sector businesses must issue their own bonds directly to the market paying (for example) a BBB+ debt risk premium. The bonds in which the funds are parked include state and Commonwealth government bonds. This means that the carrying cost would make this strategy prohibitive for private sector businesses. Moreover, the strategy could not be implemented by parking the funds in higher-yielding corporate bonds, because those bonds are insufficiently liquid – they trade so infrequently that it may be impossible to sell them in sufficient quantities prior to the determination.

79. By contrast, state government treasury corporations issue debt at semi-government rates, so the carrying cost is only a fraction of that for private sector businesses. The treasury corporations then add a competitive neutrality fee when passing the debt on to the regulated business. This structure makes it feasible for treasury corporations to implement the issue-early-and-park strategy for state-owned businesses. Note that this conclusion only holds when the treasury corporation holds constant the competitive neutrality fee, during the period between issuing the bonds and the regulatory determination. This means that the treasury corporation is effectively bearing the risk of fluctuations in the debt risk premium. If a private sector business were to implement this strategy, it bears the risk of fluctuations in DRP of its own debt, compared to government bonds. Holding the competitive neutrality fee constant means that the treasury corporation bears this risk.

Adopt a portfolio debt management approach

80. Businesses that own a portfolio of assets are able to use a portfolio debt management approach. This involves accessing debt markets from time to time when conditions are considered to be favourable, and not seeking to actively hedge interest rate risk at the time of each determination.

81. The result of this practice is that some determinations will occur at times when interest rates are relatively high, in which case the regulatory allowance will be higher than the firm's average interest expense on previously-issued debt. And other determinations will occur at times when interest rates are relatively low, in which case the regulatory allowance will be lower than the firm's average interest expense on previously-issued debt. Over a portfolio of multiple assets, with regulatory determinations occurring at different points in time, some will receive regulatory allowances that are above and some will receive regulatory allowances that are below the firm's average interest expense. Diversification implies that the "overs" and "unders" will tend to cancel out over different assets and across time.

82. For a one-asset business, there is no opportunity for any such diversification to occur. Consequently, the portfolio debt management approach is only used by firms with a portfolio of assets.

Summary of debt management approaches

83. In summary, there are four types of debt management approaches:

    a) Issue debt during the regulatory rate-setting period;

    b) Use swaps to lock in the base interest rate during the regulatory rate-setting period;

    c) Use physical trading techniques to lock in the base interest rate during the regulatory rate-setting period; and

    d) Adopt a portfolio approach rather than trying to hedge interest rate risk at the time of each determination.

84. Different types of businesses will prefer different approaches depending on their characteristics and circumstances.

Debt raised during the regulatory period

85. Regulated businesses may need to issue debt during the regulatory period to:

    a) Refinance existing debt that matures during the regulatory period; or

    b) Finance new capital expenditure to be made during the regulatory period.

86. Under the current Rules, the regulatory allowance in relation to this new financing is based on interest rates at the time of the determination. Consequently, it is common for regulated businesses to seek to lock in the rate at the time of the determination for this new debt financing. This can be done with a forward-starting swap, which plays the same role as the standard swap contracts described above, but which does not begin until the time the new debt is to be raised. This strategy may be feasible even for larger regulated businesses, given that swaps are only required in relation to new debt required during the regulatory period, which is likely to be a relatively small proportion of the firm's entire debt funding.

87. A forward-starting swap can be used to lock in the base rate at the time of the determination for new debt to be issued during the regulatory period, but it cannot lock in the DRP. Consequently, the regulated business would still bear the risk that the DRP changed materially between the time of the determination and the time the new debt was issued.

88. Another approach to hedging risk associated with debt to be issued during the regulatory period is to refinance debt prior to the time of the determination to minimise the amount of debt that matures during the regulatory period. This process of refinancing debt prior to its maturity is likely to be required by ratings agencies if the firm is to maintain an investment grade rating.

89. Refinancing debt prior to maturity is likely to involve a cost in one of two ways:

    a) A fee may be required to repay debt prior to maturity – either as a lump sum at the time of repayment or as a higher interest rate; or

    b) The existing debt can be maintained to maturity and the new debt can be "parked" until required. This approach is likely to be expensive for private sector businesses, as explained above.

6. The likely effect of historical averaging on debt management practices

Overview

90. In this section, we consider variations of the historical averaging approach and discuss whether, and how, different types of businesses are likely to alter their debt management practices under each approach.

91. The first point to note is that, for a given benchmark, the current approach (of estimating the risk-free rate and DRP at the time of the determination) and the historical averaging approach will produce the same long-run average allowed return on debt. The historical averaging approach will simply produce a less volatile time series, but one that has the same mean as the current time-of-determination approach.

92. For this reason, it is likely that the firms that currently adopt the portfolio debt management approach will continue to employ that approach, even if one of the proposed rule changes is adopted. If diversification is sufficient to manage the risk associated with the current approach (which results in more volatile estimates of the cost of debt over time), it must also be sufficient to manage the risk associated with an alternative approach that results in lower volatility over time.

93. Moreover, businesses that currently issue debt at the time of the determination do that only as a means of matching their debt service costs to the regulatory allowance. If any part of the regulatory allowance was based on an historical average, this approach would no longer serve as an appropriate hedge. Also, we note that this approach is not open to any but the smallest regulated businesses in any event.

94. Consequently, we focus attention on the businesses that are currently:

    a) Using swap contracts to lock in a base rate at the time of the determination; or

    b) Using physical securities to park debt funds raised in advance of the determination.

Historical average of DRP only, base rate set to prevailing risk-free rate at determination

95. One possible implementation of the historical averaging approach is to take a longer-term average of the DRP component only and to make no changes to the way the base risk-free rate is estimated. Of all of the historical averaging proposals, this approach involves the smallest change to the current Rules – the DRP estimate would be based on an historical average rather than on the market value at the time of the determination. In all other respects the current Rules would be unchanged.

Businesses that use swaps to lock in the base rate at the time of the determination

96. Under the "average DRP only" model, a business that currently uses swaps to lock in the base interest rate at the time of the determination is likely to continue with that practice. To see why this is the case, consider the following simplified example.

97. Suppose that every year a business routinely issues 10-year floating rate debt to cover 10% of its total borrowing needs. Also suppose that this debt has been issued at an average margin of 200 bp

above the swap rate. In particular, suppose that debt risk premiums have been generally increasing over the last 10 years, beginning at around 100 bp and ending at 350 bp.

98. Also suppose that during the rate-setting period, the yield on 10-year government bonds is 6%, the 10-year swap rate is 6.2%, and the regulator's estimate of the 10-year BBB+ DRP is 350 basis points.

99. At the time of the determination, the business enters into an interest rate swap, under which it pays the going fixed rate of 6.2% and receives the floating rate (whatever that might be from time to time).

100. Under the current Rules, the allowed return on debt would be determined according to the contemporaneous estimates of the risk-free rate plus DRP, 6%+3.5%=9.5% in this case.

101. The cost of servicing the existing debt of the business is the sum of the base swap rate (6.2%) and the average spread to swap of 2%, a total of 8.2%.

102. Under the DRP averaging approach, the same base risk-free rate can be used (6%), but the DRP is set to an historical average. Suppose the 10-year average estimate of DRP was 215 bp. Note that this regulatory estimate of 215 bp differs from the average margin for the business of 200 bp for three reasons:

    a) The regulator has estimated a spread for an efficient benchmark business. For many reasons, the particular business may differ in some respects from the regulatory benchmark;

    b) The business pays a spread to the swap rate, whereas the regulator has estimated a spread to the government bond yield; and

    c) The regulatory average is taken over every trading day over the 10-year period, whereas in this example the business has actually issued debt on only 10 specific days – one each year. Just by chance, the average spread on the 10 specific days may differ from the average over all days.

103. Even allowing for these differences, the averaging approach provides a much closer match between the service cost on previously-issued debt and the allowed return on debt. In this case, the allowed return on debt would be the sum of the regulatory estimates of the risk-free rate and the average DRP, 6%+2.15%=8.15%. This can be compared with the debt servicing cost of 8.2% on existing borrowings.

104. A business that currently uses the swap market to lock in a base interest rate at the time of the determination would continue to employ that approach under the "average DRP only" model. The result would be that the regulatory revenue allowance would better match the business's service costs on existing debt, reducing the volatility of cash flows to the (residual) equity holders.

Businesses that use physical securities to park debt funds raised ahead of the determination

105. Under the "average DRP only" model, the approach of using physical securities to park debt funds that have been raised ahead of the determination will no longer serve to match the service costs on existing debt with the regulatory allowance. The "raise early and park" method effectively locks in

both the base interest rate and the DRP that apply at the time of the determination. In particular, when the business sells the bonds in which the debt funds have been parked, it effectively locks in a rate equal to the yield on those bonds at the time of sale. This means that the raise-early-and-park method can be used to either:

a) Lock in the base rate and DRP at the time of the determination (by selling the bonds in which the debt funds have been parked at the time of the determination); or

b) Lock in the average base rate and the average DRP by simply issuing a portion of debt financing needs each year over the historical averaging period.

106. In summary, either the base rate and DRP are both locked in at the time of the determination, or they are both averaged over the historical period. This method cannot accommodate the base rate being set at the time of the determination and the DRP being averaged over an historical period.

107. For many businesses, their size potentially precludes them from using the swaps market. This leaves such businesses with no practical means of matching their debt service costs with the regulatory allowance. The result is that the mis-match flows through to the cash flows to equity holders, increasing the volatility of cash flows to equity.

Historical average of DRP only, base rate set to swap

108. CitiPower, Powercor and ETSA Utilities have proposed that the DRP should be averaged and that the swap rate, rather than the risk-free rate, should be used as the base interest rate. That is, the swap rate is measured at the time of the determination and the DRP is the historical average premium relative to the swap rate. We define this to be the "DRP/swap rate" approach.

Businesses that use swaps to lock in the base rate at the time of the determination

109. The DRP/swap rate approach minimizes equity cash flow volatility for firms that are able to access the swaps market to lock in a base swap rate at the time of the determination. The swap market can be used to lock in the base rate that enters into the calculation of the allowed return on debt, and the historical average DRP (relative to the swap rate) will closely approximate the DRP locked in when the firm actually issued its debt. The only reasons that the firm's debt service payments would not be perfectly matched with the regulatory allowance are:

a) The regulator has estimated a spread for an efficient benchmark business. For many reasons, the particular business may differ in some respects from the regulatory benchmark; and

b) The regulatory average is taken over every trading day over the (say) 10-year historical period, whereas the business will have actually issued debt on only 10 specific days – one each year. Just by chance, the average spread on the 10 specific days may differ from the average over all days.

Businesses that use physical securities to park debt funds raised ahead of the determination

110. As set out in Paragraphs 103 to 105 above, under the raise-early-and-park approach, either the base rate and DRP are both locked in at the time of the determination, or they are both averaged over the historical period. This method cannot accommodate the base rate being set at the time of

the determination and the DRP being averaged over an historical period. Changing the base rate from a government bond yield to the swap rate does not change this. The result is that the raise-early-and-park method cannot be used to match firm's debt service payments with the regulatory allowance if the historical average is applied to the DRP component only.

Historical average of total cost of debt

111. The original EURCC proposal and the more recent proposal from QTC both advocate that the historical averaging should be applied to the total cost of debt and not just the DRP component.

112. If this approach was to be implemented, it would make no sense for businesses to seek to lock in interest rates at the time of the determination. To manage interest rate risk, the business would need to match, as best it can, its debt service costs with the average cost of debt estimated by the regulator. This would require the business to actually issue debt throughout the period over which the average was taken. That is, no business would have any incentive to adopt the approach of using swaps to lock in the rate at the time of the determination or the raise-early-and-park approach, because those approaches are designed to match market rates at the time of the determination. Both of these approaches would be abandoned in favour of an approach whereby debt was issued approximately uniformly over the historical averaging period.

Debt raised during the regulatory period

113. Under the current Rules, the regulatory allowance in relation to this new financing is based on interest rates at the time of the determination. Consequently, it is common for regulated businesses to seek to lock in the rate at the time of the determination for this new debt financing using forward-starting swaps or an equivalent approach.

114. If the Rules were changed to provide for the DRP to be averaged but the base rate to be set at the time of the determination, the current risk management approach in relation to new debt issuances is likely to be maintained. This is because the current forward-starting swaps approach is designed to match the base interest rate on new debt with the base rate at the time of the determination.

115. If, however, the Rules were changed to provide for the entire cost of debt to be averaged over an historical period, there would no longer be any reason to seek to match the base interest rate on new debt with the base rate at the time of the determination, so forward-starting swaps would no longer be used. In this case, it would not be possible to hedge at all because the allowed return on debt would be based on an average of historical rates and it is not possible for the firm to access those historical rates at the time it issues the new debt – the regulated firm would have to bear the risk of a potentially material difference between the historical average and the rate at the time new debt was issued.

116. Finally, if the Rules were changed in line with the QTC proposal, there would be no need to engage in any hedging strategy as the allowed return on debt would be based on the rates prevailing at the time the new debt was issued.

7. Quantification of the mis-match between the regulatory allowance and debt service costs on previously-issued debt

Framework and notation

117. In this section, we seek to quantify the effects of any mis-match between the service costs on existing debt and the allowed return on debt. We define the debt service cost and the regulatory allowed return on debt (both expressed as annual percentage rates) as r_{act} and r_{reg} respectively. The extent to which there is a mis-match between these two quantities is given by $\varepsilon = r_{reg} - r_{act}$, which represents the difference between the allowed rate of return and the firm's debt service payments. ε can be positive or negative depending on whether the allowed return is above or below the debt service cost.

118. Consider the case where the current debt service cost is 7% p.a. and the allowed return is 6% p.a. In this case $\varepsilon = -1\%$. Other things equal, this shortfall will flow through to equity holders. To see this, we revisit the earlier example of a firm with RAB of \$5 billion, \$3 billion of which is assumed to be financed with debt, and \$2 billion with equity. Also suppose that the allowed return on equity is 10% p.a., so that the regulatory revenue allowance in relation to the return on equity is \$200 million per year. In the case where $\varepsilon = -1\%$, the revenue shortfall in relation to the return on debt is 1% × \$3 billion = \$30 million. A \$30 million shortfall represents 15% of the allowed return on equity. That is, a mis-match of 1% p.a. between the firm's debt service payments and the regulatory allowance results in a 15% variation in the cash flow to equity, other things equal.

The regulatory allowed return on debt

Current Rules – estimate the risk-free rate and DRP at the time of the determination

119. We define the risk-free rate and debt risk premium, estimated at the time of a particular determination, to be r_f and DRP_{rf} respectively. Note that the subscript on the DRP term indicates that the debt risk premium is computed relative to the risk-free rate. We make this explicit in order to clearly differentiate between proposals to estimate DRP relative to the swap rate. Under the current Rules, the regulatory allowed return is:

$$r_{reg} = r_f + DRP_{rf}.$$

EURCC and QTC Proposals – historical average of the total cost of debt

120. We define the risk-free rate and debt risk premium, averaged over all daily observations that are available for the historical averaging period, to be $\overline{\overline{r_f}}$ and $\overline{\overline{DRP_{rf}}}$ respectively.[8] Under the EURCC Proposal, the regulatory allowed return would be:

$$r_{reg} = \overline{\overline{r_f}} + \overline{\overline{DRP_{rf}}}.$$

[8] We would use the same notation if the average was to be based on weekly or monthly or quarterly observations – the two bars represent the average computed in the way that is required under the Rules.

Historical average of the debt risk premium only

121. Another variation of the regulatory allowance is to use the risk-free rate at the time of the determination (as under the current Rules) and an historical average of the DRP (as under the EURCC Proposal). Under this model, the regulatory allowed return would be:

$$r_{reg} = r_f + \overline{\overline{DRP_{rf}}}.$$

ETSA/CitiPower/Powercor Proposal – historical average of debt risk premium only, referenced to swap rate

122. ETSA Utilities, CitiPower and Powercor have proposed a model in which the regulatory allowance is set as the swap rate at the time of the determination r_s and the historical average of the DRP computed relative to the swap rate, $\overline{\overline{DRP_s}}$. Under this model, the regulatory allowed return would be:

$$r_{reg} = r_s + \overline{\overline{DRP_s}}.$$

The firm's debt service payments

123. We focus on the two debt management approaches that would be commonly used under different variations of the Rules.

Borrow uniformly over the historical averaging period, no additional hedging

124. It is infeasible for a business to issue a small proportion of its debt financing requirements every day over a long historical averaging period. For example, over an historical averaging period of 10 years, a business may issue debt once per year, funding 10% of its debt requirements on each occasion. The average over these 10 particular days can differ from the average over all days. To capture this potential difference, we define the average over only those days on which the business actually issues debt using a single bar. So, the average risk-free rate over the issuance days is denoted by $\overline{r_f}$ and the average debt risk premium is denoted by $\overline{DRP_{rf}}$, and so on.

125. The firm's debt service payments under this approach can be expressed in terms of the risk-free rate or the swap rate as:

$$\begin{aligned} r_{act} &= \overline{r_f} + \overline{DRP_{rf}} \\ &= \overline{r_s} + \overline{DRP_s}. \end{aligned}$$

Borrow uniformly over the historical averaging period, lock in swap rate at time of determination

126. As set out above, a common debt management approach is for the regulated business to issue floating rate debt uniformly over time, and to then fix the interest rate at the going swap rate at the beginning of the regulatory period. The firm's debt service payments under this approach can be expressed in terms of the risk-free rate or the swap rate as:

$$r_{act} = r_s + \overline{DRP_s}.$$

Mismatch between the firm's debt service payments and the regulatory allowance

Overview

127. There are a number of reasons why the debt service payments of a particular business may not equate to the regulatory allowance. The first is that there may be a difference between the rate at which the business can borrow and the regulatory benchmark. Assuming that the regulatory benchmark is appropriately defined and measured, a particular business may be more (or less) efficient than the regulatory benchmark, and consequently be able to borrow at a lower (or higher) rate. Under incentive-based regulation, the business is entitled to retain any such gains and it is required to bear any such losses. None of the rule change proposals seek to alter the incentive nature of the regulatory framework, so we set aside this source of difference.[9] That is, in the remainder of this section, we assume that the business in question is identical to the regulatory benchmark – because our purpose is to examine how different regulatory models and debt management practices interact, and how those interactions affect risk.

128. There are a number of reasons why (a) a particular regulatory model for estimating the cost of debt, and (b) a particular debt management practice, might result in a difference between the regulatory allowance and the firm's debt service payments. For example:

    a) One might be based on a rate at the time of the determination, whereas the other is based on an historical average;

    b) One might be based on an average over a small number of specific days (i.e., days when debt was actually issued), whereas the other is based on the average over every day; and

    c) One may be based on an underlying swap rate, whereas the other is based on an underlying government bond yield.

129. In the remainder of this section, we examine a number of combinations of regulatory model and debt management strategy to highlight the sources of any mis-match between the regulatory allowance and the firm's debt service payments. This indicates the relative degree of cash flow risk associated with alternative combinations. In the simulation analysis later in this report, we measure cash flow risks, value risks and incentive implications. This analysis accounts for variation in both the prevailing cost of debt and equity capital over time. We emphasise that these variations occur because the cost of capital is, in fact, variable over time. It does not occur simply because there is imprecision in the measurement of the cost of capital.

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[9] At the AEMC Forum, a number of participants expressed the view that the regulatory framework should not allow regulated businesses to make their debt financing operations a source of profit. However, no proposals have been made to make debt service costs a pass through – all propose that the regulatory allowance for debt should be based on an efficient benchmark. These two views can be reconciled if the regulatory allowance is based on a benchmark that allows regulated firms to recover only what an efficient firm would require. Another way to consider the issue is as follows. Debt holders could be considered in the same manner as equity holders (both are providers of capital) or interest costs can be considered in the same manner as operating costs. Treating the debt holders as providers of capital means that if the firm can manage its business in a manner which reduces its cost of capital below the benchmark, it benefits from the difference between its own cost of capital and the cost of capital for a benchmark firm. If interest costs are considered as operating costs, then if the firm can reduce these costs below benchmark costs, then it benefits from this efficiency.

Current Rules/No hedging

130. Under the current Rules, the regulatory allowance is set as:

$$r_{reg} = r_f + DRP_{rf}.$$

131. If a business simply issues debt uniformly over time and takes no further action, the firm's debt service payments will be:

$$r_{act} = \overline{r_f} + \overline{DRP_{rf}}.$$

132. Consequently, the quantum of any mis-match is:

$$\begin{aligned}\varepsilon &= r_{reg} - r_{act} \\ &= \left(r_f - \overline{r_f}\right) + \left(DRP_{rf} - \overline{DRP_{rf}}\right)\end{aligned}$$

133. That is, the regulatory allowed return on debt will differ from the firm's debt service payments to the extent that:

a) The current risk free rate differs from the average risk free rate when the firm issued its debt; and

b) The current DRP differs from the average DRP when the firm issued its debt.

134. From the properties of statistics,

$$Var(\varepsilon) = Var\left(r_f - \overline{r_f}\right) + Var\left(DRP_{rf} - \overline{DRP_{rf}}\right) + 2Cov\left[\left(r_f - \overline{r_f}\right), \left(DRP_{rf} - \overline{DRP_{rf}}\right)\right]$$

135. Using the estimates calibrated to historical data, we estimate in this case that:

$$SD(\varepsilon) = \sqrt{Var(\varepsilon)} = 2.43\%.$$

136. We note that this estimate has been reduced by the negative correlation between government bond yields and the DRP – the natural hedge that is discussed above.

137. From the properties of a normal distribution, the probability of observing a value more than one standard deviation above the mean is approximately one in six, as is the probability of observing a value more than one standard deviation below the mean. This means that one in six years we would expect a mis-match of more than 2.43% (or less than −2.43%). Recalling that a 1% mis-match results in a 15% impact on the residual cash flow to equity, 2.43% amounts to a 36% variation in the cash flow to equity. Such a variation is too large for a single asset business to bear and serves to explain why every such business adopts a debt management approach that is driven by the Rules rather than by the commercial practices that would otherwise be adopted.

138. By contrast, a business with a portfolio of regulated assets is likely to be on the positive side of this risk in relation to some assets and on the negative side in relation to others. If, for example, a

business has 12 equally-sized assets and if the risks are independent from one determination to the next, the diversification effect reduces the standard deviation to 0.7%.[10]

Current Rules/Lock in swap rate at time of determination

139. A number of businesses have submitted that their current approach is to lock in the swap rate at the time of the determination. In this case, the quantum of any mis-match is:

$$\begin{aligned}\varepsilon &= \left(r_f + DRP_{rf}\right) - \left(r_s + \overline{DRP_s}\right) \\ &= \left(r_f + DRP_{rf}\right) - \left(r_s + \overline{DRP_{rf}} + \overline{r_f - r_s}\right) \\ &= \left(\left[r_f - r_s\right] - \overline{r_f - r_s}\right) + \left(DRP_{rf} - \overline{DRP_{rf}}\right)\end{aligned}$$

140. That is, the regulatory allowed return on debt will differ from the firm's debt service payments to the extent that:

a) The current swap spread differs from the average swap spread when the firm issued its debt; and

b) The current DRP differs from the average DRP when the firm issued its debt.

141. Using estimates calibrated to historical data, we estimate in this case that:

$$SD(\varepsilon) = 2.20\%.$$

142. We note that this estimate has been increased by the positive correlation between the swap spread and the DRP – swap rates tend to move further above government bond yields at the same time as the DRP increases.

143. Under the current Rules there is a relatively high degree of risk whatever debt management approach is adopted by regulated businesses.

Average total cost/No hedging

144. The EURCC Proposal is to compute an average of the total cost of debt. If a business simply issued debt uniformly throughout the same averaging period, the quantum of any mis-match would be:

$$\begin{aligned}\varepsilon &= \left(\overline{\overline{r_f}} + \overline{\overline{DRP_{rf}}}\right) - \left(\overline{r_f} + \overline{DRP_{rf}}\right) \\ &= \left(\overline{\overline{r_f}} - \overline{r_f}\right) + \left(\overline{\overline{DRP_{rf}}} - \overline{DRP_{rf}}\right)\end{aligned}$$

145. That is, the regulatory allowed return on debt will differ from the firm's debt service payments to the extent that:

[10] $2.43/\sqrt{12} = 0.7$.

a) The average risk-free rate over the whole historical period differs from the average risk-free rate over the days on which the firm issued its debt; and

b) The average DRP over the whole historical period differs from the average DRP over the days on which the firm issued its debt.[11]

146. Using estimates calibrated to historical data, we estimate in this case that:

$$SD(\varepsilon) = 0.28\%.$$

147. This scenario has two attractive features:

a) It provides for relatively small deviations between the regulatory allowance and the firm's debt service payments; and

b) The debt management practice accords closely with the general practice of unregulated businesses with long-lived fixed assets – that is, this Rule does not seem to have the effect of changing the debt management approach that the regulated businesses would otherwise adopt.

Average DRP only (relative to risk-free rate)/Lock in swap rate at time of determination

148. If it is only the DRP that is averaged over the historical period, and if the business adopts the approach of locking in the swap rate at the time of the determination, the quantum of any mis-match is:

$$\begin{aligned}\varepsilon &= \left(r_f + \overline{\overline{DRP_{rf}}}\right) - \left(r_s + \overline{DRP_s}\right) \\ &= \left(r_f + \overline{\overline{DRP_{rf}}}\right) - \left(r_s + \overline{DRP_{rf}} + \overline{r_f - r_s}\right) \\ &= \left(\left[r_f - r_s\right] - \overline{r_f - r_s}\right) + \left(\overline{\overline{DRP_{rf}}} - \overline{DRP_{rf}}\right)\end{aligned}$$

149. That is, the regulatory allowed return on debt will differ from the firm's debt service payments to the extent that:

a) The current swap spread differs from the average swap spread when the firm issued its debt; and

b) The average DRP over the whole historical period differs from the average DRP over the days on which the firm issued its debt.

150. Using estimates calibrated to historical data, we estimate in this case that:

$$SD(\varepsilon) = 0.54\%.$$

[11] The same conclusion applies if the regulatory approach was to take the average using weekly or monthly data – so long as the frequency of actual issuances differs from the frequency of regulatory observations there is a degree of mis-match.

151. The primary source of variation in this case comes from the fact that the swap spread at the time of the determination may differ from the average swap spread when the debt was issued. This deviation can be removed by using the swap rate as the base rate, as set out below.

Average DRP only (relative to swap rate)/Lock in swap rate at time of determination

152. The ETSA/CitiPower/Powercor proposal is that the DRP should be averaged over the historical period and the swap rate (rather than the risk-free rate) should be used as the base rate. If the business adopts the approach of locking in the swap rate at the time of the determination, the quantum of any mis-match is:

$$\begin{aligned}\varepsilon &= \left(r_s + \overline{\overline{DRP_s}}\right) - \left(r_s + \overline{DRP_s}\right) \\ &= \left(\overline{\overline{DRP_s}} - \overline{DRP_s}\right)\end{aligned}$$

153. That is, the regulatory allowed return on debt will differ from the firm's debt service payments to the extent that the average DRP over the whole historical period differs from the average DRP over the days on which the firm issued its debt. Since this differential is likely to be small, this rule allows the business to minimise the size of any difference between the regulatory allowance and the firm's debt service payments – but only for businesses that are able to access the swaps market.

154. Using estimates calibrated to historical data, we estimate in this case that:

$$SD(\varepsilon) = 0.20\%.$$

155. This approach results in the minimum variation between the regulatory allowance and the firm's debt service cost. However, this is an approach that is potentially unavailable to larger businesses due to the size of the swaps market.

Average DRP only (relative to swap rate)/No hedging

156. We now consider how the ETSA/CitiPower/Powercor proposal would affect businesses that are unable to access the swaps market. One approach that could be adopted by such businesses is to simply issue debt uniformly throughout the same averaging period. In this case, the quantum of any mis-match is:

$$\begin{aligned}\varepsilon &= \left(r_s + \overline{\overline{DRP_s}}\right) - \left(\overline{r_s} + \overline{DRP_s}\right) \\ &= \left(r_s - \overline{r_s}\right) + \left(\overline{\overline{DRP_s}} - \overline{DRP_s}\right)\end{aligned}$$

157. That is, the regulatory allowed return on debt will differ from the firm's debt service payments to the extent that:

a) The current swap rate differs from the average swap rate when the firm issued its debt; and

b) The average DRP over the whole historical period differs from the average DRP over the days on which the firm issued its debt.

158. Using estimates calibrated to historical data, we estimate in this case that:

$$SD(\varepsilon) = 2.51\%.$$

159. This differential is driven almost entirely by the potential deviation between the swap rate at the time of the determination and the average swap rate when the debt was issued.

Summary and conclusions

160. The analysis above identifies two methods that result in small deviations between the allowed return on debt and the firm's debt service costs:

    a) The allowed return on debt is based on an historical average of the total cost of debt, and regulated firms issue debt uniformly over the historical averaging period; and

    b) The allowed return on debt is based on an historical average of the DRP and the swap rate at the time of the determination, and regulated firms issue debt uniformly over the historical averaging period but then lock in the swap rate at the time of the determination.

161. Other things equal, a smaller deviation between the allowed return on debt and the firm's debt service costs means a reduction in the volatility of cash flows to equity holders. It is also necessary to examine the effect that different methods for determining the allowed return on debt have on the value of equity and on potential incentive effects in relation to capital expenditure (including incentives in relation to making capital expenditure proposals and spending the capital that has been proposed). A full analysis of these issues in undertaken in our simulation analysis later in this report.

162. Finally, we note that different businesses, depending on their particular circumstances will prefer to employ different risk management strategies:

    a) Diversified businesses tend to issue debt capital over time as market circumstances permit;

    b) Small to medium single network businesses tend to stager debt issuances over time and to lock in base rates for the period of a regulatory determination; and

    c) Large single network businesses tend to stager debt issuances over time and to re-price debt as close as possible to the beginning of each regulatory period, subject to the depth of the relevant markets.

163. The current risk management strategies of these three kinds of businesses align, respectively, with three different approaches for determining the regulatory allowed return on debt:

    a) The current "rate of the day" approach;

    b) The ETSA/CitiPower/Powercor approach of averaging the DRP and using the swap rate at the time of the determination as the base interest rate; and

    c) The QTC approach of averaging the entire cost of debt.

164. Every method for determining the allowed return on debt implies a particular risk management/hedging strategy. For some regulated businesses, the implied hedging strategy may be entirely appropriate and efficient. For other businesses, with different circumstances (i.e.,

different size, different mix of assets) the implied hedging strategy may not be appropriate or efficient. In this case, the business will either have to employ a sub-optimal strategy or retain risk that could otherwise be hedged. Allowing different business to match the method for determining the regulatory allowed return on debt to the risk management strategy that is appropriate for that type of business is one of the considerations for the AEMC that we address in the following section.

8. AEMC considerations

Overview

165. In this section, we set out a number of potential issues that flow from the analysis of different rule change proposals in the previous section. In particular, we focus on issues that are relevant to the AEMC's consideration of whether a particular proposed approach is consistent with the NEO and RPP.

The volatility of cash flow to equity

166. The main conclusions from the previous section are that:

a) If the Rules are changed to provide for only the DRP to be estimated as an historical average:

i) Those businesses that are able to access the swaps market to lock in a base interest rate at the time of the determination would be able to closely match their debt service payments to the allowed return on debt; but

ii) Those businesses that cannot access the swaps market to lock in a base interest rate at the time of the determination would not be able to closely match their debt service payments to the allowed return on debt; and

b) If the Rules are changed to provide for the total cost of debt to be estimated as an historical average, all firms would be able to closely match their debt service payments to the allowed return on debt, but for some firms the match may not be quite as close and the costs of implementing hedging strategies may be somewhat higher than under (a) above.

167. The previous section also demonstrates that, other things equal, any differential between a firm's debt service payments and the regulatory allowed return on debt will flow through to the cash flow to equity. That is, the volatility of the cash flow to equity is reduced by ensuring a closer match between the debt service payments and the allowed return. It follows that an important consideration for the AEMC is the extent to which regulated businesses are able to match their debt service payments to the allowed return under different proposed rules – different rule proposals permit different degrees of matching for different kinds of businesses.

168. The reason this is an important consideration for the AEMC is that:

a) Given a particular benchmark for the cost of debt, the long-run average regulatory allowance for the cost of debt will be the same regardless of which method is adopted in the Rules. This means that, over time, consumers will pay the same amount to provide a return to debt holders regardless of which approach is adopted in the Rules;

b) Some of the proposed approaches allow the firm to reduce the volatility of the residual cash flow to equity and others do not; and

c) It is *not* the case that there is a fixed amount of volatility and the only question is how that should be distributed between shareholders and customers. Rather, shareholders and

customers are on opposite sides of the *same* risk. If there is a mis-match between the cost of servicing debt and the regulatory allowed return, then in some cases shareholders receive excess returns and customers pay relatively too much. But the reverse also occurs just as frequently. This means that shareholders and customers both wear the same risk – they are simply on opposite sides of it. If the allowed return can be made to match the cost of serving debt, the risk is eliminated for both shareholders *and* customers.

169. If the approach adopted in the Rules is one that does not allow regulated businesses (or *some* regulated businesses) to reduce the volatility of cash flows to equity, this may have an effect on risk and on the required return to equity. The AEMC would have to consider whether, other things equal, a rule change that had the effect of increasing risk, and consequently the compensation that consumers may be required to pay, was consistent with the NEO and RPP.

Does the current framework provide a natural hedge?

170. We have noted above that under the current Rules, the primary source of any mis-match between the allowed return on debt and the firm's debt service payments comes from the fact that:

a) The regulatory allowance is based on the DRP at the time of the determination; and

b) The firm's debt service payments are based on the average DRP when the debt was issued.

171. This means that:

a) In times of financial crises, when debt risk premiums are materially above their average levels, the allowed return on debt will be above the firm's debt service payments and the surplus cash flow will flow to equity holders; and

b) The reverse is true in times of strong stable economic growth when capital is more freely available.

172. We have also noted above that there is a strong negative correlation between government bond yields and the DRP. During periods of financial market crisis, a flight-to-quality occurs with funds moving out of risky assets and into government bonds. This has the dual effect of reducing government bond yields and increasing the DRP. In such circumstances, all financial risk premiums are at elevated levels, including the DRP however it is measured. During periods of strong economic growth, these effects are reversed – government bond yields tend to be relatively high and risk premiums in financial markets are low.

173. Finally, we note that the current regulatory approach to estimating the required return on equity for electricity transmission and distribution businesses is to use the Capital Asset Pricing Model (**CAPM**) with the risk-free rate estimated as the current yield on 10-year government bonds, beta set to 0.8, and a constant MRP of 6%:

$$r_e = r_f + 0.8 \times 0.06 = r_f + 0.048.$$

174. The current regulatory approach of allowing a 4.8% premium to the risk-free rate has been applied in all recent regulatory determinations with only a short period of time during which an MRP estimate of 6.5% was applied.

175. In our view, it is likely that the equity risk premium is higher-than-average during periods of financial market crisis and turmoil and lower-than-average during periods of strong stable growth. Under a regulatory approach that applies a constant equity risk premium, the allowed return to equity will be:

    a) Less than the true required return during periods of financial market crisis; and

    b) More than the true required return during periods of strong stable growth.

176. The current regulatory approach is to fix a constant average market risk premium when estimating the regulatory allowance for the return to equity. This fixed premium is then applied to the observed government bond yield, which is currently at all-time lows. The result is that the regulatory estimates of the required return on equity are also at historical lows – the implication being that equity finance is currently cheaper than it has ever been since government bonds were first issued.

177. The way the regulated return is currently estimated provides somewhat of a natural hedge in the sense that:

    a) During periods of financial market crisis:

        i) The allowed return on debt is higher than the firm's debt service payments, resulting in surplus cash flow that would flow to the equity holders; and

        ii) The allowed return on equity is lower than the required return on equity, which is offset to some extent by the surplus cash flow above; and

    b) During periods of strong stable growth, the reverse occurs.

178. This does not imply that the current Rules in relation to the DRP should be maintained simply because they tend to balance the current regulatory approach in relation to the equity risk premium. The ideal case would be for the market risk premium to be precisely measured at each point in time. Rather, we raise this issue in the context of the AEMC considering all effects of any rule change, including any offsetting or consequential effects.

Natural hedge for asset values

179. Another potentially important consideration is the effect that different rule changes might have on asset values. Here again, the current Rules may operate to provide a type of natural hedge. In particular:

    a) During periods of financial market crisis:

        i) Financial risk premiums, and required returns in the market, are higher than average so the market will apply a higher discount rate to future cash flows. That is, other things equal, asset values tend to fall during financial crises; and

ii) The allowed return on debt is higher than the firm's debt service payments, resulting in surplus cash flow, which offsets (to some extent) the effect on asset values of an increase in discount rates; and

b) During periods of strong stable growth, the reverse occurs.

180. Part of the consideration of the rule change proposals will be a consideration of the effects on asset values and whether a particular rule's effect on asset values is consistent with the NEO and RPP. We explore this issue in more detail in the simulation analysis later in this report.

Transition arrangements

181. As set out above, regulated businesses have currently adopted debt management practices that are designed to manage risk under the current Rules. If the Rules were to change, the current debt management practices may no longer be appropriate and may in fact act to increase risk when coupled with the new Rules. If such a rule change was not accompanied by some sort of transition arrangements, it may be viewed by the market for funds as a signal that a higher degree of regulatory risk should be priced into their provision of funds, and the AEMC would have to consider whether that would be consistent with the NEO and RPP.

182. This is a particular issue in relation to the EURCC proposal, which provides for no transition arrangements. Under the current Rules, many regulated businesses have adopted debt management strategies that effectively lock in the base interest rate at the time of their determination. Those businesses are no longer exposed to historical base interest rates. Under the EURCC proposal, an historical average of the base interest rate would apply from the time of the next determination for each business. In this case, it would impossible for the business to match its debt service payments to the allowed return on debt. This is because it is impossible for a business to go back and lock in rates that applied some time ago.

183. Once the EURCC system had been in operation for some time, there would be no such problems as regulated businesses could alter their debt management practices to retain exposure to historical base rates thereby matching debt service payments to the regulatory allowance.

184. Under the EURCC proposal, it would be impossible for regulated businesses to match their debt service payments to the allowed return on debt for a period equal to the length of the averaging period (e.g., five or ten years). After that transition period, businesses would be able to effectively match debt service payments to the allowed return by adopting different dent management practices. That is, this issue is a transitional one only.

185. The QTC supplementary submission deals with this issue at some length. Like the EURCC proposal, QTC have proposed that the allowed return on debt should be based on an historical average of the total cost of debt. However, QTC have proposed a set of transition arrangements to allow regulated businesses to transition to new debt management practices. In particular, QTC propose that:

a) In the first year of the next regulatory determination for each business, the allowed return on debt would be based entirely on the regulatory estimate of the cost of debt at the time of the determination. The business would then be able to lock that rate in for 1 year in relation to 10% of its debt portfolio, 2 years for another 10% of its debt portfolio, and so on;

b) In the second year of the determination, the allowed return on debt would be a weighted-average with 90% weight applied to the rate at the beginning of the determination and 10% applied to the then current rate. The business would raise 10% of its debt portfolio at the then current rate – that being the 10% that had initially been locked in for one year;

c) In the third year of the determination, the allowed return on debt would be a weighted-average with 80% weight applied to the rate at the beginning of the determination 10% weight applied to the rate at the beginning of year 2, and 10% applied to the then current rate. The business would raise another 10% of its debt portfolio at the then current rate – that being the 10% that had initially been locked in for two years; and

d) This procedure would continue for ten years, after which time the allowed return would always be the average of the rates over a lagged 10-year period.

186. In our view:

a) If a material rule change is to be made, it is important to consider an appropriate set of transition arrangements. The lack of any transition arrangements in a setting whether the rule change exposes regulated businesses to risks that they did not previously face is likely to be viewed by the market for funds as a signal that a higher degree of regulatory risk should be priced into their provision of funds. Such an outcome is unlikely to be consistent with the NEO and RPP; and

b) The type of "rolling in" arrangement that has been proposed by QTC would be an effective means of transitioning from the current Rules to the use of an historical average cost of debt approach.

Potential incentive effects

187. It is also important for the AEMC to consider the incentives that are created for regulated businesses by different regulatory frameworks. In this section, we consider two potential incentive effects that are created by the way the regulatory allowed return on debt is computed.

Incentive effects in relation to dividend smoothing

188. Regulated businesses are generally owned by shareholders who desire a stable and predictable stream of dividends. This applies to private sector businesses (which tend to be held by "yield investors") and government-owned businesses (whose government owners rely on a dividend stream as an important part of the state budget).

189. If the Rules are such that it is impossible for the business to closely match the firm's debt service payments to the allowed return on debt, any difference ultimately flows through to the cash flow to equity holders. In circumstances where the allowed return on debt is insufficient to cover the firm's debt service payments, there is an incentive to "find" funds to cover the shortfall in order to avoid having to cut or suspend dividend payments.[12] This can take the form of reducing new

[12] We do not suggest that the Rules should ensure that dividends can be maintained or that maintenance of dividends is the primary consideration. Rather, we simply note that firms *will* act to "recover" any cash shortfall and this is likely to be to the detriment of the long-term interests of consumers, other things equal.

capital expenditure or reducing operating costs below the levels that would otherwise have been adopted. Such a system of compensating for differences between the firm's debt service payments and its regulatory allowance is inconsistent with the NEO and RPP. Whereas it is possible for the regulatory framework to constrain the incentive of a business to act in this way, it will never be possible to eliminate such incentives altogether.

190. If the Rules are such that the allowed return on debt effectively assumes a debt management strategy that regulated businesses can implement in practice, the firm's debt service costs can be closely matched with the regulatory allowance, in which case the incentives described above do not arise. This does not require any increase in the average level of the allowed return – just a change to the way the allowed return on debt is estimated to accord with debt management strategies that are implementable in practice.

Incentive effects in relation to capital expenditure

191. There are also potential incentive effects relating to proposed new capital expenditure. Under the current Rules, the allowed return is set equal to the regulator's estimate of the current cost of debt. Assuming this estimate to be reasonable, the cost of debt component of the regulatory framework creates no particular incentive or disincentive in relation to the amount of new capital expenditure that is proposed.[13] This is because the allowed return on debt has been set equal to the current cost of debt (again, assuming that the regulatory estimate is reasonable).

192. Under the current Rules, there can be incentive effects in relation to the actual expenditure during the regulatory period. If, for example, the cost of debt finance increases during the regulatory period, the regulatory allowance (which is set at the beginning of the regulatory period) will be lower than the current cost of debt. Other things equal, this would create an incentive to under-spend. However, there are a number of factors that act to mitigate this incentive:

    a) Some capital expenditure is absolutely required to meet the obligations of the business, including performance standards;

    b) It is possible for the business to lock in the base rate of interest at the time of the determination (e.g., with a forward-starting swap) – although it is not generally possible to lock in the DRP at that time; and

    c) The under-compensation in relation to debt finance would persist only for the remainder of the regulatory period, at which time the regulatory allowance is reset.

193. In summary, the cost of debt provisions under the current Rules:

    a) Create no particular incentive effects in relation to proposals for new capital expenditure; and

    b) Can have incentive effects in relation to actual capital expenditure, although there are a number of factors that act to mitigate those incentive effects.

[13] There may be incentive effects from other sources, but our focus here is only on issues relating to the cost of debt finance.

194. Under the EURCC proposal, the allowed return on debt is based on an historical average of the cost of debt. Suppose, for example, that the cost of debt at the time of a determination is materially greater than the historical average. This may create an incentive for a business to propose lower capital expenditure during the regulatory period – because the regulatory allowance would not enable the firm to recover the cost of servicing debt. This incentive is mitigated to the extent that some capital expenditure may be required to meet the minimum service obligations of the business. However, we note that the differential between the allowed return on debt and the cost of servicing debt on new capital expenditure can persist beyond a single regulatory period, depending on the length of the historical averaging period. Other things equal, these incentive effects could result in more capital expenditure being proposed when interest rates have recently declined, and less being proposed after increases in interest rates.

195. Under the EURCC proposal, the same incentive effects would apply to firms considering whether to actually make capital expenditures during the regulatory period. To the extent that interest rates at the time of the possible expenditure are materially higher than the allowed return, there is a heightened incentive to under-spend. Unlike the situation under the current Rules, not even the base rate can be locked-in at the time of the determination. This is because the allowed return is not set according to the base rate at the time of the determination, but based on an historical average leading up to that point.

196. In summary, the cost of debt provisions under the EURCC proposal can have incentive effects in relation to proposed and actual capital expenditure.

197. Finally, we note that under the QTC proposal, the allowed return on debt is set equal to the cost of debt at the time the expenditure is made. This alleviates the incentive effects in relation to capital expenditure proposals and investments.

Asset values

198. One final consideration is the effect that different rule change proposals might have on the market values of regulated businesses.

Market value of debt

199. Under the current Rules, the debt portfolio in relation to each regulated network effectively operates as a floating rate bond, where interest rates reset every five years. If interest rates rise during a regulatory period, the market value of the debt will fall. This is because the regulatory allowance in relation to debt produces a series of fixed payments that will now be discounted at a higher rate. The effect is likely to be relatively minor, as rates reset again at the next determination.

200. Under the EURCC and QTC proposals, the differential between the allowed return on debt and the current cost of debt is potentially larger in magnitude and more persistent than under the current rules. This is because the allowed return is based on an historical average rather than the current cost of debt and, even at the next determination, it would be reset to the historical average rather than to the current cost of debt at that time. The consequence of this is that the market value of debt will be more volatile under the historical averaging approaches than under the current Rules. In particular, under the historical averaging approaches the market value of debt would be below the book value after interest rate rises and above the book value after interest rate declines.

201. The mark-to-market value of the debt is of most relevance in the case of regulated businesses at the time of sale. It is the mark-to-market value of debt that would have to be paid by the new owner to re-finance that debt portfolio. But for the cases of ownership changes, the mark-to-market value of the debt portfolio would not be a primary consideration for regulated businesses.

Market value of equity

202. In our consideration of the volatility of the cash flow to equity above, we noted that under the current Rules:

    a) The cash flow to equity is higher when risk premiums are higher; and

    b) The cash flow to equity is lower when risk premiums are lower.

203. This creates a natural hedge that may reduce the volatility of the market value of equity. In circumstances where required returns are high, the cash flow to equity is also high, preserving the market value, and vice versa in circumstances where required returns are low.

204. Under the historical averaging approach, the differential between the regulatory allowance in relation to debt and the firm's debt service payments is small, in which case the cash flow to equity is relatively unaffected by it. Consequently, the only source of variability in the cash flows to equity is the regulatory allowance in relation to the return on equity. Under the current regulatory approach of adding a fixed premium to the current yield on 10-year government bonds:

    a) The cash flow to equity is *lower* when risk premiums are higher; and

    b) The cash flow to equity is *higher* when risk premiums are lower.

205. That is, the historical averaging approach (coupled with the current regulatory approach for determining the required return on equity) exacerbates volatility in equity values. In one state, we have lower cash flows being discounted at a higher rate, and in the other state we have the reverse.

Summary

206. In this section, we have surveyed a number of important considerations that will be relevant to the AEMC's analysis of the proposed rule changes in relation to the estimation of the regulatory allowance for the cost of debt. The different approaches for estimating the regulatory allowance for the cost of debt have materially different effects on:

    a) The volatility of the cash flows to debt and equity holders;

    b) The market value of debt and equity;

    c) Incentive effects in relation to proposed capital expenditure and investment during the regulatory period; and

    d) The extent to which any transition arrangements might be required.

207. Many of these effects are complex and inter-related. For this reason, we examine them in the context of a simulation framework in the remainder of this report.

9. Overview of simulation analysis

208. The rule change proposals in relation to the allowed return on debt effectively involve some form of averaging of historical data. In the following sections of this report, we analyse the impact such a change would have on the cash flow and value risks to equity holders and the incentive effects associated with a divergence between the regulated return and the prevailing cost of funds.

209. Moving to a trailing average regulated return is likely to reduce the year to year variation in potential cash flows to equity holders over the regulatory period. The impact of sharp increases or decreases in the prevailing cost of funds has less impact on the revenue stream. However, this is offset by an increase in the likely variation in equity values associated with fluctuations in the cost of funds. Under the current approach to setting the regulated rate of return, fluctuations in equity value are minimised to some degree because the firm receives higher returns during periods when the market discounts those returns at higher rates. Under a trailing average approach this natural hedge is removed.

210. In our analysis, the reduction in returns volatility from smoothing the regulated revenue stream is more than offset by the increase in returns volatility from the present value impact on discount rates. Equity holders are exposed to greater returns volatility under a trailing average approach to regulated returns. If a trailing average is applied to the debt component of the regulated return, the risk increase is small. If a trailing average is also applied to the equity component of the regulated return, the risk increase is large.

211. Our analysis does not account for the refinancing risk associated with firms attempting to lock in borrowing costs at the debt component of the regulated return, when this is set at the prevailing cost of funds. Our analysis does quantify the returns volatility for a single asset owner who does not attempt this task, and instead borrows equally over the previous five- or ten-year period. This exposes equity holders to substantial cash flow and value risks. Refinancing risk will be substantial for owners of large assets, and owners who are less diversified. To incorporate refinancing risk into the analysis requires us to assume particular characteristics on these two dimensions. What is clear is that it would be unreasonable to think that the owner of a single asset, regardless of size, would simply borrow in even amounts over the previous five or ten years and not take steps to hedge the risks associated with the regulatory reset.

212. We also provide metrics around the incentive distortions created when there is a divergence between the regulated return and the prevailing cost of funds. When the cost of funds at the time of the regulatory decision exceeds the regulated return, the network business has an incentive to incur lower capital costs and higher operating costs to achieve its reliability targets. Investment will be delayed compared to the case where the regulated return matches the cost of funds. When the cost of funds is below the regulated return, the network business has an incentive to take on a more capital intensive, lower operating cost alternative to meet its targets. Investment will proceed faster than in the case where the regulated return equals the cost of funds. These outcomes do not require any under- or over-statement of capital or operating costs for a given project. They merely require there to be options available to the business to meet its reliability targets over the five-year regulatory period. Furthermore, the incentive effects are substantial.

213. To quantify the risk impact, we performed a simulation analysis whereby we generate many potential movements in the cost of debt and equity capital over time. We perform 10,000 simulations of monthly discount rates over ten years prior to the regulatory determination and 100 years subsequent to the determination. We then analyse the dispersion of cash flows to equity

holders, and the dispersion of equity values, across these many simulations assuming alternative specifications for the regulated rate of return.

214. The reason we use simulation analysis to address this question is to isolate the impact of a trailing average approach to setting the regulated rate of return. Alternative issues under consideration by the Commission are the data set used to measure the cost of debt (for example, whether analysis should consider individual bond data or an index constructed by a data provider), the appropriate term to maturity of debt and the level of prescription in the rules regarding the estimation technique. For the most part these issues are irrelevant to whether the debt component of the regulated rate of return should reflect interest costs associated with past borrowing (the trailing average approach) or whether it should reflect interest costs associated with subsequent borrowing (the prevailing cost of funds approach). In our simulation analysis, the interest rates are unbiased and observable with precision. So our primary question is "If there was no uncertainty over the measurement of interest rates at each point in time, what are the cash flow and value risks to equity holders, and the incentive distortions, associated with a trailing average approach versus a prevailing cost of funds approach?"

215. There is some interaction between the precision with which the benchmark is estimated and the appropriate length of the averaging period. If the benchmark is imprecisely estimated, and the daily movements in the benchmark estimate reflect that imprecision, then this estimation error is reduced when the averaging period is lengthened. In other words, if bond yield estimates vary day to day because of estimation error, rather than fluctuations in the true cost of funds, then this measurement error is reduced by using more data. This issue is not canvassed here.

10. Simulation method

216. We simulate the costs of debt and equity capital on a monthly basis over ten years prior to the regulatory determination and 100 years subsequent to the determination. The period of one month approximates the 20 to 40 day trading period over which the cost of debt is estimated according to the current process for setting the regulated rate of return. We perform 10,000 simulations according to the following process.

217. The risk-free rate is assumed to follow a mean-reverting process whereby the further the current rate is from the long-term mean, the greater the expected shift towards the mean over the next month. The rate also exhibits random deviations from this trend according to a normal distribution. The specific equation we use was developed by Chan, Karolyi, Longstaff and Saunders (1992) and appears below:

$$\Delta r_{ft+1} = (\alpha + \beta r_{ft})\Delta t + \sigma r_{ft}^{\gamma}\sqrt{\Delta t}\eta_{t+1}$$

where r_{ft} is the risk-free rate during month t expressed as an annualised yield to maturity, Δt is 1/12 to represent a period of one month, $-\beta$ represents the speed of mean reversion, $-\alpha/\beta$ represents the long-run mean, σr_{ft}^{γ} represents the annualised standard deviation of innovations in the interest rate (the gamma or γ parameter means that volatility increases with the level of the interest rate) and η_{t+1} is a draw from a standard normal distribution.

218. We assume parameters of $\alpha = 0.012$, $\beta = -0.200$, $\sigma = 0.320$ and $\gamma = 1.000$. These parameters imply a long-run mean risk-free rate of 6.0%, as $-\alpha/\beta = -0.012/-0.200 = 0.060$. If the interest rate was 1% above the mean, over the next month we would expect the interest rate to fall by 0.017%, as $(\alpha + \beta r_{ft})\Delta t = (0.012 - 0.200 \times 0.070) \times 1/12 = (0.012 - 0.014) \times 1/12 = 0.002 \times \times 1/12 = -0.017\%$. It also means that, at the long-run mean estimate of 6.0%, the annualised standard deviation of rate changes is 1.92%, as $\sigma r_{ft}^{\gamma} = 0.320 \times 0.060^{1} = 1.92\%$. At an interest rate 1% above the mean, annualised volatility is 2.24% and at an interest rate 1% below the mean, annualised volatility is 1.60%.

219. It is important to note that there is no term structure in the current assumptions underpinning our simulation analysis. We compute five- and ten-year averages of simulated interest rates, but have not specified whether these five- and ten-year averages refer to yields on debt with a particular term to maturity. At this stage, our intention is to quantify the potential divergence between the prevailing cost of funds and trailing averages, independent of the term structure. In reality, the typical case is an upward-sloping yield curve, and this must be considered when determining a benchmark financing structure.

220. We then simulate a debt margin according to a uniform distribution in which the lower and upper bounds are contingent upon the level of the risk-free rate. The expected level of the debt margin moves inversely with the risk-free rate, which reflects investor preference for security during periods of volatile economic conditions and reductions in official interest rates by central banks during recessions. We also have a wider range of possible values for the debt margin when the expected debt margin is high. The relationship between the risk-free rate and the debt margin is as follows:

    a) At a risk-free rate of 3.0% or below, the debt margin has a uniform distribution within the range of 3.0 to 5.0%;

b) At a risk-free rate of 9.0% or above, the debt margin has a uniform distribution within the range of 1.0 to 2.0%; and

c) At a risk-free rate within the range of 3.0 to 9.0%, the range of the debt margin is set via linear interpolation from the above bounds. For example, at a risk-free rate of 4.0%, the debt margin has a uniform distribution within the range of 2.7 to 4.5% (that is, both the lower bound and the upper bound decrease by one-sixth of the distance between their boundaries).

221. Finally, we estimate the equity risk premium as function of the debt risk premium. The debt risk premium is constrained within the range of 1 to 5%. We assume that the equity risk premium increases from a low of 4% to a high of 9% in direct proportion to where the debt risk premium lies within the range of 1 to 5%. For example, at a debt risk premium of 2% the equity risk premium is 5.2%. The range of 4 to 9% results in a mean value for the equity risk premium of 6.0% when the simulation is performed.[14]

222. Having simulated values for the prevailing cost of debt and equity each month, we also consider expectations for these values in the future. These expectations are relevant for analysing the impact on equity value. Equity will be priced according to the regulated cash flow stream and cost of equity capital during the first regulatory period, but also taking into account expectations for the regulated cash flow stream and the cost of equity capital in subsequent periods. In forming these expectations we assume the market forms the same view about discount rate movements as summarised above.

[14] We have assumed an equity beta equal to one when incorporated into the Capital Asset Pricing Model. An alternative assumption is the equity beta estimate of 0.8 adopted by the AER. Changing this assumption would impact on the magnitude of the results but would be unlikely to impact upon the relative conclusions. It would be equivalent to assuming an average market risk premium of 4.8% instead of 6.0%.

11. Descriptive statistics

223. In the table below, we present descriptive statistics from the simulation process. In Panel A we present descriptive statistics for 13.2 million monthly interest rates comprising 10,000 simulations × 110 years × 12 months per year. In Panel B we present descriptive statistics for interest rates over 10,000 months at the start of the regulatory period. In Panels C and D we summarise trailing average values for these same interest rates over five and ten years prior to the start of the regulatory period.

Table 3. Descriptive statistics (%)

Rate	Mean	StdDev	5th perc	25th perc	Median	75th perc	95th perc
Panel A: Monthly rates (N = 13.2 million)							
Risk-free	6.0	3.5	2.6	4.4	5.1	7.1	12.1
Debt margin	2.6	0.9	1.3	5.1	2.4	3.2	4.4
Cost of debt	8.6	4.2	4.0	2.4	7.5	10.3	16.2
Equity margin	6.0	1.2	4.4	7.5	5.7	6.8	8.2
Cost of equity	11.9	4.4	7.1	5.7	10.9	13.9	20.0
Panel B: Start of the regulatory period (N = 10,000)							
Risk-free	6.0	3.5	2.6	3.8	5.2	7.1	12.2
Debt margin	2.6	0.9	1.3	1.8	2.4	3.2	4.4
Cost of debt	8.6	4.3	4.1	5.7	7.6	10.3	16.2
Equity margin	6.0	1.2	4.4	5.0	5.7	6.7	8.2
Cost of equity	12.0	4.5	7.2	8.9	10.9	13.8	20.0
Panel C: Five-year trailing average (N = 10,000)							
Risk-free	6.0	2.8	3.1	4.2	5.3	7.0	11.1
Debt margin	2.6	0.7	1.6	2.0	2.5	3.1	3.9
Cost of debt	8.6	3.5	4.7	6.2	7.8	10.1	14.9
Equity margin	6.0	0.9	4.8	5.3	5.8	6.6	7.6
Cost of equity	12.0	3.6	7.9	9.4	11.2	13.6	18.6
Panel D: Ten-year trailing average (N = 10,000)							
Risk-free	6.0	2.0	3.7	4.6	5.6	6.8	9.7
Debt margin	2.6	0.5	1.8	2.2	2.6	3.0	3.6
Cost of debt	8.6	2.5	5.6	6.8	8.1	9.8	13.2
Equity margin	6.0	0.7	5.1	5.5	5.9	6.5	7.3
Cost of equity	12.0	2.7	8.8	10.1	11.5	13.3	16.9

224. Over all simulated months, the mean yield to maturity on debt is 8.6%, its standard deviation is 4.2% and 90% of values lie within the range of 4.0% to 16.2%. The mean cost of equity capital is 11.9%, its standard deviation is 4.4% and 90% of values lie within the range of 7.1% to 20.0%. The small differences between the figures reported in Panels A and B is due to the discrete number of simulations.

225. Taking a five-year average reduces the standard deviation of the cost of debt to 3.5%, which falls further to 2.5% under a ten-year trailing average. For the cost of equity capital the standard deviation falls to 3.6% and 2.7%, respectively. Hence, for both sources of funds, the dispersion of these figures fall by 18% if a five-year average is computed and 40% if a ten-year average is computed.

12. Simulation Results

Divergence between trailing average and prevailing cost of funds

226. In this section we document the difference between the prevailing cost of funds at the time of the regulatory determination and trailing averages. We summarise these differences for the total cost of borrowings along with the risk-free rate and debt premium components. These differences represent the potential difference between interest costs on historic borrowings and the regulatory allowance for debt funding, under the assumption that the debt portfolio was compiled approximately evenly over the prior five or ten years. We present results under two alternative assumptions regarding firm borrowings. First, we assume that the firm refinances its debt continuously over the previous five or ten year period, so the trailing average cost of debt places equal weight on each simulated monthly interest rate. Second, we assume that the firm refinances its debt just once per year (we use the month of June for convenience). These results are summarised in Table 4.

Table 4. Difference between prevailing cost of debt and trailing average (%)

Rate	Avg yrs	Mean	StdDev	5th perc	25th perc	Median	75th perc	95th perc
Panel A: Debt raised continuously								
Risk-free	5	0.0	2.4	-3.4	-1.3	-0.1	1.1	3.9
Debt margin		0.0	0.8	-1.2	-0.5	-0.1	0.5	1.3
Cost of debt		0.0	3.0	-4.4	-1.7	-0.2	1.6	4.9
Risk-free	10	0.0	2.8	-3.4	-1.6	-0.4	1.1	4.6
Debt margin		-0.1	0.8	-1.3	-0.6	-0.1	0.5	1.5
Cost of debt		0.0	3.4	-4.6	-2.2	-0.5	1.6	5.9
Panel B: Debt raised once per year								
Risk-free	5	0.0	2.5	-3.4	-1.6	-0.1	1.1	4.6
Debt margin		0.0	0.8	-1.3	-0.6	-0.1	0.5	1.5
Cost of debt		0.0	3.1	-4.6	-2.2	-0.2	1.6	5.9
Risk-free	10	0.0	2.8	-3.5	-1.3	-0.4	1.1	4.0
Debt margin		-0.1	0.8	-1.3	-0.6	-0.1	0.5	1.4
Cost of debt		0.0	3.4	-4.6	-1.8	-0.5	1.6	5.0

227. We can summarise the difference between the historical average borrowing costs and prevailing cost of funds with reference to the standard deviation. For the total cost of debt, the standard deviation of this divergence is 3.0% with respect to the five-year trailing average and 3.4% with respect to the ten-year trailing average. If debt is raised just once per year, there is a relatively small increase in the standard deviation. The standard deviation of the divergence between the prevailing cost of funds and the five-year trailing average is 3.1%, increasing to 3.4% for a ten-year trailing average.

228. These figures imply that, under the existing regulatory framework, it is not unusual to observe a 3.0% to 3.4% difference in the regulatory allowance for debt funding and the interest costs which would be payable under a five- or ten-year borrowing program. This does not necessarily mean that lower variation is the better regulatory approach. The greater the alignment between the regulatory allowance for debt finance and interest costs on previously-issued debt, the lower the uncertainty over the regulated revenue stream due to uncertainty over discount rates. But there will be increased uncertainty over the value of assets and equity at the regulatory determination. In addition, there will be an increased incentive to alter the proposed capital expenditure program, delaying capital expenditure when the prevailing cost of funds is high and moving forward capital

expenditure when the prevailing cost of funds is low. The issues of volatility in asset and equity values, and incentive effects, are considered in a subsequent section.

229. The divergence between the prevailing cost of funds and the trailing average interest rate is primarily attributable to fluctuations in the risk-free rate of interest. In Table 5 we present correlation coefficients for differences in the prevailing interest rate and the trailing average for the risk-free rate, the debt margin and the overall cost of debt. Pearson correlation coefficients are presented below the diagonal and Spearman correlation coefficients are presented above the diagonal.

Table 5. Correlation between divergence in prevailing interest rate and trailing average

Rate	Avg yrs	Risk-free	Debt margin	Cost of debt	Risk-free	Debt margin	Cost of debt
Avg yrs		**5**	**5**	**5**	**10**	**10**	**10**
Panel A: Debt raised continuously							
Risk-free	5	1.00	0.75	0.98	0.86	0.69	0.85
Debt margin	5	0.64	1.00	0.85	0.68	0.91	0.76
Cost of debt	5	0.98	0.78	1.00	0.86	0.78	0.87
Risk-free	10	0.89	0.56	0.87	1.00	0.82	0.99
Debt margin	10	0.60	0.92	0.73	0.68	1.00	0.89
Cost of debt	10	0.88	0.68	0.89	0.98	0.80	1.00
Panel B: Debt raised once per year							
Risk-free	5	1.00	0.73	0.98	0.86	0.68	0.84
Debt margin	5	0.63	1.00	0.84	0.67	0.89	0.75
Cost of debt	5	0.98	0.77	1.00	0.85	0.77	0.86
Risk-free	10	0.89	0.55	0.87	1.00	0.81	0.99
Debt margin	10	0.60	0.90	0.72	0.68	1.00	0.89
Cost of debt	10	0.87	0.67	0.89	0.98	0.80	1.00

Pearson correlation coefficients are presented below the diagonal. Spearman correlation coefficients are presented above the diagonal.

230. We observe a 98% correlation between the divergence between the risk-free rate and its trailing average, and the divergence between the total cost of debt and its trailing average, regardless of whether debt is raised continuously or once per year, and regardless of whether we compute a five- or ten-year trailing average. This correlation, of course, is an outcome of the assumptions which underpin our simulation process. Provided these assumptions adequately characterise the process by which interest rates fluctuate, it means that most of the misalignment between interest expense on previous borrowing and the regulatory allowance can be attributed to movements in the risk-free rate.

Cash flow risks

Concept

231. As discussed above, there are two risks associated with the regulated return – variation in cash flows and variation in values. As the trailing average for computing the regulated return is increased, cash flow risks are reduced but value risks are increased. In this sub-section we outline cash flow risks with an example. We present two measures of cash flow risk, return on equity and interest coverage. The latter is a proxy for the risk that the firm will approach financial distress, which could lead to borrowing constraints in the form of higher interest rates, or an inability to raise debt finance.

232. Consider a firm which is financed entirely by \$3 billion of debt and \$2 billion of equity, implying leverage *(D/V)* of 60%. The prevailing cost of funds at the start of the regulatory period is 8.6% for debt and 12.0% for equity. We assume that depreciation and capital expenditure are offsetting. The corporate tax rate (τ) is 30% and we ignore dividend imputation (again, this is to simplify the problem). These assumptions mean that the regulated rate of return, according to current practice, would be 8.41%, computed as follows.

$$\begin{aligned} Regulated\ rate\ of\ return &= r_e \frac{E}{V} + r_d(1-\tau)\frac{D}{V} \\ &= 0.1200 \times 0.40 + 0.0860 \times (1-0.30) \times 0.60 \\ &= 0.0841 \end{aligned}$$

233. This regulated rate of return implies the following pro-forma income statement on an asset base of \$5 billion, as shown in the table below. This table illustrates the cash flow impact associated with three alternative assumptions regarding the average interest rate on borrowings – 10.60%, 8.60% and 6.60%.

Table 6. Pro forma income statement

Scenario	Cost of funds < trailing avg	Cost of funds = trailing avg	Cost of funds > trailing avg
Interest cost on debt	10.6%	8.6%	6.6%
EBIT × (1 – τ)	421	421	421
EBIT	601	601	601
Interest expense	318	258	198
Pre-tax profit	283	343	403
Income tax	85	103	121
Net profit after tax	198	240	282
Return on equity	9.9%	12.0%	14.1%
EBIT ÷ Interest	1.9	2.3	3.0

234. In this example, the return to equity holders is 2.1% below the expected return when the cost of funds at the determination is below the trailing average, and 2.1% above the expected return in the scenario where interest rates have risen. The equation for the difference between the regulated return to equity holders and the realised return on equity attributed to this mis-match is presented below, illustrated for the case where the cost of funds is less than the trailing average:

$$\begin{aligned} ROE - r_e &= (r_d - \bar{r}_d) \times (1-\tau) \times \frac{D}{E} \\ &= (0.0860 - 0.1060) \times (1-0.30) \times \frac{0.60}{0.40} \\ &= -0.0200 \times 0.70 \times \frac{0.60}{0.40} \\ &= -0.0140 \times 2.5 \\ &= -0.0210 \end{aligned}$$

235. Interest coverage ranges from 1.9 to 3.0 in these scenarios. The equation for interest coverage is as follows, again illustrated for the case in which the prevailing cost of funds is below the trailing average:

$$\frac{EBIT}{Interest} = \frac{r_e + r_d \times (1-\tau) \times D/E}{\bar{r_d} \times (1-\tau) \times D/E}$$
$$= \frac{0.1200 + 0.0860 \times (1-0.30) \times \frac{0.60}{0.40}}{0.1060 \times (1-0.30) \times \frac{0.60}{0.40}}$$
$$= \frac{0.1200 + 0.0903}{0.1113}$$
$$= \frac{0.2103}{0.1113}$$
$$= 1.9$$

Simulation analysis

236. Return on equity represents a standardised measure of the cash flows available to equity holders and the interest coverage ratio represents a standardised measure of the risks of financial distress. As shown in the equations above, they are "standardised" because they are independent of the size of the firm. Size may be relevant in determining the trade-offs between cash flow risks and asset value risks, because it may affect the firm's ability to hedge against fluctuations in interest rates. But at present we have not estimated the incremental hedging risks associated with the size of the firm.

237. In this section, we take the example presented above and extrapolate to large-scale analysis. In our simulation analysis we estimate the regulated rate of return, return on equity and interest coverage under seven alternative specifications, summarised in the table below. There are three alternative assumptions with respect to the debt and equity components of the regulated rate of return. These can be set at the prevailing cost of funds, or a five- or ten-year average estimate of the cost of capital at monthly intervals.

Table 7. Specifications of the regulated rate of return and borrowing assumption

Specification	Regulated rate of return		Borrowing assumption
	Debt component	Equity component	
1: Current	Prevailing cost of funds	Prevailing cost of funds	Prevailing cost of funds
2: EURCC/QTC	5-year trailing average	Prevailing cost of funds	5-year trailing average
3: EURCC/QTC	10-year trailing average	Prevailing cost of funds	10-year trailing average
4: QTC	5-year trailing average	5-year trailing average	5-year trailing average
5: QTC	10-year trailing average	10-year trailing average	10-year trailing average
6: Current	Prevailing cost of funds	Prevailing cost of funds	5-year trailing average
7: Current	Prevailing cost of funds	Prevailing cost of funds	10-year trailing average

238. These specifications can be considered with reference to the current regulatory regime and alternative approaches to estimating the regulated rate of return put forward by the EURCC and QTC. At present, the debt and equity components of the regulated return are both estimated with reference to the prevailing cost of funds. In specifications 1, 6 and 7 this is how we estimate the cost of debt and equity capital.

239. The difference between specifications 1, 6 and 7 relates to the firm's financing assumption. Under specification 1, we assume that the firm can effectively finance all its borrowings at the prevailing cost of funds, either by refinancing its debt or entering into swaps contracts. In effect, specification 1 is the case where there is no practical impediment to borrowing at the cost of debt

prevailing at the time of the determination. It can be considered the perfectly hedged case with respect to financing activities.

240. Specifications 6 and 7 represent cases where the firm finances its operations by borrowing equally over an extended time period prior to the determination. These specifications can be considered unhedged cases, whereby the firm bears the cash flow risks associated with their being a mis-match between interest payments on previously-issued debt, and the debt allowance based debt yields at the time of the determination.

241. Specifications 2 and 3 are analogous to the proposal by the EURCC and the submission by QTC, which argue for the debt component of the regulated return being set at a trailing average of debt yields over an historical period. The difference between the approaches of the EURCC and QTC relates to a number of specifics which do not form part of the simulation analysis. Specifically, the QTC approach contains transitional arrangements and allows for the regulated return relating to capital expenditure to be set according to the prevailing cost of funds. The transitional arrangements allow firms to alter their debt management practices over time as they move from one regulatory regime to another. Allowing the regulated return on capital expenditure to reflect the prevailing cost of funds reduces distortions to investment decisions which we canvass later.

242. Specifications 4 and 5 incorporate a trailing average estimate to the equity component of the regulated return. This formed a small part of the QTC submission and has an initial intuitive appeal – if less variation in the regulated return is desirable by taking an historical average of the cost of debt, why not reduce variation even further by taking an historical average of the cost of equity? As we discuss later, the different nature of the payoffs to debt and equity holders means that these specifications actually substantially increase the risks to equity holders.

243. This means that in five of the specifications we make the same computational assumption for debt and equity regarding the regulated rate of return (that is, either trailing average or prevailing cost of funds). But in specifications 2 and 3, the debt component is set as a trailing average and the equity component is still estimated at the prevailing cost of funds. There has been no argument for the equity component being set as a trailing average and the debt component set at the prevailing cost of funds, so this case is not considered.

244. In all instances in which debt is borrowed over a five- or ten-year prior period, we assume that debt has been refinanced in June of each year, rather than each month. This introduces some degree of mis-match between borrowing costs and the debt component of the regulated rate of return, even in the averaging periods are the same.

245. In each case we consider the return on equity and interest coverage during the first year of the regulatory period. However the conceptual implications of the analysis are independent of whether we compile all five individual years or a single year.

246. Also note that the variations in interest coverage and return on equity summarised here are only attributable to fluctuations in the cost of funds over time. The true variability in these metrics is greater because of operational risks. Finally, recall that in this analysis there is no uncertainty over the measurement of the prevailing cost of funds at each point in time. Our intent is to isolate the impact on risks and returns attributable solely to setting the regulated rate of return as a trailing average versus the prevailing cost of funds. In Table 8 we present the distribution of the regulated returns, interest coverage and return on equity under the seven alternative specifications for the regulated rate of return and borrowing program.

247. The standard deviation provides the most useful metric for comparison. Considering first the regulated rate of return, as greater weight is placed on trailing average values there is less variation in the potential regulated rate of return. Under the prevailing cost of funds approach (specifications 1, 6 and 7) the standard deviation of the rate across simulations is 3.64%, which decreases to 2.18% if a 10-year average is computed for both the debt and equity components of the regulated rate of return. This is a 40% reduction in the dispersion of the potential regulated rate of return.

248. Considering interest coverage, in the case where the regulated rate of return is set at the prevailing cost of funds and if borrowing could be matched to this rate (specification 1), there is little dispersion in interest coverage with a standard deviation of 0.16. There remains little dispersion in interest coverage when the regulated rate of return for both debt and equity is set as a trailing average and funds are borrowed on a consistent basis (specifications 4 and 5). We observe standard deviations of 0.17 and 0.12, respectively. The increase in financial risks arises when borrowing is performed in a manner different to the setting of one or more components of the regulated rate of return. In specifications 2 and 3 the standard deviation is 0.39. In specifications 6 and 7, the standard deviation increases to 0.69 and 0.76, respectively.

249. With respect to return on equity, under the first three specifications there is no difference in the risks faced by equity holders. The standard deviation of the return on equity is 4.55%. Hence, in the situation where the equity component of the regulated rate of return is set at the prevailing cost of funds, provided borrowing is performed in a manner consistent with setting the debt component of the return, there is no change in the cash flow risk to equity holders. There is a reduction in the standard deviation of return on equity as a trailing average is introduced for the equity component of the regulated rate of return (specifications 4 and 5). In these cases the standard deviation falls to 3.73% and 2.73%, respectively. As with interest coverage, there is an increase in the dispersion of the return on equity in specifications 6 and 7. In these specifications the standard deviation of return on equity is 6.86% and 7.74%, respectively.

250. To place this analysis in context, an argument in favour of a trailing average approach to setting the regulated rate of return is that the current framework encourages businesses to behave in a different manner to what would be the case in the absence of regulation. Specifically, setting the regulated rate of return at the prevailing cost of funds provides an incentive for businesses to minimise their interest rate risk by effectively refinancing their debt every five years. Businesses act on this incentive in different ways, using different combinations of borrowing facilities, interest rate swaps and forward contracts. Regardless of the mechanism the incentive remains to match the cost of borrowing with the debt component of the regulated rate of return. Compared to borrowing evenly over the past five or ten years, this practice reduces the uncertainty over interest coverage and return on equity. However, this exposes the borrower to refinancing risk every five years.

251. In contrast, if a trailing average approach were adopted for setting the regulated return component of debt and equity, there is an incentive to borrow over the same period as the trailing average is computed. This maintains the low dispersion of interest coverage but also reduces uncertainty over the return on equity and minimises refinancing risk. However, as we document in the subsequent sub-section, this reduction in cash flow risks is offset by an increase in the variability of the value of the firm and its debt and equity components.

Table 8. Interest coverage and return on equity under alternative regulated rates of return

Spec	Debt	Equity	Borr	Mean	StdDev	5th perc	25th perc	Median	75th perc	95th perc
Panel A: Regulated rate of return (%)										
1	Prev	Prev	Prev	8.4	3.6	4.6	5.9	7.5	9.9	14.8
2	5-yr	Prev	5-yr	8.4	3.0	5.1	6.3	7.7	9.7	13.8
3	10-yr	Prev	10-yr	8.4	2.6	5.5	6.6	7.8	9.6	13.1
4	5-yr	5-yr	5-yr	8.4	2.9	5.2	6.4	7.7	9.7	13.7
5	10-yr	10-yr	10-yr	8.4	2.1	5.8	6.9	8.0	9.5	12.3
6	Prev	Prev	5-yr	8.4	3.6	4.6	5.9	7.5	9.9	14.8
7	Prev	Prev	10-yr	8.4	3.6	4.6	5.9	7.5	9.9	14.8
Panel B: Interest coverage										
1	Prev	Prev	Prev	2.4	0.2	2.2	2.3	2.4	2.5	2.7
2	5-yr	Prev	5-yr	2.4	0.4	1.8	2.1	2.4	2.6	3.1
3	10-yr	Prev	10-yr	2.4	0.4	1.8	2.1	2.3	2.6	3.1
4	5-yr	5-yr	5-yr	2.4	0.2	2.1	2.3	2.4	2.5	2.7
5	10-yr	10-yr	10-yr	2.4	0.1	2.2	2.3	2.3	2.4	2.6
6	Prev	Prev	5-yr	2.4	0.7	1.4	1.9	2.3	2.8	3.7
7	Prev	Prev	10-yr	2.4	0.7	1.3	1.8	2.2	2.8	3.7
Panel C: Return on equity (%)										
1	Prev	Prev	Prev	12.0	4.5	7.2	8.9	10.9	13.8	20.0
2	5-yr	Prev	5-yr	12.0	4.5	7.1	8.8	10.9	13.9	20.0
3	10-yr	Prev	10-yr	12.0	4.5	7.1	8.8	10.9	13.9	20.0
4	5-yr	5-yr	5-yr	12.0	3.6	7.9	9.4	11.1	13.6	18.7
5	10-yr	10-yr	10-yr	12.0	2.7	8.7	10.1	11.5	13.4	17.0
6	Prev	Prev	5-yr	11.9	6.9	4.0	7.4	10.5	15.0	24.4
7	Prev	Prev	10-yr	11.9	7.7	3.3	6.7	10.2	15.3	25.9
Panel D: Change in equity value (%)										
1	Prev	Prev	Prev	0.0	0.0	0.0	0.0	0.0	0.0	0.0
2	5-yr	Prev	5-yr	0.0	1.4	-2.4	-0.9	0.1	0.9	2.3
3	10-yr	Prev	10-yr	0.0	1.4	-2.2	-0.9	0.0	0.9	2.2
4	5-yr	5-yr	5-yr	-0.1	9.3	-14.1	-6.0	-0.8	5.3	16.0
5	10-yr	10-yr	10-yr	0.0	11.3	-17.3	-7.2	-0.6	6.8	19.2
6	Prev	Prev	5-yr	0.1	9.6	-16.8	-5.3	0.8	6.1	14.5
7	Prev	Prev	10-yr	0.0	11.4	-19.7	-6.7	0.5	7.1	17.4
Panel E: Total return to equity holders (%)										
1	Prev	Prev	Prev	12.0	4.5	7.2	8.9	10.9	13.8	20.0
2	5-yr	Prev	5-yr	12.0	4.9	6.1	8.6	11.0	14.3	20.8
3	10-yr	Prev	10-yr	11.9	4.8	6.1	8.7	11.0	14.2	20.5
4	5-yr	5-yr	5-yr	11.9	11.2	-3.4	4.2	10.2	18.0	32.4
5	10-yr	10-yr	10-yr	12.0	12.5	-6.0	3.6	10.8	19.3	34.1
6	Prev	Prev	5-yr	12.0	15.1	-11.0	3.1	11.2	20.4	37.4
7	Prev	Prev	10-yr	11.9	17.7	-14.5	0.7	10.5	21.7	42.2

Value risks

Concept

252. If a trailing average approach is adopted for setting the regulated rate of return, the potential cash flows to equity holders are less impacted by changes in the prevailing cost of funds. The cash flow risks to equity holders become closer in nature to a bond. The very reason for the reduction in cash flow risks is that discount rates are volatile. It is this very volatility in discount rates which exposes equity holders to fluctuations in asset values. Under the prevailing cost of funds approach,

equity value is hedged against fluctuations in discount rates. During periods of high discount rates, regulated cash flows are higher and those cash flows are discounted at the high cost of funds. In contrast, if we impose stability in the cash flows, equity value will fall during periods of high discount rates and there will be a capital loss.

253. We measure the capital gain or loss by estimating the present value of expected return on equity over the 100 years subsequent to the regulatory determination. This takes into account not just the return on equity over the five-year regulatory period, but also the expectation of the return on equity in subsequent regulatory periods. During each five-year regulatory period, the expected cash flows to equity holders are a level perpetuity, and these expected cash flows are discounted at the expected cost of equity capital at the start of the period. The expected cost of equity capital is a function of both the past cost of equity capital and expectations for the future cost of equity capital, given the mean-reversion in interest rates.

254. For example, suppose the simulated return on equity is 13.59% in the first regulatory period, and the cost of equity capital is 10.88%. If the returns to equity holders are a level perpetuity over five years and the equity investment is $1.00, then the present value of expected return on equity during the first five-year regulatory period is $0.5037, computed as follows.

$$\begin{aligned} Present\ value &= ROE_1 \times \frac{1-\left(1+r_{e,1}\right)^{-5}}{r_{e,1}} \\ &= 0.1359 \times \frac{1-(1.1088)^{-5}}{0.1088} \\ &= 0.1359 \times 3.7069 \\ &= 0.5037. \end{aligned}$$

255. Now suppose in the second five-year period the expected return on equity is 11.73% and the expected cost of equity capital is 11.54%. Applying the same equation, but then discounting over the five years of the first period, the present value of period two expected return on equity is $0.2552, computed as follows.

$$\begin{aligned} Present\ value &= ROE_2 \times \frac{1-\left(1+r_{e,2}\right)^{-5}}{r_{e,2}} \times \frac{1}{\left(1+r_{e,1}\right)^{5}} \\ &= 0.1173 \times \frac{1-(1.1154)^{-5}}{0.1154} \times \frac{1}{(1.1088)^{5}} \\ &= 0.1173 \times 3.6464 \times 0.5966 \\ &= 0.2552. \end{aligned}$$

256. We sum the present values of returns to equity holders across 20 regulatory periods. This is a sufficient forecasting horizon because the present value of cash flows subsequent to this period is approximately zero.

257. We compute the percentage change in capital value for equity and add this to the return on equity in the first year in order to estimate total returns. This computation is consistent with an assumption that reinvested earnings earn a return equal to their cost of capital.

Simulation analysis

258. The most relevant information is the standard deviation of the total return to equity holders. This is a measure of total risk, as opposed to just the risk associated with the cash flow component of returns. For equity holders, the lowest risk case is specification 1. There is no capital value risk because the regulated rate of return is set equal to the cost of capital at each regulatory determination. This means that equity holders are only exposes to the cash flow risk associated with fluctuating discount rates. There is a small increase in the risks to equity holders when the cost of debt component of the regulated return is set at a trailing average (specifications 2 and 3). The standard deviation of total returns to equity holders increases to around 4.8 to 4.9%.

259. If the cost of equity component of the regulated return is also set at a trailing average, the risks to equity holders increase more substantially. The standard deviation of total returns is 11.2% when a five-year trailing average is adopted and 12.5% when a ten-year trailing average is adopted. This occurs because the valuation risks associated with fluctuating discount rates more than offsets the reduction in cash flow risk associated with the less variable regulated rate of return. To summarise:

a) Specification 1 exposes equity holders to the lowest volatility of returns, in the absence of any risk associated with being able to borrow at the prevailing cost of funds. The standard deviation of returns to equity holders is about 4.5% and the standard deviation of interest coverage is about 0.2. However, it has the highest refinancing risk;

b) Specifications 2 and 3 expose equity holders to some additional total returns volatility and an increased risk of default on existing borrowings, but with lower refinancing risk. The standard deviation of equity returns is around 4.8 to 4.9% and the standard deviation of interest coverage is 0.4;

c) With respect to specifications 4 and 5, at first glance, there is an intuitive appeal to applying a trailing average approach to both the debt and equity components of the regulated rate of return. However, the results for scenarios 4 and 5 demonstrate that this results in a material increase in the volatility of returns to equity holders. There is almost no dispersion in interest coverage ratios and debt is refinanced over time. But the standard deviation of equity returns increases to 11.2% and 12.5%, respectively; and

d) With respect to specifications 6 and 7, the outcomes quantify the risks a business is exposed to if it holds a single asset and elects to borrow over time in a manner independent of the setting of regulated rates of return. The standard deviation of equity returns is 15.1% and 17.7%, respectively, and the standard deviation of the interest coverage ratio is 0.7.

Incentive implications

Concept

260. A divergence between the regulated rate of return and the prevailing cost of funds will distort incentives for investment. All investment is, in some way, discretionary. Energy network businesses have an obligation to maintain a reliable energy supply, but there will not necessarily be one way to achieve this objective. The business will select the project which achieves the reliability objective but has the highest net present value of expected cash flows to the business. In the situation where the regulated rate of return is equal to the prevailing cost of funds, every project is

a zero net present value investment. The business may subsequently be able to earn a return above the cost of funds, if it is able to be more cost-effective in implementing the project than assumed in the benchmark cash flow projections.

261. In the situation where the regulated return is higher than the prevailing cost of funds (because the trailing average cost of capital exceeds the point in time figure), the business has an incentive to choose a relatively higher capital expenditure/lower operating expenditure option to meet its reliability obligations. It will earn abnormal returns on the investment in the early years of the project life and would be expected to earn normal returns over time as the trailing average and expected prevailing cost of funds converge. In the case where the regulated return is below the prevailing cost of funds, the business has an incentive to choose a relatively lower capital expenditure/higher operating expenditure option. It will be reimbursed for the operating expenditure and will incur higher capital expenditure later.

262. This incentive distortion was the motivation behind the QTC submission that the debt component of the regulated return be a weighted average of a trailing average cost of debt and the prevailing cost of funds. The weights placed on the trailing average and the prevailing cost of funds are based on the regulated asset base and the capital expenditure over the regulatory period.

263. A simple example illustrates the point. Suppose than an investment will cost $100, have a ten-year life and assume straight-line depreciation, so the regulated asset base declines by $10 each year. The prevailing cost of funds is 10% and the regulated rate of return is 10%. The operating costs associated with this investment is $10 per year and there are no taxes. The required revenue is $30 in year one, declining to $21 in year 10 as the regulated asset base declines. That is, in year one the return on capital is $10 (that is, 10% × $100 = $10), the return on capital is $10 (to offset depreciation of $10) and the return of operating costs is $10. In year 10, the return on capital is $1 (that is, 10% × $10 = $1) and the return of capital and operating costs are the same. The time-series of cash flows is presented in Table 9.

Table 9. Incentive example

Year	RAB	Depn	Costs	RR = Cost of funds = 10%			RR =8% < Cost of funds = 10%		
				Return	NCF	TCF	Return	NCF	TCF
1	100.00	10.00	10.00	10.00	20.00	30.00	8.00	18.00	28.00
2	90.00	10.00	10.00	9.00	19.00	29.00	7.20	17.20	27.20
3	80.00	10.00	10.00	8.00	18.00	28.00	6.40	16.40	26.40
4	70.00	10.00	10.00	7.00	17.00	27.00	5.60	15.60	25.60
5	60.00	10.00	10.00	6.00	16.00	26.00	4.80	14.80	24.80
6	50.00	10.00	10.00	5.00	15.00	25.00	5.00	15.00	25.00
7	40.00	10.00	10.00	4.00	14.00	24.00	4.00	14.00	24.00
8	30.00	10.00	10.00	3.00	13.00	23.00	3.00	13.00	23.00
9	20.00	10.00	10.00	2.00	12.00	22.00	2.00	12.00	22.00
10	10.00	10.00	10.00	1.00	11.00	21.00	1.00	11.00	21.00
NPV 1 – 5		37.91	37.91	31.05	68.95	106.86	24.84	62.74	100.65
NPV 6 – 10		23.54	23.54	7.51	31.05	54.58	7.51	31.05	54.58
NPV 1 – 10		**61.45**	**64.45**	**38.55**	**100.00**	**161.45**	**32.35**	**93.79**	**155.24**

NCF (net cash flow) = return on capital + depreciation; TCF (total cash flow) = return on capital + depreciation + costs; RR = regulated return; RAB = regulated asset base.

264. The net present value of the cash flows to the business is $100.00 so this is a zero net present value project. Incorporating the $10 of annual operating costs, the net present value of total cash flows is $161.45.[15] There are two five-year regulatory periods in the life of this asset. The present value of net cash flows during the first five years is $68.95 and the present value of net cash flows during the second five years is $31.05. For total cash flows, the corresponding present values are $106.86 and $54.58.

265. Now suppose the regulated return is below the cost of funds, at 8%, but based upon current discount rates and expected future discount rates, the business projects that the regulated return and the cost of funds will both be 10% during the second regulatory period. In its current form the investment has a net present value of $93.79. The value of the business would decline by $6.21 if it undertook the investment. Instead, the business defers capital expenditure until the second regulatory period and incurs higher operating expenditure during each year of the first regulatory period. These costs will necessarily be higher, in present value terms, than the sum of the return on capital, depreciation and operating costs from the first scenario. If there were a lower cost approach available in the cost of capital was set equal to the regulated return, this would already have been adopted.

266. It is important to emphasise that in no way has the business incurred unnecessary capital expenditure or inefficient costs, in the context of the situation faced by the firm. It has responded in an entirely predictable manner by selecting the project which meets its reliability obligations, earns just a normal return on investment, and incurs the lowest amount of operating expenditure for a zero net present value project. But operating costs have increased and investment has been delayed, which in another scenario might lead to higher investment costs due to the ageing network.

267. Also note that this example relates to the capital and operating expenditure proposed to the regulator, rather than the capital and operating costs incurred once the regulatory period begins. During the regulatory period, the business has an incentive to minimise its capital and operating expenditure, because the regulated revenue stream has already been determined.

Simulation analysis

268. The extent of investment distortions associated with a mis-match between the prevailing cost of funds and the regulated rate of return will depend upon three issues: (1) how wide-ranging the options are for a firm to switch between capital and operating expenditure to meet its reliability standards; (2) the divergence between the prevailing cost of funds and the regulated return; and (3) the projected time it will take for the two returns to align.

269. Quantifying the first issue is beyond the scope of this paper, but we can address the latter two issues. We present a series of metrics to demonstrate the materiality of the incentive to alter capital expenditure decisions, in the absence of a mechanism to have the marginal investment (that is, capital expenditure during the regulatory period) earn a return equal to the prevailing cost of funds. In short, we demonstrate the magnitude and persistence of the difference in the prevailing cost of funds and the regulated return under specifications 2 and 3 (analogous to the trailing

[15] We have used the same discount rate of 10% to discount all cash flows. It is not necessarily true that the correct discount rate to apply to different series of expected cash flows is the same, as those series could have different risks. However, adopting different discount rates for different series of expected cash flows in this instance is not necessary to illustrate how incentives are distorted when the regulated return does not equal the prevailing cost of funds.

average cost of debt approaches of the EURCC and QTC) and specifications 4 and 5 (analogous to the extension alluded to by QTC in which the trailing average approach is also applied to the cost of equity).

270. In Table 10, Panel A, we summarise the difference between the prevailing cost of funds as a weighted average of the costs of debt and equity capital and the regulated rate of return, for specifications 2 to 5 in which one or more components of the regulated return is set at a trailing average.

271. In Panel B, we consider the instances in which this difference was greater than 0.5% at the start of the regulatory period. We document the proportion of cases in which these values were expected to converge during the next regulatory period, and when convergence was expected in two or more periods. These values represent the proportion of instances in which the business would consider altering its capital expenditure program to a point outside the five-year regulatory period. In the last two columns we report the mean number of periods that a distortion would be expected and the mean difference between the regulated return and the prevailing cost of funds during these periods. It is worth repeating that there is no assumption that the business is over- or under-spending on a particular capital project. The assumption is that the business will elect a capital and operating cost profile from a suite of alternatives which all allow for reliability standards to be achieved. It will select an option which allows it to earn its cost of capital on investment.

272. There are three issues to consider. First, the differences between the regulated return and the prevailing cost of funds are substantial, with the standard deviation ranging from 1.3% in specification 2 (where the debt component is set at a 5-year trailing average) to 2.9% in specification 5 (where both the debt and equity components are set at a 10-year trailing average). These standard deviations represent 15 to 34% of the mean regulated rate of return of 8.4%.

273. Second, there is a positive relation between the risk to equity holders and the dispersion of the difference between the prevailing cost of funds and the regulated return. Under specifications 4 and 5, in which the regulated return to equity holders is estimated as a trailing average, equity holders are exposed to the largest fluctuations in asset values and the largest variation in total returns. Under this specification there is also the greatest potential for investment decisions to be distorted. Under these specifications, if there is a sudden rise in the cost of capital, the following is likely to occur – cash flows will remain relatively stable, equity value will decline and investment will be deferred. Under specifications 2 and 3, cash flows will rise, equity value will fall but to a lesser degree and investment will be deferred, but with fewer distortions than under specifications 4 and 5.

274. Third, it is in the majority of situations that the regulated rate of return differs from the prevailing cost of funds by more than 0.5% during the first regulatory period. Under specifications 2 and 3, we would observe a deviation outside this range is 62% and 69% of cases, respectively. In the cases where these rates differ by more than 0.5%, the average difference is 1.3% and 1.4%, respectively. In short, incorporating a trailing average for return on debt into the regulated rate of return implies that, in about two-thirds of cases, there is an average difference between the regulated rate and the cost of funds of around 1.3%.

Table 10. Divergence between the prevailing cost of funds and the regulated return

Panel A: Summary statistics (%)

Spec	Debt	Equity	Borr	Mean	StdDev	5th perc	25th perc	Median	75th perc	95th perc
2	5-yr	Prev	5-yr	0.0	1.3	-1.9	-0.7	-0.1	0.7	2.1
3	10-yr	Prev	10-yr	0.0	1.4	-1.9	-0.9	-0.2	0.7	2.5
4	5-yr	5-yr	5-yr	0.0	2.5	-3.7	-1.5	-0.2	1.3	4.2
5	10-yr	10-yr	10-yr	0.0	2.9	-3.9	-1.8	-0.4	1.4	4.9

Panel B: How many periods before the expected WACC falls within 0.5% of the regulated return?

Spec	Debt	Equity	Borr	% within ±0.5%	Convergence in 1 period	Convergence in ≥ 2 periods	Mean periods if ±0.5%	Diff in ret if ±0.5%
2	5-yr	Prev	5-yr	38	61	1	1.0	1.3
3	10-yr	Prev	10-yr	31	57	12	1.2	1.4
4	5-yr	5-yr	5-yr	20	73	7	1.1	2.2
5	10-yr	10-yr	10-yr	15	59	26	1.3	2.3

"% within ±0.5%" is the proportion of simulations in which the regulated rate of return in the first period is within 0.5% of the prevailing cost of funds;. % "Convergence in 1 period" is the proportion of simulations in which the regulated rate of return is outside of ±0.5% of the prevailing cost of funds in the first period but falls within this range sometime during the second period. "Convergence in ≥ 2 periods" is the proportion of simulations in which the regulated rate of return is outside ±0.5% of the prevailing cost of funds in the first period, but falls within this range sometime during the second period. "Mean periods if ±0.5%" is the average number of periods there is at least a 0.5% difference between the regulated return and the prevailing cost of funds, for the cases in which this divergence exists in the first period. "Diff in ret if ±0.5%" is the mean absolute difference between the prevailing cost of funds and the regulated return in the cases were the two rates have not converged to within 0.5%.

275. Under specifications 4 and 5, the distortions to investment incentives are even greater. In 80% and 85% of cases the regulated return falls more than 0.5% outside the prevailing cost of funds. On average it takes 1.3 regulatory periods before the rates are expected to converge and the average difference in returns during this period is 2.3%.

276. This analysis implies that, if a trailing average is incorporated into the regulated rate of return, more often than not there will be an incentive to alter investment decisions. These investment distortions would be likely to occur without businesses overspending or underspending on capital requirements for a particular project. It means that, given a selection of alternative projects by which reliability standards can be met, the business will select a high capital/low operating cost alternative when the regulated return is above the cost of funds, and a low capital/high operating cost alternative when the regulated return is below the cost of funds.

13. Conclusions from simulation analysis

277. We document the risks and incentive effects associated with seven alternative specifications of the regulated rate of return and the borrowing program of a regulated business. The motivation for considering a trailing average approach to the debt component of the regulated return is refinancing risk. In the absence of refinancing risk (that is, assuming the firm can lock in its borrowing costs at the prevailing cost of funds) the current approach to setting the regulated return minimises the volatility of equity returns and does not distort incentives for investment. If the firm elects not to lock in its borrowing costs, and rather refinances over a prior five- or ten-year period, the risks to equity holders are substantial. There is a clear incentive for the firm to align its borrowing practices with the manner in which the debt component of the regulated return is set.

278. If the debt component of the regulated return is set as a trailing average there is a small increase in the volatility of returns to equity holders, assuming that debt is borrowed in a consistent manner. This occurs because equity holders are exposed to the same cash flow risk as under the current approach, but there is an increased risk that equity values fall during periods of high discount rates.

279. However, if the trailing average approach is extended to the equity component of the regulated return, equity risks increase substantially. From a cash flow perspective, risk is reduced. But this is more than offset by an increase in volatility of equity values associated with fluctuating discount rates. Extending the trailing average approach to the equity component of the regulated return also significantly increases incentive distortions, compared to just incorporating the debt component as a trailing average.

280. At first glance, there is a conceptual appeal to applying a trailing average to both the debt and equity components of the regulated return, or to neither component. However, this consistent application only makes sense if the rationale is purely to provide a pass-through of investment returns which prevailed at the time the investment was made. The regulatory framework is designed to encourage firms to make investments at each point in time which guarantee reliable energy supply. If a trailing average is applied to the equity component, the risks to equity holders increase and there are more investment distortions, compared to the case where a trailing average is applied only to debt. Neither of these outcomes will encourage investment in reliable energy supply.

281. In sum, if there is substantial risk associated with attempting to match the debt component of the regulated return with borrowing costs, then volatility of equity returns will be reduced if a trailing average is applied to this debt component. If the regulated return is applied in the current manner there will also be a distortion of capital expenditure incentives. The standard deviation of the difference between regulated returns and the cost of funds is around 1.4%, which is sufficient to alter the firms' capital and operating expenditure decisions. This would occur without any over- or under-spending on a given project. It could occur simply via project selection. Hence, it is essential that, if a trailing average approach is implemented for debt that it is accompanied by a mechanism for managing these incentives.

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