Draft Rate of Return Instrument Explanatory Statement

2 SEPTEMBER 2022

QUEENSLAND TREASURY CORPORATION

Queensland Treasury Corporation (QTC) welcomes the opportunity to provide comments to the Australian Energy Regulator's (AER) *Draft Rate of Return Instrument Explanatory Statement.* A summary of our views is provided below.

Summary

Term-matching should not be used to calculate the allowed return on equity

- The AER has proposed a term-matching approach to calculate the allowed return on equity in the 2022 Rate of Return Instrument (RoRI). This will result in the 5-year Commonwealth Government Security (CGS) yield being used as the risk-free rate in the Capital Asset Pricing Model (CAPM).
- The proposal has been informed by a report from Dr. Martin Lally, who advised that regulated equity can be viewed as a long-term floating-rate bond with a coupon that is reset at the start of each 5-year regulatory period. The floating rate bond analogy is essential to the AER's term matching proposal because it avoids the assumption that investors receive an amount equal to the residual regulated asset base (RAB) in cash at the end of the regulatory period. This assumption is one of the main reasons why the AER did not adopt term-matching in the 2018 RoRI.
- Under the floating-rate bond analogy, the risk-free component of the allowed return on equity is the required yield on a long-term risk-free bond with a coupon that is reset every five years to equal the 5-year risk-free yield. Lally considers the required yield to be the prevailing 5-year risk-free yield on each coupon reset date.
- As we demonstrate in Section 2 and Section 3, if regulated equity is viewed as a long-term floating-rate bond with 5-yearly coupon resets, the risk-free rate in the allowed return on equity should be materially *higher* than the 5-year risk-free yield. This conclusion is supported by:
  - a first principles analysis based on the incremental cost of locking in funds for longer periods of time while maintaining the same exposure to interest rate risk
  - the positive slope of the trading margin term structure for floating-rate CGS, and
  - the expected cost/return of a CGS swap package, which is a portfolio of CGS and swap transactions that approximates the cash flows on a long-term coupon-resetting CGS.
- We have used the CGS swap package to estimate the yield that investors would likely require to buy a long-term coupon-resetting CGS. QTC's estimate of the average required yield between October 2016 and July 2022 is **0.51 per cent higher than the average 5-year CGS yield**. In contrast, the average required yield is only 0.07 per cent higher than the average 10-year CGS yield during this period. As a consequence, the term-matching proposal in the *Draft Explanatory Statement* can be expected to significantly under-estimate the risk-free rate in the allowed return on equity, which will lead to **NPV<0** outcomes for equity providers to network businesses regulated by the AER.
- In our view, this is strong market-based evidence against the proposal in the *Draft Explanatory Statement* to depart from the AER's long-standing practice of using a 10-year CGS yield to calculate the allowed return on equity.
- Finally, term-matching is out of step with contemporary regulatory practice in Australia. For example, the Queensland Competition Authority (QCA) and Economic Regulation Authority Western Australia (ERAWA) were previously long-term supporters of term-matching. However, both regulators have recently chosen or proposed to abandon term-matching and use a 10-year term for the return on equity.

The Wright approach has still not been properly assessed

Assessment of the theoretical basis for the Wright approach

- Section 7.2.3.1 of the *Draft Explanatory Statement* is meant to provide the AER's assessment of the theoretical basis for the Wright approach. In QTC's view, the assessment was not done in good faith, or in way that is consistent with good regulatory practice.
- Section 7.2.3.1 does not address the main theoretical points in Wright, Mason and Miles (2003). The section appears to be more concerned with making a case against the Wright approach rather than genuinely engaging with the research and academic literature to determine an appropriate weight for the Wright approach.
- Most of the points raised in Section 7.2.3.1 relate to empirical issues rather than theoretical issues. Even so, a more comprehensive analysis of the empirical issues cited leads to different conclusions. For example:
  - Dimson, Marsh and Staunton (2001) report similar levels of variability in the cross-section of average real returns *and* average excess returns based on a sample of sixteen countries. Therefore, the claim that Siegel's Constant is not a 'global phenomenon', also applies to the AER's preferred historical excess returns (HER) approach.
  - Lettau and Ludvigson (2005) do not 'explicitly reject' a constant expected return as claimed by the AER. The authors find that excess returns are strongly predictable using a proxy for the log consumption-wealth ratio. This is consistent with the conditional expected MRP not being constant. Importantly, the variation in the conditional expected MRP is countercyclical.
  - Campbell and Cochrane (2000) refer to studies which show that the Consumption CAPM (CCAPM) does a poor job of explaining the observed returns on individual stocks and portfolios of stocks. Section 7.2.3.1 uses these empirical failures to reject the CCAPM as a theoretical basis for the Wright approach. However, Wright et al only use the theory of the CCAPM to inform their approach for estimating the expected real market return, which is an input into the Sharpe–Lintner CAPM (SL CAPM). Wright et al use the SL CAPM to calculate the return on equity for regulated businesses, so any empirical failure of the CCAPM at the individual stock level is not relevant to a theoretical or empirical assessment of the Wright approach.
  - Section 7.2.3.1 also omits the following important conclusion in Campbell and Cochrane (2000):

    One cannot believe that the CAPM does hold, but consumption-based models, as a class, fundamentally do not.

- Two dot points are provided to support the AER's conclusions based on Dimson et al and Lettau and Ludvigson. In our view, the AER should have explained the approaches used in those papers, and provided quotes and extracts to support the interpretation of the findings and the conclusions reached. Providing two dot points does not represent a genuine attempt to fully engage with the material in those papers.
- Section 7.2.3.1 states that some aspects of the Wright approach are 'subject to debate', which implies there are at least two sides for the AER to consider. However, Section 7.2.3.1 does not present a single finding that favours giving any weight to the Wright approach.
- The two pages that make up Section 7.2.3.1 have been published more than twelve months after the AER made a commitment to consider the theoretical and empirical basis for the Wright approach. Due to this delay, stakeholders only have one opportunity to respond to the AER's assessment before the Final 2022 RoRI is made. In our view, this outcome is not consistent with good regulatory practice.
- Based on the above, Section 7.2.3.1 cannot be used to make an informed decision on the appropriate weight for the Wright approach. In our view, no weight should be given to the conclusions in Section 7.2.3.1 when the AER makes the Final 2022 RoRI.

Assessment of the empirical basis for the Wright approach

- Section 7.2.3.2 of the *Draft Explanatory Statement* provides the AER's assessment of the empirical basis for the Wright approach, which is the stability (ie, stationarity) in the long-term average real return on equity.
- The 30-year rolling averages of real equity returns and excess returns, and Lally's statistical tests, both show that real equity returns and excess returns are stationary. As such, the average real return and average excess return are statistically valid unconditional estimates of the expected real market return and expected market risk premium (MRP) respectively.
- Despite these findings, the AER concludes that no weight should be given to the Wright approach because the real equity returns are more volatile than the excess returns. The standard deviation of the rolling 30-year averages are 1.60 per cent and 0.87 per cent respectively.

- It does not follow that 100 per cent weight should be given to the estimate with the lowest volatility. If relative volatility is the sole basis for determining weights, a more reasonable approach is to give proportionately more weight to the lower volatility estimate compared to the higher volatility estimate.
- This can be done using inverse volatility weights. Based on standard deviations of 1.60 per cent and 0.87 per cent, this approach produces weights for the Wright and HER approaches of 35 per cent and 65 per cent respectively.
- The empirical results in Section 7.2.3.2 of the *Draft Explanatory Statement* show that the average real return and average excess return are statistically valid unconditional estimates of the expected real market return and expected MRP respectively. In QTC's view, these empirical findings cannot be used to justify giving zero per cent weight to the Wright approach in the 2022 RoRI.

Appropriate course of action when making the Final 2022 RoRI

- In May 2021 the AER made a commitment to consider the theoretical and empirical basis for the Wright approach. This assessment should have been included in the December 2021 *Overall rate of return, equity and debt omnibus final working paper* at the latest. However, the first and only opportunity for stakeholders to comment on the AER's assessment is in submissions to the June 2022 *Draft Explanatory Statement*. This document was published more than twelve months after the AER's original commitment was made.
- This outcome is not consistent with good regulatory practice. Meaningful back-and-forth dialogue between stakeholders and the AER is essential for a sound and robust review process. Missing a single round of consultation is sufficient to significantly weaken the quality of the outcomes from the review process.
- It is too late for the AER to make a proper assessment of the Wright approach, because stakeholders will have no opportunity to respond. Therefore, QTC considers the most appropriate course of action for the AER when making the Final 2022 RoRI is to:
  - place no weight on the conclusions in Section 7.2.3.1 of the *Draft Explanatory Statement*, and
  - follow the advice already provided by its consultants and give weight to the HER and Wright approaches.
- A weight of 35–50 per cent for the Wright approach is consistent with the inverse volatility weighting approach and the other advice already provided to the AER by its consultants.
- A weighted average of the Wright and HER approaches is an estimate of the expected MRP based on historical data. This estimate can be combined with the forward-looking implied MRP from the calibrated dividend growth model (DGM) to calculate the expected MRP under the 2022 RoRI.

1 The AER's term-matching proposal

1.1 Background

- The AER has proposed a term-matching approach to calculate the allowed return on equity in the 2022 Rate of Return Instrument (RoRI). This will result in the 5-year Commonwealth Government Security (CGS) yield being used as the risk-free rate in the Capital Asset Pricing Model (CAPM).
- The proposal has been informed by a report from Dr. Martin Lally, who advised that regulated equity can be viewed as a long-term floating-rate bond with a coupon that is reset at the start of each 5-year regulatory period.
- Under the floating-rate bond analogy, the risk-free component of the allowed return on equity is the required yield on a long-term risk-free bond with a coupon that is reset every five years to equal the 5-year risk-free yield[1]. Lally considers the required yield to be the prevailing 5-year risk-free yield on each coupon reset date.
- As we demonstrate in the submission, if regulated equity is viewed as a long-term floating-rate bond with 5-yearly coupon resets, the risk-free rate in the allowed return on equity should be materially higher than the 5-year risk-free yield. This conclusion is supported by:
  - a first principles analysis based on the incremental cost of locking in funds for longer periods of time while maintaining the same exposure to interest rate risk
  - the positive slope of the trading margin term structure for floating-rate CGS, and
  - the expected cost/return of a CGS swap package that approximates the cash flows on a long-term coupon-resetting CGS.
- The CGS swap package can be used estimate the yield that investors would likely require to buy a long-term coupon-resetting CGS. QTC's estimate of the average required yield between October 2016 and July 2022 for a 25-year tenor is **0.51 per cent higher than the average 5-year CGS yield**. In contrast, the average required yield is only 0.07 per cent higher than the average 10-year CGS yield during this period. As a consequence, the term-matching proposal can be expected to significantly under-estimate the risk-free rate in the allowed return on equity, which will lead to **NPV<0** outcomes for equity providers to network businesses regulated by the AER.
- Term-matching is also out of step with contemporary regulatory practice in Australia. For example, the Queensland Competition Authority (QCA) and Economic Regulation Authority Western Australia (ERAWA) were previously long-term supporters of term-matching. However, both regulators have recently chosen or proposed to abandon term-matching and use a 10-year term for the return on equity.
- The QCA and ERAWA specifically refer to the importance of providing the correct compensation over the life of the regulated asset rather than the term of the regulatory period. For example, in the 2021 rate of return review the QCA concluded[2]:

  > In the last decade, we have estimated the risk-free rate using an interpolated term-matched bond term. However, in our most recent reviews, we have reverted to using a 10-year bond term, as we considered that it would better provide for an overall return that was commensurate with the commercial and regulatory risks associated with investment for the life of the asset.

- ERAWA reached a similar conclusion, and stated that a 10-year term[3]:

  > Recognises the reality of regulatory cashflows and returns being realised by equity investors over the life of the asset.

- The AER has rejected term-matching in multiple reviews dating back to 2009, and most recently in the 2018 RoRI. Although the outcomes from the 2020 inflation review have led to an 'evolution' in the AER's thinking and a desire

[1] In this submission a long-term risk-free floating-rate bond with a coupon that is reset every five years to equal the 5-year risk-free yield will often be referred to as a '*long-term coupon-resetting bond*'. Unless stated otherwise, the risk-free bond has a single principal repayment at maturity (ie, a bullet bond).

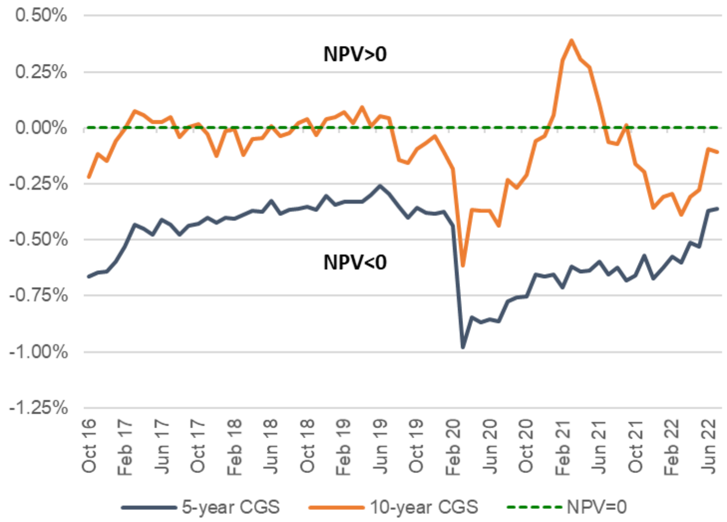
[2] QCA (November 2021), *Final report – Rate of return review*, p. 83.

[3] ERAWA (June 2022), *Explanatory statement for the 2022 draft gas rate of return instrument*, p. 96.

to re-examine past advice through a 'new lens', the main change in the AER's thinking since 2018 is the acceptance of Lally's long-term floating-rate bond analogy.

- The floating-rate bond analogy has nothing to do with the outcomes from the 2020 inflation review. However, the analogy is essential to the AER's term matching proposal because it avoids the assumption that investors receive an amount equal to the residual regulated asset base (RAB) in cash at the end of the regulatory period.
- However, as we demonstrate in this submission, a first principles and market-based assessment of the long-term floating rate bond analogy does not support using a 5-year risk-free rate to calculate the allowed return on equity. Instead, a 10-year risk-free rate has produced, and can be expected to produce, outcomes that are much closer to meeting the NPV=0 condition (Figure 1)[4].

FIGURE 1: DEPARTURES FROM NPV=0 UNDER THE FLOATING-RATE BOND ANALOGY



Source: QTC yield data and calculations

1.2 Previous AER views on term-matching

- A key problem with term-matching previously identified by the AER is the assumption that investors receive an amount equal to the residual RAB in cash at the end of the regulatory period. In the 2013 Rate of Return Guideline (RoRG) the AER concluded[5]:

> The core intuition behind the argument for a five year term is that the cash flows from the building block model have a similar structure to the cash flows from a five year bond. Put simply, the argument is that an equity investment in a regulated business is—at least in respect of its term—like an investment in a five year bond.
>
> … the assumption is that the investor receives a cash payment equal to the RAB in the final year of the regulatory control period.

- The AER reached the same conclusion in the 2018 RoRI[6]:

> We considered Lally's [August 2012] advice previously in our 2013 guidelines and noted that his reasoning is reasonable based on his assumptions that a regulated business has fixed returns and a guaranteed return of the initial investment at the end of the regulatory period. In this scenario, the investment in a regulated business would effectively be very similar to an investment in a government bond, and using a term equal to the length of the regulatory control period may be appropriate.
>
> However, the issue with using a term equal to the length of the regulatory control period, is it requires the assumption that the full recovery of the residual value of the RAB (in cash) at the end of the term is guaranteed.

[4] The approach used to produce the estimates in Figure 1 is set out in Section 3.

[5] AER (August 2013), *Draft Rate of Return Guideline Explanatory Statement*, p. 183.

[6] AER (December 2018), *Rate of Return Instrument Explanatory Statement*, p. 130.

- On both occasions the AER did not accept Lally's advice and retained a 10-year term for the return on equity.

1.2.1 Lally's 2021 advice to the AER

- The outcomes from the 2020 inflation review have led to an 'evolution' in the AER's thinking on term-matching and desire to re-examine past advice through a 'new lens'. To support this re-examination, the AER commissioned another report from Lally on the appropriate term for the allowed cost of capital.
- Lally's report is critical of the AER's previous reasons for not adopting term-matching, and the AER's interpretation of his 2012 advice. Lally rebuts the AER's arguments for not adopting term-matching in the 2018 RoRI[7]:

> In response to this kind of reasoning in Lally (2012), the AER (2018, page 130) asserts that this reasoning **assumes recovery of the asset book value in cash at the end of the first regulatory period**. No such assumption appears in equation (4); to the contrary, the equation explicitly recognizes that the payoff at the end of the first regulatory period is the market value then of the business and that this would equal the contemporaneous regulatory book value of its assets.
>
> The AER (ibid) also appears to suggest that the above proof assumes that **the value of the regulated assets at the end of the current regulatory period is known now for certainty**, and asserts that this is not true because regulated businesses may over or under perform their allowed rate of return. However the above analysis is performed in terms of expected revenues, which is entirely consistent with the possibility of actual revenues being higher or lower than this (as would occur under a price cap coupled with output being higher or lower than expected).'
>
> The AER (2018, page 130) also suggests that the above proof assumes that **the value of the regulated assets at the end of the current regulatory period is known now for certain**, and asserts that this is not true because of volatility in the stock market. However nothing in the above proof precludes the fact that the values of other assets are volatile. Nevertheless, it is possible that the value of the regulatory assets at the end of the first regulatory cycle (V1) may not be equal to the contemporaneous regulatory book value of the assets, because the regulator may err at time 1 in setting the revenues for the second regulatory cycle, and this possibility has not been recognized in equation (3) in the above analysis. However, at the commencement of the first regulatory cycle (time 0), there is no reason to expect bias in the regulator's revenue setting at time 1, i.e., any such errors at time 1 are as likely to be too high as too low. So, the expected value of V1 will be equal to the contemporaneous regulatory book value of assets, but the actual value for V1 may diverge from this asset book value.

- On this occasion, Lally has persuaded the AER to change its views on term-matching, and in particular the assumption that investors receive an amount equal to the residual RAB in cash at the end of the regulatory period[8]:

> He [Lally] confirmed that no assumption of asset book value recovery in cash at the end of the first regulatory period was made. He further observed that his analysis was performed in terms of expected revenues and did not assume the value of the regulated assets at the end of the current regulatory period was known for certain.
>
> We have reviewed Dr Lally's derivations and point out that equation (4) in Lally's report does not mean that the market value of the firm at the end of the first regulatory period is always known with certainty. Rather, the derivations on pages 7 and 8 and equations (1) to (4) suggest that a regulator should be able to set the allowed rate of return so as to ensure that the expected market value of the firm at the end of the first regulatory period is equal to its asset book value. Setting the regulatory allowance in this way would allow the regulator to achieve NPV=0.

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[7] M. Lally (April 2021), *The appropriate term for the allowed cost of capital*, p. 8–9.

[8] AER (September 2021), *Term of the rate of return & Rate of return and cashflows in a low interest rate environment Final working paper*, p. 54.

1.3 Lally's long-term floating-rate bond analogy

- The main change in the AER's thinking since the 2018 RoRI is the acceptance of Lally's advice that regulated equity can be viewed as a long-term floating-rate bond with a coupon that is reset every 5 years. Lally suggests, and the AER accepts, that the analogy justifies using a term-matching approach to calculate the allowed return on equity[9]:

> Dr Lally has advised that the term of equity should match the length of the regulatory period to satisfy the NPV=0 condition. This is because the appropriate discount rate for equity would be one that matches the length of the regulatory period. **He noted that our return on equity can be thought of as a long-term floating-rate bond with a coupon that resets at the start of every regulatory period.** Thus, the duration of the cashflow (and consequently the discount rate) is the length of the regulatory period. The expected return on equity allowance (and term) needs to match to the length of the regulatory period to satisfy the NPV=0 condition in expectation.

- Viewing regulated equity as a long-term floating-rate bond with 5-yearly coupon resets avoids the assumption that investors receive an amount equal to the residual RAB in cash at the end of the regulatory period. For example, a long-term floating rate bond might make a partial principal repayment each year similar to a long-term annuity, or a full principal repayment at maturity.
- Before determining the yield investors would likely require to buy a long-term coupon-resetting bond, it is necessary to understand the pricing and valuation of standard floating-rate bonds.

1.4 Pricing and valuing floating-rate bonds

- The AER describes valuing a floating-rate bond as follows:[10]

> Standard finance textbooks suggest that the market value of a floating-rate bond depends on the short-term rate over the period leading up to the next coupon reset (rather than the rate over the entire bond term). Further, [the] ex-coupon value of a floating-rate bond on all coupon reset dates is its par value. This is analogous to how the market value of regulated assets would equal to their book (par) value at each regulatory reset for the correctly set parameter values.

- Standard finance textbooks and market practice show that the coupon margin and trading margin are important pricing parameters that determine the value of a floating-rate bond. Floating-rate bonds are usually issued at par, which means the coupon and trading margins are equal at inception. The ex-coupon market value of a floating rate bond on each future coupon reset date will equal par if the trading margin is equal to the coupon margin.
- The coupon margin is fixed for the term of the bond and is added to a base yield to determine the total coupon.
  - The 3-month and 6-month bank bill swap reference rates (BBSW) are typically used as the base yield for floating-rate bonds in Australia. However, it is possible for other yields such as the 5-year swap or CGS yield to be used as the base yield provided the choice is NPV neutral.
  - For interest-only (ie, bullet) floating-rate bonds, the coupon margin can be valued as a fixed annuity.
- The trading margin changes over time in the same way the yield on a fixed-rate bond changes after it is issued:
  - The trading margin is added to the zero coupon swap yield curve to determine the discount factors to calculate the present value of the known future cash flows on a floating-rate bond.
  - It is important to understand that the present value calculation is not based on a 'snapshot' of the known cash flows for the current coupon period only. The fixed coupon margin payments that occur *after* the end of the current coupon period must also be included in the present value calculation.
  - The discount rate that applies the outstanding principal balance at the end of the current coupon period must also reflect the trading margin.

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[9] AER (May 2021), *Term of the Rate of Return Draft Working Paper*, p. 39.

[10] AER (September 2021), *Term of the rate of return & Rate of return and cashflows in a low interest rate environment Final working paper*, p. 55.

1.4.1 Lally's valuation of a long-term coupon-resetting risk-free bond

- The following equation is taken from Lally's 2021 report for the AER[11]:

$$V_0 = \frac{\$0.497m}{1.001} + \frac{\$0.497m}{(1.001)^2} + \frac{\$0.497m}{(1.001)^3} + \frac{\$0.497m}{(1.003)^4} + \frac{\$100.497m}{(1.005)^5} = \$100m$$

- In this example, operating costs are \$10m per annum, capex and depreciation are \$2m per annum and the opening RAB is \$100m. The asset is risk-free, so the allowed return on equity has been calculated using a 5-year risk-free par rate of 0.497 per cent. This results in an allowed revenue of \$12.497m per annum.
- The \$0.497m figures in the first four years are the net cash flows (ie, allowed revenues less opex and capex). The \$100.497m figure in year five equals a net cash flow of \$0.497m plus the residual RAB of \$100m. The discount rates are the risk-free zero coupon yields.
- Lally does not consider the residual RAB at the end of year five to be a cash flow. Under the long-term floating-rate bond analogy the residual RAB is the remaining principal balance at the end of year five that will eventually be received in cash on some date or dates after the end of year five.
- Lally uses risk-free zero coupon yields to calculate the present value of the net cash flows and closing RAB. As such, there is an implicit assumption that the coupon and trading margin on a long-term risk-free coupon-resetting bond are zero at inception.
- To determine if this is correct, or even plausible, requires replicating transactions based on market yields to estimate the yield that investors would likely require to buy this type of coupon-resetting bond. The required yield cannot be determined using equations and stylised examples.
- QTC has previously provided the AER with two market-based examples which show that the trading margin on a long-term coupon-resetting CGS is likely to be materially positive. In this submission we apply the same approach to make monthly estimates of the trading margin for a 25-year coupon-resetting bullet CGS between October 2016 and July 2022. As we show in Appendix A, the margin on a 25-year bullet CGS is a good proxy for the margin on a 50-year principal-reducing CGS, with the latter profile being consistent with a network asset that is fully depreciated on a straight line basis over a 50-year period.
- Consistent with the examples already provided to the AER, the estimated trading margins are consistently positive. The average margin is 0.51 per cent, which means the risk-free rate under the long-term floating-rate bond analogy is materially higher than the 5-year risk-free rate.

1.5 The floating-rate bond analogy and the allowed return on equity

- In our submission to the *Term of the Rate of Return Draft Working Paper* we stated that in accepting the long-term floating rate-bond analogy the AER is effectively:[12]

> … viewing regulated equity as a long-term floating-rate Commonwealth Government Security (CGS) with a coupon that is reset every 5 years to equal the prevailing 5-year CGS yield plus an equity risk premium.

- The AER responded by suggesting that[13]:

> … while we used Dr Lally's analogy of a sequence of regulatory allowance being like a floating-rate bond, we did not contemplate it being a long-term floating-rate CGS. Rather, just like floating-rate bonds in Australia use 180 day Bank Bill Swap Rate (BBSW) as a benchmark, **we contemplated a long-term floating-rate bond that used a five-year CGS yield as a benchmark for the risk-free rate in the CAPM with the CAPM equity risk premium added to the benchmark**.

- There is no difference between what we described in our submission and what the AER contemplated. The AER has always used a CGS as the proxy for the risk-free asset in the CAPM. Therefore, it is clear that what the AER

[11] M. Lally (April 2021), *The appropriate term for the allowed cost of capital*, p. 14.

[12] QTC (July 2021), *Submission to the Term of the Rate of Return Draft Working Paper*, p. 3.

[13] AER (September 2021), *Term of the rate of return & Rate of return and cashflows in a low interest rate environment Final working paper*, p. 54.

contemplated was a long-term risk-free floating-rate bond (ie, long-term floating-rate CGS) with a coupon that is reset every 5 years to equal the 5-year risk-free rate (ie, 5-year CGS yield) as the riskless asset in the CAPM. This aligns with the following conclusion in the *Draft Explanatory Statement*:[14]

> Therefore, for this draft decision we confirm our proposed approach to the following key aspects … using Commonwealth Government Securities as proxy for the riskless investment for our purposes.

- If regulated equity is viewed as a long-term coupon-resetting bond, the risk-free rate in the CAPM is the required yield on a long-term floating-rate CGS with a coupon that is reset every five years to equal the 5-year CGS yield.
- Therefore, what should have been an important objective for the AER is determining what the required yield on this type of floating-rate CGS is likely to be. However, this determination has not been made. The *Draft Explanatory Statement* includes no discussion on the long-term floating-rate bond analogy even though the term-matching proposal depends on it.
- Without having made this determination, it is not possible to conclude that using a 5-year CGS yield in the allowed return on equity satisfies the NPV=0 condition, or achieves outcomes that are closer to satisfying the NPV=0 condition compared to the current long-standing practice of using a 10-year CGS yield.
- QTC's assessment of the long-term floating-rate bond analogy is provided in Section 2. We demonstrate that if regulated equity is viewed as a long-term coupon-resetting bond, the risk-free rate in the allowed return on equity should be higher than the 5-year risk-free yield. This conclusion is based on:
  - a first principles analysis based on the incremental cost of locking in funds for longer periods of time while maintaining the same exposure to interest rate risk
  - the positive slope of the trading margin term structure for floating-rate CGS, and
  - the expected cost/return of a CGS swap package that closely approximates the cash flows on a long-term coupon-resetting CGS.

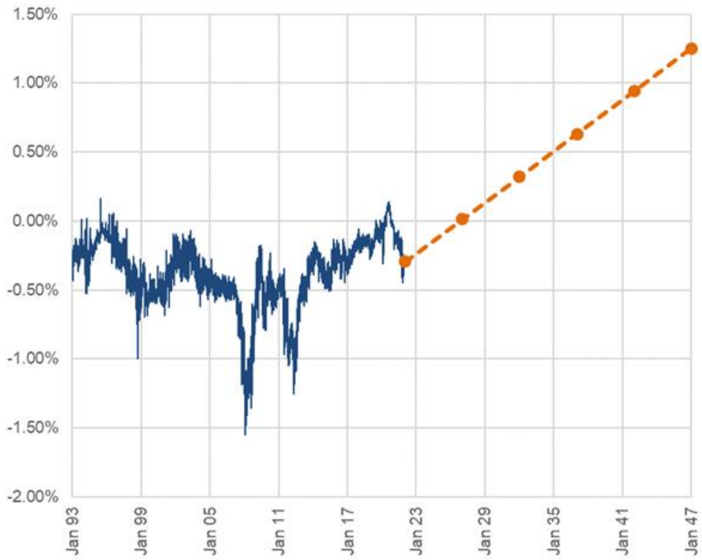
[14] AER (June 2022), *Draft Rate of Return Instrument Explanatory Statement*, p. 11 and 95.

2 Assessing the long-term floating-rate bond analogy

2.1 Material already provided to the AER

- In our submission to the *Term of the Rate of Return Draft Working Paper* we made a first principles assessment of the long-term floating-rate bond analogy. We concluded that the required yield on a long-term coupon-resetting risk-free bond should be higher than the 5-year risk-free rate.[15]
- In our submission to the *Rate of Return Information Paper and Final Working Papers* we outlined a market-based approach that confirmed our first principles conclusion. We showed that the pricing benchmark for estimating the required yield is a CGS swap package consisting of:[16]
  - a long-term floating-rate CGS with a base yield equal to 6-month BBSW, combined with
  - a series of 5-year interest rate swaps that are entered into on each coupon reset date.
- We provided an example using a 30-year floating-rate CGS, which at the time was priced at 6-month BBSW plus 0.36 per cent. We showed the path the 5-year CGS/swap spread (ie, 5-year CGS yield minus 5-year swap yield) would need to take for a 30-year CGS with a coupon that is reset every five years to equal the 5-year CGS yield to match the total cost/return of the CGS swap package (Figure 2)[17].

FIGURE 2: BREAK-EVEN PATH FOR THE 5-YEAR CGS/SWAP SPREAD



- Due to the fact that the 5-year CGS/swap spread has almost always been negative, and displays very strong mean reversion around a long-term average of –0.38 per cent, we concluded that the break-even path had the wrong sign and was implausibly high. Under a more realistic assumption that the long-term average spread is the best estimate of the expected spread on the future coupon reset dates, the required yield on the 30-year coupon-resetting CGS would have been 0.73 per cent higher than the 5-year CGS yield[18].
- This is an estimate of the trading margin that would likely apply at inception for a 30-year floating rate CGS with a coupon that is automatically reset every five years to equal the 5-year CGS yield. In order for the CGS to be priced at par, the fixed coupon margin would need to be 0.73 per cent. Therefore, the cost/return in each 5-year period will equal the 5-year CGS yield at the start of the period plus 0.73 per cent.

[15] QTC (July 2021), *Submission to the Term of the Rate of Return Draft Working Paper*, p. 3–4.

[16] QTC (March 2022), *Submission to the Rate of Return Information Paper and Final Working Papers*, p. 30.

[17] QTC (March 2022), *Submission to the Rate of Return Information Paper and Final Working Papers*, p. 30–32.

[18] QTC (March 2022), *Submission to the Rate of Return Information Paper and Final Working Papers*, p. 32.

2.1.1 Relevance to the term-matching proposal

- QTC considers this example to be highly relevant to the AER's term-matching proposal, and the claim that it satisfies the NPV=0 condition. However, the *Draft Explanatory Statement* includes no response to, or assessment of, our example. Three reasons for retaining a 10-year term are acknowledged, but QTC's example is not one of them[19].
- The AER has not provided an opinion on the 0.73 per cent margin estimate, or the approach used to produce the estimate. Given the proposal to adopt term-matching, we can only infer that the AER does not agree with our estimate, or the conclusions drawn from it. However, as no specific reasons have been provided we cannot provide a response in this submission to address whatever concerns, issues or questions the AER may have[20].
- Even if some reasons are included in the *Final Explanatory Statement*, QTC will have no opportunity to respond. As the reasons and assessment should have been provided in the *Draft Explanatory Statement*, QTC has effectively been denied a round of consultation on an important issue relating to the allowed return on equity. We do not consider this outcome to be consistent with good regulatory practice.

2.1.2 The importance of considering the practitioner perspective

- QTC understands the AER cannot provide detailed responses to every issue raised by stakeholders. However, QTC is uniquely placed to provide a practitioner's perspective on the long-term floating-rate bond analogy and how this type of bond would likely be priced in the market. For example, QTC:
  - currently has on issue $99.7 billion of nominal fixed-rate bonds with maturity dates ranging from July 2023 to October 2050, and $13.9 billion of nominal floating-rate bonds[21]
  - buys high quality bank and corporate floating-rate bonds for the $9.7 billion QTC Capital Guaranteed Cash Fund
  - is an active participant in the Australian fixed-for-floating interest rate swap market for hedging and risk management purposes, and
  - is a member of the Australian Financial Markets Association Swaps Committee.
- We consider that our real-world perspective provides important market-based information that is not captured by the equations and stylised examples relied on by the AER to support its term-matching proposal.
- Obviously, we do not expect our views to be accepted without question or scrutiny. However, we do expect the AER to clearly set out the reasons why it does or does not agree with our views, especially when topic being considered relates to interest rates and the pricing of debt instruments.

2.2 A more detailed explanation of QTC's views

- The following sections provide a more detailed explanation of the main points in our submission to the *Rate of Return Information Paper and Final Working Papers*. Hopefully this material addresses any concerns, issues or questions the AER may have with QTC's previous analysis and reasoning. Specifically:
  - We have expanded our first principles assessment to show that it is consistent with the trading margin term structure for floating-rate CGS. The incremental costs relative to a 5-year tenor reflect the addition compensation the Commonwealth must pay to investors to secure committed funding for longer periods of time while maintaining the same exposure to interest rates risk.
  - We have used the CGS swap package to estimate the required margin on 25-year coupon-resetting CGS. Based on monthly CGS and swap yield curves between October 2016 and July 2022, the average required margin is 0.51 per cent above the 5-year CGS yield.
- Our reasons for the choice of historical period and CGS tenor are provided in Appendix A. Our responses to some anticipated criticisms the AER may have of the required margin estimates and the approach used to produce them are provided in Appendix B.
- Assuming that it is correct to view regulated equity as long-term coupon-resetting bond, the required margin estimates show that using a 5-year CGS yield in the allowed return on equity would have consistently delivered NPV<0 outcomes during this period. In contrast, using a 10-year CGS yield would have delivered outcomes much closer to meeting the NPV=0 condition.

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[19] AER (June 2022), *Draft Rate of Return Instrument Explanatory Statement*, p. 94.

[20] Appendix B in the *Draft Explanatory Statement* contains two dot points that summarise our conclusions on the floating-rate bond analogy. However none of the sections in the *Draft Explanatory Statement* identified in the appendix contain any assessment of, or response to, our example.

[21] The volumes on issue are expressed in face value terms.

2.3 A first principles assessment

- The AER considers the 5-year CGS yield to be the required yield on a long-term CGS with 5-yearly coupon resets. This implies that the following related conditions are true:
  - The Commonwealth can significantly reduce refinancing risk at no cost by issuing a long-term (eg, 30-year) bond with a coupon that is reset every 5 years to equal the 5-year CGS yield compared to issuing a 5-year fixed-rate CGS and going back to the market five times to refinance over the same 30-year period.
  - CGS investors are indifferent between committing funds for 5 years compared to 30 years. Specifically, CGS investors do not require extra compensation for committing funds for 30 years compared to 5 years while maintaining the same exposure to interest rates.
- The above conditions were considered in QTC's submission to the *Term of the Rate of Return Draft Working Paper*[22]. As an issuer of fixed- and floating-rate bonds in the domestic and offshore markets, we concluded that it is highly unlikely that refinancing risk can be significantly reduced at no cost, or that investors are indifferent between committing funds for 5 years compared to 30 years. The AER responded by suggesting that CGS investors:
  - are not indifferent to providing funds for 5 years compared to 30 years because the slope of the fixed-rate CGS yield curve is typically positive, and
  - are not committing funds for 30 years because they can sell the bond prior to maturity:[23]

> … we were not proposing that investors were indifferent between committing their funds for 5 years or a much longer period of time. Indeed, the term structure of interest rates (including CGS yields) tends to be, on average, upward sloping. Further, just like with any long-term floating-rate bond, the investors could choose to hold their asset to maturity or sell it at an earlier date.

- The AER's response did not address the points made in our submission:
  - We compared a strategy of issuing a long-term (eg, 30-year) bond with a coupon that is reset every 5 years with an alternative strategy of issuing a 5-year fixed-rate bond and refinancing it every 5 years over the same period. Both strategies have the same exposure to interest rate risk (ie, 5-year fixed with 5-yearly resets). Therefore, if investors do not require additional compensation to invest in a 30-year coupon-resetting bond with the same exposure to interest rates as a rolling series of 5-year fixed-rate bonds, they must be indifferent between committing funds for 5 years or 30 years. The AER's term-matching proposal assumes that no additional compensation is required, so it follows that the AER was (implicitly) proposing that investors are indifferent between committing funds for 5 years or 30 years. In our view, this is implausible.
  - The Commonwealth has no obligation to repay investors prior to maturity. Therefore, if an investor sells the bond prior to maturity, the bond must be purchased by another investor. The change in ownership has no effect on the Commonwealth because it still has full use of the original proceeds until the CGS matures. It follows that investors, as a group, have provided committed capital to the Commonwealth for 30 years. This long-term commitment of capital should be compensated by a higher expected cost for issuing a 30-year bond with 5-yearly coupon resets compared to the expected cost from issuing a 5-year floating-rate bond and going back to the market five times to refinance over the same 30-year period[24].
- In QTC's view, a first principles assessment based on sound financial risk management principles relating to the cost of reducing refinancing risk indicates that the required yield on a long-term floating-rate CGS with a coupon that is reset every 5 years to equal the 5-year CGS yield should be higher than the 5-year CGS yield.

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[22] QTC (July 2021), *Submission to the Term of the Rate of Return Draft Working Paper*, p. 3–4.

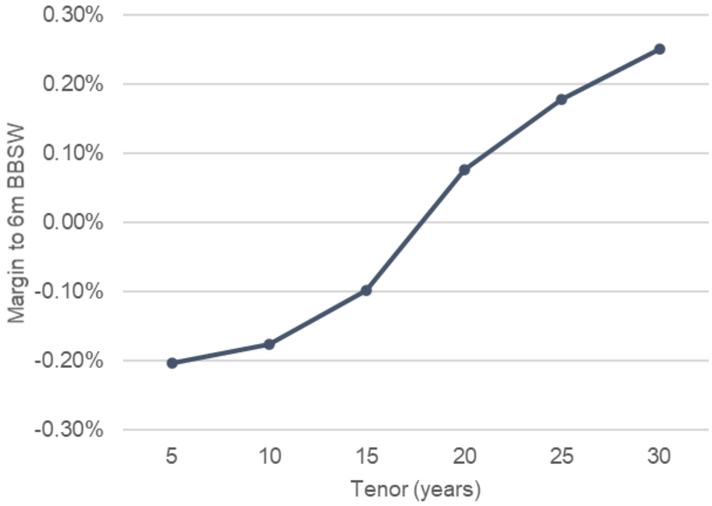
[23] AER (September 2021), *Term of the rate of return & Rate of return and cashflows in a low interest rate environment Final working paper*, p. 55.

[24] The irrelevance of an investor's ability to sell a bond prior to maturity can also be demonstrated by considering the yield on a 10-year nominal fixed-rate CGS. Part of the yield compensates investors for expected inflation over the 10-year term of the CGS. A 10-year CGS is highly liquid, so investors can easily sell prior to maturity. However, the ability to sell does not mean investors do not require compensation for 10-year expected inflation. A change in ownership simply transfers the remaining inflation compensation from one investor to another investor. The total amount of inflation compensation paid by the Commonwealth to investors over the term of the CGS is still 10-year expected inflation, regardless of how many times the ownership of the CGS changes.

2.4 Trading margin term structure for floating-rate CGS

- QTC's first principles conclusion is consistent with the trading margin term structure for floating-rate CGS. Figure 3 shows the average trading margin term structure between October 2016 and July 2022. The floating-rate CGS are bullet bonds, which means the principal is repaid in full at maturity. The floating-rate CGS are par bonds, which means the coupon and trading margin are equal.

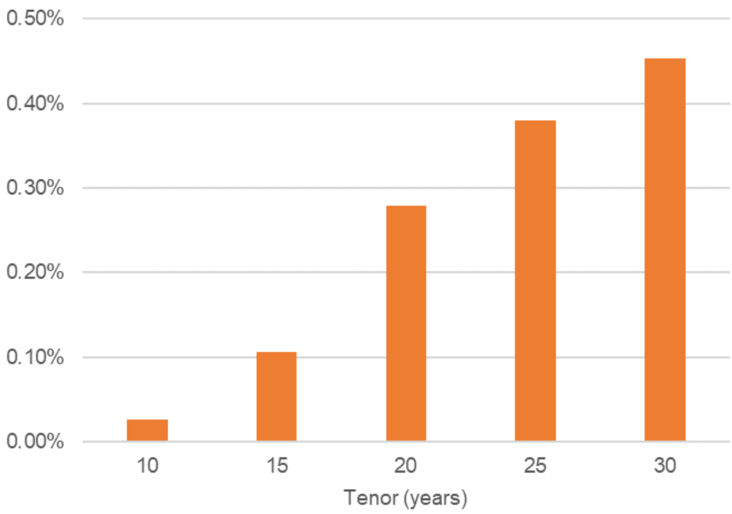
FIGURE 3: AVERAGE TRADING MARGIN TERM STRUCTURE FOR FLOATING-RATE CGS



Source: QTC yields and calculations.

- The base yield for each floating-rate CGS in Figure 3 is 6-month BBSW, so they have the same level of interest rate risk, but different levels of refinancing risk. As the tenor increases the level of refinancing risk decreases. The cost of reducing refinancing risk is reflected in the positive slope of the trading margin term structure[25].
- Figure 4 shows that the Commonwealth must pay progressively higher margins above 6-month BBSW to lock in funds for periods longer than 5 years while maintaining the same exposure to interest rates.

FIGURE 4: INCREMENTAL TRADING MARGINS VS 5-YEAR TRADING MARGIN



Source: QTC yields and calculations.

[25] The positive slope of the trading margin term structure does not mean the 5-year margin is expected to increase. As shown in Section 3, the 5-year CGS/swap spread is almost always negative, and displays very strong mean reversion around a long-term average of –0.38 per cent. This indicates that the best estimate of the expected 5-year CGS/swap spread in 5, 10, 15, 20 and 25 years' time is –0.38 per cent.

- The incremental margins show that refinancing risk cannot be significantly reduced at no cost by issuing a 30-year floating-rate bond compared to issuing a 5-year floating-rate bond and going back to the market five times to refinance over the same 30-year period. This is consistent with our conclusion based on 5-yearly rate resets:[26]

> … if the Commonwealth Government sought to issue a 30-year bond with a coupon that is reset every 5-years to equal the 5-year CGS yield, the discount rate would have to be significantly higher than the prevailing 5-year CGS yield on each reset date. This is intuitive because a 30-year bond has a significantly lower level of refinancing risk compared to a 5-year bond, and this reduction in risk should come at a cost to the borrower.

- A first principles assessment of the long-term floating-rate bond analogy indicates that the required yield should be higher than the 5-year risk-free rate. This conclusion is supported by the observable trading margin term structure for floating-rate CGS. These margins reflect the incremental costs to the Commonwealth for securing committed funding for longer periods while maintaining the same exposure to interest rates.

2.4.1 Relevance to the allowed return on equity

- Network assets can be depreciated for regulatory purposes over periods of up to 60 years. This means the return of capital occurs progressively over a period much longer than the 5-year term of the regulatory period. The equity providers to regulated network businesses are making a long-term commitment of capital that is similar to the commitment made by investors in a long-term floating-rate CGS with 5-yearly coupon resets.
- The risk-free rate in the allowed return on equity should reflect the compensation for this long-term commitment of capital. As we demonstrate below, and in Section 3, this will not occur if the proposal to use a 5-year CGS yield to calculate the allowed return on equity is adopted in the Final 2022 RoRI.

2.5 A market-based assessment

- Estimating the required margin above the 5-year risk-free rate requires a market-based approach. The margin cannot be estimated using equations and stylised examples.
- In Section 3 we use the CGS swap package from our submission to the *Rate of Return Information Paper and Final Working Papers* to make monthly estimates of the required margin between October 2016 and July 2022 for a 25-year coupon-resetting CGS with a full repayment of principal at maturity.
- The following section explains the CGS swap package transactions and provides a worked example which shows that the total coupon in a given 5-year period is the same regardless of whether the benchmark yield is the 5-year swap yield or 5-year CGS yield.

2.5.1 CGS swap package

- The pricing benchmark for a 25-year coupon-resetting CGS is a CGS swap package comprised of the following transactions[27]:
  - Issue a 25-year interest-only fixed-rate par CGS with a coupon equal to the current 25-year fixed CGS yield.
  - Enter into a 25-year receive fixed / pay 6-month BBSW interest rate swap with the receive leg equal to the current 25-year fixed swap yield.
  - Enter into five consecutive 5-year pay fixed / receive 6-month BBSW swaps during the 25-year term of the CGS. The pay leg of each swap equals the prevailing 5-year fixed swap yield on the corresponding transaction date[28].
- The first transaction allows the Commonwealth to lock in funds for 25 years with the principal repaid in full at maturity. The second transaction converts the fixed coupons into floating-rate coupons equal to 6-month BBSW plus a fixed coupon margin. The coupon margin equals the 25-year fixed CGS yield minus the 25-year fixed swap yield.
- The first 5-year swap is transacted when the CGS is issued. This swap locks in the current 5-year fixed swap yield and offsets the 6-month BBSW payments on the floating-rate CGS for the first 5 years. When this swap matures in 5 years' time a new 5-year pay fixed / receive floating swap is entered into at the prevailing 5-year swap yield. This process is repeated until the end of year 20 when the final 5-year swap is transacted.

[26] QTC (March 2022), *Submission to the Rate of Return Information Paper and Final Working Papers*, p. 31.

[27] QTC (March 2022), *Submission to the Rate of Return Information Paper and Final Working Papers*, p. 30.

[28] The pay fixed yields on the future 5-year swaps are not locked in when the CGS is issued (ie, they are not forward-starting swaps).

- These transactions produce a 25-year floating-rate CGS with a coupon that is reset every 5 years to equal the prevailing 5-year swap yield plus the fixed coupon margin. The ex-post cost equals the average 5-year yield on the five pay fixed swaps plus the fixed coupon margin.
- Each transaction in the CGS swap package is NPV=0 at inception.

2.5.2 Converting the benchmark yield to the 5-year CGS yield

- The benchmark yield in the CGS swap package is the 5-year swap yield. However, the floating-rate bond contemplated by the AER uses the 5-year CGS yield as the benchmark[29]:

> … just like floating-rate bonds in Australia use 180 day Bank Bill Swap Rate (BBSW) as a benchmark, we contemplated a long-term floating-rate bond that used a five-year CGS yield as a benchmark for the risk-free rate in the CAPM with the CAPM equity risk premium added to the benchmark.

- By definition, a 5-year swap with a fixed yield equal to the prevailing 5-year swap yield is NPV=0 at inception. Therefore, if the fixed leg of a swap has a yield that differs from the prevailing 5-year swap yield, the difference must also be applied to the yield on the floating leg to keep the swap NPV=0.
- The following worked example sets out the CGS swap package transactions in more detail. The main conclusion is that maintaining NPV=0 results in the total coupon in a given 5-year period being the same regardless of whether the base yield is the 5-year swap yield or the 5-year CGS yield.

Worked example

- Table 1 shows the 5-year and 25-year CGS and swap par yields as at 17 August 2022.

TABLE 1: CGS AND SWAP PAR YIELDS – 17 AUGUST 2022

Tenor	CGS par yield (%)	Swap par yield (%)	CGS/swap par spread (%)
5 year	3.11	3.55	**–0.44**
25 year	3.68	3.60	**+0.08**

Source: QTC yield data and calculations

- The Commonwealth can create a 25-year floating-rate CGS by issuing a 25-year par CGS with a coupon and yield equal to 3.68 per cent, and entering into a 25-year swap to receive 3.60 per cent fixed and pay 6-month BBSW. The total coupon equals 6-month BBSW plus a coupon margin of 0.08 per cent (ie, 3.68 per cent minus 3.60 per cent). The coupon margin is fixed for the 25-year term of the CGS.
- The Commonwealth can lock in a fixed base yield for the first 5-years by entering into a 5-year swap to pay 3.55 per cent fixed and receive 6-month BBSW[30]. By definition, this swap is NPV=0.
- If the pay fixed yield is reduced from 3.55 per cent to 3.11 per cent to equal the 5-year CGS yield, the yield on the floating leg must also be reduced by 0.44 per cent to keep the swap NPV=0[31]. This means the Commonwealth will pay 3.11 per cent fixed and receive 6-month BBSW *minus* 0.44 per cent.
- The CGS swap package cash flows are summarised in Tables 2 and 3. Maintaining NPV=0 produces a total coupon in the first 5-year period of 3.63 per cent regardless of whether the base yield is the 5-year swap or CGS yield.

[29] AER (September 2021), *Term of the rate of return & Rate of return and cashflows in a low interest rate environment Final working paper*, p. 54.

[30] Vanilla interest rates swaps are unfunded because there is no exchange of principal between the swap counterparties at inception or maturity. The only cash flows exchanged during the term of the swap are the net fixed/floating interest payments. As a consequence, the fixed mid-market yields that apply to swap transactions are the same for all swap counterparties because the potential credit exposure is negligible. Even though the Commonwealth has a AAA credit rating, it cannot pay a below-market fixed swap yield and receive BBSW flat unless an upfront payment is made to the swap counterparty (see below).

[31] The Commonwealth can make an upfront payment to the swap counterparty and keep the receive leg at 6-month BBSW flat. The upfront payment will equal the present value of the 0.44 per cent margin that would normally be deducted from the floating leg of the swap. In present value terms, reducing the yield on the floating leg of the swap or making an upfront payment to the swap counterparty are the same.

TABLE 2: CGS SWAP PACKAGE CASH FLOWS USING A 5-YEAR SWAP BASE YIELD

Cash flows	Pay (%)	Receive (%)	Net payment (%)
Floating	6m BBSW + 0.08	6m BBSW	0.08
Fixed	3.55	---	3.55
Total	6m BBSW + 3.63	6m BBSW	**3.63**

TABLE 3: CGS SWAP PACKAGE CASH FLOWS USING A 5-YEAR CGS BASE YIELD

Cash flows	Pay (%)	Receive (%)	Net payment (%)
Floating	6m BBSW + 0.08	6m BBSW – 0.44	0.52
Fixed	3.11	---	3.11
Total	6m BBSW + 3.19	6m BBSW – 0.44	**3.63**

- The same adjustments apply to the 5-year swaps that are entered into at the end of year 5, 10, 15 and 20. If the pay fixed yield equals the prevailing 5-year CGS yield at the start of the period, the yield on the floating leg must be adjusted by the prevailing 5-year CGS/swap spread at the start of the period for the swap to be NPV=0. Therefore, the total coupon in each 5-year period will equal:
  - the 5-year CGS yield at the start of the period *plus*
  - the 0.08 per cent coupon margin on the 25-year floating-rate CGS *minus*
  - the 5-year CGS/swap spread at the start of the period.
- Based on the above, the margin above the 5-year CGS yield in each 5-year period will equal:
  - the 0.08 per cent coupon margin on the 25-year floating-rate CGS *minus*
  - the 5-year CGS/swap spread at the start of the period.
- The *expected* margin at inception will depend on the expected average 5-year CGS/swap spread on the five coupon reset dates. Table 4 shows the outcomes from two potential paths for the expected 5-year CGS/swap spread.
  - The first path assumes the expected spread on four future coupon reset dates is –0.38 per cent.
  - The second path assumes the spread increases by 0.26 per cent in each 5-year period.

TABLE 4: EXPECTED MARGINS FOR DIFFERENT 5-YEAR CGS/SWAP SPREAD PATHS

Coupon reset	Coupon margin on 25-year floating-rate CGS (%)	Expected 5-year CGS/swap spread – Path 1 (%)	Expected 5-year CGS/swap spread – Path 2 (%)
Initial	0.08	–0.44	–0.44
First	0.08	–0.38	–0.18
Second	0.08	–0.38	0.08
Third	0.08	–0.38	0.34
Fourth	0.08	–0.38	0.60
Average	*0.08*	*–0.39*	*0.08*
Expected margin above the 5-year CGS yield		**0.47**	**0.00**

Source: QTC yield data and calculations

- The worked example shows that the expected 5-year CGS/swap spread plays an important role in determining the expected margin on a long-term coupon-resetting CGS. As we show in Section 3, the 5-year CGS/swap spread has almost always been negative, and is strongly mean-reverting around the long-term average of –0.38 per cent.

Therefore, the first path for the 5-year CGS/swap spread in Table 4 is realistic. The second path, which produces an expected margin of zero (ie, the AER's assumption under the floating-rate bond analogy), is implausible.

2.6 Comparison with the long-term floating-rate bond analogy

- The worked example is based on market transactions that meet the NPV=0 condition in the CGS and swap markets. Maintaining NPV=0 results in the total coupon in a given 5-year period being the same regardless of whether the benchmark yield is the 5-year CGS yield or the 5-year swap yield.
- The floating-rate bond contemplated by the AER does not take these real-world pricing considerations into account. The implicit assumption is that the Commonwealth can pay the 5-year CGS yield under an interest rate swap and receive 6-month BBSW flat, which is not possible because it violates NPV=0. The AER's floating-rate bond also ignores the fixed coupon margin above 6-month BBSW that must be paid on the underlying floating-rate CGS.
- In Section 3 we produce market-based estimates of the required margin above the 5-year CGS yield for a 25-year CGS with a coupon that is automatically reset every five years to equal the 5-year CGS yield. This margin can be viewed as the coupon and trading margin for a 25-year coupon-resetting CGS that is priced at par at inception.
- Our reasons for the choice of historical period and CGS tenor are provided in Appendix A. Our responses to some anticipated criticisms the AER may have of the required margin estimates and the approach used to produce them are provided in Appendix B.
- Although it is not possible to observe the margin that investors actually require, we consider the estimates in Section 3 to be reasonable estimates of the margin that investors would likely require above the 5-year CGS yield to buy a 25-year coupon-resetting CGS. In our view, the estimates are reasonable enough to support the following:
  - a 5-year CGS yield will consistently and materially underestimate the required yield (ie, NPV<0), and
  - a 10-year CGS yield has been a good proxy for the required yield, and is likely to continue to be a good proxy in the future for the reasons set out in Appendix B.2.
- Consistent with our previous submission, QTC is not proposing that the approach in Section 3 be used to determine the risk-free rate in the 2022 RoRI. It is important for the risk-free rate to be transparent, observable and market-based. However, there are no long-term coupon resetting CGS on issue, so it is not possible to observe the market-based risk-free rate that would apply under the long-term floating-rate bond analogy. Therefore, it is necessary to determine which observable risk-free rate (ie, CGS yield) is likely to be the best proxy for required yield.

3 Estimating the required margin on a coupon-resetting CGS

3.1 Approach

- Based on the worked example in Section 2, the required margin on a 25-year floating-rate CGS with a coupon that is automatically reset every 5 years to equal the 5-year CGS yield equals:
  - the fixed coupon margin on a 25-year floating-rate CGS with 6-month BBSW as the base yield, minus
  - the expected average 5-year CGS/swap spread across the five coupon reset dates.
- The fixed coupon margin on the floating-rate CGS, and initial 5-year CGS/swap spread, are known when the CGS is issued. The expected 5-year CGS/swap spread on the four future coupon reset dates need to be estimated.

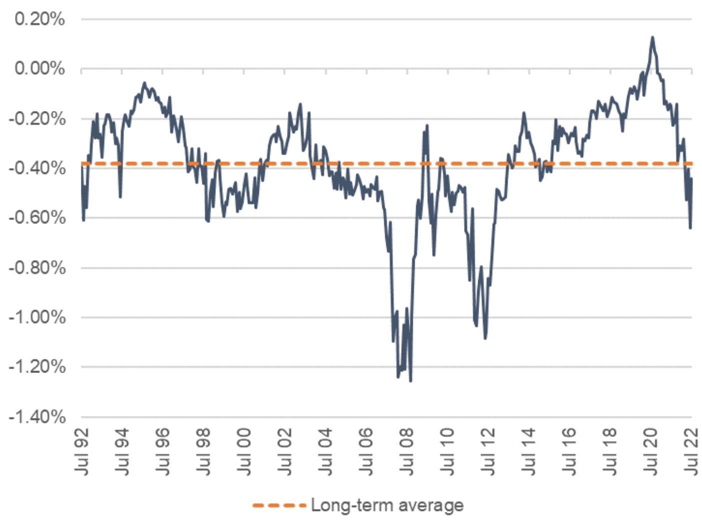
3.2 Estimating the expected average 5-year CGS/swap spread

- The expected 5-year CGS/swap spread can be estimated using the 'real-world' or 'risk-neutral' probability distribution of the 5-year CGS/swap spread.

3.2.1 Real-world probability distribution

- Figure 5 shows the monthly 5-year CGS/swap spread between July 1992 and July 2022.

FIGURE 5: HISTORICAL 5-YEAR CGS/SWAP SPREAD



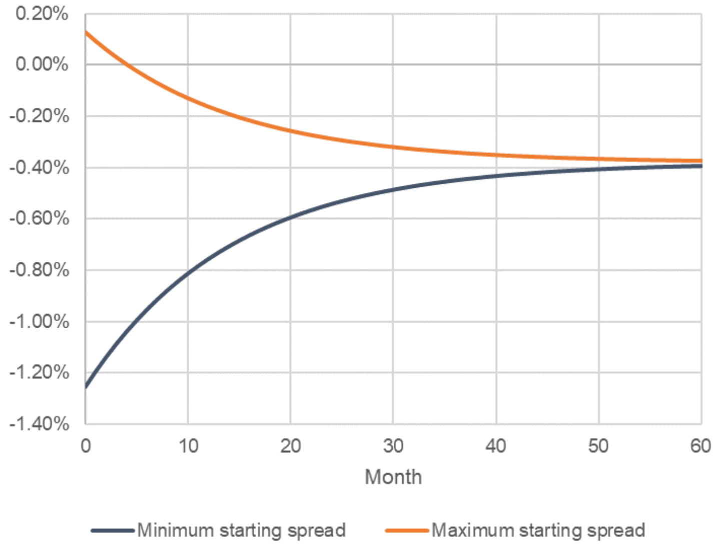
Source: Bloomberg and RBA.

- Aside from a brief period in 2020 the spread has been consistently negative (ie, 5-year CGS yield below the 5-year swap yield). The spread is strongly mean-reverting around the long-term average of –0.38 per cent. Regressing the monthly spread change on the 1-month lagged spread produces a mean reversion parameter of –0.068 with a highly significant t-statistic of -3.55. As such, the expected spread in month t+1 can be estimated using Equation 1:

Expected Spread [t+1] = Spread [t] + 0.068 x (–0.38 per cent – Spread [t]) [Equation 1]

- The mean reversion strength is evident in Figure 6, which uses Equation 1 to estimate the expected monthly spread using the minimum and maximum historical spreads of –1.26 per cent and +0.13 per cent as starting values. Even when starting from these extreme levels, the spread reverts back to the long-term average after 5 years. This indicates that the best estimate of the expected 5-year CGS/swap spread on the four future coupon reset dates is the long-term average spread of –0.38 per cent.

FIGURE 6: MEAN REVERSION FROM EXTREME STARTING SPREADS

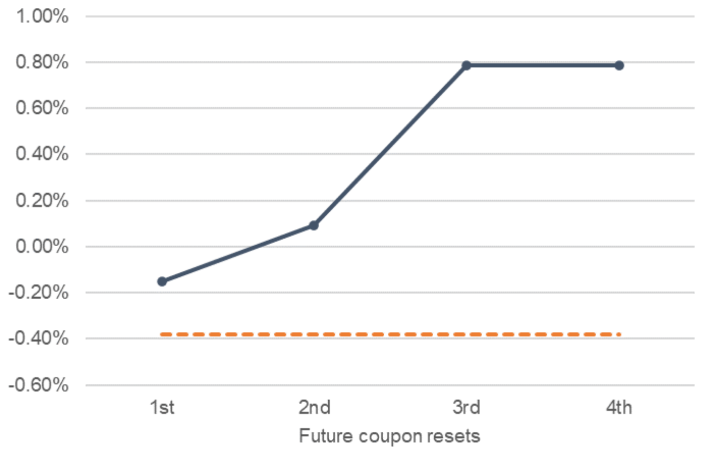


Source: Bloomberg and RBA. QTC calculations.

3.2.2 Risk-neutral probability distribution

- An alternative approach is to use the implied forward 5-year CGS and swap yields to make a 'risk-neutral' estimate of the expected spread on the four future coupon reset dates. The required margin will be zero (ie, the implied assumption under the floating-rate bond analogy) if the implied forward spreads are unbiased estimates of the expected spreads on these four future dates.
- It is well known that implied forward yields are biased estimates of expected yields because they reflect time-varying risk premiums. More importantly, implied forward yields do not capture any relationships between the 5-year CGS and swap yields, such as the strongly mean-reverting nature of the spread between these yields.
- The average implied forward 5-year CGS/swap spreads on the four future coupon reset dates are shown in Figure 7.

FIGURE 7: AVERAGE IMPLIED FORWARD 5-YEAR CGS/SWAP SPREADS (OCT 2016 – JUL 2022)



Source: QTC yield data and calculations.

- The average implied forward spreads on the third and fourth reset dates are +0.80 per cent. If the implied forward spreads are unbiased estimates, this would mean the market was expecting the 5-year CGS yield to be (on average) 0.80 per cent *higher* than the 5-year swap yield on these dates. However, the actual spread has almost always been negative, and displays very strong mean reversion around the long-term average of –0.38 per cent. As such, the implied forward spreads have the wrong sign and are implausibly high.
- The implied forward spreads also suggest the 5-year CGS/swap spread displays very strong long-term *anti-mean-reversion*, which means the spread is expected to move away from the long-term average rather than towards it. This is the opposite of how the 5-year CGS/swap spread actually behaves.

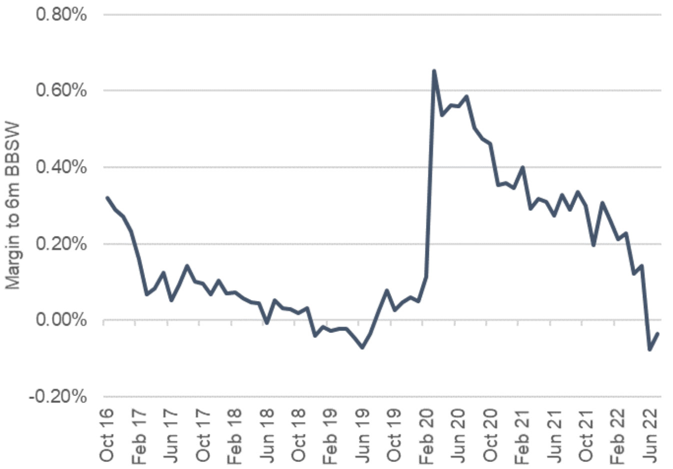
- The risk-neutral probability distribution is inconsistent with the real-world characteristics and time-series properties of the 5-year CGS/spread. Therefore, the implied forward spreads are of no use in estimating the expected 5-year CGS/swap spreads on the four future coupon reset dates.
- In our view, investors would use the real-world probability distribution of the 5-year CGS/swap spread to estimate the expected spread on the future coupon reset dates:[32]

> In the world of risk management and capital calculation, a model is good when it backtests properly. That is, risk management needs the distributions arising from the models to be as close as possible to the actual distributions seen in the market. For that reason, while derivatives pricing models typically use the “risk-neutral" measure, risk management and capital calculation models tend to use the “real" measure.

3.3 Required margin estimates for a 25-year coupon-resetting CGS

- QTC has used the CGS swap package to estimate the required margin for a 25-year coupon-resetting CGS using month-end CGS and swap yield curves between October 2016 and July 2022.
- Figure 8 shows the trading/coupon margin on a 25-year floating-rate CGS with a base yield equal to 6-month BBSW. The average margin is 0.18 per cent above 6-month BBSW.

FIGURE 8: TRADING/COUPON MARGIN ON A 25-YEAR FLOATING-RATE CGS



Source: QTC yield data and calculations

- Figure 9 shows the expected average 5-year CGS/swap spread across the five coupon reset dates. The expected average spread is based on the current spread and the expected spreads at the end of year 5, 10, 15 and 20 calculated using Equation 1. The strongly mean-reverting behaviour of the spread results in a relatively stable expected average spread over the 25-year term. The average value of the estimates in Figure 9 is –0.33 per cent, which is close to the long-term average spread of –0.38 per cent.

[32] Ignacio Ruiz and Piero Del Boca (May 2012), *Modelling Credit Spreads for Counterparty Risk: Mean-reversion is not Needed*, p. 1–2.

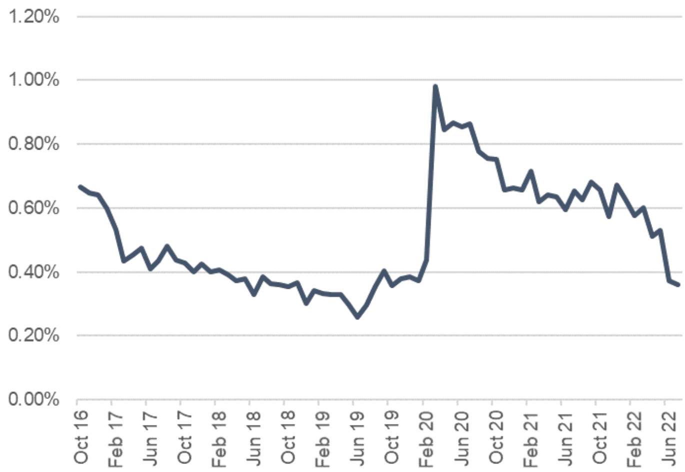
The title of this paper is based on an analysis of single-name corporate credit default swap spreads. The lack of ‘standard’ mean reversion in these spreads has no implications for modelling and estimating the expected 5-year CGS/swap spread using a mean-reverting model.

FIGURE 9: EXPECTED AVERAGE 5-YEAR CGS/SWAP SPREAD

Source: QTC yield data and calculations

- Figure 10 shows the estimated required margin above the 5-year CGS yield. The required margin has been consistently positive and has an average value of 0.51 per cent.

FIGURE 10: REQUIRED MARGIN ABOVE THE 5-YEAR CGS YIELD



Source: QTC yield data and calculations

3.3.1 Interpreting the required margin

- The required margins in Figure 10 are estimates of the trading margin at inception for a 25-year floating-rate CGS with a coupon that is automatically reset every 5-years to equal the 5-year CGS yield (ie, the coupon margin is zero). As the trading margin has been consistently positive, the 25-year coupon-resetting CGS will be priced at a discount to par, which means the market value will be lower than the face value.
- In the *Term of the Rate of Return Final Working Paper* the AER stated[33]:

> … [the] ex-coupon value of a floating-rate bond on all coupon reset dates is its par value. This is analogous to how the market value of regulated assets would equal to their book (par) value at each regulatory reset for the correctly set parameter values.

- The above reasoning does not consider the trading and coupon margins that apply to floating-rate bonds. The ex-coupon value of a floating-rate bond will only equal par if the trading margin is equal to the coupon margin on the reset date. This also applies when a floating-rate bond is first issued.

[33] AER (September 2021), *Term of the rate of return & Rate of return and cashflows in a low interest rate environment Final working paper*, p. 55.

- The AER's implicit assumption is that the trading and coupon margins are always zero. Presumably, this is because the benchmark yield is the 5-year CGS yield rather than the 5-year swap yield. However, the worked example Section 2 shows that the choice of base yield is not important.
- For the long-term floating-rate bond contemplated by the AER to be priced at par at inception, the coupon margin must equal the trading margin. This is consistent with the following conclusion in our submission to the *Rate of Return Information Paper and Final Working Papers*:[34]

> As the correct discount rate is higher than the 5-year CGS yield, the market value of the rate-resetting CGS will be lower than its face value. In a revenue building block model, the CGS face value has the same meaning as the book value of the equity-funded portion of the RAB.
>
> It follows that in order for the book and market value to be equal at the start of each 5-year regulatory period, the margin must be reflected in the return on equity allowance. **Excluding the margin from the allowed revenues will produce an NVP<0 outcome**.

- We reached the same conclusion in our submission to the *Term of the Rate of Return Draft Working Paper*:[35]

> The longest CGS has a remaining term to maturity of ~30 years. The current yield on this CGS is ~40 basis points above swap, whereas the 5-year CGS yield is ~10 basis points below swap.
>
> If an investor buys a 30-year CGS on a floating-rate basis and swaps the base rate to fixed for the next 5 years, they will receive a coupon equal to the prevailing 5-year swap rate plus 40 basis points. This is 50 basis points higher than the prevailing 5-year CGS yield.
>
> **Due to the positive slope of the CGS/swap spread curve, the expected difference between the coupon and the 5-year CGS yield across the five remaining rate resets is also positive.**
>
> Therefore, if a term-matching approach was imposed on this investment (ie, setting the coupon to equal the prevailing 5-year CGS yield on each reset date), the expected outcome over the 30-year life of the asset is NPV<0.

- We did not formally estimate the required margin for the example in the quote immediately above. However, our conclusion that 'due to the positive slope of the CGS/swap spread curve, the expected difference between the coupon and the 5-year CGS yield across the five remaining rate resets is also positive' is consistent with the approach used to estimate the required margins in Figure 10. Due to the strongly mean-reverting nature of the 5-year CGS/swap spread, a reasonable estimate of the expected spread on the five remaining reset dates is –0.38 per cent. Therefore, the expected coupons are 0.78 per cent higher than the 5-year CGS yield (ie, the 0.40 per cent fixed coupon margin on the underlying floating-rate CGS minus –0.38 per cent). When combined with the known 0.50 per cent margin in the first 5-year period, the required margin at inception would have been 0.73 per cent.

3.4 NPV outcomes and the allowed return on equity

- The *Draft Explanatory Statement* presents a stylised example based on a regulated asset that is fully depreciated over a 2-year period, and an allowed return on equity that is reset annually. Based on this example, the AER reaches the following conclusions[36]:

> The above example is not based on Dr Lally's modelling approach and instead assumes the modelling assumptions consistent with the valuation practices described in stakeholder submissions. The example demonstrates that, even under those assumptions, setting the allowed rate of return on equity to the expected return required by investors over a longer period than the time between resets would not generally satisfy the NPV=0 condition.

---

[34] QTC (March 2022), *Submission to the Rate of Return Information Paper and Final Working Papers*, p. 32.

[35] QTC (July 2021), *Submission to the Term of the Rate of Return Draft Working Paper*, p. 4.

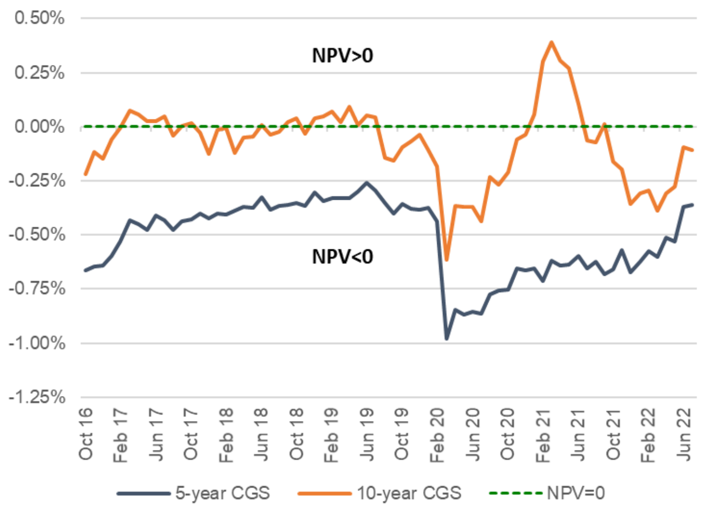
The *Term of the Rate of Return Final Working Paper* (p. 54–55) did provide a response to our first example and the conclusion that term-matching will result in an expected NPV<0 outcome. However, the AER did not correctly differentiate between the positive slope of the fixed-rate CGS yield curve and the positive slope of the CGS/swap spread curve. As such, the response did not address the example we provided.

[36] AER (June 2022), *Draft Rate of Return Instrument Explanatory Statement*, p. 109–110.

We made a number of simplifying assumptions in the above example. However, this does not limit the generality of our conclusions. To prove a result, one would generally test its robustness to underlying assumptions, but to overturn a result, one only needs to find one counterexample.

- QTC's counterexample to the claim that using a term for the allowed return on equity that differs from the reset frequency of the allowance would not generally not satisfy the NPV=0 condition is summarised in Figure 11.

FIGURE 11: DEPARTURES FROM NPV=0 UNDER THE FLOATING-RATE BOND ANALOGY



Source: QTC yield data and calculations

- In the context of the long-term floating-rate bond analogy, the NPV=0 condition is satisfied when the risk-free rate in the allowed return on equity equals the required yield on a long-term coupon-resetting CGS. Figure 11 shows the difference between the 5-year and 10-year CGS yields, and the required yield on a 25-year floating-rate CGS with 5-yearly coupon resets. The required yield equals the 5-year CGS yield plus the required margins in Figure 10.
- On average, the 10-year CGS yield was only 0.07 per cent lower than the required yield. This compares favourably to the outcomes from the AER's proposed term-matching approach as the average 5-year CGS yield was 0.51 per cent lower than the required yield.
- Figure 11 shows that the 5-year CGS yield always produced material NPV<0 outcomes between October 2016 and July 2022. In contrast, the 10-year CGS yield consistently produced outcomes that were much closer to satisfying the NPV=0 condition.

3.5 Implications for the long-term floating-rate bond analogy

- Recall the following equation from Lally's April 2021 report for the AER:

$$V_0 = \frac{\$0.497m}{1.001} + \frac{\$0.497m}{(1.001)^2} + \frac{\$0.497m}{(1.001)^3} + \frac{\$0.497m}{(1.003)^4} + \frac{\$100.497m}{(1.005)^5} = \$100m$$

- QTC's estimate of the required margin at the end of April 2021 is 0.64 per cent. The 1–5-year risk-free zero coupon yields at the end of April 2021, including the 0.64 per cent required margin, are 0.68, 0.63, 0.81, 1.10 and 1.38 per cent respectively. The net cash flow in each year plus the closing RAB of \$100m that produces *Vo* = \$100m is \$1.366m. Therefore, the allowed return on equity is 1.366 per cent, which implies a 5-year base CGS yield of 0.726 per cent (ie, 1.366 per cent minus 0.640 per cent). This yield is only 0.006 per cent lower than the 0.733 per cent 5-year CGS yield at the end of April:

$$V_0 = \frac{\$1.366m}{1.0068} + \frac{\$1.366m}{(1.0063)^2} + \frac{\$1.366m}{(1.0081)^3} + \frac{\$1.366m}{(1.0110)^4} + \frac{\$101.366m}{(1.0138)^5} = \$100m$$

- QTC considers the above to be a more realistic market-based description of the risk-free cash flows and discount rates under the long-term floating-rate bond analogy. The fact that the residual RAB of $100m is received in cash 20 years after the end of the current 5-year regulatory period affects the allowed return on equity in *each* 5-year regulatory period to satisfy the NPV=0 condition in expectation. This is consistent with a long-term floating rate-bond that pays a fixed coupon margin above the base yield, and ERAWA's conclusion that a 10-year term[37]:

> Recognises the reality of **regulatory cashflows and returns** being realised by equity investors over the life of the asset.

- Figure 11 shows that the 10-year CGS yield has been a good, but not perfect, proxy for the required yield on a long-term CGS with 5-yearly coupon resets. In contrast, the 5-year CGS yield has consistently and materially under-estimated the required yield. In QTC's view, the 10-year CGS yield is the best observable proxy for the required yield under the long-term floating-rate bond analogy.

3.5.1 Conclusions on the AER's term matching proposal

- Term-matching does not require the risk-free rate in the allowed return on equity to *equal* the 5-year risk-free rate. As we have demonstrated, the estimated required margin (ie, trading margin) on a long-term coupon-resetting CGS has been consistently positive with an average value of 0.51 per cent between October 2016 and July 2022. This empirical finding is supported by the first principles analysis in Section 2.3.
- If regulated equity is viewed as a long-term coupon-resetting bond, which is the AER's newly formed view, the required margin must be reflected in the risk-free rate used to calculate the allowed return on equity. The AER's term-matching proposal assumes the required margin is always zero, which is implausible. Therefore, if the proposal is adopted in the Final 2022 RoRI, material NPV<0 outcomes can be expected by the equity providers to network businesses regulated by the AER.
- In QTC's view, Section 2 and Section 3 of this submission provide strong market-based evidence against the proposal in the *Draft Explanatory Statement* to depart from the AER's long-standing practice of using a 10-year CGS yield to calculate the allowed return on equity.

[37] ERAWA (June 2022), *Explanatory statement for the 2022 draft gas rate of return instrument*, p. 96.

4 The Market Risk Premium

4.1 The Wright approach has still not been properly assessed

- Section 7.2.3.1 of the *Draft Explanatory Statement* is meant to provide the AER's assessment of the theoretical basis for the Wright approach. In QTC's view, the assessment in Section 7.2.3.1 was not done in good faith, or in way that is consistent with good regulatory practice.
- Section 7.2.3.1 does not address the main theoretical points in Wright, Mason and Miles (2003). The section appears to be more concerned with making a case against the Wright approach rather than genuinely engaging with the research and academic literature to determine an appropriate weight for the Wright approach in the 2022 RoRI.
- The two pages that make up Section 7.2.3.1 have been published more than twelve months after the AER made a commitment to consider the theoretical and empirical basis for the Wright approach. Due to this delay, stakeholders only have one opportunity to respond to the AER's assessment before the Final 2022 RoRI is made. In our view, this outcome is not consistent with good regulatory practice.
- As a consequence, the conclusions in Section 7.2.3.1 cannot be used to make an informed decision on the appropriate weight for the Wright approach. In our view, no weight should be given to the conclusions in Section 7.2.3.1 when the AER makes the Final 2022 RoRI.
- The remainder of Section 4 is structured as follows:
  - Section 4.2 summarises the theoretical basis for the Wright approach and sets out the main points that should have been assessed in Section 7.2.3.1.
  - Section 4.3 reproduces Section 7.2.3.1 in full.
  - Section 4.4 provides our response to Section 7.2.3.1, and a more comprehensive assessment of the research and academic literature cited in that section.
  - Section 4.5 provides our response to Section 7.2.3.2, which sets out the AER's assessment of the empirical basis for the Wright approach.
  - Section 4.6 summarises the advice already provided to the AER by Lally, CEPA and Sapere, which supports giving weight to the HER and Wright approaches.
  - Section 4.7 sets out our views on an appropriate course of action for the AER when it makes the Final 2022 RoRI.

4.2 The theoretical basis for the Wright approach

- Wright, Mason and Miles (2003) support using the Sharpe–Lintner CAPM (SL CAPM) to calculate the return on equity for regulated businesses. Wright et al express the SL CAPM in the following form to show that the parameters to be estimated are the risk-free rate, equity beta and the expected real market return:

$$E(R_i^E) = (1 - \beta_i)R_f + \beta_i E(R_m)$$

- The SL CAPM is silent on how the parameters should be estimated. However, the risk-free rate can be observed and there are statistical methods for making an empirical estimate of the equity beta. Wright et al turn to the Consumption CAPM (CCAPM) for guidance on how to estimate the expected real market return[38]:

> As Cochrane (1997) has pointed out, neither the standard CAPM, nor its more recently developed alternative asset pricing models, are designed to explain the common components: these are simply used as inputs to such models. To find any such candidate explanation, it is necessary to look deeper at the fundamental determinants of asset prices: the "Consumption CAPM", or some variant thereof.

- The theory of the CCAPM predicts that assets with future payoffs that are positively correlated with consumption (and therefore negatively correlated with the marginal utility of consumption) require a positive risk premium because high (low) payoffs tend to occur when the marginal utility of consumption is low (high).

[38] Wright, Mason & Miles (2003), *A study into certain aspects of the cost of capital for regulated utilities in the U.K*, p. 14.

- The CCAPM explains why equity offers a higher expected return than a risk-free asset. However, the CCAPM requires an unrealistically high level of risk aversion to explain the size of the difference between observed equity and risk-free returns (ie, the historical MRP).
- The failure of the CCAPM to explain the historical MRP does not extend to the historical real return on equity[39]:

> Since Mehra & Prescott (1985) and Weil (1989) it has been established that simple versions of the consumption CAPM model signally fail to explain observed values of either the risk-free rate or the equity premium ... however, **a feature of the model that it is less frequently acknowledged is that there is no such clear-cut failure of the model to explain the market return (the cost of equity) itself**.
>
> While the standard [consumption-based] theory applied by Mehra and Prescott has major problems explaining the relative historic returns on equities vs safe investments, this is largely because it fails to explain the low absolute returns on safe assets. **In contrast, it is not particularly hard to derive estimates of the expected stock return itself that are consistent with the theory**.
>
> Note that if “Siegel's constant" really were constant, or at least close to being so, this would offer some empirical support for the argument … that the equity premium puzzle and risk-free rate puzzles are one and the same, since **there is no obvious conflict between observed mean stock returns and the predictions of theory**.

- The above conclusions are based on Figure 12, which is the theoretical basis for the Wright approach. It shows the expected real market return implied by the CCAPM based on different levels of risk aversion[40]:

FIGURE 12: EXPECTED REAL RETURNS IMPLIED BY THE CCAPM

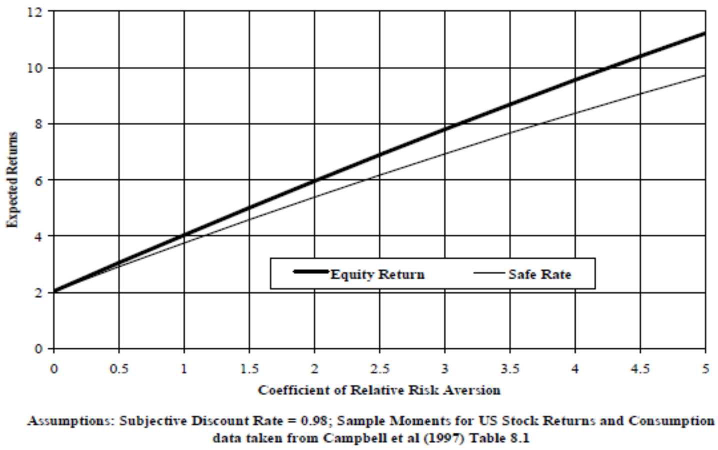


Figure 2.1: Expected Returns Implied by the Consumption CAPM

Source: Wright, Mason and Miles (2003), p. 18.

- Reasonable estimates for the coefficient of relative risk aversion are considered to be between 1.0–4.0. The 6.7 per cent long-term average real return on equity in the United States is consistent with a coefficient of about 2.7, which well within the 1.0–4.0 range. This is what Wright et al were referring to when they stated that:
  - it is not particularly hard to derive estimates of the expected stock return itself that are *consistent with the theory of the CCAPM*, and
  - there is no obvious conflict between *observed mean stock returns* and the *predictions of theory*.

4.2.1 Using historical real returns to estimate expected real returns

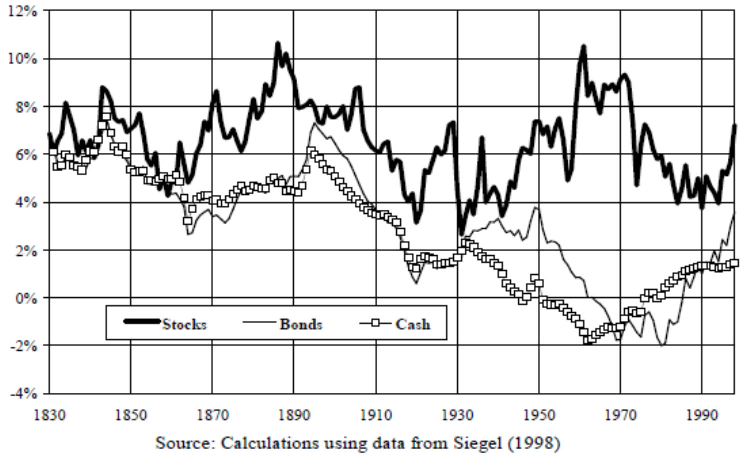
- Figure 12 is what motivated Wright et al to determine if the historical real return on equity is a ‘good’ estimate of the expected real market return.

[39] Wright, Mason & Miles (2003), *A study into certain aspects of the cost of capital for regulated utilities in the U.K*, p. 14, 17 and 19.

[40] The formulas used to produce Figure 12 are derived and explained in R. Mehra (February 2003), *The Equity Premium: Why Is It a Puzzle?*, p. 58–59.

- At this point the CCAPM has served its purpose and is no longer required. The average real return on equity is a statistically valid estimate of the expected real market return *if* the underlying real returns are stable (ie, stationary). Wright et al demonstrate this stability using rolling 30-year averages of historical real equity returns (Figure 13). The rolling averages oscillate around the long-term average, which is consistent with the real returns being stationary.

FIGURE 13: ROLLING 30-YEAR AVERAGES



Source: Wright, Mason and Miles (2003), p. 32.

- Based on Figure 13, Wright et al conclude that the long-term average real return on equity is a statistically valid unconditional estimate of the expected real market return. Therefore, the long-term average real return on equity can be used to make a direct estimate the expected real market return in the SL CAPM.

4.2.2 Wright et al use the SL CAPM to calculate the return on equity for a regulated business

- Wright et al only use the theory of the CCAPM to inform their approach for estimating the expected real market return. They do not suggest using the CCAPM to estimate the expected return on equity for a regulated business. They support using the SL CAPM for this purpose[41]:

> In summary: the empirical shortcomings of the CAPM are known. Alternative models to address this issue have their own shortcomings – weak theoretical foundations and empirical challenges. In our view, there is no one clear successor to the CAPM for practical cost of capital estimation.

- Using the CCAPM to calculate the expected return for a regulated business requires estimating the 'consumption beta' of the business, which is based on the covariance of its historical returns and aggregate consumption growth. This is not how Wright et al suggest the expected return should be calculated, so any studies showing the failure of the CCAPM to explain returns on individual stocks or portfolios of stocks are not relevant to a theoretical or empirical assessment of the Wright approach.
- In our submission to the *Rate of Return Information Paper and Final Working Papers* we recommended the AER[42]:

> … provide an assessment of the theoretical basis for the Wright approach in Wright, Mason & Miles (2003), and a comparable assessment of the theoretical basis for the HER approach.

- The AER 'does not accept the CCAPM as a theoretical basis for the Wright approach'. However, the AER has still not set out the theoretical basis for the HER approach. Without having made a side-by-side assessment, there is no theoretical basis for giving zero per cent weight to the Wright approach in the 2022 RoRI.

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[41] Wright, Mason & Miles (2003), *A study into certain aspects of the cost of capital for regulated utilities in the U.K*, p. 76.

[42] QTC (March 2022), *Submission to the Rate of Return Information Paper and Final Working Papers*, p. 2.

4.3 Section 7.2.3.1 from the *Draft Explanatory Statement*

The QTC cites the Consumption CAPM (CCAPM) as the theoretical basis for the Wright approach in response to the overall rate of return, equity and debt working paper. The motivation of Wright's original argument for using a constant expected return is the so-called equity premium puzzle and risk-free rate puzzle identified in Mehra & Prescott (1985) and Weil (1989). Various CCAPM models have been developed since then to address the two puzzles, but there has been no consensus among the academics as to what underlies the puzzles or whether the puzzles even exist.

This was discussed in the CEPA (2021) report to the AER.

> *The existence of this puzzle seems to throw into question whether CCAPM models are useful in explaining observed (or expected) risk-free rate and MRP or any relationship between the two. Furthermore, in 2017 Siegel observed a substantial divide between academics and practitioners on this point – 'In one of the sharpest divides in memory, some academics still consider the ERP puzzle literature relevant while almost no practitioners do'.*
>
> *More recently, Jorda et al (2019) has continued the debate, demonstrating how asset returns from 15 countries from 1870 onwards are inconsistent with consumption-based theory.*
>
> *That these theories have not been reconciled is important for the question we address here. It means that asset pricing models, and models of the relationship between equity returns and some fundamental variables do not rely on micro foundations of behaviour in the same way as preferred macroeconomic models do. In our opinion these models are of no help in the task of estimating MRP for regulatory purposes.*

Wright (2003) considers that the two puzzles are two sides of the same coin, which leads him to argue that one should focus on the expected market returns since the historical mean return on equity is much more stable than the historical mean return on bonds and bills.

In our view:

- Wright's conclusion is based on empirical evidence about realised returns in Siegel (1998). However, the Siegel's Constant is subject to debate.
- Wright's argument assumes an expectation error of zero in order to go from stable historical mean return to stable expected mean return.

The assumption of constant expected returns implies an inverse relationship between risk-free rate and MRP mechanically. Lally (2012) points out this is not in Siegel's papers.

> *In turn Smithers and Co reach this view based upon the observation that the real return on US stocks over the last 100–200 years has been much more stable than the real risk-free rate, and they refer to this as 'Siegel's Constant'. This view presumably comes from Siegel (1992, 1999), who claims that the real return on equities is more stable than that on long-term government bonds, that this is due to significant unexpected inflation during the 20th century, that historical average excess returns from 1926 overestimate the true MRP during that period, and that the MRP in the future will therefore be significantly less than that estimated by historical average excess returns using data from 1926. However, Siegel's arguments are concerned with real rather than nominal returns. Furthermore, even in respect of real returns, Siegel does not argue that the MRP moves inversely with the risk-free rate to the point that the cost of equity is largely unchanged.*

The 'Siegel's Constant' has been subject to debate, for instance:

- Dimson, Marsh and Staunton (2001) argue that the Siegel's Constant is not a global phenomenon.
- Lettau and Ludvigson (2005) explicitly reject [sic] constant expected return.

In our view, the CCAPM does not predict [sic] stable expected total return, so it cannot act as a theoretical basis for the Wright approach as QTC argued.

The CCAPM also fails empirical tests. For instance, Campbell and Cochrane stated that:

> *Unfortunately, consumption-based pricing models prove disappointing empirically.*
>
> *Alas, the canonical consumption-based model performs no better, and in many respects worse, than even the simple static Capital Asset Pricing Model (CAPM).*
>
> *The canonical consumption-based model has failed perhaps the most important test of all, the test of time. Twenty-five years after the development of the consumption-based model, almost all applied work in finance still uses portfolio-based models to correct for risk, to digest anomalies, to produce cost of capital estimates, and so forth.*

Based on this evidence, we do not accept CCAPM as a theoretical basis for the Wright approach as argued by QTC.

4.4 QTC's response to Section 7.2.3.1

4.4.1 General comments

- The detailed referencing of source materials in the *Draft Explanatory Statement* is absent in Section 7.3.2.1. For example, no titles or page references are provided for Dimson, Marsh and Staunton (2001), Lettau and Ludvigson (2005), Campbell and Cochrane (no year provided), or Lally (2012). This makes it very difficult and time consuming for stakeholders to respond to the assessment and verify the AER's conclusions.
- The points raised after **In our view:** about one third of way through Section 7.2.3.1 relate to empirical issues rather than theoretical issues, and it is the latter that the section was meant to assess. Even so, a more comprehensive analysis of the empirical issues cited, which we have done in the remainder of Section 4.4, leads to different conclusions. For example:
  - Dimson et al report similar levels of variability in the cross-section of average real returns *and* average excess returns based on a sample of sixteen countries. Therefore, the claim that Siegel's Constant is not a 'global phenomenon' also applies to the HER approach.
  - Lettau and Ludvigson (2005) do not 'explicitly reject' a constant expected return. The authors find that excess returns are strongly predictable using a proxy for the log consumption-wealth ratio. This is consistent with the conditional expected MRP not being constant. Importantly, the variation in the conditional expected MRP is countercyclical.
- Two dot points are provided to support the AER's conclusions based on Dimson et al and Lettau and Ludvigson. In our view, the AER should have explained the approaches used in those papers, and provided quotes and extracts to support the interpretation of the findings and the conclusions reached. Providing two dot points does not represent a genuine attempt to fully engage with the material in those papers.
- The selection of quotes from Campbell and Cochrane (2000) are submitted without any explanation for why they are relevant to Wright et al's use of the theory of the CCAPM to inform their approach for estimating the expected real market return. The failed empirical tests referred to in Campbell and Cochrane are based on studies that use empirical consumption betas to estimate the expected return for individual stocks and portfolios of stocks. Wright et al do not suggest the CCAPM should be used for this purpose. They explicitly support using the SL CAPM to calculate the return on equity for regulated businesses.
- Based on the above, QTC considers that no weight should be given to the conclusions in Section 7.2.3.1 of the *Draft Explanatory Statement* when the AER makes the Final 2022 RoRI.
- Our response to the specific points raised in Section 7.2.3.1 are provided below.

4.4.2 CEPA (2021)

> The existence of this puzzle seems to throw into question whether CCAPM models are useful in explaining observed (or expected) risk-free rate and MRP or any relationship between the two.

- The failure of the CCAPM to explain the observed risk-free rate and MRP is acknowledged by Wright et al. However, this failure does not extend to the observed total return on equity:

> Since Mehra & Prescott (1985) and Weil (1989) it has been established that simple versions of the consumption CAPM model signally fail to explain observed values of either the risk-free rate or the equity premium ... however, a feature of the model that it is less frequently acknowledged is that **there is no such clear-cut failure of the model to explain the market return (the cost of equity) itself**.

- Furthermore, a explained in Cochrane (1997) the SL CAPM cannot be used to inform the approach for estimating the expected market return because the expected market return is an input into the SL CAPM[43]:

[43] J. Cochrane (December 1997), *Where is the market going? Uncertain facts and novel theories*, p. 16.

> Finance researchers and practitioners often express disbelief (and boredom) with consumption-based models such as the above. Even the CAPM performs better: Expected returns of different portfolios line up much better against their covariances with the market return than against their covariances with consumption growth. Why not use the CAPM or other, better-performing finance model to understand the equity premium? **The answer is that the CAPM and related finance models are useless for understanding the market premium**. The CAPM states that the expected return of a given asset is proportional to its "beta" times the expected return of the market. This is fine if you want to think about an individual stock's return given the market return. But the average market return—the thing we are trying to explain, understand, and predict—is a given to the CAPM.

- It our view, the above comments in CEPA (2021) do not refute Wright et al's use of the theory of the CCAPM to inform their approach for estimating the expected real market return.

4.4.3 Reliance on empirical evidence that is subject to debate

> Wright's conclusion is based on empirical evidence about realised returns in Siegel (1998). However, the Siegel's Constant is subject to debate.

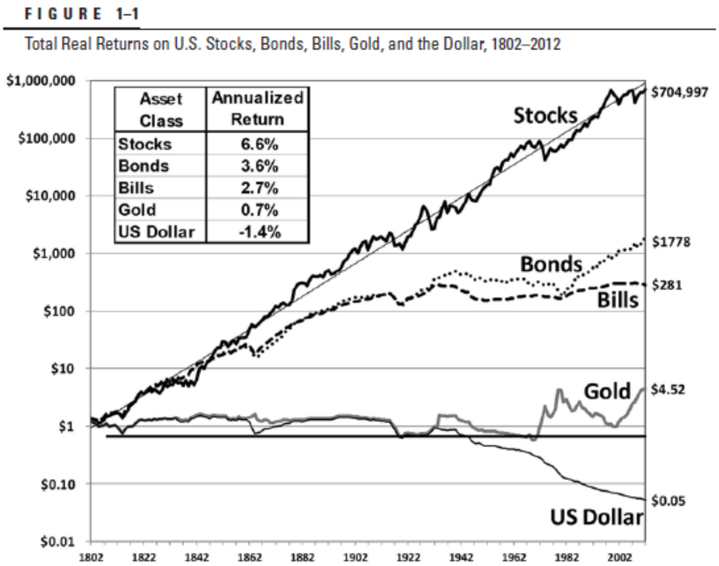
Empirical evidence

- The Wright approach uses the long-term average real return on equity as an unconditional estimate of the expected real market return. The empirical basis for doing this the stability (ie, stationarity) of the long-term real return on equity. This is often referred to as Siegel's Constant[44].

> Siegel (1998), using two centuries' worth of data for real returns on stocks, bonds and bills in the US, has forcibly argued for the apparent stability of real returns on stocks, both in absolute terms, and relative to competing assets. Smithers and Wright (2002) christen the apparently stable geometric mean stock return "Siegel's Constant".

- Figure 1–1 from Siegel's book *Stocks for the Long Run – The Definitive Guide to Financial Market Returns & Long-Term Investment Strategies* is reproduced in Figure 14.

FIGURE 14: FIGURE1–1 FROM *STOCKS FOR THE LONG RUN*



Source: Siegel – Stocks for the Long Run, p. 6.

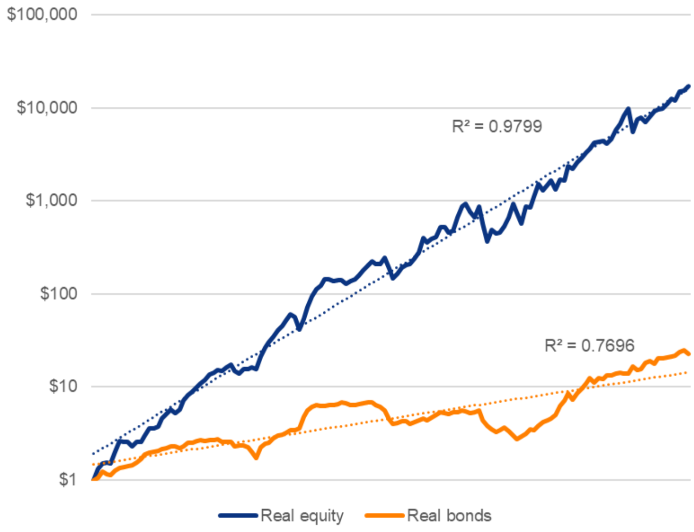
[44] Wright, Mason & Miles (2003), *A study into certain aspects of the cost of capital for regulated utilities in the U.K*, p. 31.

- Siegel describes Figure 1–1 as 'the most important chart' in his book, and summarises the main findings as follows[45]:

> **The stability of real returns is striking; real stock returns in the nineteenth century do not differ appreciably from the real returns in the twentieth century**. Note that stocks fluctuate both below and above the trendline but eventually return to the trend. Economists call this behavior mean reversion, a property that indicates that periods of above average returns tend to be followed by periods of below-average returns and vice versa. **No other asset class—bonds, commodities, or the dollar— displays the stability of long-term real returns as do stocks.**

- Figure 15 shows the real return on equities and bonds based on Australian data between 1883 and 2021.

FIGURE 15: REAL EQUITY AND BOND RETURNS IN AUSTRALIA (1883–2021)



Source: Brailsford, Handley and Maheswaran. QTC calculations.

- The results are consistent with the results based on United States data:
  - Real equity returns in Australia fluctuate below and above the trendline, but eventually return to the trend. The trend deviations are strongly mean-reverting, which means the distribution of the expected real market return is narrower than it would be if the deviations followed a random walk[46].
  - Real bond returns in Australia display sustained deviations from the trendline that are not mean-reverting.
- The empirical evidence relied on by Wright to conclude that the average real return on equity is a statistically valid unconditional estimate of the expected real market return, based on United States and Australian data, is very strong. As such, the empirical evidence clearly supports giving weight to the Wright approach in the 2022 RoRI.

'Subject to debate' as an assessment criterion

- Most topics in asset pricing that are important are subject to ongoing debate by practitioners and academics. However, it does not follow that zero weight should be given to an estimation approach simply because it is subject to debate, which is the implied position in the *Draft Explanatory Statement*. For example:
  - The best way to implement the dividend growth model (DGM) is clearly subject to debate. However, the *Draft Explanatory Statement* is considering giving equal weight to the HER and DGM approaches to estimate the expected MRP in the 2022 RoRI.
  - The Concurrent Evidence Session on the MRP demonstrated that the best way to use historical data to estimate the expected MRP is also subject to debate. However, the AER is proposing to give zero weight to the Wright approach, which implies there is no debate on the best way to use historical data to estimate the expected MRP.

[45] J. Siegel, *Stocks for the Long Run – The Definitive Guide to Financial Market Returns & Long-Term Investment Strategies*, p. 5–6.

[46] A regression of the annual change in the trend deviation on the 1-year lagged trend deviation produces a mean reversion parameter of –0.134 with a t-statistic of –3.33. The long-term average trend deviation is not significantly different from zero.

- By definition, there are at least two sides to a debate. However, Section 7.2.3.1 does not present a single point in favour of giving any weight to the Wright approach.
- In QTC's view, if the AER considers that something being subject to debate is a valid assessment criterion, it must be applied to all sides of the debate, or not at all.

4.4.4 Assumptions about expectational errors

> Wright's argument assumes an expectation error of zero in order to go from stable historical mean return to stable expected mean return.

- All approaches that use historical data to estimate the expected value of some quantity assume that expectational errors will average out zero provided the sample size is large enough. If the statement above is genuinely considered to be a factor against the Wright approach, it must also be a factor against the HER approach.

4.4.5 Lally 2012

> The assumption of constant expected returns implies an inverse relationship between risk-free rate and MRP mechanically. Lally (2012) points out this is not in Siegel's papers:
>
> > *… Siegel's arguments are concerned with real rather than nominal returns. Furthermore, even in respect of real returns, Siegel does not argue that the MRP moves inversely with the risk-free rate to the point that the cost of equity is largely unchanged.*

- Wright et al explain that Siegel has 'forcibly argued for the apparent stability of real returns on stocks'. What Siegel did or did not say or argue regarding an implied MRP is not relevant.
- In QTC's view, the point made by Lally means that 100 per cent weight should not be given to the Wright approach. However, the same point cannot be used to justify giving zero weight to the Wright approach.
- Finally, it is unclear why the AER chose to cite a 2012 paper by Lally to support giving zero weight to the Wright approach when Lally's 2022 advice is for the AER to give equal weight to the HER and Wright approaches[47]:

> What's the best method? We don't have to pick one. If we were picking one, we'd have to face this awful conundrum. I would say to you, all methods are imperfect. So choose a set of methods that you think are, for all their imperfections, worth putting weight on, and then equally weight those methods. And the set of methods that I would recommend is not only historical averaging and the dividend growth model, but this Wright estimator.

4.4.6 Siegel's Constant is subject to debate

> The 'Siegel's Constant' has been subject to debate, for instance:
>
> - Dimson, Marsh and Staunton (2001) argue that the Siegel's Constant is not a global phenomenon.
> - Lettau and Ludvigson (2005) explicitly reject [sic] constant expected return.
>
> In our view, the CCAPM does not predict [sic] stable expected total return, so it cannot act as a theoretical basis for the Wright approach as QTC argued.

- There are several problems with the AER's assessment of Dimson et al and Lettau and Ludvigson:
  - Submitting two dot points as evidence without providing any context or further explanation does not represent a genuine attempt to fully engage with the material in those papers. A more comprehensive consideration of those papers leads to different conclusions. For example:

[47] AER Concurrent Evidence Session 3 – Market Risk Premium, proofed transcript, p. 65–66.

- > Dimson et al report similar levels of variability in the cross-section of average real returns *and* average excess returns based on a sample of sixteen countries. Therefore, the claim that Siegel's Constant is not a 'global phenomenon' also applies to the HER approach.
- > Lettau and Ludvigson (2005) do not 'explicitly reject' a constant expected return. The authors find that excess returns are strongly predictable using a proxy for the log consumption-wealth ratio. This is consistent with the conditional expected MRP not being constant. Importantly, the variation in the conditional expected MRP is countercyclical.

– The conclusion that the CCAPM does not predict a stable expected total return is not relevant because stability is an empirical issue, and the stability of the real return on equity has been demonstrated by Wright et al, and by the AER in Section 7.2.3.2 of the *Draft Explanatory Statement*[48]. Furthermore, the expected real market returns implied by the CCAPM are shown in Figure 12. There is no inconsistency between the CCAPM-implied expected returns and the observed real return on equity.

– Finally, as explained in Section 4.4.3, if the AER considers that something being subject to debate is a valid assessment criterion, it must be applied to all sides of the debate, or not at all.

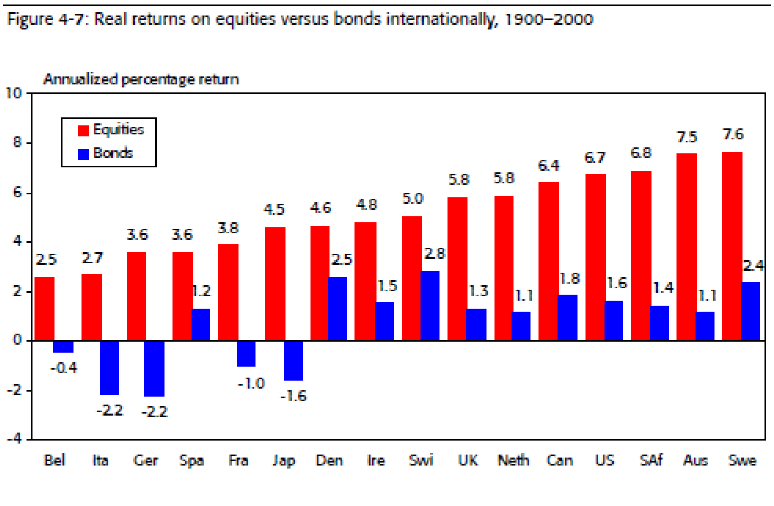
Dimson, Marsh and Staunton

- Section 7.2.3.1 does not provide a reference to the page(s) where Dimson et al argue that Siegel's Constant is 'not a global phenomenon'. However, Wright et al note that[49]:

> Dimson, Marsh, and Staunton (2001c) dispute the concept of "Siegel's Constant" being a global phenomenon, in the light of the variation across countries in their sample …

- The variation referred to by Wright et al relates to the cross-sectional variation in the average real return on equity for a sample of sixteen countries as shown in Figure 16. The cross-section of the average equity premium for the same sixteen countries is shown in Figure 17.

FIGURE 16: HISTORICAL REAL RETURN ON EQUITY

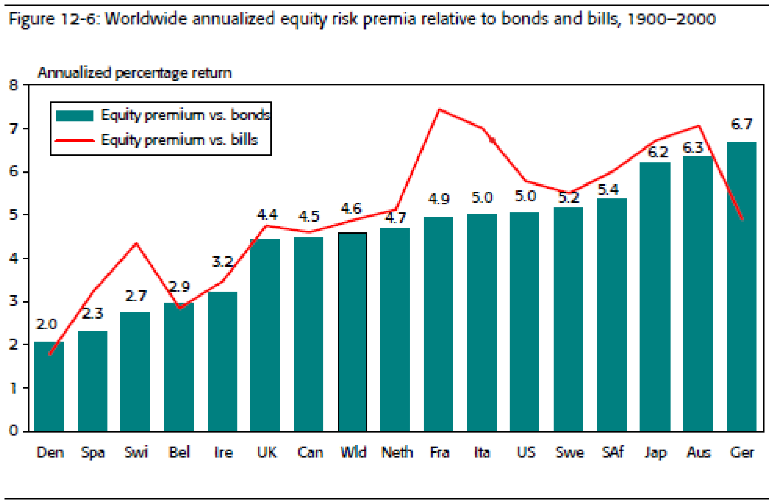


Source: Dimson, Marsh and Staunton, Triumph of the Optimists – 101 Years of Global Investment Returns, p. 53.

[48] AER (June 2022), *Draft Rate of Return Instrument Explanatory Statement*, p. 159–160.

[49] Wright, Mason & Miles (2003), *A study into certain aspects of the cost of capital for regulated utilities in the U.K*, p. 33.

FIGURE 17: HISTORICAL EQUITY PREMIUM



Source: Dimson, Marsh and Staunton, Triumph of the Optimists – 101 Years of Global Investment Returns, p. 172.

- The standard deviations of the cross-sectional average real return and average equity premium are similar at 1.62 per cent and 1.45 per cent respectively. If the criterion for some measure being a 'global phenomenon' is based on its cross-sectional standard deviation, which is the implied position in the *Draft Explanatory Statement*, then similar weights should be given the Wright and HER approaches.
- Furthermore, Siegel's Constant is based on the time-series properties of the real return on equity. As explained by Siegel[50]:

> The stability of real returns is striking; real stock returns in the nineteenth century do not differ appreciably from the real returns in the twentieth century … No other asset class—bonds, commodities, or the dollar— displays the stability of long-term real returns as do stocks.

- The same long-term stability is also a feature of the real return on equity in Australia (Figure 15).
- In QTC's view, the findings in Dimson, Marsh and Staunton (2001) support a weight for the Wright approach in the 2022 RoRI that is closer to 50 per cent than zero per cent.

Lettau and Ludvigson (2005)

- No reference is provided to the page(s) where Lettau and Ludvigson (2005) 'explicitly reject' a constant expected return. However, the section of the paper that appears to relate to the AER's claim is as follows[51]:

> Empirical evidence on the behavior of the dividend-price ratio has transformed the way financial economists perceive asset markets. It has replaced the age-old view that expected returns are approximately constant, with the modern-day view that time-variation in expected returns constitutes an important part of aggregate stock market variability.

- The above statement is a general description of the findings of other researchers. It does not relate to Lettau and Ludvigson's main finding, which is that a proxy for the log consumption-wealth ratio (referred to as cay_t) has[52]:

> … **statistically significant forecasting power for future excess returns** at horizons ranging from one to six years. This evidence is consistent with that reported in Lettau and Ludvigson (2001a) using quarterly data. Using this single variable alone achieves an R^2 of 0.25 for excess returns at a one-year horizon, 0.44 for excess returns over a two-year horizon, and 0.50 for excess returns over a six-year horizon.

[50] J. Siegel, *Stocks for the Long Run – The Definitive Guide to Financial Market Returns & Long-Term Investment Strategies*, p. 5–6.

[51] M. Lettau and S. Ludvigson (2005), *Expected returns and expected dividend growth*, p. 1.

[52] M. Lettau and S. Ludvigson (2005), *Expected returns and expected dividend growth*, p. 15.

- The results based on excess stock returns are summarised in Table 4 in Lettau and Ludvigson (2005).

Table 4: Univariate long-horizon regressions – excess stock returns

h-period regression: $\sum_{i=1}^{h}(r_{t+i} - r_{f,t+i}) = k + \gamma \ z_t + \epsilon_{t,t+h}$

$z_t =$	Horizon h (in years) 1	2	3	4	5	6
$d_t - p_t$	0.14	0.24	0.27	0.34	0.52	0.73
	(1.90)	(1.40)	(1.21)	(0.73)	(0.84)	(1.12)
	{0.26}	{0.19}	{0.16}	{0.10}	{0.11}	{0.15}
	[0.08]	[0.10]	[0.10]	[0.10]	[0.16]	[0.23]
$\widehat{cay}_t$	**5.87**	**10.50**	**11.93**	**12.54**	**16.31**	**21.66**
	(4.15)	(5.58)	(6.86)	(6.72)	(7.18)	(7.82)
	{0.51***}	{0.75***}	{0.90***}	{0.78***}	{0.96***}	{0.81***}
	[0.25]	[0.44]	[0.40]	[0.32]	[0.36]	[0.50]
$\widehat{cdy}_t$	1.50	**5.54**	**6.36**	**6.90**	**8.30**	**11.81**
	(1.45)	(7.54)	(4.89)	(5.07)	(4.69)	(4.96)
	{0.26}	{1.10***}	{0.59***}	{0.61***}	{0.74***}	{0.69***}
	[0.01]	[0.19]	[0.23]	[0.22]	[0.22]	[0.36]

Source: Lettau and Ludvigson (2005)

- The estimated coefficients on ***cay**$_t$* are positive and highly statistically significant. The positive sign is important because Lettau and Ludvigson (2001) show that variation in ***cay**$_t$* is countercyclical, as it tends to decline during expansions and rise just prior to the onset of a recession[53]. In fact, one of the main findings in Lettau and Ludvigson (2001) is that[54]:

> ... the deviation in wealth from its shared trend with consumption and labor income has **strong predictive power for excess stock returns at business cycle frequencies, providing direct evidence that risk premia vary countercyclically**.

- The main finding in Lettau and Ludvigson (2005) is that ***cay**$_t$* forecasts excess returns (ie, the expected MRP). This means the conditional probability distribution of the expected MRP displays countercyclical time-variation.
- This would seem to be evidence against using a constant MRP to calculate the allowed return on equity. However, the existence of a conditional probability distribution for the expected MRP does not preclude using the long-term average MRP to make an unconditional estimate of the expected MRP. The only requirement is for the historical excess returns to be stationary. Section 7.2.3.2 of the *Draft Explanatory Statement* provides visual and statistical evidence which indicates that historical excess returns *and* historical real equity returns are stationary.
- Even if Lettau and Ludvigson (2005) had found that ***cay**$_t$* forecasts total returns, this would mean the conditional probability distribution of the expected total return displays countercyclical time-variation. As with the expected MRP, this finding would not preclude using the long-term average real return on equity to make an unconditional estimate of the expected real market return (ie, the Wright approach)
- It is not practical to use an estimate of ***cay**$_t$* based on Australian data to estimate the expected MRP in the 2022 RoRI. However, the findings in Lettau and Ludvigson (2005) can still be used to inform the choice of weights for the HER and Wright approaches:
  - The main finding is that ***cay**$_t$* is countercyclical and positively related to expected excess returns. This means the expected MRP displays countercyclical time-variation.
  - The Wright approach produces implied MRP estimates that change point-for-point in the opposite direction as the change in the risk-free rate.
  - To the extent that risk-free rates are more likely to be procyclical than countercyclical, giving some weight to the Wright approach is likely to produce an expected MRP that captures some of the countercyclical time-variation referred to by Lettau and Ludvigson.

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[53] M. Lettau and S. Ludvigson (2001), *Consumption, Aggregate Wealth, and Expected Stock Returns*, The Journal of Finance – Vol. LVI, No. 3, p. 830.

[54] M. Lettau and S. Ludvigson (2001), *Consumption, Aggregate Wealth, and Expected Stock Returns*, The Journal of Finance – Vol. LVI, No. 3, p. 844.

- In QTC's view, the findings in Lettau and Ludvigson (2005) support a weight for the Wright approach in the 2022 RoRI that is closer to 50 per cent than zero per cent.

4.4.7 The CCAPM does not predict a stable expected total return

- The conclusion that the CCAPM does not predict a stable expected total return is not relevant because stability is an empirical issue, and the stability of the real return on equity has been demonstrated by Wright et al, and by the AER in Section 7.2.3.2 of the *Draft Explanatory Statement*[55]. Furthermore, the expected real market returns implied by the CCAPM are shown in Figure 12. There is no inconsistency between the CCAPM-implied expected returns and the observed real return on equity.

4.4.8 The CCAPM fails empirical tests

> The CCAPM also fails empirical tests. For instance, Campbell and Cochrane stated that:
>
> > *Unfortunately, consumption-based pricing models prove disappointing empirically.*
> >
> > *Alas, the canonical consumption-based model performs no better, and in many respects worse, than even the simple static Capital Asset Pricing Model (CAPM).*
> >
> > *The canonical consumption-based model has failed perhaps the most important test of all, the test of time. Twenty-five years after the development of the consumption-based model, almost all applied work in finance still uses portfolio-based models to correct for risk, to digest anomalies, to produce cost of capital estimates, and so forth.*
>
> Based on this evidence, we do not accept CCAPM as a theoretical basis for the Wright approach as argued by QTC.

- There are several problems with the AER's reliance on Campbell and Cochrane (2000). Firstly, the 'evidence' relates to empirical studies that calculate the return on equity for individual stocks and stock portfolios using empirical consumption betas and standard empirical equity betas[56]. In general, these studies find that the estimates based on empirical consumption betas to a poor job of explaining observed returns.
- These empirical findings are not relevant because Wright et al do not use the CCAPM to calculate the expected return for a regulated business. Wright et al only use the theory of the CCAPM to inform their approach for estimating the expected real market return. This estimate is used as an input into the SL CAPM, which is the model Wright et al use to estimate the expected return for regulated businesses.
- Secondly, the conclusion that immediately follows the last quote from the AER is informative given the AER's strong support for using the SL CAPM (similar to Wright et al) to calculate the allowed return on equity[57]:

> This history is often interpreted as evidence against consumption-based models in general rather than against particular utility functions, particular specifications of temporal nonseparabilities such as habit persistence or durability, and particular choices of consumption data and data-handling procedures. But this conclusion is internally inconsistent, because all current asset pricing models are derived as specializations of the consumption-based model rather than as alternatives to it. All current models predict that expected returns should line up against covariances of returns with some function of consumption …
>
> **One cannot believe that the CAPM does hold, but consumption-based models, as a class, fundamentally do not.**

---

[55] AER (June 2022), *Draft Rate of Return Instrument Explanatory Statement*, p. 159–160.

[56] J. Campbell and J. Cochrane (December 2000), *Explaining the Poor Performance of Consumption-based Asset Pricing Models*, The Journal of Finance Vol. LV, No. 6, p. 2863–64.

[57] J. Campbell and J. Cochrane (December 2000), *Explaining the Poor Performance of Consumption-based Asset Pricing Models*, The Journal of Finance Vol. LV, No. 6, p. 2864.

- Finally, the way Wright et al use of the theory of the CCAPM to inform their approach for estimating the expected real market return is consistent with Campbell and Cochrane's final conclusion that[58]:

> … consumption-based models will always be best used to understand the deeper economic forces that determine the prices of risk in portfolio-based models, to help sort out which ones really work and which were just lucky in particular samples, and to analyze structural changes in the distribution of risks or risk aversion.

- In QTC's view, the evidence in Campbell and Cochrane (2000) provides no basis rejecting Wright et al's use of the theory of the CCAPM to inform their approach for estimating the expected real market return. Therefore, the following conclusion should be given no weight when the AER makes the final 2022 RoRI:

> **Based on this evidence**, we do not accept CCAPM as a theoretical basis for the Wright approach ...

4.4.9 Summary and conclusions

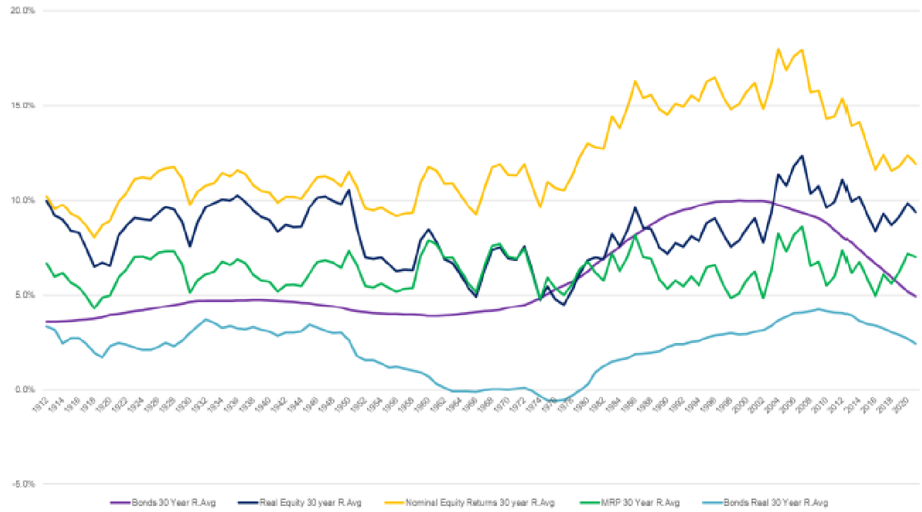
- It is the AER's duty to objectively assess all of the evidence before it when determining the approach for calculating the allowed return on equity under the 2022 RoRI. Despite some aspects of the Wright approach being 'subject to debate', which implies there are at least two sides for the AER to consider, Section 7.2.3.1 of the *Draft Explanatory Statement* does not identify a single point in favour of giving any weight to the Wright approach.
- In our view, Section 7.2.3.1 appears to be more concerned with making a case against the Wright approach rather than fully engaging with relevant research and academic literature to determine an appropriate weight for the Wright approach.
- Based on our responses in Section 4.4, there is no theoretical basis for the proposal to give zero weight to the Wright approach in the 2022 RoRI. Furthermore, the draft proposal is extreme given that the Wright approach:
  - is based on sound economic theory, as shown in Section 4.2 of this submission
  - is a statistically valid estimation approach, as shown in Section 7.2.3.2 of the *Draft Explanatory Statement*, and
  - has received some support from advisors to the AER including Lally, CEPA and Sapere.
- Based on the above, QTC considers that no weight should be given to the conclusions in Section 7.2.3.1 of the *Draft Explanatory Statement* when the AER makes the Final 2022 RoRI.
- However, QTC considers the research and academic literature cited in Section 7.2.3.1 to be useful. We consider that our more comprehensive review of the material cited suggests that a more balanced approach is appropriate, which means giving weight to the HER and Wright approaches to estimate an expected MRP based on historical data.

4.5 QTC's response to Section 7.2.3.2

- Section 7.2.3.2 of the *Draft Explanatory Statement* provides the AER's assessment of the empirical basis for the Wright approach, which is the stability (ie, stationarity) in the long-term average real return on equity. Wright's 30-year rolling averages have been reproduced using Australian nominal equity returns, real equity returns and excess returns as shown in Figure 18.

[58] J. Campbell and J. Cochrane (December 2000), *Explaining the Poor Performance of Consumption-based Asset Pricing Models*, The Journal of Finance Vol. LV, No. 6, p. 2877.

FIGURE 18: ROLLING 30-YEAR AVERAGES BASED ON AUSTRALIAN DATA



Source: AER Draft Explanatory Statement, p. 160.

- The 30-year rolling averages for the real and excess returns tend to oscillate around their long-term averages, which is consistent with the underlying data being stationary. It is not clear if the nominal return on equity is stationary. Although not reported, the standard deviation of the 30-year rolling averages for the nominal, real and excess returns are 2.42, 1.60 and 0.87 per cent respectively.
- Lally performs a more formal statistical test and concludes that the hypothesis that nominal, real and excess returns are stationary cannot be rejected[59]. Based on the 30-year rolling averages and Lally's stationarity tests, the AER reaches the following conclusion[60].

> Dr Lally's finding were also consistent with the comparison of rolling averages in Figure 7.7 showing the greatest variability for nominal returns, followed by real returns, and the least variability for excess returns. The reported F statistics were generally consistent with this result. These results suggest that in our circumstance, a fixed MRP may be more suitable than alternative specification.
>
> Having evaluated the material before us, we have determined that the TMR [Wright] approach should not play a role in our MRP estimation process.

- In QTC's view, the AER's conclusion is not consistent with the material before it:
  - Even if an estimation method is considered to be 'more suitable', it does not follow that alternative methods are of no value and should be given zero weight. This is especially true when several advisers to the AER have supported giving some weight to an alternative specification (ie, the Wright approach).
  - It does not follow that 100 per cent weight should be given to the estimate with the lowest variability. For example, if the standard deviations of the rolling 30-year averages of real and excess returns were 1.60 per cent and 1.59 per cent respectively, it would be not be appropriate to give 100 per cent weight to the HER approach. However, what if the standard deviations were 1.60 per cent and 1.20 per cent? Or 1.60 per cent and 1.00 per cent? There is no way to objectively identify the point at which the relative standard deviations justify giving 100 per cent weight to the HER approach.
  - In our view, a reasonable approach is to give proportionately more weight to the lower volatility estimate compared to the higher volatility estimate. This can be done using inverse volatility weights, which is an approach we explained in our submission to the *Rate of Return Information Paper and Final Working Papers*[61].
  - Based on standard deviations of 1.60 per cent and 0.87 per cent, the inverse volatility weighting approach produces a 35 per cent weight for the Wright approach and a 65 per cent weight for the HER approach[62].

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[59] M. Lally (June 2022), *Tests of mean stationarity for Australian share market returns data*, p. 10.

[60] AER (June 2022), *Draft Rate of Return Instrument Explanatory Statement*, p. 160.

[61] QTC (March 2022), *Submission to the Rate of Return Information Paper and Final Working Papers*, p. 27.

[62] Weight for the Wright approach = (1/1.60) / (1/0.87 + 1/1.60) = 35 per cent.

- Inverse volatility weights are analogous to using a dimmer switch to control the output from a light bulb compared to using an on/off switch. In our view, an 'all-or-nothing' approach is not the best way to use historical information to estimate the expected MRP, especially when the best way is subject to debate.
- Finally, Lally does not recommend how, or even if, the results from his stationarity tests should be used to determine the weights for the HER and Wright approaches. As shown in Section 4.6.1, Lally does not support giving 100 per cent weight to any single estimation approach.
- The empirical results in Section 7.2.3.2 of the *Draft Explanatory Statement* show that the average excess return and average real return are both statistically valid unconditional estimates of the expected MRP and expected real market return respectively. In QTC's view, these empirical results do not support giving zero per cent weight to the Wright approach in the 2022 RoRI.

4.6 Advice already before the AER

4.6.1 Lally

- In the Concurrent Evidence Session on the MRP, Lally advised that equal weight should be given to the Wright and HER approaches. He also advised against giving 100 per cent weight to any single estimation approach[63]:

> What's the best method? We don't have to pick one. If we were picking one, we'd have to face this awful conundrum. I would say to you, all methods are imperfect. So choose a set of methods that you think are, for all their imperfections, worth putting weight on, and then equally weight those methods. And the set of methods that I would recommend is not only historical averaging and the dividend growth model, but this Wright estimator.

- The following advice from Lally in 2019 to the New Zealand Commerce Commission is consistent with giving material weight to the Wright approach[64]:

> ... the second version [Wright] has merit independent of any historical inflation shock because it assumes that the expected real market return is stable over time and this may be a better assumption than that underlying the historical averaging of excess returns (that the TAMRP is stable over time).

4.6.2 CEPA

- CEPA's 2021 report for the AER made several important observations on the best way to use historical data to estimate the expected MRP, including the benefits of using a weighted average of the HER and Wright approaches[65]:

> There also appears to be **as strong a theoretical basis** for the argument that the RfR and the MRP are perfectively negatively correlated (the "Wright" approach) as there is for the argument that the RfR and total equity market returns are perfectly positively correlated (the fixed MRP approach).
>
> Our assessment is that (i) there is acceptance that MRP is not stable and (ii) **it is possible that there is an inverse relationship between the forward looking MRP and the risk-free rate**, (iii) there is no good evidence that the MRP should be assumed to be independent of the RfR the current assumption of the AER, and (iv) **there is no conclusive theoretical basis for an assumption of independence or dependence**.
>
> Our review of international regulators demonstrates that regulatory processes can accommodate any of these approaches [HER, Wright and weighted average]. The data to implement these for Australia is available. **Each of them is subject to error, and potentially reliability can be made acceptable by combining estimates.** The fact that each approach has been adopted in some respect by other regulators indicates that they are sufficiently simple to be accepted by stakeholders.

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[63] AER Concurrent Evidence Session 3 – Market Risk Premium, proofed transcript, p. 65–66.

[64] M. Lally (September 2019), *Estimation of the TAMRP*, p. 15.

[65] CEPA (June 2021), *The relationship between RFR and MRP*, p. 14 and 44.

> **The evidence indicates that the second two alternatives cannot be ruled out, and may provide a better estimate of the forward looking MRP consistent with the AER's duty**. We suggest that consideration of these options, and the evidence that would be necessary to decide between them is undertaken as part of the 2022 RORI process.

- The second two alternatives in the last quote from CEPA are the Wright approach and a weighted average of the Wright and HER approaches.
- Although CEPA did not make a recommendation on the weights for the HER and Wright approaches, there is nothing in CEPA's report that suggests the best way to use historical data to estimate the expected MRP is by giving 100 per cent weight to either approach.

4.6.3 Sapere

- The weighted average approach referred to by CEPA is the same as the 'Historical-Smart' approach in Sapere's report to the AER's Consumer Reference Group[66]:

> In practice, neither Historical-MRP [HER] nor Historical-ERM [Wright] are likely to perfectly reflect reality and Historical-Smart acknowledges this point by generating a weighted average of the two, with the weights reflecting the MRP-Rf correlation and hence the extent to which the two approaches approximate market reality. If the MRP-Rf correlation can be estimated accurately, this results in lower cost of equity estimation errors and (usually) greater estimate stability, but inaccurate estimation of the MRP-Rf correlation can have the opposite effect.

- Although Sapere express doubts as to whether the correlation between the expected MRP and prevailing risk-free rate can be determined using empirical analysis, Sapere explain that good reasons exist for a less than perfect negative relationship between the expected MRP and prevailing risk-free rate[67]:

> There would seem to be at least two good reasons to suspect a negative correlation between MRP and Rf:
>
> First, conventional monetary policy typically forces interest rates down when economic conditions are weak. Such conditions are also likely to be characterised by high risk and/or high investor risk aversion, resulting in higher risk premia. Similarly, interest rates are typically high when economic conditions are buoyant and risk premia are low. This suggests that **intertemporal movements in Rf are likely to be at least partly offset by opposite movements in MRP and hence the cost of equity estimate moves by less than 1-for-1 with the riskless rate**.
>
> Second, any phenomenon that causes a portfolio rebalancing between stocks and bonds, and hence drives stock and prices in different directions, must induce a negative relationship between MRP and Rf. For example, an adverse banking or financial shock frequently induces a so-called "flight to safety" where investors sell stocks and buy government bonds. **This forces riskless bond yields down at the same time risk premia rise.**

- The above observations suggest the expected MRP is likely to display countercyclical variation over time, which is consistent with the empirical findings in Lettau and Ludvigson (2005) as discussed in Section 4.4.6.
- Although Sapere did not make a specific recommendation on an appropriate set of weights for the HER and Wright approaches, it did suggest that[68]:

> … the best approach might be to set *bERM* close to 1 (i.e., close to Historical-MRP) and adopt a watching brief. Regardless, we recommend that the chosen weights be explicitly quantified so that regulatory judgement is transparent.

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[66] Sapere Research Group (February 2022), *Estimation of the market risk premium and its relationship to the risk free rate in the context of regulation of electricity and gas energy networks: A report for the Australian Energy Regulatory Consumer Reference Group*, p. 68.

[67] Sapere Research Group (February 2022), *Estimation of the market risk premium and its relationship to the risk free rate in the context of regulation of electricity and gas energy networks: A report to the Australian Energy Regulator Consumer Reference Group*, p. 35.

[68] Sapere Research Group (February 2022), *Estimation of the market risk premium and its relationship to the risk free rate in the context of regulation of electricity and gas energy networks: A report to the Australian Energy Regulator Consumer Reference Group*, p. 68.

- A watching brief cannot be adopted under a binding RoRI that must be applied automatically and without discretion. The AER cannot depart from the approach in the RoRI even if market conditions at the time of a regulatory determination justify making a departure.
- Taking this unique constraint into account, QTC considers Sapere's discussion of the Historical-Smart approach, in conjunction with the view that good reasons exist for a less than perfect negative relationship between the expected MRP and the prevailing risk-free rate, are consistent with giving some weight to the Wright approach.

4.6.4 Conclusion

- In our view, the empirical evidence in Section 7.2.3.2 of the *Draft Explanatory Statement*, and the advice already before the AER, all support giving weight to the HER and Wright approaches to calculate the allowed return on equity.
- On this basis, QTC considers it appropriate for the AER to reconsider the proposal in the *Draft Explanatory Statement* to give zero weight to the Wright approach in the 2022 RoRI.

4.7 Appropriate course of action when making the Final 2022 RoRI

- In May 2021 the AER made a commitment to consider the theoretical and empirical basis for the Wright approach[69]. This assessment should have been included in the December 2021 *Overall rate of return, equity and debt omnibus final working paper* at the latest. However, the first and only opportunity for stakeholders to comment on the AER's assessment is in submissions to the June 2022 *Draft Explanatory Statement*. This document was published more than twelve months after the AER's original commitment was made.
- This outcome is not consistent with good regulatory practice. Meaningful back-and-forth dialogue between stakeholders and the AER is essential for a sound and robust review process. Missing even one round of consultation is sufficient to significantly weaken the quality of the outcomes from the review process.
- It is too late for the AER to make a proper assessment of the Wright approach because stakeholders will have no opportunity to respond. Therefore, QTC considers the most appropriate course of action for the AER when making the Final 2022 RoRI is to:
  - place no weight on the conclusions in Section 7.2.3.1 of the *Draft Explanatory Statement*, and
  - follow the advice already provided by its consultants and give weight to the HER and Wright approaches.
- A weight of 35–50 per cent for the Wright approach is consistent with the inverse volatility weighting approach and the other advice already provided to the AER by its consultants.
- A weighted average of the Wright and HER approaches is an estimate of the expected MRP based on historical data. This estimate can be combined with the forward-looking implied MRP from the calibrated DGM to calculate the expected MRP under the 2022 RoRI.

[69] AER (May 2021), *Rate of return and cashflows in a low interest rate environment Draft working paper*, p. 29.

5 Other issues relating to the MRP

5.1 Desirability of positive point-for-point relationship between the risk-free rate and allowed return on equity

- The *Draft Explanatory Statement* lists some properties of the HER approach that the AER considers to be desirable:[70]

> Our current approach has been to set the MRP primarily based on estimates of historical excess returns. This approach has some desirable properties:
>
> • Investor expectations of future returns are informed by past realised returns.
>
> • Historical excess returns are able to be estimated simply.
>
> • Deriving the MRP from historical excess returns produces an MRP that is reasonably stable over time.
>
> • Using a fixed MRP will result in the total return on equity moving in line with the risk-free rate. The risk-free rate moves in line with economic conditions, which means that our return on equity will also tend to move with the base cost of money as it varies with changing market conditions.
>
> • The CRG submits that applying this approach consistently over time will ride through short-term economic cycles and promote stability and predictability.

- The first and second points would equally support the Wright approach, or at least giving meaningful weight to the Wright approach. The third point, if applied to the Wright approach, would produce relatively stable estimates of the allowed return on equity and prices for consumers.
- The fourth point has not been previously raised by the AER in the 2022 RoRI review process. There is no reference to the desirability of a positive point-for-point relationship in the *Overall rate of return, equity and debt omnibus Final working paper*:[71]

> In our view, the historical excess returns method has several desirable characteristics for estimating the MRP in a regulatory setting. The method is observable, easily replicable, transparent, and widely used in both regulation and by market practitioners.

- The *Draft Explanatory Statement* does not present evidence to support the claim that it is desirable for the expected return on risky asset to move point-for-point in the same direction with the expected return on a risk-free asset. Although the risk-free rate may move in line with economic conditions, it does not follow that a given set of economic conditions will cause the expected return on risky and risk-free assets to change by the same amount and/or in the same direction.
- In a report for the AER's Consumer Reference Group, Sapere advised that[72]:

> … there may be good reasons for scepticism about such a simple deterministic relationship.

- As explained in Section 4.6.3, Sapere outline two good reasons for a less than perfect negative relationship between the expected MRP and prevailing risk-free rate, which is the same as a less than perfect positive relationship between the allowed return on equity and the prevailing risk-free rate[73]:

[70] AER (June 2022), *Draft Rate of Return Instrument Explanatory Statement*, p. 16.

[71] AER (December 2021), *Overall rate of return, equity and debt omnibus Final working paper*, p. 38.

[72] Sapere Research Group (February 2022), *Estimation of the market risk premium and its relationship to the risk free rate in the context of regulation of electricity and gas energy networks: A report for the Australian Energy Regulatory Consumer Reference Group*, p. 22.

[73] Sapere Research Group (February 2022), *Estimation of the market risk premium and its relationship to the risk free rate in the context of regulation of electricity and gas energy networks: A report to the Australian Energy Regulator Consumer Reference Group*, p. 35.

> First, conventional monetary policy typically forces interest rates down when economic conditions are weak. Such conditions are also likely to be characterised by high risk and/or high investor risk aversion, resulting in higher risk premia. Similarly, interest rates are typically high when economic conditions are buoyant and risk premia are low. This suggests that intertemporal movements in Rf are likely to be at least partly offset by opposite movements in MRP and hence the cost of equity estimate moves by less than 1-for-1 with the riskless rate.
>
> Second, any phenomenon that causes a portfolio rebalancing between stocks and bonds, and hence drives stock and prices in different directions, must induce a negative relationship between MRP and Rf. For example, an adverse banking or financial shock frequently induces a so-called “flight to safety" where investors sell stocks and buy government bonds. This forces riskless bond yields down at the same time risk premia rise.

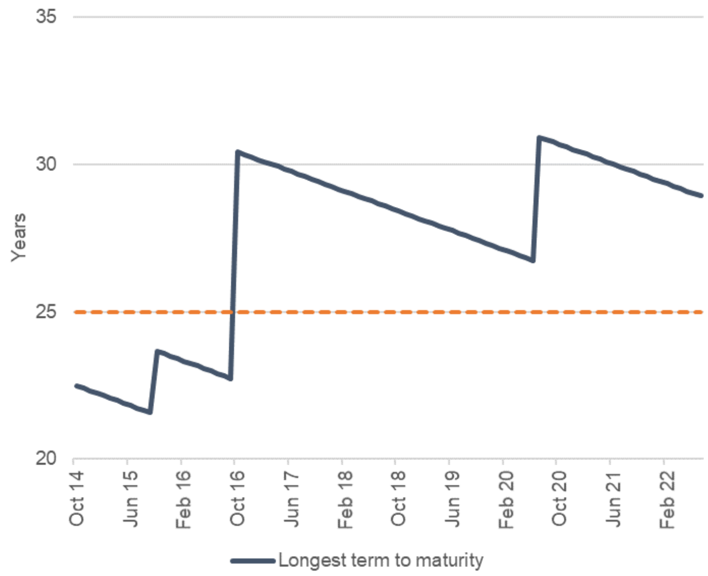
- These observations suggest that it is *not desirable* for the expected return on equity to have a perfect positive relationship with the prevailing risk-free rate because this would mean the expected return on equity will tend to be low (high) when investor risk aversion is high (low). There is no theoretical or empirical basis to support embedding this type of relationship in the 2022 RoRI.
- Sapere’s reasoning is consistent with certain sets of economic conditions affecting the expected return on risky and risk-free assets by different amounts and/or in opposite directions. A countercyclical expected MRP is also consistent with findings by Lettau and Ludvigson as discussed in Section 4.4.6.
- In our view, no consideration should be given to the desirability of the allowed return on equity moving point-for-point with changes in the risk-free rate when the AER makes the Final 2022 RoRI.

Appendix A: Choice of historical period and tenor

A.1: Choice of historical period

- Figure 19 shows the remaining term to maturity of the longest nominal fixed-rate CGS since October 2014.

FIGURE 19: TERM TO MATURITY OF THE LONGEST NOMINAL FIXED-RATE CGS



Source: Australian Office of Financial Management data hub

- The historical period for estimating the required margin is October 2016 to July 2022. This period was chosen based on the extension of the fixed-rate nominal CGS yield curve out to a 30-year tenor. The extension occurred when the Australian Office of Financial Management (AOFM) issued the 21 March 2047 ultra-long CGS on 12 October 2016. Since that time the remaining term of the longest nominal fixed-rate CGS has been longer than 25 years.
- Table 5 shows the remaining term to maturity of the ultra-long fixed-rate CGS at various dates between October 2016 and July 2022. There is a sufficient number of bonds on issue to make yield estimates for an exact 25-year tenor without relying on extrapolation.

TABLE 5: REMAINING TERM TO MATURITY OF ULTRA-LONG CGS

Date	21 Apr 2037	21 Jun 2039	21 May 2041	21 Mar 2047	21 Jun 2051	Maximum
Oct 2016	20.5	22.7	----	30.4	---	**30.4**
Jul 2018	18.7	20.9	22.8	28.7	---	**28.7**
Jul 2020	16.7	18.9	20.8	26.7	30.9	**30.9**
Jul 2022	14.7	16.9	18.8	24.7	28.9	**29.8**

Source: QTC calculations.

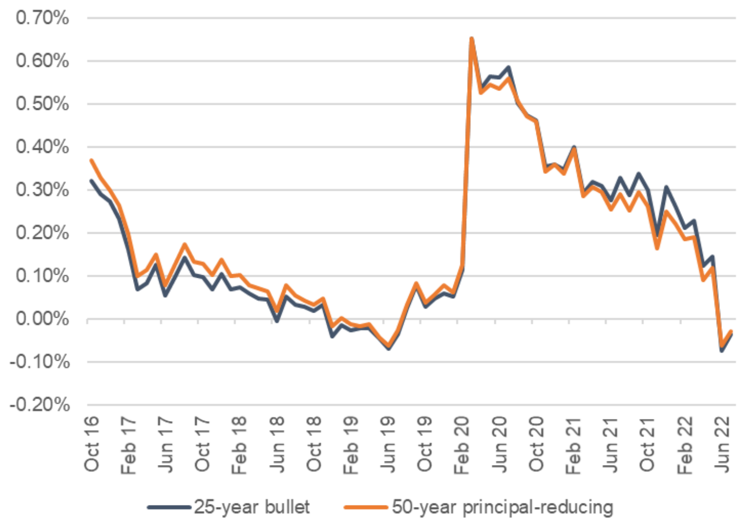
A.2: Choice of tenor

- Network assets can be depreciated for regulatory purposes over periods of up to 60 years. Ideally, the principal cash flow profile used to estimate the required margin on a long-term coupon-resetting CGS would progressively reduce to zero over periods of up to 60 years.
- The CGS and swap yield curves extend out to maximum tenors of 25–30 years, so it is not possible to observe the discount rates that should apply to cash flows between 30–60 years. One approach is to assume the longest observable yield is the same for the longer tenors out to 60 years.
- An alternative approach is to use a shorter-term bullet bond as a proxy for a longer-term principal reducing bond. The average term of the principal cash flows for a network asset that is depreciated on a straight line basis over a

50- year period is 25 years. As such, a 25-year floating-rate bullet bond might be a reasonable proxy for a 50-year floating-rate principal-reducing bond.

- Figure 20 shows the estimated trading margin above 6-month BBSW for a 25-year bullet and 50-year principal-reducing floating rate CGS. The estimated margins are very similar and both have average values of 0.18 per cent. Therefore, QTC considers the trading margin for a 25-year bullet floating-rate CGS to be a reasonable proxy for the trading margin that would likely apply to a 50-year floating-rate CGS with principal-reducing cash flow profile.

FIGURE 20: ESTIMATED TRADING MARGINS FOR BULLET AND PRINCIPAL-REDUCING PROFILES



Source: QTC yields and calculations.

Appendix B: Potential criticisms of QTC's analysis

B.1: Reliance on a mean-reverting model

- The required margin estimates in Section 3 are based on a mean-reverting model of the 5-year CGS/swap spread. It could be argued that the strong mean reversion between 1992–2022 might be a chance outcome that is unique to the 5-year CGS/swap spread, or that the required margins are sensitive to the estimated parameters.
- The mean reversion parameters for a range of yield spreads in are summarised in Table 6. The mean reversion parameters are all highly statistically significant (the t-statistics are in brackets below the slope estimates) and have the correct negative sign. These results indicate that mean reversion in yield spreads is a widespread phenomenon that is not unique to the 5-year CGS/swap spread.

TABLE 6: REGRESSION OUTPUTS FOR MEAN REVERSION TESTS (MONTHLY DATA)

Spread	Time period	Intercept (%)	Slope (mean reversion parameter)	Implied mean[74] (%)	Volatility (%)
5yr CGS – 5yr swap	Jul 1992 – Jul 2022	–0.026 (–3.01)	**–0.068** **(–3.55)**	–0.38	0.086
10yr CGS – 5yr CGS	Jul 1992 – Jul 2022	0.030 (3.55)	**-0.096** **(–4.76)**	0.31	0.094
25-year required margin	Oct 2016 – July 2022	0.056 (1.79)	**–0.116** **(–2.03)**	0.48	0.081
10yr CGS – 10yr swap	Jul 1992 – Jul 2022	–0.024 (–2.95)	**–0.063** **(–3.41)**	–0.38	0.075
5yr UST – 5yr US swap	Nov 1988 – Jul 2022	–0.018 (–2.42)	**-0.052** **(–3.27)**	–0.35	0.089
5yr NSWTC – 5yr swap	Jul 1998 – Jul 2022	–0.012 (–2.17)	**–0.137** **(–4.62)**	–0.09	0.080
5yr US Corp – 5yr US swap	Nov 1988 – Jun 2022	0.053 (3.03)	**–0.078** **(4.06)**	0.68	0.247
10yr US Baa – 10yr UST	Jan 1986 – Jul 2022	0.104 (3.02)	**–0.045** **(–3.15)**	2.33	0.208

Source: RBA, Bloomberg, St. Louis Federal Reserve. QTC calculations.

B.1.1: Sensitivity analysis

- Table 7 shows the average required margins based on different values of the mean reversion parameter. The value of 0.000 is consistent with a random walk model for the 5-year CGS/swap spread. This can be viewed as an absolute upper bound because there is no reason to expect the spread to display anti-mean reversion (ie, a mean reversion parameter greater than zero). The –0.030 parameter is 1.96 standard deviations above –0.068.

TABLE 7: AVERAGE REQUIRED MARGINS FOR DIFFERENT MEAN REVERSION PARAMETERS

0.000	–0.030	–0.068
0.38	0.51	0.51

Source: QTC yield data and calculations.

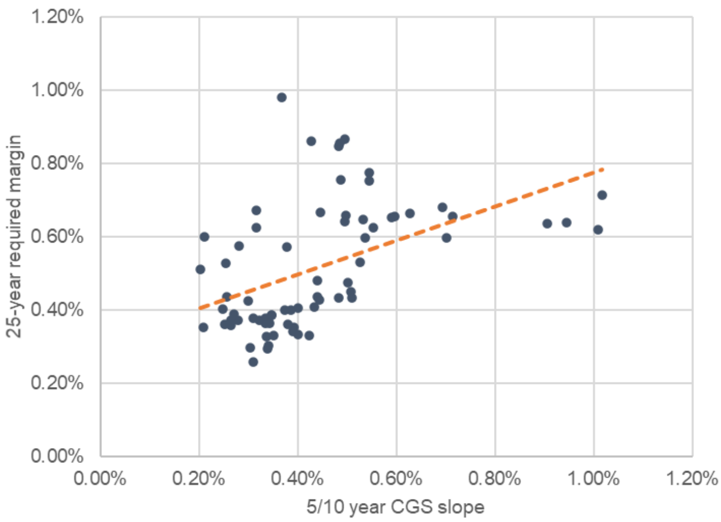
- Table 7 show that the average required margins are materially positive even under the extreme assumption that the 5-year CGS/swap spread follows a random walk rather than displaying any mean reversion.

[74] The implied mean equals (intercept ÷ slope) × -1

B.2: 10-year CGS yield as a proxy for the 5-year required yield

- Figure 11 in Section 3.4 provides market-based evidence that the 10-year CGS yield has been a good proxy for the required yield on a 25-year floating-rate CGS with 5-yearly coupon resets.
- The estimates for the 10-year CGS yield in Figure 11 are identical to subtracting the required margin from the 5/10-year slope of the fixed-rate CGS yield curve. This indicates that the average 5/10-year CGS slope has been a good proxy for the average required margin between October 2016 and July 2022.
- However, while the 5/10-year slope was consistently positive during this period, there have been earlier periods where the slope was negative (ie, an inverse yield curve). During these periods a term-matching approach would have produce better outcomes because it assumes the required margin is always zero.
- The average 5/10-year CGS slope between July 1992 and July 2022 is 0.31 per cent. During this period the 20-day average of the slope was positive on 91.3 per cent of days. On the 8.7 per cent of days when the slope was negative the average was only –0.15 per cent. Furthermore, the second row in Table 6 above shows the slope is strongly mean-reverting around a long-term average of 0.31 per cent, so any negative slope periods are likely to be short.
- The 5/10-year CGS slope represents the incremental cost of locking in a fixed rate for 10-years compared to 5-years, whereas the required margin is based on the incremental cost of locking in funds for a longer-period of time. Therefore, it could be argued that the 5/10-year slope cannot be a proxy for the required margin because it based on interest rate risk rather than funding risk.
- Figure 21 shows that a positive relationship exists between the required margin and the 5/10-year CGS slope.

FIGURE 21: REQUIRED MARGIN VS 5/10-YEAR CGS SLOPE



Source: QTC yield data and calculations.

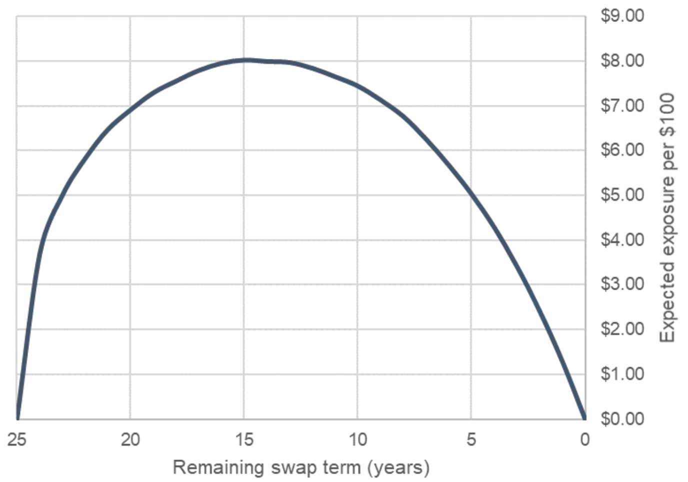
- Regressing the required margin on the 5/10-year slope produces a slope estimate of 0.47 with a t-statistic of 4.58. The intercept estimate is 0.31 per cent with a t-statistic of 6.44. This indicates that:
  - there is a significant positive relationship between the 5/10-year CGS slope and the required margin, and
  - a significant part of the required margin is attributable to factors other than the 5/10-year CGS slope.
- The above points indicate that the 5/10-year CGS slope is a good, but not perfect, proxy for the required margin. However, it is far superior to assuming the required margin is always zero, which is the outcome under the AER's term-matching proposal.
- Based on the above, the 5/10-year CGS slope can be viewed as a good, but not perfect, proxy for the required margin on a long-term coupon-resetting CGS. It is reasonable to expect both values to be positive in the future, and while there may be periods where the slope is negative, in the majority of cases the outcomes will be superior to the outcomes under the AER's term-matching proposal, which assumes the required margin is always zero.

B.3: Credit risk and transaction costs for the CGS swap package

- The coupons on a 25-year coupon-resetting CGS are made by the Commonwealth. An investor who uses the CGS swap package as an alternative will be exposed to some credit risk on the swap transactions. The swaps will also incur transactions costs. Therefore, it could be argued that the required margin on a 25-year coupon-resetting CGS should be lower than the expected margin on the CGS swap package because it avoids these risks and costs.

- Firstly, the coupon-resetting CGS and CGS swap package both involve lending money to the Commonwealth for a 25-year term, with a full prepayment of principal at maturity. Therefore, the underlying credit exposure is identical.
- The main swap exposure for an investor in the CGS swap package is the 25-year pay fixed / receive floating swap. The net market value of the swap will change over time as the swap yield curve changes. If the net market value of the swap is positive (ie, the current swap yield is higher than the fixed yield on the 25-year swap), and the swap counterparty defaults, the investor will incur a cost to enter into a new swap at the original 25-year swap yield.
- One approach to estimate the quantum of this risk is to use a simulation model to calculate the net market value of the swap in each year during the term of the swap. Because the investor is only exposed to credit risk when the net market value is positive, any negative simulated net market values are set to zero. The expected exposure in a given year equals the average simulated net market value for that year.
- Figure 22 shows the expected net market values in each year during the 25-year term of the swap. The expected exposure (in dollar terms) peaks when the remaining term of the swap is 15 years. If the swap counterparty defaults at this time, the expected cost to the investor to enter into a new swap at the original 25-year fixed swap yield is $8.00 per $100 of swap notional value. This cost will increase the effective 25-year swap yield paid by the investor.

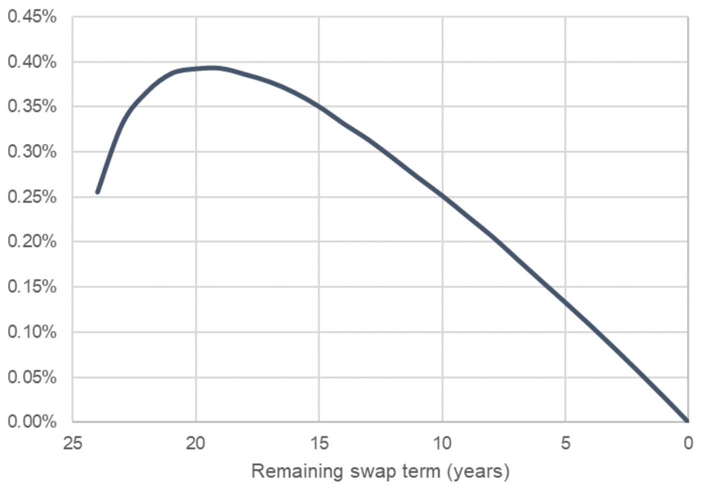
FIGURE 22: EXPECTED NET MARKET VALUE EXPOSURES



Source: QTC calculations

- Figure 23 shows the increase in the effective 25-year swap yield assuming the swap counterparty defaults (ie, a default probability of 100 per cent). The increase in a given year is calculated as follows:
  – Start with the fixed swap interest payments over 25-years based on the original 25-year pay fixed swap yield.
  – Add the corresponding expected exposure from Figure 22 to the fixed interest payment in the relevant year.
  – Calculate the internal rate of return (IRR) using the adjusted 25-year cash flows from the preceding step.
- The increase equals the IRR minus the original 25-year pay fixed swap yield.

FIGURE 23: IMPACT ON EFFECTIVE SWAP YIELD ASSUMING A DEFAULT



Source: QTC calculations

- The maximum increase occurs when the remaining swap term is 19 years. If the swap counterparty defaults at that time, the expected cost to the investor to enter into a new 19 year swap at the original 25-year pay fixed yield will increase the effective swap yield paid over the 25-year term by 0.39 per cent per annum.
- The estimates in Figure 23 do not take into account the probability of the swap counterparty defaulting or the recovery rate. However, even under an extreme scenario where the probability of default is (say) 5.0 per cent and the recovery rate is zero, the *maximum* probability-adjusted increase in the effective 25-year pay fixed yield is only 0.02 per cent per annum. As such, the swap credit risk exposure of the CGS swap package is negligible.
- Based on our experience, reasonable transaction cost estimates for a 5-year and 25-year swap are 0.01 per cent and 0.05 per cent respectively. These costs reduce the average net expected margin on the CGS swap package from 0.51 per cent to 0.45 per cent.
- Based on the above, the swap credit risk exposure and transaction costs will not result in a material difference between the required margin on a coupon-resetting CGS and the net expected margin on the CGS swap package.

B.4: No allowance for uncertainty in the 5-year CGS/swap spread

- The estimates of the expected 5-year CGS swap spread on the future coupon reset dates do not take the volatility of the spread into account. However, it is straightforward to incorporate volatility into the mean reversion model to calculate the standard deviation of the average 5-year CGS/swap spread across the four future coupon dates.
- Table 8 shows the results based on 5,000 random simulations of the monthly 5-year CGS/swap spread. The upper end of 95 per cent confidence interval is well below zero.

TABLE 8: STANDARD DEVIATION OF THE EXPECTED AVERAGE 5-YEAR CGS/SWAP SPREAD

Standard deviation (%)	Lower 95%	Average	Upper 95%
0.10	–0.58	–0.38	–0.18

Source: QTC yield data and calculations.

B.5: Are the estimates distorted by impact of Covid–19 in 2020?

- The initial impact of Covid–19 on the global financial markets caused a sharp increase in the required margin estimate in March 2020. However, as shown in Table 9, the average required margin was materially positive between October 2016 and February 2020 (ie, pre-Covid–19). The most recent required margin estimate (as at 17 August) is 0.49 per cent, which is in line with the longer-term average required margin.
- The bottom two rows in Table 9 show that the average departures from the NPV=0 condition based on a 10-year CGS yield were significantly smaller than the departures based on a 5-year CGS yield pre- and post-March 2020.

TABLE 9: AVERAGE REQUIRED MARGIN ESTIMATES PRE- AND POST-COVID

	Oct 2016 – Jul 2022	Oct 2016 – Feb 2020	Mar 2020 – Jul 2022	17 August 2022
Required margin	0.51	0.41	0.67	0.49
5/10-year CGS slope	0.44	0.38	0.53	0.18
Departure from NPV=0 (10yr CGS)	**–0.07**	**–0.03**	**–0.14**	**–0.31**
Departure from NPV=0 (5yr CGS)	**–0.51**	**–0.41**	**–0.67**	**–0.49**

Source: RBA, QTC yield data and calculations.

B.6: Why have speculators not driven the implied forward spreads down?

- The difference between the long-dated implied forward 5-year CGS/swap spreads and the current spread is large. Therefore, it reasonable to ask why speculators have not acted on this seemingly attractive trading opportunity, which would push the implied spreads down to lower levels. There are two main reasons.
- Firstly, the replicating portfolio to receive a 5-year CGS/swap spread in 20 years' time requires:
  - a 20-year receive fixed / pay floating interest rate swap
  - a 25-year pay fixed / receive floating interest rate swap
  - a short position in a 20-year fixed-rate CGS, and
  - a long position in a 25-year fixed-rate CGS
- Each leg of the replicating portfolio will incur transaction costs. The total dollar value of the transaction costs will be amortised over the 5-year term of the forward spread, and this will significantly reduce the net forward spread that can be achieved in the market.
- For example, the two swap transactions produce a 5-year pay fixed / receive floating swap starting in 20 years' time. The present value of a basis point (PVBP) for a 20-year swap, 25-year swap and 20-year forward 5-year swap are $1,400, $1,650 and $225 respectively. A reasonable estimate of the transaction cost for a 20-year and 25-year swap is 5 basis points each, which produces a total transaction cost of $15,250 (ie, 5 x ($1,400 + $1,650).
  - Based on the $225 PVBP for the 5-year implied forward swap, the total transaction costs will *increase* the net forward 5-year pay fixed yield by 0.68 per cent (ie, $15,250 ÷ $225).
- The two CGS transactions produce a 5-year fixed-rate CGS investment starting in 20 years' time. The PVBP for a 20-year, 25-year and 20-year forward 5-year CGS are similar to those for the corresponding swaps. A reasonable estimate of the transaction cost for a 20-year and 25-year CGS is 3 basis points each, which produces a total transaction cost of $9,150 (ie, 3 x ($1,450 + $1,600).
  - Based on the $225 PVBP for the 5-year implied forward swap, the total transaction costs will *decrease* the net implied forward 5-year CGS yield by 0.41 per cent (ie, $9,150 ÷ $225).
  - The combined outcome from the amortised swap and CGS transaction costs is a reduction in the net forward 5-year CGS/swap spread starting in 20 years' time of 1.09 per cent. This is significant given that the average implied forward spread between October 2016 and July 2022 is 0.80 per cent.
- Secondly, it is unlikely that a short position in a fixed-rate CGS can be continuously held for 20 years. Furthermore, short CGS positions incur ongoing funding charges that are in addition to the transaction costs outlined above.
- The long-term forward 5-year CGS/swap spreads that can be derived mathematically do not represent the net spreads that can be locked-in using a replicating portfolio. What appears to be an attractive trading opportunity on paper is far less attractive in the market.

B.7: Liquidity premiums in ultra-long CGS yields

- It could be argued that ultra-long fixed-rate CGS yields may contain a liquidity premium due to the relatively smaller volumes on issue compared to 5-year and 10-year CGS (Table 10).

TABLE 10: CGS FACE VALUE VOLUMES OUTSTANDING

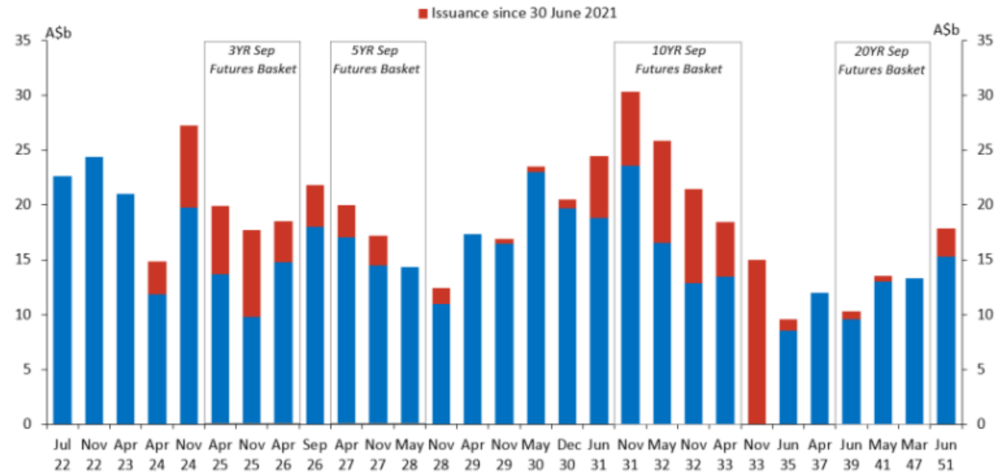
Maturity	Term to maturity (years)	Face value ($m)
21 Nov 2027	5.3	30,700
21 Nov 2032	10.3	25,200
21 Jun 2035	12.9	9,550
21 Apr 2037	14.7	12,300
21 Jun 2039	16.9	10,300
21 May 2041	18.8	13,500
21 Mar 2047	24.6	13,600
21 Jun 2051	28.9	17,800

Source: Australian Office of Financial Management data hub

- The ultra-long CGS lines are not small in an absolute sense, and there is a large panel of intermediaries who make two-way prices for these bonds in the secondary market. Furthermore, in a June 2022 speech the AOFM stated[75]:

> … our focus now is on supporting ultra-long bond lines through more regular tenders. This chart shows that four of the six ultra-long lines were tapped this year – most on several occasions. We have done this in favour of the pivot away from the use of syndicated taps as advised last year.
>
> In the AGS [Australian Government Securities] market demand for bonds underlying the 3 and 10-year futures baskets remain the predominant points of consistent demand. But we are also seeing the 30-year point on the curve become a distinct point of interest. This has only served to reinforce our view that regular replacement of the 30-year benchmark bond will be important. The decision as to when the next 30-year bond should be established hasn't been finalised but three considerations remain: (1) allowing sufficient time for any 30-year maturity to be built to a liquid level (and hence for it to attract solid interest); (2) launching at a bit longer than 30-years, which seems to have attracted market support; and (3) not allowing it to become too short so as to undermine its role as a true 30-year benchmark.

FIGURE 24: CGS ISSUANCE PROFILE



Source: AOFM (June 2022), Beyond the crisis: the outlook for AOFM issuance, Australian Business Economists luncheon.

- Given the above comments by the AOFM, and the observation that the 30-year tenor has become a 'distinct point of interest', it is unlikely that ultra-long CGS yields include a large liquidity premium.

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[75] AOFM (June 2022), *Beyond the crisis: the outlook for AOFM issuance*, Australian Business Economists luncheon.

- More importantly, to the extent that a premium does exist it will only affect the fixed coupon margin for long-term floating-rate CGS. The expected 5-year CGS/swap spread, which is unlikely to be affected by liquidity issues, makes a larger contribution to the required margins than the underlying floating-rate coupon margin (Table 11).

TABLE 11: AVERAGE COMPOSITION OF THE REQUIRED MARGIN

Margin above 6m BBSW (%)	Expected average 5yr CGS/swap spread (%)	Required margin above 5yr CGS(%)	Contribution of expected average 5yr CGS/swap spread (%)
0.18	–0.33	0.51	65

Source: QTC yield data and calculations

- Given the strength of mean reversion in the 5-year CGS/swap spread, it is reasonable to assume the expected average spread will contribute about 0.38 per cent to the required margins in the future. Even if the fixed coupon margins on long-term floating-rate CGS were zero, the required margins can be expected to be approximately 0.38 per cent, which is still higher than the long-term average 5/10-year CGS slope of 0.31 per cent.