COMPETITION ECONOMISTS GROUP

WACC for nbn

June 2022

COMPETITION ECONOMISTS GROUP

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1 Executive summary

1. This report assesses the reasonableness of nbn's methodology estimating the weighted average cost of capital (WACC). In this context, the WACC is the return that investors require to fund infrastructure assets with the same risk exposure as nbn's assets. Most assets are funded with a mix of debt and equity capital. This is why the WACC is a weighted average of debt and equity funding costs.

1.1 What is the WACC?

2. The "weight" applied to debt funding costs depends on the assumed amount of debt funding. Debt leverage ("L") is the proportion of all funding that is debt, while the remainder ("1 – L") is funded by equity. The WACC can, therefore, be expressed algebraically as:

$$WACC = (1 - L) \times Cost\ of\ equity + L \times Cost\ of\ debt$$

3. nbn's proposed method uses the capital asset pricing model (CAPM) to estimate the cost of equity. This is standard practice amongst Australian regulators of regulated infrastructure businesses. The CAPM is a commonly used model by finance experts and is a reasonable basis for estimating the cost of capital.

4. The CAPM develops the cost of equity from four parameters:

   a. The risk-free rate (RFR) - which is the required return on an asset that has zero risk (often proxied by the yield on government bonds);

   b. The market risk premium (MRP) – which is the risk premium (the expected return above and beyond the RFR) that investors require for holding a market wide diversified portfolio of assets;

   c. The asset beta (β_a) – which is a measure of the risk of the asset assuming 0% debt leverage (L=0%); and

   d. Debt leverage ("L") – which is defined above.

5. The CAPM cost of equity can be expressed as the following combination of these parameters.

$$Cost\ of\ equity = RFR + \frac{\beta_a}{1-L} \times MRP$$

6. The term "$\frac{\beta_a}{1-L}$" is also known as the equity beta ($i.e., \beta_e = \frac{\beta_a}{1-L}$). The equity beta rises as debt leverage rises because higher debt leverage concentrates the fundamental risk of the business (β_a) into a smaller amount of equity funding (raising its risk in the process).

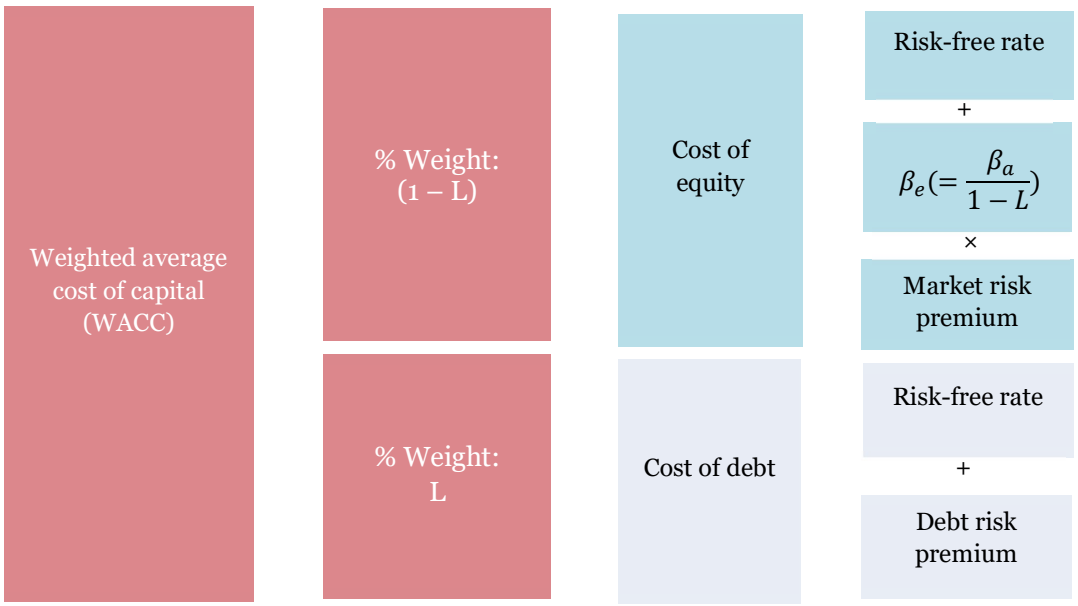
7. nbn's WACC method also requires an estimate of the return required by debt investors to lend to a business with nbn's risks. The risk facing debt holders, above and beyond the risk lending via government bonds, is primarily the probability that the firm will default on its loans but also any risks from lower liquidity of corporate debt. Like the cost of equity, the cost of debt can be expressed as the sum of the risk-free rate and a debt risk premium (DRP):

$$Cost\ of\ debt = RFR + DRP$$

8. The DRP is a function of a business's credit worthiness which can be inferred from the rating assigned to them by credit rating agencies such as Standard & Poor's. The Reserve Bank of Australia (RBA) along with other well-respected institutions publishes the debt risk premium estimates for Australian non-financial corporations with different credit ratings.

9. The parameters used to calculate the cost of equity and the cost of debt are illustrated in the following figure.

Figure 1-1: Parameters for calculating the WACC



Source: CEG illustration

1.2 Answers to questions posed to CEG

10. In my view nbn's methodology for estimating the WACC is reasonable and will result in an estimate that falls within a reasonable range – albeit this will likely be towards the bottom end of that range.

11. In this context I answer each of the questions put to me by **nbn**. These answers draw on the facts and analysis presented in the main body of this report.

1.2.1 Question 1

> ***Q1.*** *Whether it is reasonable, having regard to the statutory criteria, for nbn to estimate a nominal vanilla WACC for each Financial Year in each Regulatory Cycle of the Subsequent Regulatory Period using the methodology set out in Table 1. Please note each reference in Table 1 to a "current" figure can be disregarded for the purpose of this question, as these figures may change over the course of the Subsequent Regulatory Period.*

12. I understand that the statutory criteria requires that the method proposed by nbn is reasonable. In considering whether that method is reasonable, I understand regard must be had to the factors set out in section 152AH of the Competition and Consumer Act 2010 (Cth.), including whether the terms and conditions promote the long-term interests of end-users (which itself requires consideration of the extent to which the method is likely to result in the achievement of the objective of encouraging economically efficient use of and investment in the relevant infrastructure).

13. I consider it reasonable that a methodology be established for setting the WACC that is applied in future regulatory cycles. Whilst this reduces future regulatory discretion somewhat, when the method is based on sound economic principles, any reduction in regulatory discretion is more than offset by greater certainty for investors and end-users both of which are to the benefit of end-users.

14. A critical threshold for whether a WACC methodology is reasonable is whether the parameter estimates of the cost of equity are internally consistent and will result in accurate estimates across various market circumstances. I consider that nbn's methodology is internally consistent and will deliver accurate estimates of the cost of capital overtime. Subject to this accuracy threshold being met it is also desirable that the estimate of the WACC is predictable (can be predicted by stakeholders) and avoids unwarranted instability (i.e., volatility that is not warranted by actual variations in market funding costs). I consider that the nbn methodology satisfies all three of these factors (accuracy, predictability, and stability).

15. This conclusion relies, in part, on the fact that the nbn method adopts an internally consistent approach to combining prevailing and long-term estimates of WACC parameters. The nbn 10 year trailing average method for estimating the cost of debt is set to be internally consistent with efficient debt management practices. The nbn method for estimating the cost of equity ensures that a prevailing estimate of the risk-free rate is only ever paired with a prevailing estimate of the MRP (and similarly for long-run estimates of these parameters).

16. nbn's adoption of internally consistent methods for estimating the cost of debt and equity is a necessary condition to achieve accuracy in the final WACC estimate.

17. This method also promotes stability in both the cost of debt and the cost of equity estimates. The cost of debt is stable by construction (a 10 year trailing average changes only slowly with changes in debt market conditions). The cost of equity estimate will also be relatively stable given:

- the long-run estimate will not vary materially from year-to-year because the long-run estimates of the risk-free rate and the MRP will, by construction, vary only slowly from year-to-year; and
- The short-run estimate may vary more materially but, because the prevailing risk-free rate and the prevailing MRP are reliably estimated to have a negative (inverse) relationship to each other, the short-run estimate of the cost of equity will be less volatile than its constituent parts. That is, volatility in the prevailing risk-free rate and the prevailing MRP can be expected to partially "cancel out".

18. The nbn method is also clearly set out and able to be implemented by stakeholders which provides for predictability.

19. The predictability and stability of the nbn's methodology offers substantial benefits to end-users separate to the accuracy of the method. I consider that a predictable and stable WACC estimate is in the long-term interests of end-users because it allows all parties (including nbn and end-users) to budget and plan. This can also be expected to promote efficient operation of nbn and consumption of nbn's services over time. I discuss this in Section 6.

20. It is important to note that the expected stability of the nbn WACC estimates derives from the internal consistency of the method which is, itself, required for the method to be accurate. It follows that, in this case, stability and accuracy are complements not substitutes (i.e., there is no trade-off between these objectives inherent in the nbn's method.)

21. nbn's methodology for estimating the cost of equity follows, in important ways, the methodology of the Independent Pricing and Regulatory Authority of NSW (the IPART). In this context, the Supreme Court of Western Australia recently decided on a WACC dispute between Perth Airport and QANTAS. The Court agreed with me that IPART's approach to ensuring internal consistency (which is also largely nbn's approach) was not only reasonable but to be preferred to alternative methods that combined a prevailing risk-free rate and a historical average MRP.[1]

> *Dr Hird's views (and therefore those of IPART) in relation to estimating WACC are more persuasive than Dr Hern's. The IPART approach appears to appropriately take into account the benefits of internal consistency between time periods and, having regard to both short and long-term estimates, reduce the*

[1] PERTH AIRPORT PTY LTD -v- QANTAS AIRWAYS LTD [No 3] [2022] WASC 51 (18 February 2022), para 327.

potential for error in one type of estimate disproportionally affecting the final WACC.

22. In the body of this report, I perform a parameter -by -parameter assessment of nbn's methodology and conclude that the method for estimating each parameter is reasonable. When these parameters are combined the final WACC estimate both:

- does fall within a reasonable range when applied at the time of writing;
- can be expected to fall within a reasonable range in foreseeable future market circumstances.

23. I also conclude that the final WACC, derived by combining all of these parameters, likely falls towards the bottom end of a reasonable range for the WACC. That is, the estimated WACC, is more likely to underestimate the "true" (but unobservable) WACC than to overestimate it.

1.2.2 Question 2

Q.2. *Whether, and the extent to which, the methodology set out in Table 1 appropriately has regard to efficient financing practices.*

24. For the reasons set out in answer to question 1, I consider that the method does accurately estimate the cost of equity and, therefore, has appropriate regard to efficient equity financing practices.

25. The methodology set out in Table 1 derives the cost of debt based on the following assumptions regarding debt financing practices:

- The debt portfolio consists of a set of 10 different tranches of 10-year debt such that only 10% of debt must be refinanced in each year.
- 40% of assets are debt funded with the remainder equity funded;
- An investment grade (BBB) credit rating for bond yields.

26. It is consistent with efficient financing practices for large infrastructure firms which maintain staggered maturity profiles for their debt portfolios. In fact, a staggered maturity profile is necessary in order for a firm to be able to achieve an investment grade credit rating. As noted by IPART:[2]

The reason for the trailing average approach is that it mimics the staggered tranches debt portfolio strategy that any prudent borrower would employ. Given such a strategy, the information about interest rates from prior years

[2] IPART, Submission on Draft Report: SA Water Regulatory Determination 2020, 3 April 2020, p. 1.

is not out-of-date. The interest rates that applied to older, but still active tranches of debt are still relevant.

27. On this basis I conclude that, as it relates to debt funding, the methodology set out in Table 1 appropriately has regard to efficient financing practices. The methodology can be deemed to have appropriate regard to efficient equity funding practices to the extent that it accurately estimates the cost of equity.

1.2.3 Question 3

Q.3. *Whether, and the extent to which, the methodology set out in Table 1 has regard to the risks involved in providing nbn's services.*

28. The asset beta and credit rating are the estimates of relative risk in the WACC. I consider that nbn's methodology is more likely to result in an under-estimate than an over-estimate of both the asset beta and credit rating. Consequently, I consider that the nbn method is, if anything, likely to underestimate the level of compensation for risk required by private investors in a business with similar risks to those of nbn.

29. For equity beta, the nbn methodology is to adopt the 2015 ACCC estimates of asset beta and gearing to derive an equity beta.[3] To support the reasonableness of those estimates, nbn's method requires a comparison to a broader sample of comparators but this only results in a change in beta if there is a statistically meaningful difference between the beta estimates.

30. The ACCC 2015 decision set an equity beta of 0.70 at 40% gearing. This is at least 10% lower than more recent estimates. The most recent regulatory decision for a regulated internet wholesale business is that for Chorus by the New Zealand Commerce Commission (NZCC) which set a 0.50 asset beta (equivalent to a 0.83 equity beta at 40% gearing). My own updated estimates based on the NZCC sample estimates a 0.77 equity beta at 40% gearing.

31. In relation to the cost of debt, my benchmarking analysis results in the same credit rating for debt issues (BBB) as the 2015 ACCC estimate but is associated with a lower gearing (31% versus 40%). It follows that my benchmarking analysis would suggest, if anything, a lower credit rating (higher cost of debt) than BBB (adjusted to be consistent with nbn's 40% gearing assumption).

32. In summary, nbn's methodology has reasonable, albeit conservative, regard to the asset beta risk and debt financing risk of a regulated internet wholesale business.

3 ACCC, Public inquiry into final access determinations for fixed line services, Final Decision, October 2015.

1.2.3.1 *Low beta bias in the Sharpe-Lintner CAPM*

33. The nbn method uses the Sharpe-Lintner CAPM to estimate the cost of equity. This version of the CAPM is known to underestimate the cost of equity for firms with equity beta less than 1.0 (see section 5.2 below). nbn's estimate of the equity beta is 0.7 and, therefore, application of the Sharpe-Lintner CAPM will tend to underestimate the compensation for beta risk required for such a firm.

1.2.3.2 *Asset stranding risk and other non-systemic risks*

34. nbn has invested considerable capital ahead of revenues. These investments may not be recoverable if competing services emerge that are economic substitutes for the services it provides. I note that asset stranding does not imply the inability to recover any of nbn's past expenditures. It simply requires that a portion of past expenditures being unable to be recovered given the potential for future substitutes and regulatory constraints limiting nbn's ability to raise prices (and accelerate cost recovery/depreciation) before they emerge.

35. nbn's WACC estimate only captures compensation for systemic risks. The WACC does not include compensation for any uninsurable non-systemic risks that nonetheless have a positive expected cost. In particular, the WACC does not provide any compensation for the expected cost of asset stranding. Asset stranding occurs when customers are unwilling to pay enough to allow for the RAB to be fully recovered (e.g., because the cost of alternative technologies has fallen to such a level that expected revenues would fall with price rises due to substitution to the alternative technology).

36. As discussed in section 9.1, I would expect nbn to be faced with non-trivial probability of asset stranding. To the extent that nbn is not seeking compensation for asset stranding risks via another process, then nbn's proposed WACC method will deliver an expected return that is below the WACC calculated from the methodology in Table 1. The expected return will be below the WACC by the (probabilistically) expected cost of asset stranding. If this is the case then the WACC estimate is an even more conservative estimate of the compensation required for the risks, both systematic and non-systematic, that nbn faces.

37. I also note that the expected cost of asset stranding can only ever be compensated for prior to any asset stranding even occurring. One cannot wait for asset stranding to have occurred because then, by definition, it is impossible to recover this cost. Therefore, compensation today must, if it is to fully reflect risk, reflect the expected cost of asset stranding that might only crystallise in the distant future. This is the New Zealand Commerce Commission method discussed in section 9.1.

1.2.4 Question 4

> ***Q.4***. *Whether you consider that the midpoint estimate for the nominal vanilla WACC set out in Table 2 is reasonable for* ***nbn*** *for each Financial Year in the first Regulatory Cycle of the Subsequent Regulatory Period.*

38. Consistent with the question put to me, an assessment of overall reasonableness of nbn's method must be undertaken at the level of the WACC. This is because every individual parameter estimate may lay within a reasonable range for that parameter but if all of the estimates are at the top/bottom of the reasonable range for that parameter the final estimated WACC may be above/below a reasonable range for the WACC. That is, it may not be reasonable for every parameter to be chosen at the top/bottom of the reasonable range for that parameter.

39. nbn's estimated midpoint WACC in Table 2 is 7.2% (FY1). By contrast, my cross-check analysis suggests a reasonable range is 7.2% to 8.9% with a midpoint of 7.7%. I therefore consider that not only are nbn's individual parameter estimates reasonable but their combination into a final midpoint WACC estimate is reasonable (although at the low end of a reasonable range).

40. nbn's FY2 WACC differs from its FY1 WACC based solely on a forecast of how the trailing average cost of debt will differ between FY1 and FY2.

41. nbn's forecast of the change in the trailing average accounts for the fact that the value for the cost of debt 10 years prior to FY1 will be removed from the trailing average in FY2. nbn's method replaces this value with the most recent estimate of the cost of debt (which is essentially a forecast that the cost of debt will remain constant at current levels). I consider that this assumption is a reasonable assumption. It follows that the midpoint estimate of the WACC in FY2 is also reasonable (given this is the only change from the midpoint estimate of the WACC in FY1).

1.2.5 Question 5

> **Q.5**. *Whether it is reasonable, having regard to the statutory criteria, for* ***nbn*** *to estimate gamma and inflation for each Financial Year in each Regulatory Cycle of the Subsequent Regulatory Period using the methodology set out in Table 3.*

42. As noted in paragraph 12 above, I understand that the statutory criteria requires that the method proposed by nbn is reasonable which in turn must have regard to the promotion of the long-term interests of end-users (which itself requires consideration of promotion of economically efficient use of and investment in the relevant infrastructure).

43. nbn has proposed to use a 'market value' interpretation of the value of imputation tax credits (gamma) informed by evidence from dividend drop-off studies. I consider that this is the approach most consistent with efficient financing costs. This follows

from the fact that the efficient financing costs are based on market valuations and, consequently, reflect market valuations of costs.

44. nbn's approach to the forecast of inflation adopts the Queensland Competition Authorities (QCA) methodology. I consider that this is a reasonable methodology and is based on reputable forecasts provided by the RBA. The QCA/nbn method also applies a reasonable method for extending those forecasts, if necessary, beyond the RBA forecast period by implementing a glide path to an anchor point within the RBA's long-term target range of 2% to 3% per annum.

1.2.6 Question 6

Q.6. *Whether you consider that the estimates of gamma and inflation set out in Table 4 for each Financial Year in the first Regulatory Cycle of the Subsequent Regulatory Period are reasonable.*

45. I consider that nbn has, in implementing its methodology to populate Table 4 of my brief, arrived at reasonable point estimates for inflation and gamma.

2 Introduction

46. I, Tom Hird of Ripponlea, Victoria, have been engaged by Webb Henderson to provide an independent expert report in relation to a review of the WACC methodology and estimates proposed by nbn.

47. My letter of instruction and full Curriculum Vitae are attached. My letter of instructions asks the following questions

1 *Whether it is reasonable, having regard to the statutory criteria, for nbn to estimate a nominal vanilla WACC for each Financial Year in each Regulatory Cycle of the Subsequent Regulatory Period using the methodology set out in Table 1. Please note each reference in Table 1 to a "current" figure can be disregarded for the purpose of this question, as these figures may change over the course of the Subsequent Regulatory Period.*

2 *Whether, and the extent to which, the methodology set out in Table 1 appropriately has regard to efficient financing practices.*

3 *Whether, and the extent to which, the methodology set out in Table 1 has regard to the risks involved in providing nbn's services. If you consider that the methodology set out in Table 1 is reasonable (as per point 1), whether each of the current figures in Table 1, and each of the estimated figures set out in Table 2, are reasonable for nbn to use to calculate a midpoint estimate nominal vanilla WACC for each Financial Year in the first Regulatory Cycle of the Subsequent Regulatory Period.*

4 *Whether you consider that the midpoint estimate for the nominal vanilla WACC set out in Table 2 is reasonable for nbn for each Financial Year in the first Regulatory Cycle of the Subsequent Regulatory Period.*

5 *Whether it is reasonable, having regard to the statutory criteria, for nbn to estimate gamma and inflation for each Financial Year in each Regulatory Cycle of the Subsequent Regulatory Period using the methodology set out in Table 3. Please note each reference in Table 3 to a "current" figure can be disregarded for the purpose of this question, as these figures may change over the course of the Subsequent Regulatory Period.*

6 *Whether you consider that the estimates of gamma and inflation set out in Table 4 for each Financial Year in the first Regulatory Cycle of the Subsequent Regulatory Period are reasonable.*

48. Tables 1 to 4 from my letter of instructions are reproduced in Appendix A.

49. I hold the following qualifications:

- Bachelor of Economics (Honours First Class), Monash University (1989); and

- PhD in Economics, Monash University.

50. From 1990 to 2000 (both prior to, during and after the completion of my PhD in economics) I was employed by the Commonwealth Treasury. Since 2001 I have worked as a consulting adviser specialising in economics: first with Arthur Andersen, then NERA Australia and, since 2007, for my own firm (Competition Economists Group). I have advised private clients, regulators and other Government agencies on a large number of cases specialising in finance theory.

51. I have more than 30 years of experience in the economic analysis of markets and in the provision of expert advice in regulatory, litigation and policy contexts. I have provided expert testimony before courts and tribunals and in numerous regulatory forums in Australia, the United Kingdom and New Zealand.

52. In completing this report, I have received assistance from my colleagues at CEG Samuel Lam and Ker Zhang. Notwithstanding this assistance, all of the opinions expressed in this report are my own.

53. In preparing this report I have had regard to the materials specifically identified throughout the report, in the form of footnotes or in the text.

54. I declare that I have made all enquiries which I believe are desirable and appropriate. No matters of significance which I regard as relevant have, to my knowledge, been withheld from the Court. I have read, understood and complied with the Federal Court of Australia Expert Evidence Practice Note and its annexures which was provided with my letter of instructions.

Tom Hird

2.1 Report structure

55. The remainder of this report is structured as follows:

- Section 1 provides an executive summary and answers the questions put to me in my brief;
- Section 3 provides an overview of the concept of the weighted average cost of capital (WACC);
- Section 4 reviews nbn's cost of debt methodology;
- Section 5 reviews nbn's cost of equity methodology;
- Section 6 discusses the utility of stability in the WACC estimate derived from the nbn methodology;
- Section 7 applies a cross-check analysis to nbn's estimate of the WACC using data as at 31 December 2021;
- Section 8 addresses nbn's approach to expected inflation and tax parameters; and
- Section 9 discusses asset stranding risk (which is likely an important risk for nbn that is not captured in the nbn WACC estimates).

3 What is the WACC?

3.1 WACC parameters

56. The WACC is calculated as a weighted average of the cost of debt and the cost of equity, where the former is weighted by the debt leverage estimate and the latter is weighted by (1 – L). L is the percentage of assets financed by debt, while (1 – L) is the percentage of assets financed by equity.

57. The WACC can, therefore, be expressed algebraically as:

$$WACC = (1 - L) \times Cost\ of\ equity + L \times Cost\ of\ debt$$

58. nbn's proposed method uses the CAPM to estimate the cost of equity. This is standard practice amongst Australian regulators of regulated infrastructure businesses. The CAPM develops the cost of equity from four parameters:

a. The risk-free rate (RFR) - which is the required return on an asset that has zero risk (often proxied by the yield on government bonds);

b. The market risk premium (MRP) – which is the risk premium (the expected return above and beyond the RFR) that investors require for holding a market wide diversified portfolio of assets;

c. The asset beta (β_a) – which is a measure of the risk of the asset assuming 0% debt leverage (L=0%); and

d. Debt leverage ("L") – which is defined above.

59. The CAPM cost of equity can be expressed as the following combination of these parameters.

$$Cost\ of\ equity = RFR + \frac{\beta_a}{1-L} \times MRP$$

60. The term "$\frac{\beta_a}{1-L}$" is also known as the equity beta ($i.e., \beta_e = \frac{\beta_a}{1-L}$). The equity beta rises as debt leverage rises because higher debt leverage concentrates the fundamental risk of the business (β_a) into a smaller amount of equity funding (raising its risk in the process).

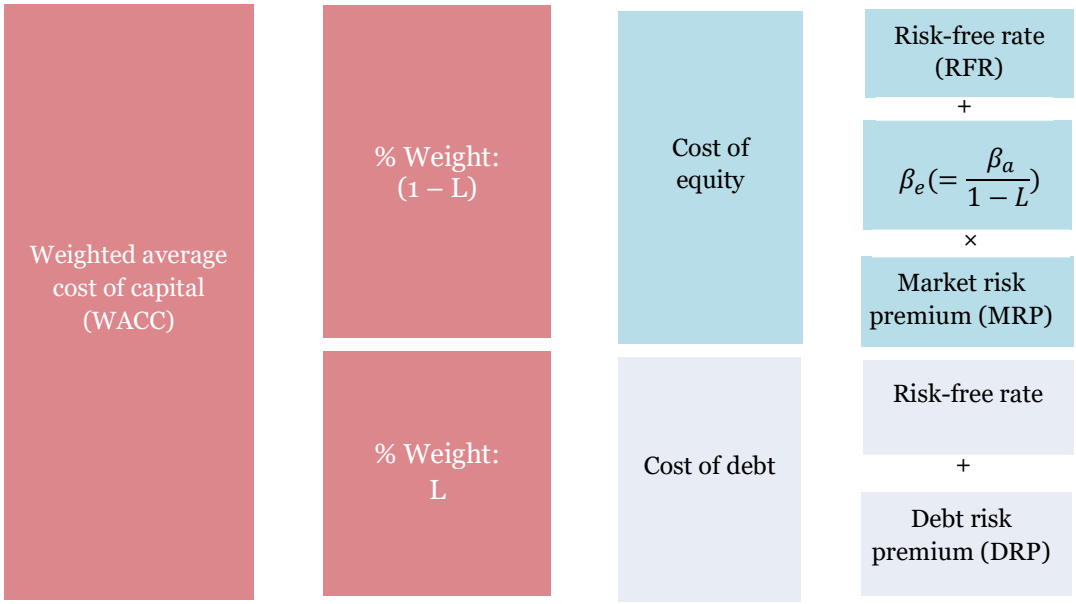
61. nbn's WACC method also requires an estimate of the return required by debt investors to entice them to lend to a business with nbn's risks. The risk facing debt holders is primarily the probability that the firm will default on its loans. Like the cost of equity, the cost of debt can be expressed as the sum of the risk-free rate and a debt risk premium (DRP):

$$Cost\ of\ debt = RFR + DRP$$

62. The DRP depends on a business's credit rating (assigned to them by credit rating agencies such as Standard & Poor's). The RBA along with other well-respected institutions publishes the debt risk premium estimates for Australian non-financial corporations with different credit ratings.

63. The parameters used to calculate the cost of equity and the cost of debt are illustrated in the following figure.

Figure 3-1: Weighted average cost of capital components



64. Figure 3-1 breaks down the WACC formula to its components. The WACC can also be expressed using the following equation:

$$WACC = (1 - L) \times Cost\ of\ equity + L \times Cost\ of\ debt$$

$$= (1 - L) \times \left(RFR + \frac{\beta_a}{1 - L} \times MRP\right) + L \times (RFR + DRP)$$

3.2 Debt raising and tax costs ("gamma")

65. nbn's estimate of the DRP is inclusive of the cost of raising debt. This includes, at a minimum: fees paid to rating agencies in order to obtain credit ratings for the company and its debt; legal fees; and fees paid to investment banks to arrange the

sale of the debt. nbn's approach of including this cost in the DRP is reasonable and is generally consistent with regulatory precedent.[4]

66. Similarly, nbn includes an estimate of "gamma" in its WACC methodology. Gamma is an estimate of the value to investors of imputation credits created by the payment of corporate taxes. Gamma is generally agreed to be less than 1.0 for two reasons. First, not all imputation credits are immediately distributed to equity investors.[5] Second, foreign nationals, who are important investors in the Australian equity market, cannot claim imputation credits.[6]

67. The value of debt raising costs and gamma are typically estimated alongside the WACC because the valuation of imputation credits requires similar expertise to the estimation of the WACC.

4 The cost of raising debt is a legitimate cost and must be accounted for somewhere. Most regulators include it directly in the DRP while some, such as the AER, include these costs in operating expenses. These approaches are functionally equivalent (i.e., give rise to the same revenue/price estimates).

5 And even if they were, the investor must wait until their tax return is processed to receive any benefit.

6 It is also the case that domestic Australian investors may place lower than face value on the allocation of imputation credits because: a) they are prevented from accessing them due to the "45 day rule" that states that shares must have been owned for 45 days before the ex-dividend date in order to qualify for imputation credits; b) they must wait until their tax return is processed to receive any benefit; c) there are compliance and administration costs associated with tracking and processing credits.

4 nbn's cost of debt methodology

68. When a company issues debt, the amount of debt that was borrowed is referred to as the "principal", which will be gradually paid back over the term of the debt along with interest payments.[7] The debt is issued for a specific term, at which point the debt is fully paid back to creditors.[8] The interest payments that the company incurs when obtaining debt financing make up the cost of debt, which reflects the return that creditors require in order to provide debt financing for an asset.

69. Companies generally issue two main types of debt, namely, bank loans and corporate bonds. Bank loans are financed directly to the borrower by a financial institution or a syndicate and tend to have shorter maturities, while corporate bonds are financed by investors on the open market and can be issued at both short and long maturities. Bank loan obligations are seldom traded on the open market and the terms of the loan (such as interest rate and debt term) are mostly kept confidential. Corporate bonds, on the other hand, are openly traded and the characteristics of the bond are publicly available to potential investors.

70. Large infrastructure businesses tend to rely most heavily on corporate bond issues using bank debt to manage liquidity.[9] This, along with the public nature of yields on such instruments, is why economic regulators typically estimate the debt component of the WACC based on long-term corporate bond yields with the relevant credit rating. These credit ratings are published by credit rating agencies such as S&P, Moody's, and Fitch. Businesses with better quality credit ratings have a lower likelihood of defaulting on their debt such that the debt that they issue is less risky for debt holders.

71. Large infrastructure businesses also typically attempt to fund long-term assets with long-term[10] debt where the maturity dates of the debt are spread out evenly through

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7 Some debt instruments such as zero-coupon bonds repay both principal and interest as a lump sum when the debt matures.

8 Some debt instruments such as perpetual bonds have indefinite terms, meaning that the issuer will pay the interest on the debt in perpetuity without being required to pay back the principal.

9 For example, Ehlers, Packer and Remolona (2014) state:

> *infrastructure projects tend to need large sums at long maturities – requirements that would seem to favour bond financing over bank financing*

See: Ehlers, Packer and Remolona, Infrastructure and Corporate Bond Markets in Asia, RBA Conference Volume 2014, p. 67. Available at (accessed 1 November 2020): https://www.rba.gov.au/publications/confs/2014/pdf/ehlers-packer-remolona.pdf

10 Long term meaning that the maturity date is many (e.g., 10) years after the bond is initially issued (and the funds received)

time. This ensures that only a limited amount of debt falls due in any given period reducing refinancing risk.[11]

72. Refinancing risk refers to the risk that a business is unable to issue new debt at reasonable rates when existing debt matures. In fact, a business may simply be unable to refinance debt at all if large amounts of debt fall due in a period of market disruption/financial crisis. This market disruption could arise from factors that are specific to the business (e.g., large debts falling due when the business itself is suffering from financial insecurity/uncertainty) or that are unrelated to the business or its industry (such as tight credit markets, including financial crises, where creditors are reluctant to lend generally).

73. A business that funds long-term assets with short term debt runs the risk of being forced to refinance large amounts of debt in unfavourable circumstances – potentially leading to defaults and/or insolvency. Such events can be extremely costly to a business and minimising the potential for them to occur is a key part of prudent treasury operations.

74. The cost of debt can be decomposed as the sum of a risk-free rate (RFR) and a debt risk premium (DRP), where the former is calculated based on the interest rates observed for government bonds, while the latter is calculated based on the interest rate premium (above and beyond the risk-free rates for the same maturity) observed for corporate bonds with similar levels of risk.[12]

$$Cost\ of\ debt = RFR + DRP$$

75. Issuing long-term debt with evenly spaced maturities lowers refinancing risk (as described at paragraph 72) and leads to improved credit rating. A better quality credit rating reflects a lower level of risk, as discussed in paragraph 70, in turn resulting in a lower DRP.

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[11] For example, the Australian Energy Regulator (AER) states in its final decision on its rate of return instrument:

> *We consider that a business will, within the constraints of the market for corporate bonds, aim to match the length of the debt term to the asset life in order to minimise refinancing risk. We note, however, that this is subject to consideration of the increased cost of debt associated with a longer term*

See: AER, Rate of return instrument: Explanatory Statement, December 2018, p. 278.

[12] Bank loans are usually not used when estimating the cost of debt because unlike bonds, data on bank loans is usually not publicly available. It is common practice to include the costs incurred in debt raising (e.g., fees to rating agencies, fees to investment banks for organising bond sales etc.) in the debt risk premium. This is IPART's approach, which I consider is a reasonable methodology and which I have also adopted for my cross-check.. IPART estimates that these costs are equivalent to 0.125% per annum on the amount of debt raised.

4.1 Term of debt

76. nbn adopts a 10 year term to estimate of the cost of debt. This is consistent with observed practice of large infrastructure businesses in Australia and internationally. In a separate capacity I have been provided with the debt portfolios of all privately owned electricity and gas networks regulated by the AER. This has consistently shown an average term of debt of around 10 years.[13] On this basis I consider that nbn's adoption of a 10 year term of debt issuance is reasonable.

4.2 Trailing average

77. nbn's methodology achieves a staggered maturity profile by assuming that 10% of debt is refinanced each year -leading to a 10 year trailing average cost of debt.

78. It is prudent, and standard, practice for a business to ensure that its debt portfolio has maturity dates that are spread over time. Indeed, this is a requirement for firms to maintain an investment grade credit rating. This means that some long-term debt must be issued at staggered intervals. As the AER noted when explaining its adoption of the trailing average approach:[14]

> *…we observe that most service providers hold a diversified portfolio of debt with staggered maturity dates. This means that a service provider will only have to refinance a proportion of its debt at any point intime. Holding a portfolio of debt with different terms to maturity allows a service provider to manage its refinancing risk.*

79. This fact was the driver of Australian regulators' shift towards a trailing average approach. Specifically, Australian regulators seek to reduce refinancing risk by ensuring that businesses who prudently raise long-term debt (e.g., 10 year debt) receive compensation that gives some weight to long-term debt issued in the past but not yet matured. Since 2013, the Australian Energy Regulator and every state based infrastructure regulator in Australia[15] that has considered the merits of the trailing average approach has adopted it (in one form or another) and has moved away from the 'on the day' approach that was ubiquitous prior to 2013. In doing so, these regulators have aligned with international practice of regulators (including in the US, Canada, UK, and New Zealand).

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[13] For example, see my 11 November letter to the AER available here. See also the AER's most recent analysis in its Rate of return | Annual update | December 2021, Figure 14, available here.

[14] AER, Better Regulation |Explanatory Statement| Rate of Return guideline, December 2013, p. 105

[15] ERA (WA), QCA (QLD), ICRC (AC), OTTER (TAS), ESCOSA (SA) ESCV (VIC) and IPART (NSW).

80. This emphasis on estimating the cost of debt allowance based on a corresponding long-term debt issuance strategy (necessary to manage refinance risk) can be seen in IPART's explanation of its approach [emphasis added]:[16]

> *We have considered stakeholders' analysis and decided to change our approach. Because our 2013 method does not update the historic cost of debt within a regulatory period, it implicitly assumes that debt maturing within the period is refinanced at historic costs rather than prevailing interest rates.* ***In general, this means firms are not able to match the cost of debt maturing within a regulatory period with the cost of new debt issuance. As a result, our 2013 method can create refinancing risks for firms on the portion of their debt that is maturing during the regulatory period.***
>
> ***We also accept that because a trailing average approach updates the historic cost of debt annually within a regulatory period, it assumes that maturing debt is refinanced at prevailing interest rates. This increases accuracy and reduces refinancing risks for firms.***

81. Similarly, the AER cited the mismatch between actual cost of debt and the cost of debt allowance as one reason behind its shift towards a trailing average approach [emphasis added]:[17]

> *We have recognised that the trailing average approach, paired with an appropriate transition, may have some benefits. These potential benefits mainly relate to smoother prices and a* ***potentially reduced mismatch between the actual debt cost outcomes (or cash outflows) for providers of energy network services and the allowed return on debt****. Against this, the on-the-day approach consistently measures the opportunity cost of capital. In our explanatory statement to the current Guideline, we observed that the majority of stakeholders, including consumer groups, supported moving to a trailing average approach.*

82. The ERA also referred to the same issue as one consideration when selecting its return on debt approach which involves a 10 year trailing average of 10 year debts [emphasis added]:[18]

> *In line with these requirements, any approach to estimating the rate of return should, among other things:*

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16 IPART, Review of our WACC method, Final Report, February 2018, p. 27.

17 AER, Review of the rate of return guidelines, Issues paper, October 2017, p. 22.

18 ERA, Final Gas Rate of Return Guidelines: Explanatory Statement, 18 December 2018, pp. 79-80 at [470].

...

***Minimise any differences between the regulated return on debt and that of the benchmark efficient entity**, given this is a factor the ERA must consider under the National Gas Rules.*

83. The discussion above emphasises the importance of adopting a cost of debt approach that captures the cost of long-term debt efficiently issued in the past. nbn's adoption of a trailing average does this and, on this basis, I consider that nbn's adoption of a 10 year term of debt issuance is reasonable.

4.3 Credit rating

84. nbn adopts a BBB credit rating for the purpose of estimating the cost of issues that form its 10 year trailing average. This is consistent with the ACCC's 2015 estimate for Telstra's fixed line assets. I consider that this is a reasonable approach.

85. I have tested the reasonableness of this approach by estimating a credit rating using the same comparator set as I used to cross-check nbn's beta (being the NZCC sample set used to estimate asset beta for Chorus). The credit rating for any comparator is the median between S&P, Moody's and Fitch as of Dec 2021, presented in S&P's scale.

Table 4-1: Credit ratings of comparator set

Company	Country	Credit Rating	Company	Country	Credit Rating
Chorus Ltd	New Zealand	BBB	Rai Way	Italy	#N/A
Telecom New Zealand (Spark)	New Zealand	A-	SBAC	United States	BB
Telstra Corp Ltd	Australia	A	SES	Luxembourg	BBB
Cogent Communications	United States	B+	Sonaecom	Portugal	#N/A
Verizon	United States	BBB+	Vodafone	Britain	BBB
Lumen	United States	BB	SK Telecom	South Korea	A-
BCE Inc	Canada	BBB+	Consolidated Comm. Holdings	United States	B
Deutsche Telekom Ag-Reg	Germany	BBB+	LG U+	South Korea	#N/A
Telefonica Sa	Spain	BBB-	KDDI	Japan	#N/A
Orange	France	BBB+	Tele2	Sweden	BBB
Telecom Italia Spa	Italy	BB	Softbank Group	Japan	BB
BT Group Plc	Britain	BBB	Gamma	Britain	#N/A
Telenor Asa	Norway	A-	Go	Malta	#N/A
Swisscom Ag-Reg	Switzerland	A	Cable One	United States	BB
Koninklijke Kpn Nv	Netherlands	BBB	Telephone and Data Systems	United States	BB+

Proximus Sadp	Belgium	A+	Cogeco	Canada	BB+
Telekom Austria Ag	Austria	BBB+	Telia Company	Sweden	BBB+
Hellenic Telecommun Organiza	Greece	BBB	Liberty Global	Britain	BB-
Elisa Oyj	Finland	BBB+	Rogers	Canada	BBB+
SingTel (Singapore Teleco)	Singapore	A	T-Mobile US	United States	BBB-
Nippon Telegraph & Telephone	Japan	A+	Shaw Communications	Canada	BBB
Uniti	United States	B-	Superloop	Australia	#N/A
American Tower Corporation	United States	BBB-	US Cellular Corporation	United States	BB
Crown Castle	United States	BBB-	Shenandoah Teleco. Company	United States	#N/A
Cellnex Telecom	Spain	BBB-	StarHub	Singapore	#N/A
INWIT	Italy	BBB-	Siminn	Iceland	#N/A
Mean			**BBB-/BBB**		
Median			**BBB**		

Source: Bloomberg, CEG analysis

86. The mean and median credit rating using nbn's comparator set with the same methodology gives the same result of BBB-/BBB and BBB respectively.

4.4 Debt raising costs

87. nbn's methodology is to include a 12.5bppa allowance for debt raising costs in the DRP. This is generally consistent with regulatory precedent. The QCA has recently summarised this precedent in Table 11 of its November 2021 rate of return review where it reports a range of estimates from 10 to 15bppa.[19] More recently, the ERA commissioned Chairmont to estimate efficient debt raising costs and its advice is that these costs are 15.5bppa.[20]

88. In my view, all of these estimates, including nbn's, are below the best estimate of debt raising and debt management costs. There are two key reasons for this:

    a. None of the estimates include the indirect costs of raising debt; and

    b. None of the estimates include an allowance for the costs of liquidity management.

[19] QCA, Final report Rate of return review, November 2021, p. 56.

[20] Chairmont, Debt Raising and Hedging Costs, 21 December 2021, Table 4, p.26.

4.4.1 Indirect costs

89. The indirect costs of raising debt relate primarily to the costs of arranging for debt issues. When a debt is being issued it is common practice to have an investment bank "arrange" the sale of the bonds (also commonly referred as "underwriting"). The arranger/underwriter is compensated for their efforts in two ways:

- Directly in the form of a fee;
- Indirectly by way of being supplied the bonds at an "issue price" that is less than the market price of the bonds.

90. Direct arrangement fees account for about half the standard Australian regulatory estimate of debt raising costs (with the other half being legal and credit rating costs). However, I estimate that arrangement costs are underestimated due to the failure to factor in the need to sell bonds at a discount to arrangers/arrangers clients.

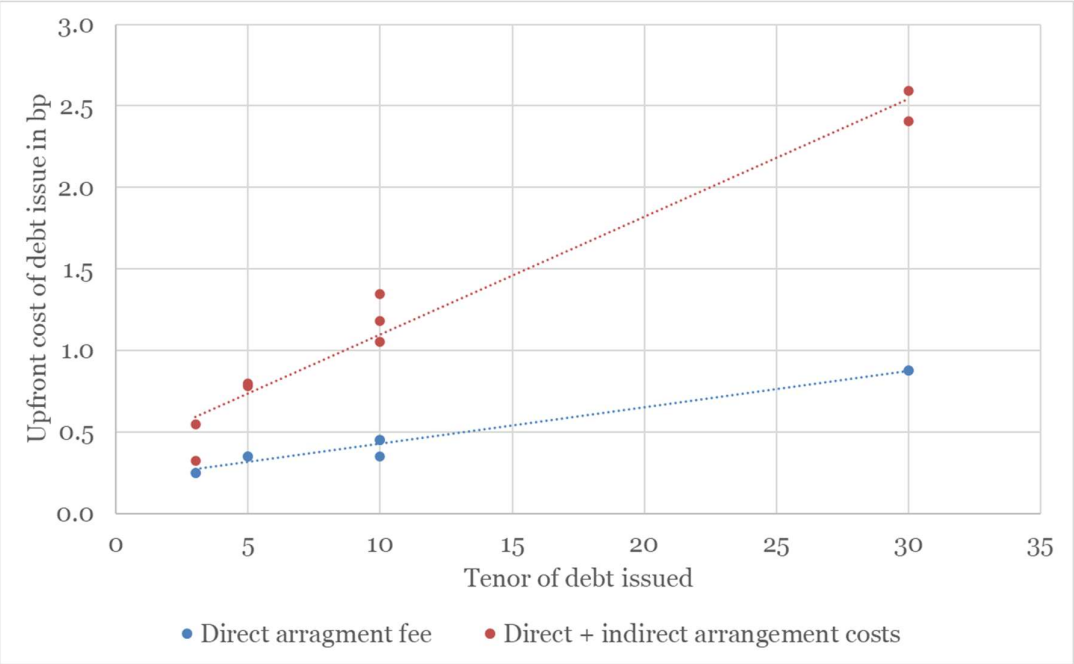
91. I estimate that indirect costs (the costs of these discounts) add around 6bppa to the full cost of arranging a debt issue.[21] Indirect costs are just as costly to issuers as direct costs and are interchangeable to parties to the arrangement. Issuers and arrangers can, and do, negotiate different mixes of these payments. For example, an arranger will sometimes accept a low direct fee in exchange for a higher indirect compensation (lower issue price) and *vice versa*. However, regulators' (and Chairmont's) estimates of debt raising costs only capture the direct fees. Moreover, it is common practice of regulators to reject as "outliers" arrangement fees that are higher than normal solely because the indirect compensation (market price less issue price) is lower than normal.[22]

92. To illustrate the magnitudes involved I plot below all BHP bond issues since 2010 for which arrangement fees are available on Bloomberg. I show two series. One is just the arrangement fee. The other is the arrangement fee plus the difference between the bond issue price and the value of the bond in the secondary market (as estimated by Bloomberg). I plot these against bond tenor which is an important determinant of arrangement fees.

[21] See Table 1-1 of CEG, Debt transaction costs and PTRM timing benefits, January 2019.

[22] See section 3.1.1 of CEG, Debt transaction costs and PTRM timing benefits, January 2019.

Figure 4-1: BHP arrangement costs since 2010



Source: Bloomberg, CEG analysis. There appear to be more red dots than blue dots but this is because some blue dots are coincident (i.e., some bond issues have the same tenor and direct fee).

93. It can be seen that a 10 year bond issued by BHP attracted a direct fee from arrangers of around 40bp (or around 6bppa spread out in an annuity over the life of the bond at a discount rate of 8%). However, much more than this was paid to the arranger (and/or the arrangers clients) by virtue of setting the issue price at least 0.6% below the bond's true value on the secondary market (equivalent to 9bppa over the life of the bond).

94. That is, in order to successfully sell bonds in the primary market they must be priced at a discount to the value in the secondary market. This is common practice and can be seen clearly in the above chart.

95. However, nbn's cost of debt methodology relies on RBA estimates of the BBB yield in the secondary market.[23] This means that nbn is being compensated "as if" they can issue debt at secondary market prices when, in reality, all issuers issue their debt at a discount to secondary market prices. This is simply part of the cost of marketing a new issue.

[23] The RBA uses as its input Bloomberg estimates of secondary market yields for individual bonds– which is precisely the same source I use to estimate the difference between the secondary market yield on a bond and the issue price of that bond.

96. In order be fully compensated for the cost of debt nbn's debt raising cost would need to include indirect arrangement costs.

4.4.2 Liquidity management costs

97. Liquidity management costs relate to the costs associated with maintaining a liquidity reserve sufficient to achieve an investment grade credit rating. If these costs are not incurred then an issuer will be unable to maintain an investment grade credit rating.[24] These costs generally come in two forms.

98. First, rather than raising new debt to refinance existing debt on the day that debt matures, credit rating agencies require a policy that the refinanced debt is raised 3 months prior to maturity. This results in costs to the business in the form of the difference between the 10 year cost of debt (the cost to them of early refinance) and the 3 month return on investing liquid assets (the return to them of investing those funds until maturity of the existing debt).

99. Second, the holding of undrawn committed facilities with banks that allow the firm to draw on that facility if required. While these facilities are almost always undrawn, the firm will need to pay the relevant financial institution a "commitment fee" to have the facility available.

100. I estimate the cost of liquidity management to be around 12bppa. [25]

4.4.3 Conclusion

101. I consider that nbn's methodology for estimating the direct costs of debt is reasonable, having regard to general regulatory precedent. nbn's methodology does not estimate the costs of indirect debt raising and liquidity management. My estimate of indirect debt raising and liquidity management costs is around 18bppa. These costs have not been included by regulators in their cost of debt estimates in the past. When I add these costs to the range for regulatory precedent reported by the QCA (10 to 15bppa) I estimate a cost of 28 to 33bppa for total debt raising/management costs (midpoint 30.5bppa).

102. nbn's methodology seeks to recover less than half the bottom end of this range. On this basis I consider that nbn's methodology will underestimate the actual efficient debt raising and debt management costs. However, this is unlikely to result in nbn's final estimate of the WACC falling below the bottom end of a reasonable range (see section 7.

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[24] For example, see S&P, Methodology and Assumptions: Liquidity Descriptors for Global Corporate Issuers, December 16 2014.

[25] See Table 1-1 of CEG, Debt transaction costs and PTRM timing benefits, January 2019.

4.5 Estimation of a 10 year trailing average

103. nbn's method relies solely on the Reserve Bank of Australia's published BBB estimate of the cost of 10 year BBB debt (derived from Bloomberg estimates of secondary market yields) to populate its 10 year trailing average. I consider that this is a reasonable, albeit conservative, method.

104. This is conservative because the RBA published estimate of the cost of 10-year BBB debt is for an effective tenor that is almost always less than 10 years. The RBA method is to estimate the 10-year BBB cost of debt as a weighted average of all bonds – with the weights applied to each bond higher the closer its remaining maturity is to 10 years. At any given time, there are likely to be more bonds with tenor just under rather than just above 10 years (e.g., more 9-10 year bonds than 10-11 year bonds). As a result, the weighted average tenor of the estimate has, since its inception, been less than 10 years and has averaged 8.8 years.

Figure 4-2: Effective tenor of RBA 10 year BBB estimate

Source: RBA F03, CEG analysis

105. Given an upward sloping yield curve, this leads to a slight downward bias in the RBA estimate at a measure of the 10-year cost of debt. The AER (and I) correct this by extrapolating the RBA credit spread from its effective tenor to a tenor of 10 years. As can be seen, from Table 4-2 below, this results in an average increase over the last decade of 10bppa.

106. There are other third party estimates of the cost of 10 year BBB debt, namely, from Bloomberg and Reuters. However, these estimates have historically been similar, albeit higher, than the RBA estimates.

107. The average of all three sources results in a 10 year trailing average cost of debt for 10 year BBB corporate debt up to December 2021 of 5.0% (inclusive of nbn's 12.5 bppa debt raising costs in order to ensure an "apples for apples" comparison).[26] This is consistent with both:

- The RBA's published series for BBB debt extrapolated to an effective tenor of 10 years following the AER method for this extrapolation;
- The estimates published by Reuters and Bloomberg (also for the 10 year trailing average cost of debt for 10 year BBB corporate debt)

108. This is consistent with nbn's estimate after I update the series to Dec 2021 and apply AER's method of extrapolating the RBA series to an effective tenor of 10 years. I estimate the cost of debt for nbn to be 5.0% for FY1 (nbn's estimates in Table 2 of my brief were 4.9% in FY1 and 4.6% in FY2).

Figure 4-3 Broad BBB bond yield to 10-year commonwealth government bonds from RBA, Reuters and Bloomberg

109. As observed, the RBA series follows closely the Reuters and Bloomberg series, and the inclusion of these 2 providers to estimate the cost of debt is not material, as shown in the below table.

[26] This is nbn's debt raising cost estimate. As already noted, I consider that this is conservative and that the best estimate is more than double nbn's estimate.

Table 4-2: Cost of debt estimates (inclusive of 12.5bppa debt raising costs)

	RBA 10 year target tenor (as published)	RBA 10 year effective tenor (AER method)	RBA (effective) Reuters & Bloomberg series
Cost of debt	4.9%	5.0%	5.0%

5 nbn's cost of equity methodology

110. nbn's methodology for estimating the cost of equity is reasonable and, in my view, is conservative in that it is likely to underestimate the true cost of equity for a business with the same risk as nbn.

- nbn's methodology adopts the Sharpe-Lintner version of the CAPM. The CAPM is the standard model used to estimate the cost of equity. However, absent any correction, the Sharpe-Lintner version of the CAPM is known to underestimate the cost of equity for lower than average beta firms and vice versa for higher than average beta firms (see section 5.2 below). nbn's estimate of equity beta is 0.70 which is below the average (which is 1.0 by construction). Therefore, the adoption of the Sharpe-Lintner CAPM is likely to underestimate the cost of equity for nbn.
- nbn's method for populating the parameters of the CAPM is internally consistent in that prevailing estimates (long-term) of the risk-free rate are combined with prevailing (long-term) estimates of the MRP. This is a necessary condition for an estimate of the cost of equity to be reasonable.
- nbn's methodology adopts estimates of the MRP derived from dividend growth models as published by the IPART and also the IPART's 50% weighting of current and long-term estimates for the cost of equity. I consider that this is a reasonable approach. In summary:
  - The IPART's adoption of dividend growth models evolved to better deal with market circumstances that existed following the global financial crisis.
  - nbn follows the IPART's method in adopting an internally consistent approach to estimating the return on equity – ensuring that prevailing (long-term) estimates of the risk-free rate were matched with prevailing (long-term) estimates of the MRP.
  - nbn follows the IPART's adoption of well-respected dividend growth models from the Bank of England and Damodaran to estimate prevailing MRP;
  - nbn follows the IPART method in applying a reasonable weighting to prevailing and long-term estimates (namely 50% each)
  - nbn also gives weight to a calibrated DGM model that is not included in the IPART method. For technical reasons, I consider that the implementation of this approach will tend to underestimate the true long run growth rate and, therefore, underestimate the MRP. On this basis, I consider that giving weight to the calibrated DGM model is conservative.

111. I discuss each of these points in the following subsections.

5.1 The Sharpe-Lintner CAPM

112. The nbn methodology adopts the Sharpe-Lintner[27] version of the CAPM. This model develops the cost of equity from four parameters:

a. The risk-free rate (RFR) - which is the required return on an asset that has zero risk (often proxied by the yield on government bonds);

b. The market risk premium (MRP) – which is the risk premium (above and beyond the RFR) that investors require for holding a market wide diversified portfolio of assets;

c. The asset beta (β_a) which is a measure of the risk of the asset assuming 0% debt leverage (L=0%) as was explained in section 3 of my separate report on the asset beta; and

d. Debt leverage ("L") which is defined above.

113. The CAPM cost of equity for a company with zero debt can be expressed as the following combination of these parameters.

$$Cost\ of\ equity\ (L = 0\%) = RFR + \beta_a \times MRP \qquad \text{Equation 5.1-1}$$

114. For any given level of fundamental risk (i.e., given by the asset beta) the equity beta rises as debt leverage rises because debt funding has the first claim on a business's cash-flows – with equity holders being residual claimants. Consequently, higher debt leverage concentrates the fundamental risk of the business (concentrates β_a) into a smaller amount of equity funding (raising its risk in the process).

115. If none of the fundamental risk of the business is transferred to debt holders, then the effect of debt leverage on the cost of equity is captured in the following equation:

$$Cost\ of\ equity\ (L > 0\%) = RFR + \frac{\beta_a}{1-L} \times MRP \qquad \text{Equation 5-1a}$$

116. A move from 0% debt leverage to 50% debt leverage doubles the required risk premium (i.e., for L=50%, $\frac{\beta_a}{1-0.5} = 2\,\beta_a$). This can be intuitively understood by imagining some level of fundamental risk (asset beta) initially spread evenly across a set of investors. Then let the company raise debt and buy back half of the outstanding

[27] Sharpe, William F. 1964. "Capital Asset Prices: A Theory of Market Equilibrium Under Conditions of Risk." Journal of Finance. September, 19, pp. 425–42. Lintner, John. 1965a. "The Valuation of Risk Assets and the Selection of Risky Investments in Stock Portfolios and Capital Budgets." Review of Economics and Statistics. February, 47, pp. 13–37.

equity. Now, the same fundamental risk is spread across half as much equity investment, causing the equity risk per dollar invested to double.[28]

117. In this example I assume that debt holders do not bear any of the fundamental risk. This is a reasonable assumption for low levels of leverage but becomes potentially problematic at high levels of debt leverage. For a firm that is 99% debt funded the distinction between debt and equity capital is blurred because there is a high probability that, in the event of a negative shock, the equity holders will be wiped out (bankruptcy declared) and debt holders will end up owning the underlying assets. [29]

118. The term "$\frac{\beta_a}{1-L}$" is often referred to as the equity beta ($i.e., \beta_e = \frac{\beta_a}{1-L}$). This means that the above formula (Equation 5-1a) can be, and often is, written equivalently as:

$$Cost\ of\ equity = RFR + \beta_e \times MRP \qquad \text{Equation 5-1b}$$

119. By definition, an equity beta of 1.0 implies that the equity in question has the same risk as the market portfolio and, therefore, the cost of equity will be the same as the expected return on the market portfolio. This can be seen by substituting $\beta_e = 1.0$ into Equation 5-1b above. When this is done the cost of equity is equal to the risk-free rate plus the market risk premium – which is the same as the expected return on the market.

120. The equity risk premium on a specific asset ($=\frac{\beta_a}{1-L} \times MRP$) captures the additional expected return that investors require for taking on the non-diversifiable risks associated with investing in an asset.

121. I consider that the adoption of the Sharpe-Lintner CAPM is a reasonable, albeit conservative, aspect of nbn's methodology. For the reasons described in the next section, the adoption of the Sharpe-Lintner CAPM provides a lower bound estimate of the cost of equity for a firm with an equity beta of less than 1.0.

5.2 Low beta bias in the Sharpe-Lintner CAPM

122. nbn estimates an equity beta that is less than 1.0 and adopts the Sharpe-Lintner CAPM. This is a conservative approach because the Sharpe-Lintner CAPM is likely

[28] The numerator (total fundamental risk) stays the same but the denominator (amount of equity funding) halves.

[29] Furthermore, with such a high level of leverage, the lowest ranked debt holder also faces a similar level of risk to an equity holder in terms of being potentially wiped out by a negative shock. In the above example, if the lowest ranked debt holder funded 1% of the debt in a firm that is 99% debt funded, then said debt holder will lose its investment if the firm declares insolvency and the underlying assets turn out to only be worth 98% of its book value or less. The other higher ranked debt holders will recover their investments, but the 2% loss will have to be borne by the lowest ranked debt holder and the equity holders, which each funded 1% of the firm's capital.

to under/over-estimate the cost of equity for firms with lower/higher than average equity beta (noting that the average equity beta is 1.0 by definition). nbn's estimate of the equity beta (0.7) is below the average equity beta of 1.0. For this reason, I consider that estimates of the cost of equity derived from the Sharpe-Lintner CAPM form a lower bound for a reasonable range.

123. In this section, I describe finding of bias from the empirical finance literature and describe how the magnitude of this bias could be accounted for by adjusting nbn's cost of equity estimate to be consistent with 'the Black CAPM'. I then report on this comparison between the Sharpe-Lintner and Black CAPM estimates in section 7.2.

124. The Sharpe-Lintner CAPM assumes that investors can borrow at the risk-free rate to invest in risky equities. This assumption is clearly falsified in the real world – at least where a government bond rate is used as the proxy for the risk-free rate. The theoretical insight of the Black CAPM,[30] is that, when this assumption is relaxed, the required return on low beta stocks increases relative to the predictions of the Sharpe-Lintner CAPM implemented using government bond rates as the risk-free rate.

125. The predictions of the Black CAPM can be mathematically represented by introducing the concept of a zero beta premium (ZBP) that is analogous to the market risk premium (MRP). The MRP is the return on stocks with average risk (beta of 1.0) in excess of the risk-free rate (RFR).[31] The ZBP is the return on stocks with zero risk (beta of zero) in excess of the RFR. The difference between the Sharpe-Lintner CAPM and the Black CAPM can be expressed mathematically as follows:

$$R^{SL\ CAPM} = RFR + \beta \times MRP \qquad \text{Equation 5.2-1}$$

$$R^{Black\ CAPM} = RFR + ZBP + \beta \times (MRP - ZBP) \qquad \text{Equation 5.2-2}$$

126. If the best empirical estimate of the ZBP equals zero then these two formulae collapse to the same value. I reiterate here the importance of focussing on the best empirical evidence of the value of the ZBP.

127. It can be seen from the second equation that, if β is equal to 1.0 then both formulae give the same result. However, for all values of β not equal to 1.0 and all values of ZBP greater than zero the Black CAPM will predict a higher/lower return than the Sharpe-Lintner CAPM depending on whether β is less/greater than 1.0.

128. Subtracting the Sharpe-Lintner CAPM estimate from the Black (Empirical) CAPM estimate provides the magnitude of the empirical bias.

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30 Fischer Black, Capital Market Equilibrium with Restricted Borrowing, The Journal of Business, 1972, vol. 45, issue 3, 444-55.

31 The rate at which an investor can borrow/lend where there is zero probability of default of any kind.

$$Bias = R^{Black\ CAPM} - R^{SL\ CAPM} = ZBP \times (1 - \beta) \qquad \text{Equation 5.2-3}$$

129. Obviously, for β less/greater than 1.0 the Sharpe-Lintner CAPM is downward/upward biased. This is the theoretical insight of the Black CAPM. Critically, in order to estimate the magnitude of this bias it is necessary to form a view about the best estimate of the ZBP.

130. The following extract from the 10th edition of Brealey, Myers and Allen *Principles of Corporate Finance*[32] illustrates this bias.

Figure 5-1: Extract from *Principles of Corporate Finance*

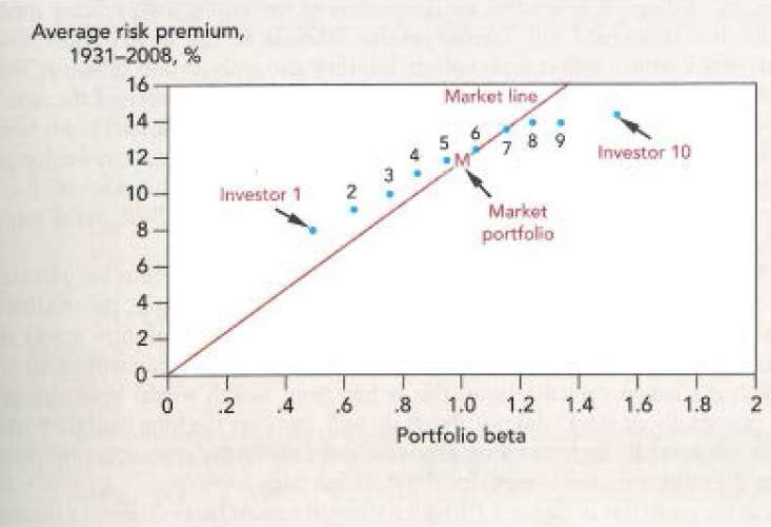


FIGURE 8.8

The capital asset pricing model states that the expected risk premium from any investment should lie on the security market line. The dots show the actual average risk premiums from portfolios with different betas. The high-beta portfolios generated higher average returns, just as predicted by the CAPM. But the high-beta portfolios plotted below the market line, and the low-beta portfolios plotted above. A line fitted to the 10 portfolio returns would be "flatter" than the market line.

Source: F. Black, "Beta and Return," *Journal of Portfolio Management* 20 (Fall 1993), pp. 8–18. © 1993 Institutional Investor. Used with permission. We are grateful to Adam Kolasinski for updating the calculations.

131. If the relationship between excess[33] stock returns and beta is proportional to the overall excess market return then $\frac{ZBP}{MRP}$ is zero. If the relationship is flatter (less than proportional) then $\frac{ZBP}{MRP}$ is greater than zero. This is classically illustrated by Fama and French[34] in Figure 2 from their 2004 survey of the literature.

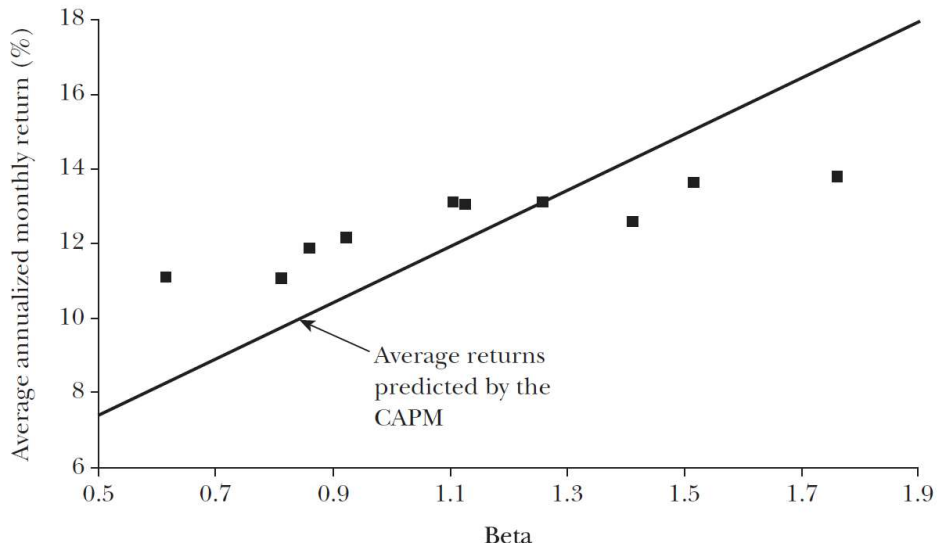
32 Brealey, R.A., S.C. Myers, and F. Allen, 2011, Principles of Corporate Finance, 10th ed., McGraw-Hill Irwin, New York, NY, USA.

33 Over and above the risk-free rate.

34 Fama E., and French K., The Capital Asset Pricing Model: Theory and Evidence, Journal of Economic Perspectives, Volume 18, Number 3, 2004, p. 33.

Figure 5-2: Observed vs assumed slope

Average Annualized Monthly Return versus Beta for Value Weight Portfolios Formed on Prior Beta, 1928–2003



Source: Fama and French 2004.

132. The estimate of $\frac{ZBP}{MRP}$ implied by the above study is the difference in the slope of the drawn line shown on the chart (which has a slope equal to the MRP) and the slope of a line of best fit drawn through the actually observed data points (which has slope equal to the MRP less the ZBP). While not reported in the study, casual inference from above chart puts the MRP (slope of the drawn line) at around 7% and value of MRP less ZBP (slope of the line fitted to the observations) at around 2%. This implies a value for ZBP of around 5% and a value for $\frac{ZBP}{MRP}$ of around 0.7.

133. Professor Grundy and I estimated that $\frac{ZBP}{MRP}$ in Australia was 0.62.[35] This is the standard result in international studies from the finance literature. Professor Grundy (2010) surveyed the international empirical literature and found a range for $\frac{ZBP}{MRP}$ of 0.23 to 0.76 with an average of 0.5.[36] More recently, SFG (2014)[37] estimated the Australian $\frac{ZBP}{MRP}$ at 0.52. I adopt a value of 0.5 in this report.

35 CEG, Estimation of, and correction for, biases inherent in the Sharpe CAPM formula, September 2008

36 Grundy, B., 2010, "The calculation of the cost of capital: A report for Envestra," 30 September.

37 SFG, 2014, Cost of equity in the Black Capital Asset Pricing Model, May.

134. Consistent with this, I note that it is common practice for measured betas to be adjusted using the "Blume adjustment"[38] or similar to adjust beta from its 'raw' estimate towards 1.0 – just as occurs in the Black CAPM.

135. With an estimate of $\frac{ZBP}{MRP}$ it is mathematically simple to solve for the value of β* that corrects the bias in the Sharpe-Lintner CAPM identified in the theoretical insight of the Black CAPM. First replace β in equation 1 with β* - where β* is the adjusted value of beta that corrects for the bias in the Sharpe Linter CAPM. Call this Equation 5.2-4

$$R^{SL\ CAPM} = RFR + \beta^* \times MRP \qquad \text{Equation 5.2-4}$$

136. Now set this equation equal to Equation 2 and solve for β*. When this is done the value of β* is defined by:

$$\beta^* = \beta + \frac{ZBP}{MRP} \times (1 - \beta) \qquad \text{Equation 5.2-5}$$

137. By way of illustration, nbn's estimate of equity beta (β in equation 5) is 0.70. Substituting this value into Equation 5.2-5 along with an estimate of $\frac{ZBP}{MRP}$ equal to 0.5 gives me an estimate for β* of 0.85 when implementing the Black CAPM.

5.3 Internal consistency of parameters (current versus long-term cost of equity)

138. In order for an estimate of the cost of equity to be reasonable it must be derived from internally consistent estimates of the MRP and risk-free rate (RFR); such that the resulting total market return (RFR +MRP) is derived from internally consistent parameters.

139. Specifically, if a prevailing (current) estimate of the risk-free rate is used then this must be combined with an estimate of the MRP that is also prevailing (i.e., is taken from the same financial market conditions as the risk-free rate and has been estimated relative to that risk-free rate). By contrast, if, as is common, the MRP is estimated over long-term historical period then this must be paired with a consistent estimate of the long-term risk-free rate.

140. nbn's method takes the average of two estimates of the cost of equity – one derived from internally consistent prevailing estimates and one derived from internally consistent historical estimates. As a result, nbn's methodology satisfies this necessary condition for the method to be reasonable.

[38] The Blume adjustment is a standard 'automatic' adjustment that users can select on data service providers terminals (such as Bloomberg, Value Line and Reuters).

141. This internal consistency is of critical importance because there is strong financial theory and evidence that when the risk-free rate is low the MRP is high and vice-versa. That is, these two parameters are inversely related and, consequently, the total market return (TMR=risk-free rate plus MRP) is more stable than either of its constituent parts.

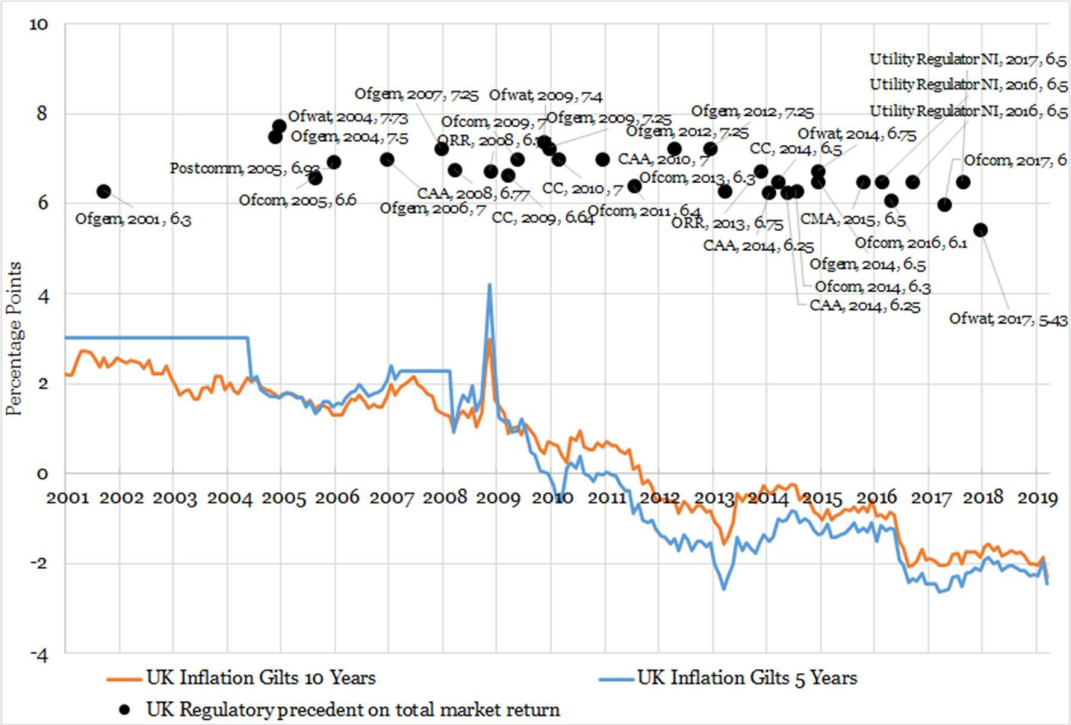
142. This has in the past been recognised by UK regulators who have maintained a relatively stable estimate of the TMR in the face of falling risk-free rates. PwC provides the following description of UK regulatory precedent.[39]

> *"In setting the cost of equity, UK regulators have tended to take a more through-the-cycle view of required returns. This involves the calibration of the cost of equity towards long-run historical averages for parameters such as the RFR, EMRP and TMR (EMR in our terminology) .... Such an approach smooths out any short-term, cyclical variations and supports investor confidence by providing long-term stable returns on their long-term investments."*

143. The stability of UK regulators cost of equity estimates in the face of falling risk-free rates is illustrated in the following chart based on data presented in a 2018 Oxera consulting report.

[39] PWC (2017), Appendix B, p 75.

Figure 5-3:Market cost of equity and real risk-free rates - UK regulators

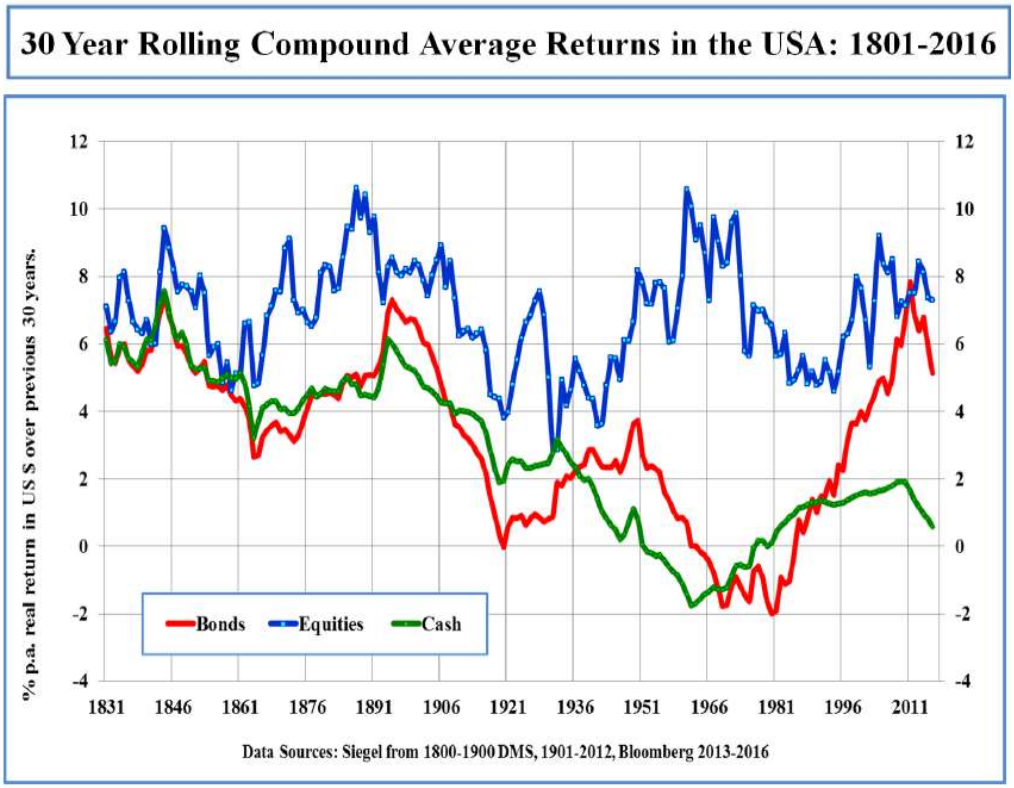


Source: Oxera, The cost of equity for RIIO-2: A review of the evidence, February 2018, p. 32; Oxera, What WACC for a crisis?, Agenda, February 2013, p. 4; Bloomberg; CEG analysis

144. The extreme version of this stability in the TMR is known, in Australia, as the "Wright approach". This approach assumes the TMR is perfectly stable over time and, therefore, the MRP moves in a perfectly offsetting relationship to the risk-free rate – such that their sum is constant.

145. This approach is named after Wright, et. al., (2018) who, in their advice to UK regulators, argue that while the risk-free rate is not stable, the actual return on equity is remarkably stable. The authors show a chart of 30 year rolling compound returns for equities, cash and bonds. They state this figure, that I reproduce below, "*brings out the remarkable stability of the US stock return over more than two centuries*" and that it highlights "*the distinct **lack** of stability of long-term returns on competing asset classes, the real return on "cash" … and on bonds*" (emphasis is original).

Figure 5-4: Reproduction of Figure 4.4 from Wright et al (2018)



146. I consider this, along with similar evidence from other countries, to be compelling evidence of the relative stability of actual and expected equity returns over time – and the lack of any strong relationship between equity returns and risk-free rates.

147. The theoretical basis for believing in an inverse relationship between the risk-free rate and the MRP is illustrated by the events of the financial crisis of 2008/09. Most analysts would agree that risk premiums rose sharply during the financial increase in the estimated cost of equity observed during the 2008/09 financial crisis. This is amply illustrated in the following figure published by the IPART.

Figure 5-5: Replication of IPART MRP and DRP time series analysis

Figure 5.1 MRP estimates and debt margin (bps, %)

Data source: IPART and SFG analysis of RBA, Bloomberg and Thomson Reuters data

Source: IPART, 2018, "Review of our WACC method".

148. As one would expect, the upheaval of the 2008/09 financial crisis was associated with extremely high estimated risk premiums. The debt risk premium on BBB bonds, which is relatively easily observable, rose from around 100 bppa from 2005 to 2007 to a maximum of 800 bppa in late 2008. The prevailing MRP, estimated using a variety of contemporaneous methods, rose from around 6% pa from 2005 to 2007 to around 10% pa in late 2008.

149. However, over the same period 10 year risk-free rates fell from over 6% to around 4%. That is, the risk-free rate fell by around one third at the same time that risk premiums were rising to unprecedented levels.

150. This inverse relationship between the prevailing risk-free rate and the MRP is consistent with the predictions of finance theory. Specifically, when there is heightened risk aversion, such as in a financial crisis, investors tend to sell off risky assets and buy safe assets. This is known as "flight to safety". A "flight to safety" tends to simultaneously:

- Push up the price, and lower the required returns for investing in low or risk-free assets (i.e., investors require a lower interest rate for holding risk-free assets in a crisis); and
- Push down the price, and raise the return required to persuade investors to invest in risky assets (i.e., investors demand a higher return for holding risky assets during a crisis as they perceive them as even higher risk than in other times).

151. The problem with combining a historical average MRP with a prevailing risk-free rate is manifest in the above circumstance. Such an internally inconsistent approach assumes that risk premiums in equity markets are constant. I consider that this is inconsistent with the finance literature that clearly demonstrates market risk

premiums vary through time and do so in a relatively predictable manner.[40] The Nobel prize winning finance academic Eugene Fama, along with his co-author Kenneth French, conclude that the MRP is inversely related to business conditions. Their abstract reads as follows: [41]

> *"Expected returns on common stocks .... contain a term or maturity premium that has a clear business-cycle pattern (low near peaks, high near troughs). Expected returns also contain a risk premium that is related to longer-term aspects of business conditions. The variation through time in this premium is stronger .... for stocks than for bonds.* ***The general message is that expected returns are lower when economic conditions are strong and higher when conditions are weak****."*

152. The inverse relationship between the market risk premium and economic conditions also gives rise to an inverse relationship between the market risk premium and the prevailing risk-free rate. Put simply, when the economy is weak, and interest rates are low, the market risk premium will tend to be higher than average (and vice versa).

153. Therefore, applying the CAPM requires an internal consistency between the risk-free rate and the market risk premium. If a short term current (prevailing) estimate of the risk-free rate is to be used then this must be paired with a short term (prevailing) estimate of the MRP.

5.4 nbn's method for estimating prevailing and historical estimates

154. Given that nbn's methodology in large part follows IPART's methodology it is instructive to first examine the economic and regulatory history that led the IPART to adopt its methodology.

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40 For example, French, Schwert and Stambaugh show that investors risk premiums are not constant but instead varies with the risk of the market based on forecasts of future volatility. For French, Kenneth R., G. William Schwert and Robert F. Stambaugh, 1987, *Expected stock returns and volatility*, Journal of Financial Economics 19, 3-29.

41 Fama, Eugene F., and Kenneth R. French, 1989, *Business conditions and expected returns on stocks and bonds*, Journal of Financial Economics 25, 23-49.

5.4.1 The 2008/09 financial crisis and the evolution of the IPART methodology

155. In 2009 the AER was legally required to set the MRP at 6.0% by the National Electricity Rules (NER) which, at least for electricity transmission businesses, specified: [42]

> *ke is the return on equity (determined using the Capital Asset Pricing Model) and is calculated as:*
> $r_f + \beta e \times MRP$
> *where:*
> r_f *is the nominal risk-free rate for the regulatory control period determined in accordance with paragraph (c);*
> βe *is the equity beta, which is deemed to be 1.0; and*
> *MRP is the market risk premium, which is deemed to be 6.0%*

156. The NER also specified that the regulated business could propose a period over which to measure the risk-free rate (rf) and the AER could agree to that period or, if it disagreed, specify a different period. At this time, the businesses involved[43], based on advice from me, specified a period to measure the risk-free rate from before the financial crisis. The AER did not accept that proposal because it was inconsistent with their historic practice of adopting a period to measure the risk-free rate as close as practicable to the beginning of the regulatory period – which was in July 2009. The AER, instead, set the period to measure the risk-free rate in February 2009. This was, as can be seen from Figure 2 1 and Figure 2 2 above, the period when risk-free rates were at then unprecedentedly low levels.

157. I wrote a report for the affected businesses with the following key conclusion: [44]

> *In the context of the NER and current conditions in finance markets, the advice referred to by the AER does not support the adoption of an averaging period that is affected by current market conditions. Rather, properly construed, the advice supports the conclusion that the selection of an averaging period during a period that is affected by aberrant market conditions such as a financial crisis should be avoided, particularly given the fixing of the MRP in the NER.*

158. The AER did not accept the NSW businesses' submission and proceeded to set a then historically low allowance for the cost of equity by paring a historically low risk-free

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42 Rule 6A.6.2 (b) of NER Version 26.

43 These were all NSW regulated electricity distribution and transmission business.

44 CEG, Rate of return and the averaging period under the National Electricity Rules and Law, January 2009.

rate with a historical average MRP. This decision was appealed by the businesses to the Australian Competition Tribunal (the Tribunal).

159. The Tribunal upheld the NSW businesses' appeal and determined that the AER must use the businesses' preferred averaging period as originally submitted to the AER by the businesses. [45] In making its decision the Tribunal stated (emphasis added):

> *The Applicants submitted that these facts demonstrated that basing a risk-free rate on the AER's specified averaging periods would not achieve the objective of an unbiased rate of return consistent with market conditions at the date of the final decision.* ***They appealed to expert opinion that the market risk premium was far higher than its deemed value while the risk-free rate was abnormally low, so that the return required by investors was much higher than the AER's specified averaging period would generate.***
>
> ...
>
> *In fact, the Tribunal must simply have regard to what the NEL and the Rules provide. This has been discussed above.* ***The Tribunal considers that an averaging period during which interest rates were at historically low levels is unlikely to produce a rate of return appropriate for the regulatory period.***

160. The Tribunal decision, and the financial crisis that engendered it, triggered material change amongst all Australian regulators. At the core of this change was recognition that, with falling risk-free rates, it could no longer be presumed that a historical average MRP paired with a prevailing risk-free rate would result in a reasonable estimate of the cost of equity.

161. The National Electricity Rules (NER) were amended to remove the prescribed (invariant) value of 6.0% for the MRP from the NER. Instead, the NER was reformed to allow flexibility to set the MRP in a manner that was consistent with the market conditions at the time of the decision and to require the AER to constantly review its practice to make sure that its rate of return decisions reflected market conditions. In explaining their decision to amend the NER, the rule making body, the Australian Energy (AEMC) stated: [46]

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45 Application by EnergyAustralia and Others (includes corrigendum dated 1 December 2009) [2009] ACompT 8 (12 November 2009), paragraph 117. I note that the Tribunal relied on evidence submitted by me for this decision – see paragraph 102.

46 AEMC, RULE DETERMINATION National Electricity Amendment (Economic Regulation of Network Service Providers) Rule 2012 National Gas Amendment (Price and Revenue Regulation of Gas Services) Rule 2012, 29n November 2012, p.iii.

> *The rate of return framework for electricity transmission is prescriptive about how the rate of return should be estimated and is not well suited to taking account of changes in market circumstances.*

162. The AEMC summarised their decision as follows:

> *The most significant changes made in response to these rule change requests relate to how the rate of return for service providers is determined under the NER and the NGR.*
>
> *The amendments in relation to the rate of return provisions in the NER and NGR provide for a common framework that enables the regulator to make the best possible estimate of the rate of return at the time a regulatory determination is made. When making the estimate the regulator must take into account the market circumstances, estimation methods, financial models and other relevant information.*

163. The IPART, like all major Australian regulators, responded to the events of the 2008/09 financial crisis by reviewing their method for estimating the cost of equity by pairing a long-term historical average MRP with a prevailing risk-free rate. In its 2013 review of its methodology the IPART stated:

> *The problem outlined above is that assuming that the market risk premium is equal to a long-term average equity market return above government bond yields* ***led to implausibly low cost of equity estimates when bond yields fell substantially.***

164. In describing why this is the case the IPART describes the "flight to quality" phenomenon which is effectively the same as the "flight to safety" phenomenon I describe above.

> *The second possible explanation is that there is a flight to quality. Investors pay high prices for the safest security available, pushing down yields on government bonds. This would occur when the cost of equity capital is high, and it would be entirely inappropriate to apply the normal market risk premium to these government bond yields to estimate the cost of equity.*

165. The IPART considered adopting a constant total market return (TMR) approach. The constant TMR approach is where the MRP is assumed to rise to perfectly offset any fall in risk-free rates – leaving the TMR unchanged. However, the IPART was, in my view reasonably, concerned that this could lead to too high a TMR in some circumstances and too low a TMR in others.

> *The challenge, however, is that we need a technique for estimating the market risk premium in all circumstances, not just during normal market conditions (when applying a constant premium of 6% had previously seemed to suffice), and not just during crisis periods (when using a long-*

term average equity return would probably have led to more plausible estimates of the cost of equity than applying a constant premium of 6%)

5.4.2 Using DGM to estimate the prevailing TMR/MRP

166. The IPART prevailing estimate of the MRP is derived from a range of different well accepted methodologies. These include dividend growth models (DGM) developed by the Bank of England (both 2002 and 2013 versions) and by Professor Damodaran (2013) from the Stern School of Business.

5.4.3 nbn's estimate of the long run MRP and risk-free rate

167. nbn estimates the long run MRP at 6.5% and the long run risk-free rate at 5.0%. My brief states in relation to each of these parameters that:

- the long run MRP has been determined as consistent with the available evidence on the arithmetic average of historical excess returns for Australia, and is not proposed to be reassessed during the Subsequent Regulatory Period; and
- The long-term risk-free rate is fixed in line with the long-term risk-free rate assumed in Treasury's 2021 Intergenerational Report or the most recent version of any subsequent update or equivalent report by Treasury. This figure for the long-term risk rate is currently 5.0%.

168. I consider that both of these methods and estimates is reasonable.

169. The historical average excess return on the Australian equity market since 1958 has been 6.5%. This is the longest period over which there is, in my view, reliable data on both equity returns and also risk-free rates. It is roughly consistent with the estimated realised MRP over the longer and shorter periods shown.

Table 5-1: Historical average realised MRP (updating BHM to 2021)

Time period	Realised MRP
1883-2021	6.3%
1958-2021	**6.5%**
1980-2021	6.4%

Source, BHM data set published by the AER, updated to 2021 using Bloomberg data. The calculations use a valuation of 35 cents per dollar of imputation credits distributed. This is consistent with my gamma estimate of 0.25.

170. My long-term estimates of the risk-free rate over the same 1958-2021 period is that the nominal 10 year risk-free rate has averaged 7.0%. However, this encompasses a different set of inflationary environments to that which is likely in the future given current and expected central bank policy. In order to estimate the historical average risk-free rate over 1958-2021 that would have existed under the current inflation targeting regime I:

- Estimate the historical average real risk-free rate; and
- Add long-term expected inflation of 2.5% based on the centre of the RBA target band for inflation.

171. Table 5-2 presents two alternative estimates of the long-term real risk-free rate associated with the financial market conditions over which my 6.5% MRP was estimated. The first estimate of 2.4% is simply the nominal 10 year bond yields since 1958 less inflation since 1958. This is an estimate of expected real yields on the basis that investors expected inflation to turn out as it actually did. The other estimate of 3.0% is based on directly observed real yields on inflation indexed bonds. This latter method has the advantage of representing the real yield actually expected by (and delivered to) investors in these bonds. However, it only has data available since 1986 (when CPI indexed bonds were introduced).

Table 5-2: Historical real risk-free rates

Estimate	Methodology	Source
2.4%	Average 10 year bond rates 1958-2021 less average inflation 1958-2021.	AER BHM data,[47] ABS and Bloomberg (updated from 2017 to 2021 by me)
3.0%	Average yields on inflation indexed bonds over the longest period available (1986-2021)	RBA. F2 Capital market yields - government bonds

Source: CEG analysis

172. I also note that the RBA began inflation targeting in 1993 and since then it is generally accepted that inflation expectations have been anchored around the midpoint of the RBA target range (2.5%).[48] Average nominal yields have been 4.95% over this period which is consistent with an average real expected yield of around 2.4%.

173. These estimates support a range for the real risk-free rate of between 2.4% to 3.0%. I adopt an estimate of 2.5% which is towards the bottom end of this range. I then convert this long-term historical estimate of the real risk-free rate into a long-term future nominal risk-free rate by adding 2.5% inflation. This gives me a 5.1% long-term nominal risk-free rate (via application of the Fisher equation).

174. This estimate is similar to, albeit slightly above, nbn's estimate.

47 Available at https://www.aer.gov.au/system/files/Historical%20excess%20returns%20and%20Wright%20approach%20data.XLSX.

48 For example see: Warwick J McKibbin and Augustus J Panton, Twenty-five Years of Inflation Targeting in Australia: Are There Better Alternatives for the Next Twenty-five Years? Available on the RBA website here.

5.4.4 50% weighting current and long-term estimates

175. nbn adopts the same weighting scheme as the IPART (and other regulators)[49] to estimates of the TMR based on current and long-term market conditions.

176. As already stated, I consider that the IPART method ensures internal consistency by only ever pairing a prevailing (historical) estimate of the MRP with a prevailing (historical) estimate of the risk-free rate. This promotes both accuracy and stability in the cost of equity estimate (noting that the evidence supports the view that the true (unobservable) cost of equity is stable through time). Both accuracy and stability in the regulatory estimate of the cost of equity are desirable qualities.

177. These views have recently been tested in the Supreme Court of Western Australia. In 2021 I gave evidence on the best estimate of the cost of capital for Perth Airport in the context of a commercial dispute between Perth Airport and Qantas.

178. In those proceedings I was instructed by solicitors for Perth Airport and expressed the same views on internal consistency as set out in this report. Qantas' solicitors instructed Dr Richard Hern from NERA. Dr Hern adopted the, in my view, internally inconsistent approach of combining a historical average MRP with prevailing risk-free rate.

179. The Court's judgement was handed down in February 2022 and found in support of my (and the IPART's) method.[50]

> *Dr Hird's views (and therefore those of IPART) in relation to estimating WACC are more persuasive than Dr Hern's. The IPART approach appears to appropriately take into account the benefits of internal consistency between time periods and, having regard to both short and long-term estimates, reduce the*

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49 This has also been the approach of the Belgian regulator (Belgian Institute for Postal services and Telecommunications (BIPT)). The BIPT, like IPART, estimated the cost of equity based on: a) combining long-term historical risk-free rate and MRP estimates; and b) combining short term prevailing risk-free rate and MRP estimates. The BIPT then averaged the two. I summarised the BIPT method in a 2015 report to the New Zealand Commerce Commission, on behalf of Chorus, as follows:

> *An alternative solution is to follow the precedent of the Belgian regulator, the Belgian Institute for Postal services and Telecommunications (BIPT). The BIPT recognises, as do the vast majority of regulators, the potential for internal inconsistency if a prevailing risk free risk-free rate is combined with a historical average MRP. I believe that the BIPT has set out a robust and very useful framework for ensuring that risk free risk-free rate and TAMRP are estimated in an internally consistent manner –with the same mix of prevailing and historical data used to determine each. (CEG, Response to the further draft determination, August 2015. Available at: https://comcom.govt.nz/__data/assets/pdf_file/0031/87664/CEG-on-behalf-of-Chorus-on-further-draft-determination-for-UBA-and-UCLL-services-August-2015.PDF)*

50 PERTH AIRPORT PTY LTD -v- QANTAS AIRWAYS LTD [No 3] [2022] WASC 51 (18 February 2022), para 327.

potential for error in one type of estimate disproportionally affecting the final WACC.

180. For the same reasons, I consider that nbn's adoption of the IPART's prevailing/historic weighting scheme and the IPART's use of the DGM to estimate the prevailing TMR is a reasonable approach.

5.4.5 nbn's adoption of the calibrated DGM

181. In addition to the IPART DGM models, nbn also gives weight to a calibrated DGM model. This model's assumed long-term growth in market earnings is calibrated to deliver a MRP of 6.5% on average over the estimation period; where 6.5% is chosen to be consistent with the long-term MRP. However, in order to implement a DGM model it is necessary to obtain analysts' forecasts of short term earnings growth. These are only available relatively recently and, for that reason, nbn's model is calibrated over the period starting in 1996.

182. I consider that calibration of the dividend growth model to deliver a 6.5% MRP over this period will underestimate the true expected long run growth in earnings for the simple reason that I believe that the true MRP over this period was above 6.5%. If this is the case, then the model will be being calibrated to an artificially low MRP and, consequently, will estimate an artificially low long run earnings growth assumption. This, in turn, will mean that estimates of the prevailing MRP from this model will be understated.

183. My view that the true MRP since 1996 has been above the historical average MRP is predicated on the fact that this period is strongly affected by the global financial crisis and historically very low risk-free rates. The advent of the financial crisis suggests that, if anything, the expected total market return in this period was higher than the historical average. This, combined with the fact of unusually low risk-free rates and the evidence surveyed in section 5.3 above (that low risk-free rates are typically offset by higher MRP), suggests that the true MRP in this period would be materially above the long run MRP of 6.5%. This is also supported by the evidence in Figure 5-5 above.

184. For this reason, I consider that by giving this model weight nbn's methodology is likely to, if anything, underestimate the prevailing MRP and, therefore, is conservative.

5.5 Asset beta and leverage

185. nbn adopts the ACCC 2015 estimates of asset beta and leverage for Telstra's fixed line network. I consider that this approach, which is based on the application of a robust method by the Australian telecommunications regulator, is reasonable. While the ACCC's estimate is from 7 years ago, the nature of asset betas is such that they can be expected to be relatively stable overtime – with variations in measured asset betas

likely to reflect noise in the estimation process rather than variations in actual beta risk.

186. Nonetheless, as a cross-check I attempt to estimate an asset beta for nbn using the most up-to-date data – see section 7.2.4. This results in an estimate of 0.46 which is modestly higher than nbn's estimate for asset beta (0.42, equivalent to 0.70 equity beta at 40% gearing) but below the recent estimate of asset beta of 0.50 set by the NZCC for Chorus (which translates to an equity beta of 0.83 at a gearing of 40%).[51] Having conducted my cross-check analysis, I remain of the view that nbn's methodology, and its estimated equity beta and leverage, are reasonable (albeit conservative).

[51] NZCC, Cost of capital determination for Chorus' price quality path for PQP1, 2021.

6 Stability of the WACC estimate

187. In general, I consider it reasonable that a methodology be established for setting the WACC that is applied in future regulatory cycles. Whilst this reduces future regulatory discretion somewhat, when the method is based on sound economic principles, it is more than offset by certainty for investors to the benefit of end-users.

188. It is also the case that nbn's proposed methodology can be expected to result in a stable WACC over time. I consider that stability in the WACC estimate derived from nbn's methodology will promote the long-term interests of end-users. This is for three reasons:

- The true cost of capital is likely to be stable over-time. This is consistent with the evidence (discussed in sections 5.3 and 5.4) that the return on equity is stable over time. It is also consistent with the fact that prudent debt funding strategies require a staggered issuance/maturity profile – which give rise to a relatively stable trailing average cost of debt. Therefore, a necessary condition for a methodology to be accurate over time is that the estimated WACC is relatively stable overtime.
- End-users, like most consumers, typically prefer stable prices to volatile prices. This is, in part, because stable prices assist in their own planning and budgeting. Other things equal, end-users will be better off with a methodology that prioritises stability in the rate of return;
- nbn will be better able to plan and budget its own investment program if its return on investment is stable. Other things equal, nbn will have better incentives to efficiently plan if the rate of return on its assets is stable. This will promote the long-term interests of end-users because it promotes efficient operation of nbn to end-users' benefit.

189. nbn propose a threshold for adjusting the beta in future regulatory periods. In effect, the proposal means that the beta would not be updated for at least two regulatory cycles and only then when the previously established beta is more than one standard deviation from the new mean estimate. This approach is consistent with the approach adopted by IPART. I agree with IPART's reasons for this approach as follows:[52]

> *Noting that beta estimates are imprecise and volatile, and that small changes in beta can lead to large changes in prices, we are aware of the possibility that new analysis could result in departures from the status quo beta that are driven by noisy data rather than genuine market trends.*

[52] https://www.ipart.nsw.gov.au/sites/default/files/documents/final-report-estimating-equity-beta-august-2020.pdf page 6

190. Stability is promoted by this approach to estimating the asset beta and gearing – which requires a 'burden of proof' before changes to these parameters are implemented in subsequent regulatory periods.[53]

191. In addition, nbn's approach to estimating the TMR (RFR+MRP) is consciously designed to deliver stability in the WACC. nbn's method gives 50% weight to the long-term estimate of the expected return on the market (risk-free rate and MRP). The long-term return on the market is, by definition, stable over time. The other 50% weight is given to a prevailing estimate of the TMR. While both the RFR and the MRP are volatile over-time they have negative correlation – such that the sum of the two is less volatile than the individual components.

192. nbn's internally consistent prevailing estimate of the TMR (which receives 50% weight) is likely to be less volatile than an estimate that combined a prevailing estimate for one parameter and a historical average for the other (e.g., a fixed MRP but a prevailing RFR).

193. nbn's methodology of providing a 50% weight to internally consistent prevailing and long-term estimates follows the same logic as the methodology of the IPART. In this context, note again the Supreme Court of Western Australia's conclusion.[54]

> *…The IPART approach appears to appropriately take into account the benefits of internal consistency between time periods and, having regard to both short and long-term estimates, reduce the potential for error in one type of estimate disproportionally affecting the final WACC.*

194. nbn's estimate of the cost of debt funding is also based on a staggered debt portfolio of 10 year debt including an allowance for debt raising cost. This is inherently stable as only 10% of the portfolio updates each year. This debt allowance is based on a debt management strategy which is common amongst infrastructure businesses and is replicable by nbn. The replicability of the debt management strategy implied by the allowance avoids a potential mismatch between actual debt raising costs and the allowed costs. I consider replicability to be an essential element of a reasonable debt funding allowance.

53 Any new estimate must be at least one standard deviation different to the estimate for the first regulatory period.

54 PERTH AIRPORT PTY LTD -v- QANTAS AIRWAYS LTD [No 3] [2022] WASC 51 (18 February 2022), para 327.

7 Cross check of nbn's Table 2 (WACC) estimates

195. In this section I combine a number of cross-checks of nbn's parameters into a cross-check at the level of the WACC. This allows me to perform a holistic comparison of the nbn WACC from Table 2 of my brief produced by nbn's methodology for the first Regulatory Cycle (FY24-FY25) (as opposed to each individual parameter).

196. This cross-check results in an estimated midpoint and range for the WACC that is modestly higher than nbn's estimated WACC. Having conducted my cross-check analysis, I remain of the view that nbn's methodology, and its estimated equity beta and leverage, are reasonable (albeit conservative).

7.1 nbn Table 2

197. Table 2 of my brief is set out below. This table states that it is populated using data available to 31 December 2021.

Table 7-1: Table 2 from letter from Webb Henderson to Tom Hird (8 March 2022)

Parameter	'Current' estimate		'Long-term' estimate		Midpoint estimate	
	FY1	FY2	FY1	FY2	FY1	FY2
Risk-free rate	1.7%		5.0%		3.4%	
Equity beta	0.7		0.7		0.7	
Market risk premium	9.0%		6.5%		7.8%	
Return on equity (nominal, post-tax)	8.0%		9.6%		8.8%	
Return on debt (nominal, pre-tax, including allowance for debt raising costs)	4.9%	4.6%	4.9%	4.6%	4.9%	4.6%
Gearing	40%		40%		40%	
Nominal vanilla WACC	6.8%	6.7%	7.7%	7.6%	7.2%	7.1%
Inflation (2-year regulatory period)	2.4%		2.4%		2.4%	
Gamma	0.25		0.25		0.25	

7.2 Cross-check estimates of the cost of equity

7.2.1 Current estimates of the TMR, MRP and RFR at December 2021

198. For my cross-check analysis my current estimate of the MRP is taken as the average of the most recently published estimates by IPART of the MRP derived from the Bank of England (2010) and (2013) and the Professor Damodaran (2013) dividend growth models. These models estimate the required return on the equity market by:

- projecting out dividend growth (based on part on analyst forecasts and long run economic growth assumptions);
- calculating the discount rate (TMR) that investors would have to apply to that stream of dividends in order to arrive at current equity market valuations;
- estimating the MRP by subtracting the current risk-free rate from the estimated TMR.

Table 7-2: Current MRP estimates

Method	MRP
Damodaran (2013)	9.72%
Bank of England (2002)	10.41%
Bank of England (2013)	9.26%
Average	**9.84%**

Source: IPART Biannual WACC update, August 2021.

199. I note that all of these estimates are materially above nbn's estimate of the MRP from the calibrated DGM (6.69%). This is consistent with the logic set out in section 5.4.5 where I explained why I think that the calibrated DGM (calibrated to 6.5% MRP over the period since 1996) is likely to underestimate the MRP.

200. My current estimate of the risk-free rate is 1.7% based on the average annualised yield on 10 year Commonwealth Government securities (CGS, averaged over the 21 days centred on 31 December 2021).[55]

7.2.2 Long run estimates of the TMR, MRP and RFR

201. I base my cross-check of long run estimates of the MRP and the risk-free rate on the values set out in section 5.4.3. Namely, an MRP of 6.5% and a risk-free rate of 5.1%.

[55] The IPART estimates a prevailing risk-free rate that is slightly lower (1.60%) as at 31 July 2021 in its WACC update document from which the MRP estimates are derived. IPART, WACC Biannual Update, Fact Sheet, August 2021, Table 2.

7.2.3 TMR estimate from the Wright approach

202. In order to implement the Wright approach I need to estimate the long-term average real return on the Australian equity market. Consistent with my approach to the long-term MRP, I base my long run estimates of the MRP and the risk-free rate on evidence from financial markets since 1958. This is the longest period over which there is, in my view, reliable data on both equity returns and also risk-free rates. It is roughly consistent with the estimated realised TMR over the longest periods and moderately below the TMR since 1980.

Table 7-3: Historical average realised real TMR (updating BHM to 2021)

Time period	Realised real TMR
1883-2021	8.5%
1958-2021	**8.7%**
1980-2021	9.4%

Source: AER BHM data, ABS and Bloomberg (updated from 2017 to 2021 by me)

203. I then convert 8.7% into a nominal TMR by adding 2.5% expected inflation (using the Fischer equation). This yields a nominal TMR of 11.4% and a prevailing MRP estimate of 9.7% (relative to my 1.7% prevailing estimate of the risk-free rate).

7.2.4 Asset beta, gearing and equity beta

204. As a cross-check I attempt to estimate an asset beta for nbn using the most up-to-date data using the asset beta methodology set out by the NZCC in its Chorus decision. This cross-check results in an estimated asset/equity beta that falls above the nbn estimate but below the NZCC estimate.

205. I note that my cross-check method is likely to underestimate the true asset beta for nbn. This is because the NZCC comparator set (which I adopt) captures telecommunications business that are not wholesale only and are not predominantly supplying services over fibre network services. Ofcom considered that asset betas for non-fibre comparators may need to be adjusted upwards due to the higher demand risk and operating leverage associated with fibre network broadband providers.[56] I do not propose an adjustment to the estimated beta for these factors but note that the absence of an adjustment may lead to an underestimate.

206. After removing the 13 companies from the NZCC sample that are no longer listed, I rely on the following list in Table 7-4 of 60 companies in 27 countries.

[56] Ofcom (2020), Promoting competition and investment in fibre networks: Wholesale Fixed Telecoms Market Review 2021-26.

Table 7-4: Comparator sample of fixed line businesses

Name	Name	Name
Chorus Ltd, New Zealand	Elisa Oyj, Finland	Tele2, Sweden
Telecom Corp of New Zealand (Spark), New Zealand	SingTel (Singapore Teleco), Singapore	Softbank Group, Japan
Telstra Corp Ltd, Australia	Nippon Telegraph & Telephone, Japan	Gamma, Britain
Cogent Communications Holdin, United States	Uniti, United States	Go, Malta
Verizon Communications Inc, United States	American Tower Corporation, United States	Cable One, United States
Lumen Technologies Inc, United States	Crown Castle, United States	Telephone and Data Systems, United States
BCE Inc, Canada	Cellnex Telecom, Spain	Cogeco, Canada
Deutsche Telekom Ag-Reg, Germany	INWIT, Italy	Telia Company, Sweden
Telefonica Sa, Spain	Rai Way, Italy	Liberty Global, Britain
Orange, France	SBAC, United States	Rogers, Canada
Telecom Italia Spa, Italy	Eutelsat, France	T-Mobile US, United States
BT Group Plc, Britain	SES, Luxembourg	Shaw Communications, Canada
Telenor Asa, Norway	Sonaecom, Portugal	Superloop, Australia
Swisscom Ag-Reg, Switzerland	Vodafone, Britain	US Cellular Corporation, United States
Koninklijke Kpn Nv, Netherlands	SK Telecom, South Korea	Shenandoah Telecommunications Company, United States
Proximus Sadp, Belgium	Consolidated Communications Holdings, United States	StarHub, Singapore
Telekom Austria Ag, Austria	LG U+, South Korea	Siminn, Iceland
Hellenic Telecommun Organiza, Greece	KDDI, Japan	

Source: Adopted by the New Zealand Commerce Commission in its 2020 Fibre Input Methodologies decision

207. As noted above, my cross-check adopts both the comparator set and methodology used by the NZCC. That is, I rely primarily on betas estimated using 5 years of return data reported on a weekly basis.[57] In line with standard practice, I estimate the return on market for each comparator based on Bloomberg's default relative index list under the field "*REL_INDEX*".

208. Table 7-5 below sets out my point estimate of the average gearing, asset beta and the subsequent equity beta for nbn using 5-year weekly data.

[57] I use the Practitioner's method of de-levering and re-levering the equity beta. This assumes a debt beta of zero.

Table 7-5: 5-year weekly average gearing, asset and equity beta

	5-year weekly
Average gearing	31%
Asset beta	0.46
Equity beta	0.67
Equity beta at 40% gearing	0.77

Source: Bloomberg, CEG analysis

209. My cross-check estimated equity beta is similar to nbn's (0.67 vs 0.70). However, this is not an apples for apples comparison because my estimate is associated with a materially lower gearing (31% vs 40%). When adjusted to the same 40% gearing my equity beta cross-check would be 0.77 – above nbn's estimate.

210. As already noted, the NZCC's estimate for Chorus is higher still. The NZCC set an asset beta of 0.5 (which translates to an equity beta of 0.83 at a gearing of 40%). This higher value is due to the change in period (asset betas have declined recently) and a change in the comparator set due to some companies being delisted.

211. Figures 7-1 and 7-2 below show the asset beta of individual comparators over a 5-year period from 1 Jan 2017 to 31 Dec 2021, and the time series of 5-year weekly average of raw equity beta, asset beta & gearing for the comparator list.

Figure 7-1: Comparator set 5-year weekly asset beta

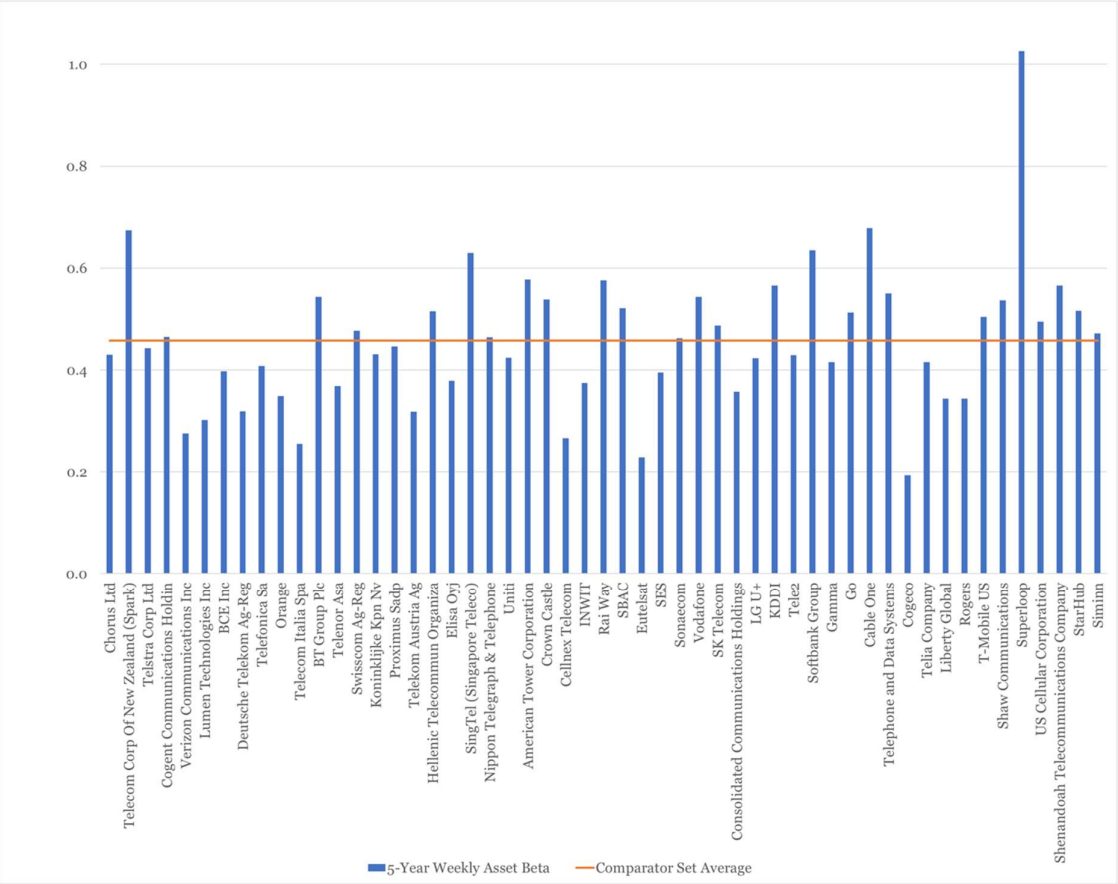
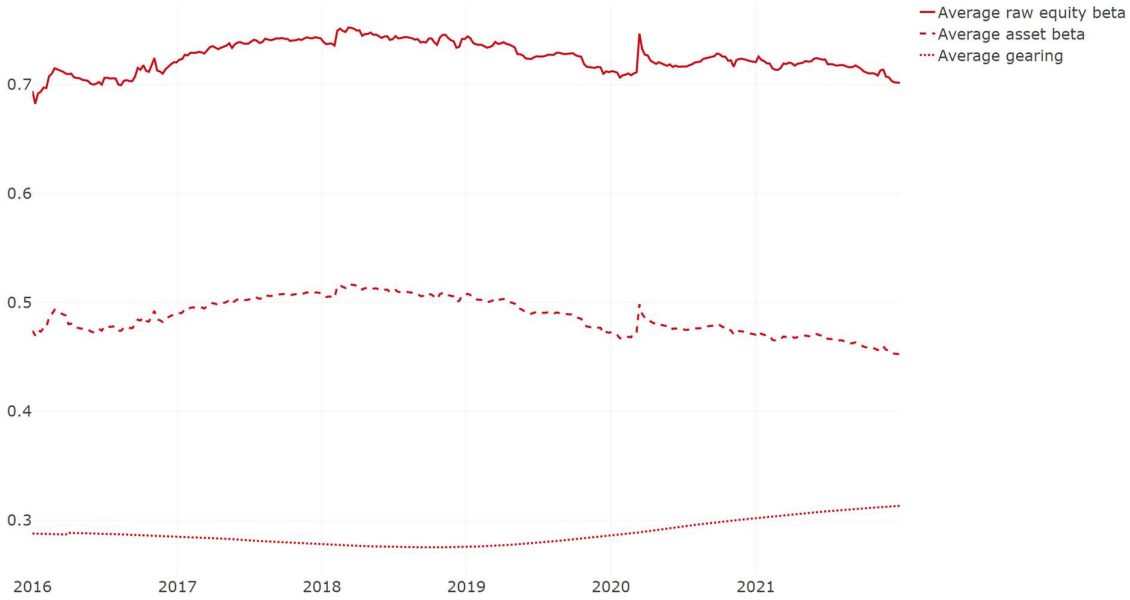


Figure 7-2: Time series of 5-year weekly asset beta & gearing for comparator list



212. As a further cross check, I report estimates of beta separately using 2-year and 10-year periods. In Table 7-6 below, I estimated the beta using 2-year daily data with the latest gearing available, and a longer-term beta using 10-year weekly data with the average gearing over the same period.

Table 7-6: 2-year daily and 10-year weekly asset & equity beta with latest and average gearing

	Current: 2-year daily	Long-term: 10-year weekly
Gearing	33%	30%
Asset beta	0.46	0.47
Equity beta at 40% leverage	0.77	0.78

213. All of these estimates are above, but similar to, nbn's estimate of the equity beta of 0.7 at 40% leverage. Having conducted my cross-check analysis, I remain of the view that nbn's methodology, and its estimated equity beta and leverage, are reasonable.

214. Consistent with the NZCC approach, my cross-check estimate of gearing is based on the average gearing of the comparators set used to estimate the asset beta. [58]

Table 7-7: 5-year weekly average gearing, asset and equity beta

	5-year weekly
Average gearing	31%
Asset beta	0.46
Equity beta	0.67

7.2.5 Combined impact on cost of equity

215. Based on the forgoing analysis and estimates I derive the following cross-check estimates of the cost of equity for nbn.

[58] The NZCC counsels against using a different leverage assumption due to the existence of a 'leverage anomaly' whereby the estimated WACC tends to increase with debt leverage. According to the Modigliani Miller theorem this should not be the case. (The Modigliani Miller theorem is a cornerstone of modern finance theory. It states that if financial markets are efficient and there are no transaction costs, then a firm's WACC is not affected by its capital structure. Modigliani, F.; Miller, M. (1958). "The Cost of Capital, Corporation Finance and the Theory of Investment". American Economic Review. 48 (3): 261–297.)

The source of the anomaly identified by the NZCC is ultimately because the assumption that $\beta e = \beta a/(1-L)$ is only correct to a first approximation. In reality, some fundamental risk is transferred to debt holders when new debt is issued and, consequently, the above formula overstates the rate at which βe increases with leverage and the correct estimates would need to account for "debt betas". (A "debt beta" assumes that part of the reason the DRP rises with leverage is due to debt bearing some of the fundamental asset beta risk. Consequently, a positive debt beta implies that the equity beta increases more slowly with debt leverage (but the debt risk premium increases faster).)

However, the exact nature of this relationship is difficult to estimate and the whole exercise can be avoided if debt leverage is set equal to the average leverage of the firms used to estimate the asset beta. To this end the NZCC states:

> *We continue to consider that using the average leverage of the asset beta comparator samples is the best way of dealing with the anomaly. As we have estimated a notional leverage in line with the companies in our asset beta comparator samples, the resulting WACC will be the same for those services regardless of the value assumed for the debt beta.* (NZCC, Input methodologies review decisions, Topic paper 4: Cost of capital issues, December 2016, p. 144)

I consider that this approach is slightly biased to estimate too low a WACC. (See, CEG (report prepared for ENA) cross submission on IM review draft decisions papers: Topic paper 4 (Cost of capital) "Asset betas for gas versus electricity businesses in the Commission's sample" (25 August 2016), para 100-104.) However, this bias is small and in the interests of simplicity and conservatism, I do not pursue the reasons why in this report. Consequently, I base my estimate of gearing on the average of the NZCC sample I used to estimate asset beta.

Table 7-8: Best estimate of the RoE range at December 2021

		Current estimate	Long-term estimate	Wright approach
A	Debt funding		31%	
B	Equity funding (=1-A)		69%	
C	Nominal risk-free rate	1.7%	5.1%	1.7%
D	Market Risk premium	9.8%	6.5%	9.7%
E	Asset beta		0.46	
RoE for Sharpe-Lintner CAPM				
F	Equity beta (=E/(1-A))		0.67	
G	Cost of equity (=C+F×D)	8.3%	9.4%	8.2%
RoE for Black CAPM				
F'	Equity beta (=F+0.5*(1-F)		0.83	
G'	Cost of equity (=C+F'×D)	9.9%	10.5%	9.8%

216. My cross-check range for the cost of equity is 8.2% (Wright approach with the Sharpe-Lintner CAPM) to 10.5% (long-term estimate with the Black CAPM). The nbn midpoint estimate of 8.8% falls within this range – albeit towards the bottom of the range.[59]

217. These comparisons supports my conclusion on a parameter by parameter basis that nbn's method for estimating the cost of equity is reasonable.

7.3 Cross check estimate of the cost of debt

218. For the purpose of this cross-check analysis my cost of debt estimate is 5.1%. This is higher than nbn's current estimate of FY1 cost of debt in Table 1 (4.9%). There are two reasons for this difference.

- I explained in section 4.4 my best estimate of the cost of debt inclusive of 12.5bppa debt raising costs was 5.0%. However, I also explained in section 4.4 that the midpoint of my best estimate of debt raising and management costs was at least 10bppa higher than nbn's estimate.
- I explained in section 4.5 that nbn's method did not adjust the RBA published estimates of the cost of debt to be consistent with an effective tenor of 10 years. Doing so raises my estimate by around 10bppa.

219. Having conducted my cross-check analysis, I remain of the view that nbn's methodology, and its estimated cost of debt, are reasonable (albeit conservative).

[59] It should be noted that this assessment is comparing my RoE at 31% gearing to nbn's estimate at 40% gearing. If they were compared on the same gearing nbn's estimate would fall relative to mine (i.e., would appear even more conservative).

7.4 Reasonable range for WACC as at 31 December 2021

220. My estimate of a reasonable range for the nominal vanilla WACC for a company with similar risks to nbn as at December 2021 is a range of 7.2% to 8.9%. The lower bound of this range is formed by my estimate using the Sharpe-Lintner CAPM and the Wright approach and my estimate of the long run cost of equity using the Black CAPM forms the upper bound. Each estimate is derived from the parameters as set out in Table 7-9 below.

Table 7-9: Best estimate of the WACC range at December 2021

		Current estimate	Long-term estimate	Wright approach
A	Debt funding		31%	
B	Equity funding (=1-A)		69%	
C	Nominal risk-free rate	1.7%	5.1%	1.7%
D	Market Risk premium	9.8%	6.5%	9.7%
E	Asset beta		0.46	
RoE for Sharpe-Lintner CAPM				
F	Equity beta (=E/(1-A))		0.67	
G	Cost of equity (=C+F×D)	8.3%	9.4%	8.2%
RoE for Black CAPM				
F'	Equity beta (=F+0.5*(1-F)		0.83	
G'	Cost of equity (=C+F'×D)	9.9%	10.5%	9.8%
Cost of debt				
H	Cost of debt		5.1%	
Nominal Vanilla (=H×A+G×B)				
	WACC (SL CAPM)	7.3%	8.1%	7.2%
	WACC (Black CAPM)	8.4%	8.9%	8.4%

221. The midpoint estimate of the WACC estimated by nbn in Table 2 of my brief is 7.2% for FY1. This is within, but at the bottom of, my estimated reasonable range.

8 Inflation and tax parameters

8.1 Inflation

222. I consider that nbn's method for estimating expected inflation is reasonable. Specifically, to use the RBA's most recent inflation forecasts where available. If a forecast is required beyond the RBA forecasts then nbn will apply a straight line glide path out to an anchor point for the fifth year of the forecast period. That anchor point will be within the RBA target range (2-3% pa) and will be determined as follows:

- at the top quartile of the RBA target range (2.75%) if the longest dated RBA forecast is at or above the top of the RBA target range;
- the middle of the RBA target range (2.50%) if the longest dated RBA forecast is within the RBA target range; or
- the bottom quartile of the RBA target range (2.25%) if the longest dated RBA forecast is at or below the bottom of the RBA target range.

223. This follows the method recently adopted by the Queensland Competition Authority. The adoption of anchor points within the RBA target range, but calibrated to a point consistent with the last available RBA forecast, is appropriate given:

- The RBA does not target the midpoint of its target range. Rather, under the inflation-targeting framework, the RBA's price stability objective is defined as achieving a medium-term average inflation rate of 2 to 3 per cent over the cycle for consumer price inflation (CPI).
- Economic logic, and empirical evidence,[60] supports the view that actual and forecast inflation below/above the target range is more likely to be associated with inflation beyond the forecast period that is towards the bottom/top of the RBA target range.

8.2 Gamma

224. nbn includes an estimate of "gamma" in its WACC methodology. Gamma is an estimate of the value to investors of imputation credits created by the payment of corporate taxes. Gamma is generally agreed to be less than 1.0 for two reasons. First, not all imputation credits are immediately distributed to equity investors.[61] Second,

60 From 2009 to 2021 Australian inflation has been persistently below or at the bottom of the RBA forecast range. A naïve estimate of future inflation that assumed immediate return of inflation to the midpoint of the RBA target range at the end of the RBA forecast period would have materially overestimated actual inflation in the relevant forecast years.

61 And even if they were, the investor must wait until their tax return is processed to receive any benefit.

foreign nationals, who are important investors in the Australian equity market, cannot claim imputation credits.[62]

225. nbn has proposed to use a 'market value' interpretation of the value of imputation tax credits (gamma) and evidence from dividend drop-off studies.

226. I consider a market approach to estimating the value of imputation credits is the approach most consistent with efficient financing costs. This follows from the way in which firms compete for equity funding. Firms compete for equity funding by promising investors a combination of cash dividends and imputation credits in return for the investors providing equity funding.

227. The level of cash dividends that must be provided depends on the market value of imputation credits. If the market places a low value on imputation credits then, other things equal, higher cash dividends must be promised in order to attract equity funding. Similarly, if the market places a high value on imputation credits then, other things equal, lower cash dividends must be promised in order to attract equity funding. This is true irrespective of the rate at which resident taxpayers "use" imputation credits (noting that resident taxpayers are only a fraction of the total market providing equity funding to Australian businesses).

228. Once it is accepted that businesses must pay the market rate for equity funding it follows that the correct value to place on imputation credits when estimating the cost of equity funding is the market value.

229. Dividend drop-off analysis is a standard tool for estimate the market value of imputation credits. The use of such studies has been endorsed by the Australian Competition Tribunal[63] and is commonly used by regulators in Australia adopting the market value approach. These studies estimate the value of imputation credits based on the change in market value of shares when their status changed from *cum* to *ex* dividend.

230. The best estimate of the value of distributed imputation credits from dividend drop off studies is 0.35.[64] This estimate is consistent with the predictions of economic

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62 It is also the case that domestic Australian investors may place lower than face value on the allocation of imputation credits because: a) they are prevented from accessing them due to the "45 day rule" that states that shares must have been owned for 45 days before the ex-dividend date in order to qualify for imputation credits; b) they must wait until their tax return is processed to receive any benefit; c) there are compliance and administration costs associated with tracking and processing credits.

63 Application by Energex Limited (Gamma) (No 5) [2011] ACompT 9 (12 May 2011), Paragraph 22.

64 Gray, S. and D. Cannavan, (2017), "Dividend drop-off estimates of the value of dividend imputation tax credits," Pacific Basin Finance Journal, 43B, 213-226.

theory for small equity market relative to the global equity market where imputation credits are restricted to domestic residents.[65]

231. However, not all imputation credits will be distributed. The value of gamma is estimated as the product of the distribution rate and the market value of distributed credits. Thus, 0.35 is a cap on the possible value of gamma (associated with a 100% distribution rate) and the lower bound estimate is zero (associated with a 0% distribution rate).

232. The distribution rate is a firm specific estimate. I have not been provided with any nbn specific modelling that pertains to distribution rates – although it seems likely to me that nbn will neither generate nor distribute imputation credits for many years. This is consistent with the following excerpt from NBN Co Tax Transparency Report 2021:[66]

> *As a government business enterprise (GBE), NBN Co is subject to tax in the same way as any other large corporate taxpayer. However, in light of the current stage of the Company's lifecycle, NBN Co will not pay corporate income tax in the foreseeable future. This is due to the fact that the Company has generated historical tax losses as a result of the significant up-front*

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65 All investors must have the same marginal valuation of stocks that they own. If one set of investors (e.g., domestic investors) are given a tax advantage they will rationally adjust their portfolios, over concentrating in Australian equity, until the last dollar of credits they receive just offsets the cost they bear by concentrating their portfolio into franked dividend paying stocks and away from what would otherwise be optimal. Thus, the benefit to Australian investors must be perfectly offset, at the margin, by the combined cost of: a) lost diversification; and/or b) higher prices. However, so long as Australian equity markets rely on foreign investors to any material extent then most of this adjustment will come as a result of a) rather than b). Foreign investors will not be prepared to pay materially higher prices because they receive relatively little diversification benefit from Australian equity (as compared to the diversification benefit to Australian investors of foreign equity). Consequently, any pressure of imputation credits on domestic equity values will be offset by substitution away from Australian equities by foreign investors. The only scenario in which most of the value of imputation credits is reflected in the market value of equities is one where Australian equity is owned almost exclusively by Australian investors.

To make the economic concepts discussed above clear, imagine a scenario where the Australian government announced that investors born in Tasmanian would receive tax refunds for 20 times the imputation credits they submitted. How much of this tax benefit would be reflected in higher valuations of Australian equity? Consistent with the above analysis, close to zero is the correct answer. Tasmanians would certainly be given a strong incentive to sell international equity and invest the proceeds in Australian equity. They may also sell and rent back their houses to mainlanders and invest the proceeds in Australian equity. However, unless Tasmanian's wealth was sufficient to fund the entirety of the Australian equity market then other investors would be required. Those other investors would not have any higher valuation on Australian equity and would not be willing to pay a higher price. That is, the market value of Australian equity would not be materially affected even by a very large tax subsidy to a subset of investors.

66 NBN Co Tax Transparency Report 2021, p.2. Available at: https://www.nbnco.com.au/content/dam/nbn/documents/about-nbn/reports/financial-reports/nbn-co-tax-transparency-report-2021.pdf

> *investment in the construction and rollout of the National Broadband Network prior to the Company generating taxable profits. This situation is expected to continue until NBN Co becomes profitable which is forecast to occur in future years.*

233. In this context I consider that using the "typical" distribution rate for a 100% Australian based entity is a reasonable, although conservative, estimate of the distribution rate for nbn. I consider that the best estimate of this is around 0.69.[67]

234. Combining these estimates, I arrive at a value for gamma of 0.24 (=0.35*0.69). This is very similar to nbn's estimate of 0.25. I consider that nbn's current value of 0.25 to be within the range of recent reasonable estimates of the market value of imputation credits.

235. I note that my reasoning and conclusion is consistent with that undertaken by the IPART which also adopts a value of gamma equal to 0.25 based on the market value approach.[68]

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67 SFG, An appropriate regulatory estimate of gamma, June 2015, Table 1 p. 27. From this table I adopt the value of "public but not top 20 ASX listed" being 0.693. I adopt this value because the top 20 ASX listed entities have substantial foreign source income. It is, therefore, much easier for these companies to achieve a high distribution rate for imputation credits simply by distributing Australian source profits and reinvesting foreign source profits. This option is not available to an entity with 100% of Australian source profits.

68 IPART, Review of our WACC method, February 2018, section 7.6.

9 Asset stranding and other non-systemic risks

236. In Question 3 of my instructions, I have been asked to consider whether the cost of capital methodology reasonably compensates for the risk involved in providing nbn services.

237. In the previous sections of this report I have considered the elements of the methodology that have regard to systemic risks faced by nbn. These systemic or market risks relate to the variability in nbn's cashflows that are correlated with variability in the market economy. These market risks are compensated for in the capital asset pricing model (CAPM) that underpins the methodology set out by nbn. Specifically, the level of market risk is reflected in the measure asset beta, which reflects the correlation of net cashflows with the market.

238. nbn faces other non-systemic risks in providing nbn services. These are risk that are not compensated for directly in the methodology outlined by nbn. In particular, the risk that nbn's investment will be unrecoverable, commonly referred to as asset stranding, is not directly compensated for in its cost of capital methodology. I observe that regulators in other jurisdictions have compensated for such risks through uplifts to the allowed return. I consider that it would be reasonable to apply such an uplift to nbn's WACC (notwithstanding that nbn is not currently proposing to do so).

239. I discuss these issues in the following sections.

9.1 Asset stranding risk

240. Whenever costs are incurred in advance of receiving revenues there is a risk that such expenditures will not be recovered. The inability to recover past expenditures, including a normal return, results in those costs being stranded. A common reason that costs may be stranded is because of unexpected reductions in demand for the product. The reduction in demand may be for a range of reasons including unexpected advancement in competing technologies, changing consumer preferences or interventions by government to restrict demand.

241. In a regulated setting, prices are typically held below the willingness to pay of consumers.[69] Regulators smooth the recovery of costs. They do this by adopting a

[69] In unregulated settings, a firm will only incur costs if they expected to at least earn a normal return. The risk of stranded costs in this setting is borne by the firm. The compensation for assuming this risk is in the upside returns in circumstances that stranding does not occur. In a competitive market this upside is constrained by the potential for entry.

depreciation profile that achieves a path of prices that is considered to be desirable and which, ideally, aims to promote economic efficiency.[70]

242. In practice, the likelihood and the degree of stranding may not be known with certainty. There will be some states of the world in which stranding will occur and in other states of the world stranding might not occur. Hence the terminology of stranding risk.

243. Without explicit allowance for the possible states of the world in which stranding might occur, investors face an asymmetry. Investors face the potential for there to be a downside without any commensurate potential for upside.[71] This asymmetry means a key principle of regulation is no longer adhered to – that of giving investors an expectation, or a fair bet, that they will be able to recover the cost of investing in assets to provide regulated services.

9.2 nbn faces asset stranding risk

244. nbn has invested considerable capital ahead of revenues. These investments may not be recoverable if competing services emerge that are economic substitutes for the services it provides. I note that asset stranding does not imply the inability to recover any of nbn's past expenditures. It simply requires that a portion of past expenditures being unable to be recovered given the potential for future substitutes and regulatory constraints limiting nbn's ability to raise prices (and accelerate cost recovery/depreciation) before they emerge.

245. There appear to already be emergent technologies that may prevent nbn from being able to achieve cost recovery. These involve the deployment of 5G mobile telecommunications networks throughout Australia which offer fixed wireless services. These are marketed as substitutes for nbn services.

246. Optus, Telstra and TPG position their 5G service offerings as nbn comparable and market their 4G/5G network services as a substitute for an nbn fixed line service. For

[70] This would entail setting prices such that they minimise dead-weight loss. In effect, this would be an intertemporal application of the well-known Ramsey pricing problem. Prices, or the level of depreciation of the asset, would be set in each period to maximise use of the service over the life of the asset. This would require recovering a greater proportion of costs in periods where demand was relatively less sensitive to higher prices (the inverse elasticity rule) See Baumol, W. J. (1971). Optimal Depreciation Policy: Pricing the Products of Durable Assets. The Bell Journal of Economics and Management Science, 2(2), 638

[71] The nature of regulation is that it caps the potential upside to be a normal rate of return.

example, Vodafone and TPG highlight their 4G/5G offerings as "Our fast alternative to the nbn™"[72] and a "Great value alternative to the nbn™"[73] respectively.

247. In addition, low-earth orbit satellites are being deployed over Australia with the intent of competing with the NBN to provide broadband services.[74] Media reports suggest that these deployments could constrain nbn's cost recovery if that requires nbn to raise prices.[75]

9.3 Regulators address stranding risk from competing technologies for broadband providers

248. One approach adopted by regulators to address stranding risk is to add a premium to the allowed rate of return for the regulated business. This is because the asset/equity beta estimates do not capture stranding risks (which are asset specific expected costs and not systemic costs). This approach was adopted by the New Zealand Commerce Commission in its decision on the regulatory framework for providers of fibre broadband services (the Fibre Input Methodologies).

249. The NZCC identified an asymmetric risk faced by operators of fibre networks due to the potential for assets to be stranded. It identified that, even with flexibility around depreciation, accelerated depreciation was "unlikely to fully mitigate" this risk.[76] As such, the regulatory regime would not provide an expectation of full cost recovery (referred to as financial capital maintenance).

250. In determining the premium applied to the rate of return, the NZCC used a model developed by Dixit and Pindyck (1994).[77] The model is used to estimate what addition return an investor would need in order to invest in an asset with an assumed probability of stranding.

251. In the Fibre Input Methodologies, the NZCC's treatment of stranding risks was to provide Chorus with ex ante compensation in the form of a 10-basis point allowance

72 https://www.vodafone.com.au/home-internet/5g

73 https://www.tpg.com.au/home-wireless-broadband)

74 In 2020 McKinsey described the outlook as follows: "*…nongeosynchronous-orbit (NGSO) communications constellations, including low-Earth-orbit (LEO) and medium-Earth-orbit (MEO) satellites, are taking to the skies, and their number could soon soar. If current satellite internet proposals become reality, about 50,000 active satellites will orbit overhead within ten years. Even if the most ambitious plans do not come to pass, the satellites will be manufactured and launched on an unprecedented scale.*"

75 https://www.afr.com/chanticleer/telstra-s-satellite-hit-to-nbn-20220202-p59t7q

76 Fibre Input Methodologies, Table 6.18.

77 Dixit and Pindyck "Investment under Uncertainty" (1994), Princeton University Press, pages 200 to 207.

implemented in cash flows. That is, its cashflows were increased by 0.001 multiplied by the regulatory asset base.[78]

252. Similarly, in the United Kingdom, Ofcom has allowed an uplift in the WACC to compensate for the potential for downside risks.[79]

9.4 Equity beta does not compensate for stranding risk

253. Equity beta is a measure of systemic risk. It would be wrong to assume that stranding risk is compensated via equity beta. This includes nbn's estimate of equity beta which is taken from the ACCC's 2015 estimate.

254. Stranding risk is first and foremost a non-systemic risk. Even if stranding risk had an element that was systemic (and, therefore, might be captured in beta) it would still require compensation above and beyond any embodied in the beta estimate.

255. By way of example, exposure to the risk of a meteor strike on Sydney is primarily a non-systemic risk. The expected cost of this is the probability of a strike multiplied by the value of the destruction that would be wrought.

256. In addition to this, there may be a small increment of cost of holding physical assets located in Sydney due to the fact that if a meteor does destroy those assets then it is likely to also destroy a lot of other assets in a diversified portfolio. That is, there may be some expected beta cost associated with exposure to a meteor strike on Sydney. But this will be a tiny fraction of the total expected non-systemic costs.

257. The same logic applies to stranding risk for nbn. It is possible that this may have a systemic component. For example, it might be the case that asset stranding is most likely in a world with faster than expected technological innovation in satellite/wireless technology. This might be associated with strong wealth effects in the economy – such that stranding risk is correlated with high stock market valuations. In this case, exposure of nbn to stranding risk may be associated with a lower asset beta (i.e., nbn assets perform badly when the rest of the market portfolio performs well). However, this must, by definition, be a fraction of the magnitude of the underlying cost of the stranding event.

258. *In the context of the above, I consider it would be reasonable to apply an uplift to nbn's WACC to account for the non-systemic risk of asset-stranding (notwithstanding that nbn is not currently proposing to do so).*

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78 Fibre Input Methodologies, paragraph 6.1163 onwards.

79 Ofcom (2018), 'Wholesale Local Access Market Review: Statement – Volume 1, Markets, market power determinations and remedies', March, para. 9.10.

Appendix A Tables from my brief

Table 1: Summary of proposed WACC methodology

Item	Parameter/issue	Methodology
(a)	Form of WACC	Nominal vanilla WACC: $$WACC = Return\ on\ equity \times (1 - Gearing) + Return\ on\ debt \times Gearing$$
(b)	Return on equity	Estimated using Capital Asset Pricing Model (**CAPM**) $$Return\ on\ equity = Risk\text{-}free\ rate + Equity\ beta \times MRP$$ The default point estimate of the return on equity is to be derived by giving equal weight to estimates of the 'long-term' and 'current' return on equity: $$Return\ on\ equity_{long} = Risk\text{-}free\ rate_{long} + Equity\ beta \times MRP_{long}$$ $$Return\ on\ equity_{current} = Risk\text{-}free\ rate_{current} + Equity\ beta \times MRP_{current}$$ The weights applied to the long-term and current return on equity estimates may be varied to address a financeability issue, if one is identified (see section 3.5 below). Risk-free rate and MRP estimates are paired consistently when estimating the required return on equity.
(c)	Risk-free rate	• Current risk-free rate estimated using a 40-day average of the prevailing annualised yield on 10-year Commonwealth Government Securities using data published by the RBA.[80] • Long-term risk-free rate fixed in line with the long-term risk free rate assumed in Treasury's 2021 Intergenerational Report or the most recent version of any subsequent update or equivalent report by Treasury.[81] This figure for the long-term risk rate is currently 5.0%.

[80] For context, in the Initial Regulatory Period **nbn** uses a similar approach to estimating the risk-free rate, albeit with a 20-day average rather than 40-day average. See clause 1E.7.1(b) of the SAU.

[81] Commonwealth of Australia, "2021 Intergenerational Report: Australia over the next 40 years" (June 2021), p. 79 https://treasury.gov.au/sites/default/files/2021-06/p2021_182464.pdf.

(d)	Market Risk Premium (**MRP**)	• Current MRP estimated using four differently-specified Dividend Growth Models (**DGMs**): o Damodaran (2013); o Bank of England (2002); o Bank of England (2010); and o 3-stage DGM (implemented using Bloomberg and consensus analyst earnings forecasts) and calibrated to the long-term MRP of 6.5% (see below). While the current MRP will be estimated ahead of each Regulatory Cycle in the Subsequent Regulatory Period, the four DGMs specified above will be used to undertake this estimation for each such Regulatory Cycle. That is, **nbn** is not proposing to change or substitute the DGMs it will use. • Long-term MRP fixed at 6.5%. This figure has been determined as consistent with the available evidence on the arithmetic average of historical excess returns for Australia, and is not proposed to be reassessed during the Subsequent Regulatory Period.
(e)	Equity beta	Estimate the equity beta as follows: • For the first Regulatory Cycle, using the same equity beta used by the ACCC in its 2015 determination for Telstra's fixed line services. For your background, the estimates derived by this sample were cross-checked by **nbn** against a broader sample of comparators (which supplemented the ACCC sample using samples from New Zealand Commerce Commission in its 2020 Fibre Input Methodologies decision and from **nbn** (see Attachment B for full list of comparators). **Note:** the current equity beta value for the first Regulatory Cycle is 0.7. • For each subsequent Regulatory Cycle: o estimate an equity beta (**new beta**) using a new comparator sample that reflects a broad global telecommunications market for **nbn**-comparable firms at that time; o compare that new beta against the equity beta used in the immediately-preceding Regulatory Cycle (**old beta**); o apply the old beta, unless:

		▪ the old beta is more than one standard deviation from the new beta; and ▪ the evidence supporting the new beta was persistent over the two preceding Regulatory Cycles, in which case apply the new beta. This materiality test for deviating from the old beta in future regulatory periods is intended to promote stability in the equity beta estimate, and to avoid the WACC allowance varying unduly in response to random 'statistical noise' in equity beta estimates.
(f)	Return on debt	• Estimated as a 10-year historical trailing average of 10-year BBB corporate bond yields (**10-year trailing average**). • The return on debt allowance for each year in the regulatory period will be determined prior to the commencement of the regulatory period, using a forecast of how the 10-year trailing average is expected to change in each year of the regulatory period. For each year in the regulatory period, the forecast will exclude from the 10-year trailing average the rates that will be more than 10 years old when that year occurs, and will include an assumed rate for each year between the start of the regulatory period and the relevant year. That assumed rate will be equal to the 10-year trailing average for the year immediately preceding the upcoming regulatory period. This forecast will be fixed for each year at the beginning of the regulatory period. It will not be adjusted during the regulatory period to reflect actual changes to 10-year BBB corporate bond yield. • Historical data on 10-year BBB corporate bond yields obtained from published RBA statistics. • For completeness, note that a "return on debt true-up" will be applied at the beginning of each Regulatory Cycle (other than the first Regulatory Cycle of the Subsequent Regulatory Period). This true-up will adjust the Forecast Nominal ABBRR and Forecast Nominal Core Services ABBRR of the upcoming Regulatory Cycle to recover any difference between the forecast return on debt and the actual return on debt relating to the preceding Regulatory Cycle. This does not affect the calculation of the rate of return and you are not required to comment on this adjustment.
(g)	Allowance for debt raising costs	A specified number of basis points added to the prevailing return on debt in each year to reflect the debt issuance costs an efficient firm would expect to incur in raising debt capital.

		Note: This figure is 12.5 basis points. This figure is not proposed to be reconsidered during the Subsequent Regulatory Period.
(h)	Gearing	Estimate gearing as follows: • For the first Regulatory Cycle, using the same gearing used by the ACCC in its 2015 determination for Telstra's fixed line services. For your background, the estimates derived by this sample were cross-checked by **nbn** against a broader sample of comparators (which supplemented the ACCC sample using samples from the New Zealand Commerce Commission in its 2020 Fibre Input Methodologies decision and from **nbn** (see Attachment B for full list of comparators). **Note:** the current gearing ratio for the first Regulatory Cycle is 40%. • For each subsequent Regulatory Cycle: ○ estimate a gearing ratio (**new gearing**) using a new comparator sample that reflects a broad global telecommunications market for **nbn**-comparable firms at that time; ○ compare that new gearing against the gearing ratio used in the immediately-preceding Regulatory Cycle (**old gearing**); ○ apply the old gearing, unless: ▪ the old gearing is more than one standard deviation from the new gearing; and ▪ the evidence supporting the new gearing was persistent over the two preceding Regulatory Cycles, in which case apply the new gearing.
(i)	Tax	The prevailing company tax rate for the relevant Financial Year. **Note:** This figure is currently 30%.

Table 2: Indicative estimates of WACC using proposed WACC methodology

Parameter	'Current' estimate		'Long-term' estimate		Midpoint estimate	
	FY1	**FY2**	**FY1**	**FY2**	**FY1**	**FY2**
Risk-free rate	1.7%		5.0%		3.4%	
Equity beta	0.7		0.7		0.7	

Market risk premium	9.0%		6.5%		7.8%	
Return on equity (nominal, post-tax)	8.0%		9.6%		8.8%	
Return on debt (nominal, pre-tax, including allowance for debt raising costs)	4.9%	4.6%	4.9%	4.6%	4.9%	4.6%
Gearing	40%		40%		40%	
Nominal vanilla WACC	**6.8%**	**6.7%**	**7.7%**	**7.6%**	**7.2%**	**7.1%**
Inflation (2-year regulatory period)	2.4%		2.4%		2.4%	
Gamma	0.25		0.25		0.25	

Table 3: Summary of methodology for calculating gamma and inflation

Item	Parameter/issue	Methodology
(a)	Gamma	A 'market value' interpretation of the value of imputation tax credits (gamma) and evidence from dividend drop-off studies. **Note:** This figure is currently 0.25.

(b)	Inflation	The forecast average annual inflation rate over each regulatory period is to be determined using the QCA glidepath approach:
		
		• Inflation forecasting period = regulatory period;
		
		• For a five-year regulatory period, inflation would be forecast by computing the geometric average of five numbers:
		
		  ○ Forecasts for years 1 and 2 would be obtained from the latest RBA Statement on Monetary Policy; and
		
		  ○ The figures for years 3 and 4 would be determined by a linear glidepath to the 'anchor point' estimate in year 5.
		
		• The 'anchor point' estimate in year 5 would be determined using the following decision rule:
		
		  ○ If the RBA's 2-year ahead forecast is less than or equal to 2.0%, the anchor point would be set at 2.25%;
		
		  ○ If the RBA's 2-year ahead forecast is between 2.0% and 3.0%, the anchor point would be set at 2.5%; and
		
		  ○ If the RBA's 2-year ahead forecast is greater than or equal to 3.0%, the anchor point would be set at 2.75%.
		
		• For a three-year regulatory period, inflation would be forecast by computing the geometric average of three numbers:

		○ Forecasts for years 1 and 2 would be obtained from the RBA; and ○ The figure for year 3 determined using the approach for the 'anchor point' outlined in the previous solid dot point. • For a two-year regulatory period (which is expected to be the first Regulatory Cycle only), inflation would be forecast by calculating the geometric average of inflation forecasts for years 1 and 2 from the RBA.

Table 4: Indicative estimates of gamma and inflation

Parameter	Estimate	
	FY1	FY2
Inflation (2-year regulatory period)	2.4%	
Gamma	0.25	