COMPETITION ECONOMISTS GROUP

CPI indexed debt: a panacea for EDBs?

Report for Vector

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Table of Contents

List of Figures

List of Tables

1 Executive summary

1. The questions I have been asked are set out below. I briefly summarise my answer to each of these in this executive summary. I also provide an even more condensed summary of my key responses in the table on the next page.

a.i. Is there a timing mismatch between when electricity distribution businesses (EDBs) are compensated for the inflation portion of debt costs and when EDBs must pay debt holders?

a.ii. Does any such timing mismatch have implications for the ability of the stylised EDB assumed in the IMs to achieve the IMs assumed credit rating of BBB+?

a.iii. Would the answer to the above two questions be any different if it were assumed that an EDB issued CPI indexed debt rather than nominal debt?

b.i. Do the IMs expose an EDB that borrows in nominal terms to the risk that its debt costs will not be aligned with IMs compensation for debt costs? Specifically, that the EDB's debt related inflation costs will be different to IMs debt related inflation compensation?

b.ii. Would an EDB be able to reduce its risk (better align its debt costs to IMs debt compensation) by borrowing using CPI indexed debt instead of nominal debt?

c.i. Have any corporations issued CPI indexed bonds in New Zealand? If so, do these have the characteristics assumed for an EDB under the IMs (e.g., privately owned with a BBB+ credit rating)?

c.ii. Is the expected nominal cost of CPI indexed bonds higher or lower than for nominal bonds from the same issuer? When answering this question assume that the IMs method for estimating expected inflation is accurate.

1.1 Summary

2. The expected cost of issuing CPI indexed debt for a BBB+ rated EDB is certainly higher than the cost of nominal debt. However, even if this were not the case, issuing CPI indexed debt would not assist an EDB in matching IM debt compensation for the reasons set out in the table below.

Problem	Can issuing CPI indexed debt help?
The IMs compensate for current inflation over a period of 50+ years. When nominal risk free rates are low, the IMs deferred compensation for inflation places pressure on credit metrics.	No. Issuing CPI indexed debt cannot defer inflation costs beyond the tenor of the debt (assumed to be 5 years in the IMs). Moreover, while a single CPI indexed bond can defer inflation compensation to a large lump sum at the final maturity of the bond, a portfolio of CPI indexed debt has zero deferral properties because every year bonds will be maturing and the CPI compensation over the whole life of that bond will need to be paid to investors.
The IMs compensates for a real return on debt into. This exposes any EDB borrowing in nominal terms to risk associated with deviations between actual and IMs forecast inflation.	No. The IMs real return on debt is built from: ▫ First, an estimate of the **nominal** cost of debt (based on an average of 5 years of nominal debt issuance and a set of nominal interest rate swap contracts); and ▫ Second, a deduction of a single forecast of inflation at the beginning of the DPP. There is no CPI indexed debt issuance strategy that can match a real return derived in this manner. The only way an EDB could (in theory) hedge the IM real return is if the EDB: ▫ Entered all the IM assumed nominal debt and derivative contracts; and ▫ Entered into a pay floating/receive fixed CPI swap at the same rate as the IMs inflation forecast. However, this is a purely theoretical conjecture because: a) there is no liquid CPI swap market in New Zealand; and b) even if there were, the IMs would need to use the CPI swap rate as the IMs inflation forecast.

1.2 Question by question response

a.i. Is there a timing mismatch between when electricity distribution businesses (EDBs) are compensated for the inflation portion of debt costs and when EDBs must pay debt holders?

3. Yes. There is a timing mismatch between debt related inflation costs and IMs compensation. The IMs compensate for the inflation component of debt costs via higher future revenues spread over a period of 50+ years (and less than half of inflation related interest costs are compensated within the first 20 years after inflation occurs). By contrast, EDBs have to pay debt holders for 100% of inflation related debt costs by the final maturity date of the debt instrument (where that final maturity is within, at most 5, years for an EDB funding itself consistent with the IMs).

a.ii. Does any such timing mismatch have implications for the ability of the stylised EDB assumed in the IMs to achieve the IMs assumed credit rating of BBB+?

[redacted]

5. It follows that the IMs treatment of inflation compensation is an obstacle to EDBs, as modelled in the Commerce Commission's financial model, achieving BBB (let alone BBB+) credit metrics. It must be noted, however, that S&P has regard to factors other than credit metrics when determining a credit rating. Thus, the credit metrics alone are not determinative of the credit rating for an EDB.

a.iii. Would the answer to the above two questions be any different if it were assumed that an EDB issued CPI indexed debt rather than nominal debt?

6. No. The above answers are independent of whether an EDB issued inflation indexed or nominal debt. In fact, the expected time profile of compensation for inflation related debt costs is the same for nominal and for CPI indexed debt portfolios. The metrics would be unchanged if all nominal debts were replaced with CPI indexed debt.

b.i. Do the IMs expose an EDB that borrows in nominal terms to the risk that its debt costs will not be aligned with IMs compensation for debt costs? Specifically, that the EDB's debt related inflation costs will be different to IMs debt related inflation compensation?

7. Yes. If actual inflation is higher/lower than forecast inflation (as estimated under the IMs) then an EDB that otherwise borrows at the IM nominal cost of debt will be over/under compensated for debt related inflation costs.

b.ii. Would an EDB be able to reduce its risk (better align its debt costs to IMs debt compensation) by borrowing using CPI indexed debt instead of nominal debt?

8. No. Issuing CPI indexed debt would increase rather than reduce the risk of mismatch between debt costs and IM compensation. This is true even if an EDB could issue CPI indexed and nominal debt at identical expected costs.

9. This is because the IM real cost of debt is estimated based on an EDB entering an assumed set of nominal debt and derivative contracts. Namely, refinancing 20% of debt every year with a 5 year nominal bond and then using a series of nominal interest rate swap contracts convert these to nominal floating rate and then back into fixed rate during the risk free rate averaging period immediately prior to the DPP.

10. These nominal contracts give rise to a nominal cost of debt that matches the IM nominal cost of debt (which is a trailing average debt risk premium plus an 'on the day' nominal base rate determined in the risk free rate averaging period. Only then does the IMs turn this nominal return into a real return by deducting a forecast of inflation from the compensation provided over the DPP. Consequently, the IMs real return on debt is best thought of as:

- The nominal cost of engaging in a set of nominal contracts spanning the 5 years prior to the DPP (all of which arrive at a nominal IM cost of debt); less
- An estimate of inflation expectations immediately prior to the DPP period.

11. This does not result in the same "real" cost of debt associated with any CPI indexed debt issuance strategy. By way of illustration, consider the two CPI indexed debt issuance strategies.

- **Trailing average CPI indexed issuance**. If an EDB refinanced 20% of its portfolio every year with CPI indexed debt then the EDB would, as the IMs assumes, have a trailing average DRP. However, its real base rate of interest would be an average of real rates over the previous five years. This would not match, except by fluke, the real base rate in the IMs – which is solely based on prevailing conditions in the risk free rate averaging period immediately before the DPP.
- **100% refinance using CPI indexed debt every 5 years**. If an EDB structured its debt portfolio so that 100% of its debt came due in the risk free rate averaging period then it could (in theory and ignoring refinance risk) lock in a real base interest rate that matches the IM real interest rate.[1] However, it

[1] Assuming that the IM inflation forecast actually matches what lenders demand for bearing inflation risk

would have a debt risk premium that was solely set in that one year – while the IM DRP is based on a 5 year average of DRPs.

12. This illustrates a simple fact. For issuance of CPI indexed bonds to provide a hedge against the IMs real cost of debt the IMs would need to estimate that cost based on a CPI indexed debt issuance programme. This is not how the IMs arrive at a real return on debt and, therefore, issuing CPI indexed debt simply cannot help to hedge the IM real return on debt.

13. This conclusion does not rely on an assumption that CPI indexed debt would have higher expected costs than nominal debt. However, such an assumption would certainly be justified for a BBB+ privately owned corporation in New Zealand (see my answer to questions c.i. and cii. below). Factoring in my answer to questions c.i. and cii., relying on CPI indexed debt would be both more costly and more risky for an EDB than relying on nominal debt issuance.

14. There is a theoretical potential alternative method for EDBs to hedge the real return on debt provided by the IMs. This alternative method would involve the following steps:

   - Enter into all of the nominal contracts (debt issuance and interest rate swaps) currently assumed by the IMs to arrive at the nominal IM cost of debt; then
   - During the risk free rate averaging period immediately prior to the DPP, also enter into a pay floating/receive fixed 5 year CPI swap for 100% of its debt portflio.

15. The CPI swap overlay would mean that the EDB is paid an amount equal to the contracted fixed rate less the actual inflation rate over the period.

16. If the fixed rate of the CPI swap matched the IMs inflation forecast then this would mean the EDB would be paid an amount equal to forecast less actual inflation on 100% of its nominal debt portfolio. This is precisely the amount that the EDB is undercompensated for under the current structure of the IMs when inflation is below forecast (and *vice versa* when inflation is higher than forecast).

17. Naturally, the caveat at the beginning of the previous paragraph is critical. This is only a hedge if the fixed CPI swap rate matches the IMs inflation forecast. This could only be guaranteed if the IMs were changed such that the IMs inflation forecast method was based on the fixed rate of a 5 year CPI swap in the risk free rate averaging period.

18. Unfortunately, there does not appear to be any market for CPI swaps in New Zealand. Consequently, the above discussion is theoretical in nature only. Absent such a market developing and/or changes to the IMs there is simply no method available to EDBs to hedge their debt portfolios to the real return on debt set in the IMs

c.i. Have any corporations issued CPI indexed bonds in New Zealand? If so, do these have the characteristics assumed for an EDB under the IMs (e.g., privately owned with a BBB+ credit rating)?

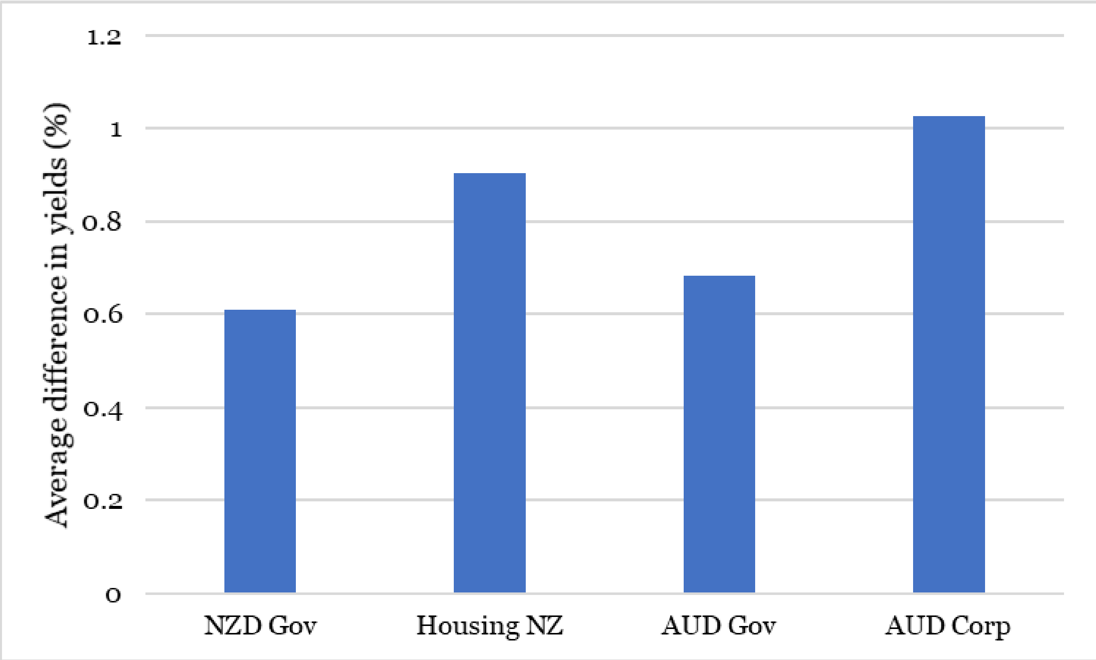
19. Only two corporations have issued CPI indexed bonds in New Zealand (Transpower once in 2010 and NZ Housing). Both of these corporations are 100% owned by the New Zealand Government and both have a broad AA credit rating. Neither corporation has the characteristics assumed for an EDB under the IMs (i.e., privately owned with a BBB+ credit rating).

c.ii. Is the expected nominal cost of CPI indexed bonds higher or lower than for nominal bonds from the same issuer? When answering this question assume that the IMs method for estimating expected inflation is accurate.

20. In the small number of cases where an entity does issue CPI indexed debt, the expected nominal cost of CPI indexed bonds has been materially higher than for nominal bonds issued by the same issuer with the same maturity. This is true for Housing New Zealand bonds and New Zealand Government bonds. It is also true for Australian corporate and government issuers of CPI indexed debt. (Where an entity does issue CPI indexed bonds this is always in small amount (a small fraction of the total debt portfolio)).

21. Figure 1-1 shows the average difference between inflation-adjusted yields and nominal yields for all issuers of CPI indexed bonds in New Zealand and Australia.

Figure 1-1: Average difference between inflation-adjusted yields and nominal yields



Source: Bloomberg, NZCC, CEG analysis

22. In summary, most issuers, including all private New Zealand issuers, do not issue CPI indexed debt. Where there are issues of CPI indexed debt it invariably trades at a yield that is materially higher than the yield on similar maturity nominal bonds by the same issuer.

2 Introduction

23. I have been asked to answer the following questions:

a. The electricity distribution input methodologies (IMs) currently compensate for the inflation component of debt costs via CPI indexation of the RAB rather than via contemporaneous compensation in revenues. Given this context:

   i. Is there a timing mismatch between when electricity distribution businesses (EDBs) are compensated for the inflation portion of debt costs and when EDBs must pay debt holders?

   ii. Does any such timing mismatch have implications for the ability of the stylised EDB assumed in the IMs to achieve the IMs assumed credit rating of BBB+?

   iii. Would the answer to the above two questions be any different if it were assumed that an EDB issued CPI indexed debt rather than nominal debt?

   Please answer the above questions in the context of the New Zealand Commerce Commission's modelling for Vector's electricity distribution business in the third default price quality path (DPP3) decision covering the period 2020/21 to 2024/25.

b. The IMs compensate for the cost of debt by building up a nominal cost of debt and then subtracting expected inflation to arrive at an estimate of the real cost of debt – with inflation compensation provided via indexation of the debt portion of the RAB. Given this context:

   i. Do the IMs expose an EDB that borrows in nominal terms to the risk that its debt costs will not be aligned with IMs compensation for debt costs? Specifically, that its debt related inflation costs will be different to debt related inflation compensation?

   ii. Would an EDB be able to reduce its risk (better align its debt costs to IMs debt compensation) by borrowing using CPI indexed debt instead of nominal debt?

c. What evidence is available regarding the use of CPI indexed debt by corporations and other entities in NZ? Specifically:

   i. Have any corporations issued CPI indexed bonds in New Zealand? If so, do these have the characteristics assumed for an EDB under the IMs (e.g., privately owned with a BBB+ credit rating)?

   ii. Is the expected nominal cost of CPI indexed bonds higher or lower than for nominal bonds from the same issuer? When answering this question, assume that the IMs method for estimating expected inflation is accurate.

24. This report sets out my analysis and responses to those questions. The remainder of this report is structured as follows:

- Section 3 sets out how the IMs framework compensates EDBs for their debt and inflation costs, and demonstrates that borrowing in CPI indexed debt will not reduce the risk of mismatch between the actual and IMs compensated real cost of debt.
- Section 4 shows that inflation indexing of the debt portion of the RAB backloads compensation for inflation over a period of 50+ years. In the context of DPP3, this places severe stress on credit metrics used by S&P - forcing them below investment grade levels. Section 4 explains that an EDB issuing CPI indexed debt will in no way alleviate this stress.
- Section 5 analyses the market for inflation-indexed debt. It shows that the only instances where inflation-indexed debt has been issued is by the New Zealand government or government owned entities. Moreover, the real cost of those bonds is materially higher than the expected real cost of similar nominal bonds issued by the same entities. (The same is true when the analysis is extended to Australia in Appendix D).
- Appendix A sets out formulae for S&P credit ratios and shows that cash flow pressures can be alleviated by modifying the IMs estimates of expected inflation;
- Appendix B provides a numerical example showing that cash flows are identical for two portfolios of nominal and inflation-indexed debt with the same outstanding principal;
- Appendix C sets out the methodology I used for the empirical analysis in section 5; and
- Appendix D provides additional empirical results for inflation-indexed bonds issued in Australia.

3 Debt and inflation compensation in the IM

3.1 Current IMs compensation for debt costs

25. In order to answer the questions put to me it is useful to first set out how the current IMs framework compensates EDBs for their cost of debt.

3.1.1 How the IMs arrive at a nominal cost of debt

26. The IMs nominal cost of debt is built from the following three components:

    i. Trailing average debt risk premium (DRP) estimated based on nominal 5-year bond yields in each of the preceding 5 years immediately prior to the commencement of the DPP; plus

    ii. The prevailing nominal 5 year risk free rate associated with the cost of debt observation 6 months prior to the beginning of the DPP; plus

    iii. Compensation for the cost of debt raising – including interest rate swaps used "to cover the cost of aligning the interest rate setting to the price setting".[2]

27. The logic for this approach is clearly set out in the Commerce Commission's decisions. The IMs nominal cost of debt is specifically designed to reflect the costs incurred by an EDB with a portfolio:

    i. With 5 tranches of 5-year bonds – with 20% of the portfolio being refinanced each year.

    ii. Where all bonds are "floating rate bonds"[3] such that the interest rate paid to lenders is a fixed DRP plus the prevailing short term (3 month) risk free rate of interest (which can vary "float" from one coupon payment to the next).

    iii. Where the EDB enters into a 5 year pay fixed and receive floating interest rate swap immediately prior to the commencement of each DPP (in the same averaging period used to set the risk free rate for the DPP).

28. The assumptions listed in paragraph 27 above provide justification for the structure of the IMs cost of debt compensation set out in paragraph 26. Specifically:

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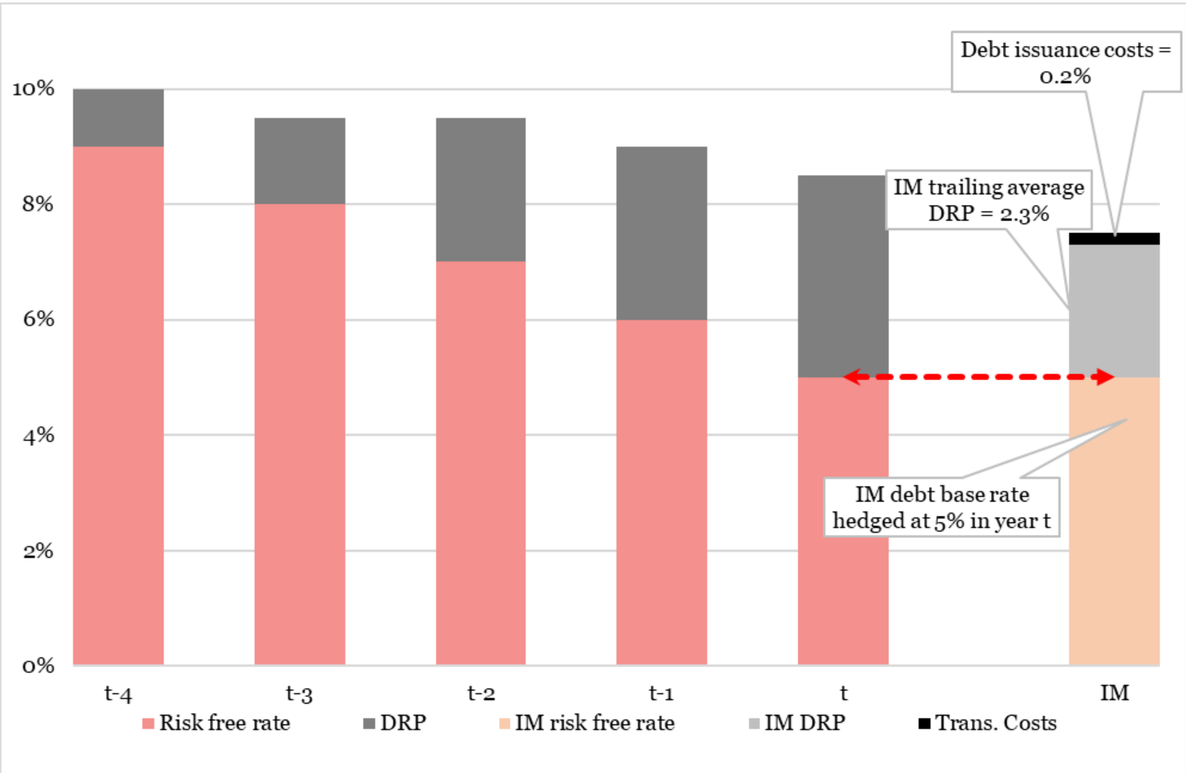
2 NZCC, Input methodologies review decisions, Topic paper 4: Cost of capital issues, December 2016 p. 15

3 Or are fixed rate bonds converted into floating rate bonds by the contemporaneous entering into a pay floating/receive fixed interest rate swap for the life and face value of the bond.

- The assumption an EDB portfolio has 5 tranches of 5-year bonds is what justifies the IMs using an average of the DRPs from the 5 years prior to the beginning of the DPP as an estimate of the average DRP on the portfolio (i.e., 27.i. justifies 26.i).
- The assumption that interest rate swaps are used in this way also justifies the inclusion of interest rate swap costs in debt raising costs (i.e., 27.iii justifies 26.iii).
- The assumption that 20% of the debt portfolio is refinanced with floating rate bonds every year and an interest rate swap is used once every five years to fix rates for the 5 years of the DPP is what justifies adding a trailing average DRP to a single prevailing risk free rate (i.e., 27.ii and 27.iii justify 26.ii).

29. A graphical summary of the assumed debt management strategy may also be helpful to the reader. Figure 3-1 shows an example where risk free rates have been falling progressively by 1.0% per annum over each of the 5 years prior to the DPP (from 9% to 5%) while the DRP has risen by 0.5% per annum from 1.0% to 3.5% (averaging 2.3%) over those five years. In the example, "*t*" is the averaging period immediately prior to the DPP and "*t-1*" is the averaging period from the preceding year and so on.

Figure 3-1: Graphical illustration of IMs debt management strategy



30. If the "benchmark EDB" issues 5 year bonds in each of the 5 years *t-4* to year *t* then it will have a 5 year trailing average DRP of 2.3%. This is the DRP that is shown for the IMs cost of debt (final bar on the right hand side). However, the IMs cost of debt ignores the risk free rates that prevailed in years *t-4* to *t-1*. This is because it is assumed the EDB issued floating rate nominal debts (or used interest rate swaps to convert those debts to floating rate debt). The EDB is also assumed to convert the floating rate exposure on all previous debts into a fixed rate exposure during the year *t* averaging period. That is why the IMs base rate for the cost of debt is equal to the risk free rate in "year *t*". The costs of entering into these interest rate swaps are included in the estimate of debt raising costs.

31. The Commerce Commission explains this approach as follows. [4]

> *Businesses are able to hedge their interest rate exposure for the risk-free rate using the interest rate swap market. Swaps can be used to fix a supplier's interest rate payments such that they broadly match the risk-free rate (which is set by us for the length of a regulatory period). This is despite year-by-year variations in market government bond yields (which we use as a proxy for the risk-free rate).*
>
> *The existence of this swap market, and the ability of suppliers to use it to hedge the majority of their interest rate exposure, means that there will be minimal violations of the NPV=0 principle in regard to the risk-free rate under a prevailing regime. The ability to use the swap market meant that this is the case even if firms undertake staggered debt issuances over a longer period of time.*

32. The Commerce Commission adopted a trailing average DRP rather than a prevailing estimate of the DRP because, unlike for the risk free rate, there is "no practical way to hedge the debt premium" [emphasis added]:[5]

> *An issue recognised in the draft decision was the potential mismatch between the debt premium incurred by firms who issue debt on a regular rolling basis, and the corresponding compensation allowed for in our estimate of WACC. Firms can be exposed to any difference between the debt premium paid at the time they issue debt and the debt premium determined during the averaging window prior to the setting of the WACC.*

4 NZCC, Input methodologies review decisions, Topic paper 4: Cost of capital issues, December 2016 pp. 25-26.

5 NZCC, Input methodologies review decisions, Topic paper 4: Cost of capital issues, December 2016 p. 35

> ***The mismatch arises because there is no practical way to hedge the debt premium in New Zealand (i.e., there is no significant credit default swap market)****. Therefore, unless all debt is refinanced during the determination window, the debt premium allowed for by the Commission would not be perfectly matched by the supplier.*

3.1.2 How the IMs convert a nominal cost of debt into a real cost of debt

33. Having estimated a nominal cost of debt (based on well specified set of nominal debt and derivative transactions), the IMs then convert this into a real cost of debt by:

    i. Subtracting the IMs forecast of 5 year inflation that is prevailing during the risk free rate averaging period immediately prior to the DPP (averaging period "t" in the above example); and

    ii. Adding compensation for actual inflation via RAB indexation over the DPP (which is only recovered in revenues over the next 50+ years).

3.2 Can an EDB match the real cost of debt by issuing inflation indexed bonds?

34. We have already seen that an EDB can match the nominal cost of debt estimated in the IMs. The process for doing so has been well articulated by the Commerce Commission as described above. It involves issuing a trailing average of nominal debts and entering into nominal interest rate swaps to "hedge" (reset) the base rate of the portfolio every five years (in the risk free rate averaging period immediately prior to the DPP).

35. However, as noted in section 3.1.2, the IMs apply a further transformation to the nominal cost of debt to arrive at an implicit compensation for a real cost of debt. This clearly has the potential to result in a mismatch between the IMs nominal cost of debt (which an EDB is assumed to have incurred) and the nominal compensation that the IMs will provide – with the mismatch equal to the difference between the IMs inflation expectation estimate and actual inflation.

36. On this basis the answer to question b.i. must be in the affirmative. An EDB that borrows in nominal terms will have a nominal cost of debt that is different to the final nominal compensation for debt under the IMs. This is true even if the EDB matches its nominal costs to the IMs nominal cost of debt.

37. Question b.ii. asks me:

b.ii. *Would an EDB be able to reduce its risk (better align its debt costs to IMs debt compensation) by borrowing using CPI indexed debt instead of nominal debt?*

38. The answer to this question is "no". The reason for this answer is relatively simple. The IMs do not derive a real cost of debt from the issuance of CPI indexed debt. Rather, the IMs derives:

a. a nominal cost which is based on a set of nominal transactions (in both debt and interest rate swap markets);

then

b. deducts an estimate of expected inflation.

39. The IMs nominal cost (dot point "a.") reflects bond market conditions in two different time periods:

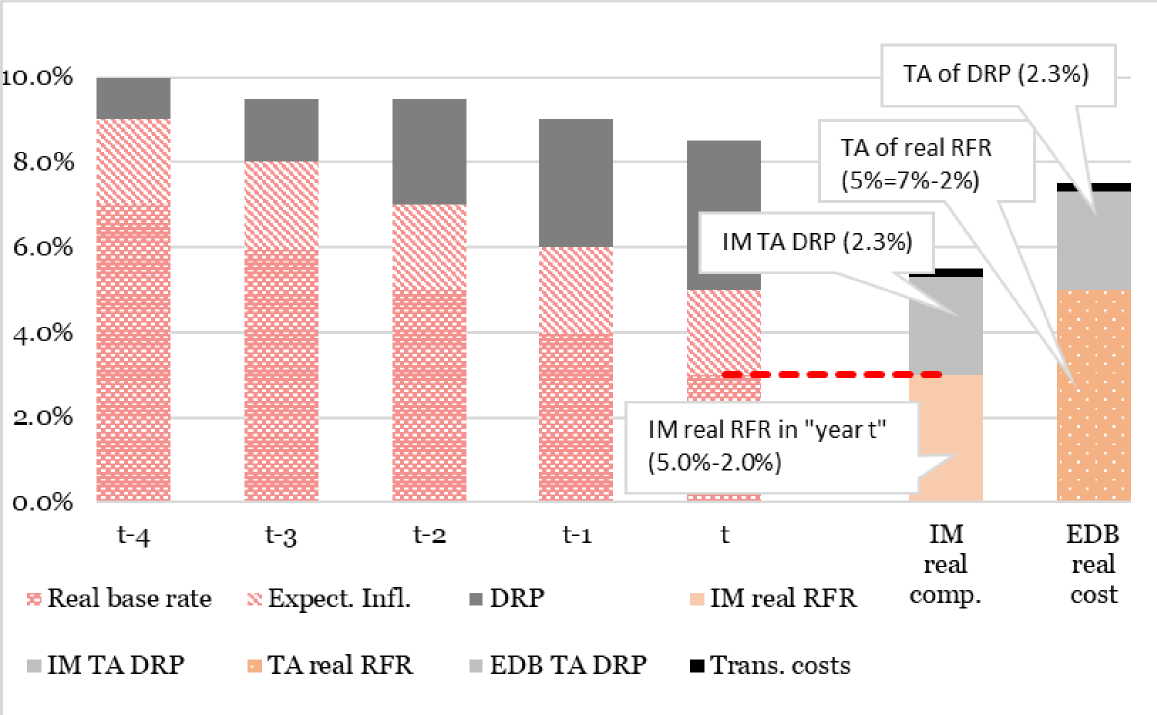
- a real risk free rate and expected inflation that reflects conditions only in the averaging period immediately prior to the start of the DPP; and
- a trailing average DRP that reflects bond market conditions over a 5 year period.

40. When the IMs remove expected inflation the resulting real cost of debt is equal to: the prevailing real risk free rate immediately prior to the DPP; plus a 5 year trailing average DRP.

41. If an EDB maintained a staggered portfolio of CPI indexed debt then it would have a real base interest cost that reflected a 5 year trailing average of real risk free rates. This would create a serious mismatch to the IMs cost of debt which is based on a prevailing real risk free rate. The EDB may be able to match the DRP but not the real risk free rate compensated under the IMs.

42. This can be illustrated using a slightly amended version of Figure 3-1 where the nominal risk free rate set out in Figure 3-1 is divided into a real and an inflation expectation component (assuming inflation expectations are constant at 2% per annum). The real risk free rate is simply the nominal risk free rate less 2% - so it starts at 7% (=9%-2%) in year *t-4* and falls by 1.0% each year as nominal risk free rates fall.

Figure 3-2: Comparison of IMs real compensation with trailing average CPI indexed debt costs



43. Figure 3-2 and Figure 3-1 have an identical nominal bond yield in all years (*t-4* to year *t*). The only difference is that the nominal risk free rate from Figure 3-1 is decomposed into a real risk free rate and inflation expectations[6] in Figure 3-2.

44. The IMs real cost of debt is 5.5%; comprised of the real risk free rate in year *t* (3.0%) plus the trailing average DRP (2.3%) plus transaction costs (0.2%). By contrast, the real cost of debt for an EDB issuing CPI indexed debt is 7.5%; comprised of a trailing average real risk free rate (5.0%) plus a trailing average DRP (2.3%) plus transaction costs (0.2%).[7]

45. The real cost of debt for an EDB issuing CPI indexed debt is higher than the real IMs cost of debt (7.5% vs 5.5%). The 2.0% difference reflects the fact that the trailing average real risk free rate (which the CPI indexed debt issuing EDB must

6 Which are assumed to be constant at 2.0%

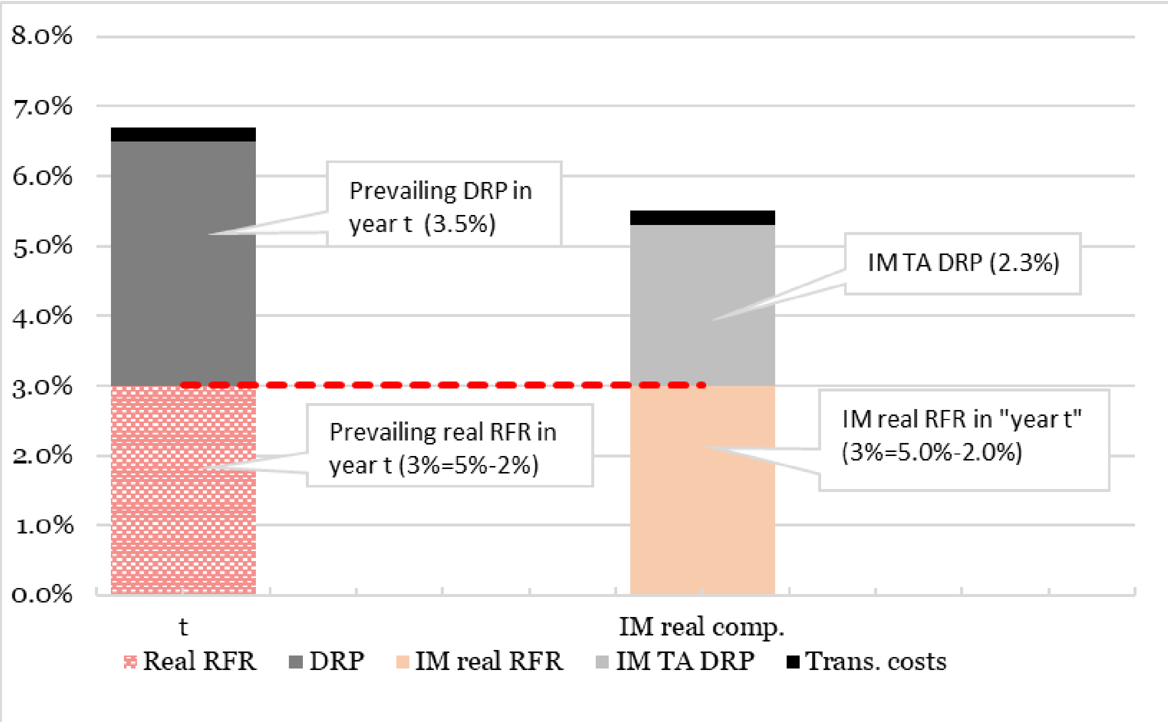
7 For the purpose of this illustration it is assumed that debt raising costs ("transaction costs") are the same whether nominal or CPI indexed debt are issued. The Commerce Commission estimated its 20bp allowance based broadly on: 9-10bp issuance cost; 3-4bp swap transaction cost; and 7-9bp "other" costs. While swap transaction costs would be avoided with a trailing average real cost of debt, "other" costs (especially the new issue premium) would likely increase by materially more than this given the niche nature of CPI indexed debt – discussed more in section 5.

pay) is 2.0% higher than the prevailing real risk free rate in year *t* (which the IMs use as the real risk free rate for debt costs). The EDB and IMs DRPs are not mismatched because both are based on a trailing average (of 2.3%).

46. This illustration assumes the EDB maintains a staggered (trailing average) debt issuance programme. An EDB could, at least in theory, attempt to refinance 100% of its debt with a CPI indexed bond immediately prior to the beginning of a DPP. This would expose the EDB to what are likely untenable refinancing risks. This would not be prudent treasury management of debt and does not match how any large firms with material debt portfolios manage their debts. It would heavily be penalised by rating agencies and would be inconsistent with an EDB maintaining the IM assumed BBB+ credit rating. However, for the purpose of illustration, I discuss how the cost of such a strategy (abstracting from refinance risk) would compare with the IMs real cost of debt compensation.

47. Figure 3-3 compares an "on the day" issuance of a single CPI indexed debt in year *t* (immediately prior to the start of the DPP) with the IMs cost of debt. This strategy aligns the real risk free rate paid by the EDB with the IMs real risk free rate allowance. However, now the EDB has an "on the day" DRP of 3.5% which is a mismatch to the 5 year trailing average in the DRP of 2.3%.

Figure 3-3: Comparison of IMs real compensation with "on the day" issuance of CPI indexed debt costs



48. These two examples illustrate the impossibility of using CPI indexed debt to match the IMs' real compensation for debt costs. This is because the latter is a combination of a prevailing real risk free rate and a trailing average DRP. An EDB issuing CPI indexed debt can match only one of these elements. If it matches one element it will inevitably have a mismatch with the other element.

3.3 Why can an EDB match the IMs nominal cost of debt but not the IMs real cost of debt?

49. The above discussion brings into focus the critical role of nominal interest rate swaps in allowing an EDB to have a staggered debt portfolio while simultaneously resetting the risk free rate for the portfolio at the beginning of each DPP. It is a liquid nominal interest rate swap market that allows an EDB to, at least in theory, attempt to reset nominal risk free rates from historical debt issuance into a prevailing risk free rate at the beginning of each DPP.

50. There is no such derivative market that allows an issuer to reset the base real (CPI indexed) interest rates on their debt portfolio.

51. It is theoretically conceivable that financial markets could develop a liquid real interest rate swap product. For such a product to be developed there would need to first be a liquid 90 day bank bill rate that was specified in CPI indexed terms (i.e., a real 90 day product that also paid one quarter of actual CPI). If so, then the observed real 90 day rate from this product could be used as the floating rate in a real interest rate swap. Such real interest rate swaps could then be used by an EDB to reset the real risk free rate on a CPI indexed portfolio immediately prior to the beginning of each DPP. The existence of such a market would allow an EDB to match the trailing average DRP and the real risk free rate used to set debt compensation in the IMs.

52. However, there is no such liquid market for 90 day inflation indexed debts anywhere in the world. Similarly, and consequentially, there is no real interest rate swap products anywhere in the world. It is, therefore, unlikely that such a market will exist in New Zealand in the foreseeable future.

3.4 Other strategies for minimising risk due to actual inflation deviating from IMs expected inflation

53. A more realistic, but still likely unavailable in New Zealand, strategy for EDBs to match IM inflation compensation would be to:

- follow the entirely nominal issuance strategy that underpins the IMs nominal cost of debt as outlined in paragraph 28; and

- enter into an additional 5 year pay actual/receive fixed CPI swap for 42% of the EDBs RAB – the EDB is also assumed to be geared with the assumptions of the IM

54. If the fixed rate of this swap contract matched the IMs expected inflation estimate and if there were zero transaction costs for the contract (and no counterparty risk) then this would provide a hedge to any future difference between IMs expected inflation and actual inflation.

55. It must be noted that there is no role for issuing CPI indexed debt in this strategy. Rather, the EDB creates a real cost of debt by trading in both interest rate swaps and CPI swaps during the "year *t*" averaging period immediately before the DPP. This strategy will deliver the EDB with a real risk free rate on its portfolio that is equal to the nominal risk free rate in the "year *t*" averaging period less the fixed leg of the CPI swap.

56. If the fixed leg of the CPI swap is the same as the IMs estimate of expected inflation, then the EDB will have matched its debt portfolio real risk free rate with the IMs real risk free rate used to compensate for the cost of debt.

57. However, there is no liquid market for CPI swaps in New Zealand. It appears that whatever CPI swaps are undertaken in New Zealand are negotiated on a bespoke basis with financial institutions and the prices/volumes of such trades are not publicly available. Bloomberg does not provide any inflation swap pricing for New Zealand.

58. Consistent with this the New Zealand Financial Markets Association does not publish any data on CPI swaps prices or volumes in New Zealand. The New Zealand Treasury when discussing inflation swap pricing in other countries states that:[8]

> *"…the equivalent data is not available in New Zealand…"*

59. It follows that reliable access to CPI swaps at a "fair" price during the 'year *t*' averaging period cannot be assumed. Indeed, the only reasonable assumption would be that if an EDB (let alone all EDBs) attempted to enter into 5 year CPI swaps in the "year *t*" averaging period for 42% of their RAB(s) then they would have to pay a very steep penalty relative to true expected inflation in order to achieve those trades.[9]

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8 NZ Treasury, Risk-Free Discount Rates and CPI inflation. Assumptions for Accounting Valuations 21 May 2019, p. 5.

9 In this case a penalty would take the form of accepting a receive fixed CPI rate well below the actuarially fair estimate of likely future inflation.

60. For this reason, an EDB using CPI swaps in this manner is not a viable funding strategy – and would not result in a real cost of debt that matched the IMs real cost of debt allowance.

61. If a justification for the current structure of the IMs is that EDBs can pursue the use of CPI swaps, then it would seem to follow that the IMs should allow EDBs who do use CPI swaps in this manner to substitute the CPI swap fixed rate for the current IMs estimate of expected inflation.

4 Backloading of compensation for inflation

4.1 IMs spread compensation for today's inflation over the next 50+ years

62. As described in section 3.1, the current IMs framework removes expected inflation from the nominal return provided in DPP cash-flows and, instead, compensates EDBs for inflation by indexing the RAB by actual inflation. Even if actual inflation is always exactly equal to IMs expected inflation, this means that compensation for inflation from "Year *t*" is, in effect, spread over the life of the RAB while debt investors demand compensation for inflation over the life of their debt instrument.

63. The nominal CPI compensation added to the RAB during DPP3 is only returned to investors via depreciation of the RAB over the average remaining life of assets in the RAB (which is 25 years for existing assets and 44 years[10] for newly commissioned assets).[11] However, the real compensation for CPI is never fully returned to the EDB via depreciation because part of that compensation is itself capitalised into the RAB when future inflation occurs.

64. Figure 4-1 illustrates this with an example where the RAB in "Year 0" is $100 and expected inflation is 2%. In that case, the IMs remove $2 (=2% of $100 RAB) compensation from the rate of return (both debt and equity) and, in compensation, add this same amount to the RAB. This is then returned to investors as the RAB depreciates. However, this is a very slow process because the RAB is depreciated only very slowly (this example uses a depreciation rate of 3.3% per annum - equivalent to an average asset life of 30 years which is between the average remaining life of existing and new assets).

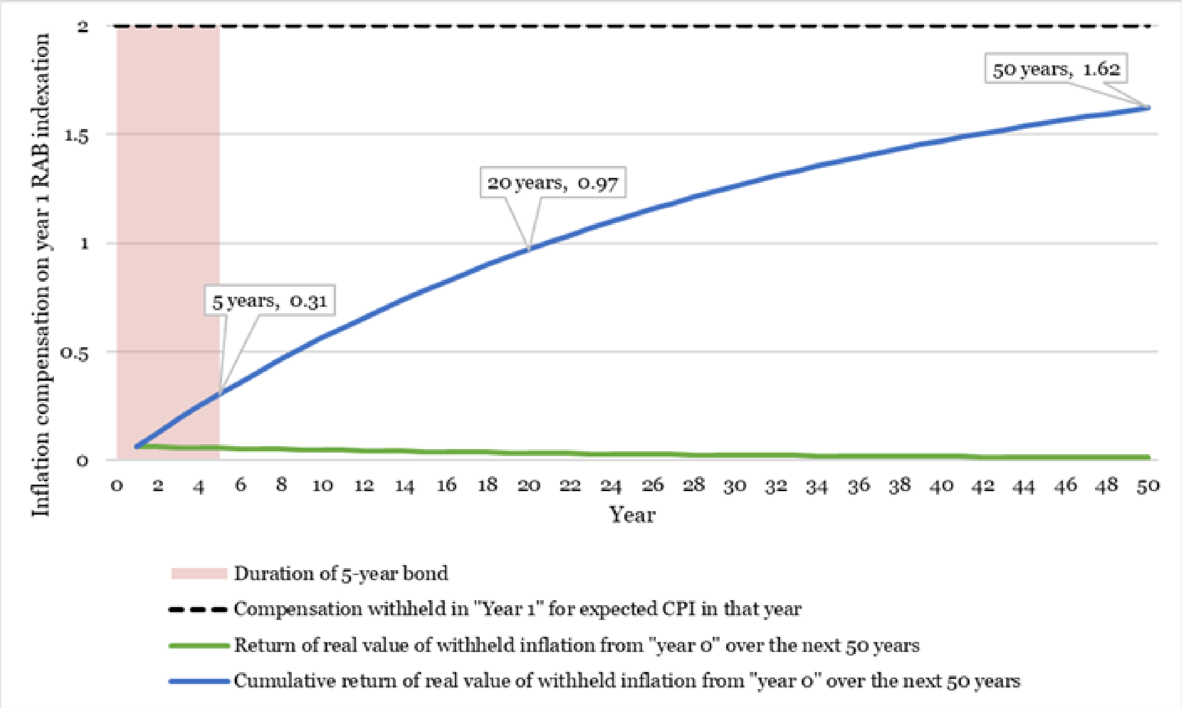
65. Moreover, there will be further inflation while the $2 withheld in "Year 0" is being returned – such that the real rate at which the $2 is returned is lower than 3.3% per annum. With a constant 2% inflation, after 20 years, the blue line in Figure 4-2

[10] This is the simplification in the financial model for new additions – but in fact the IMs do correct the depreciated life of new additions based on a weighted average of the standard lives of the assets commissioned in the year at the end of the DPP period. It also washes up the depreciation assumed in the financial model for new additions during the DPP to the weighted life of the new additions for the year – so that number could be higher or lower than 44 years.

[11] See: NZCC, Financial model – EDB DPP3 final determination – 27 November 2019, 'Inputs' sheet cell B17 and 'RAB' sheet row 17.

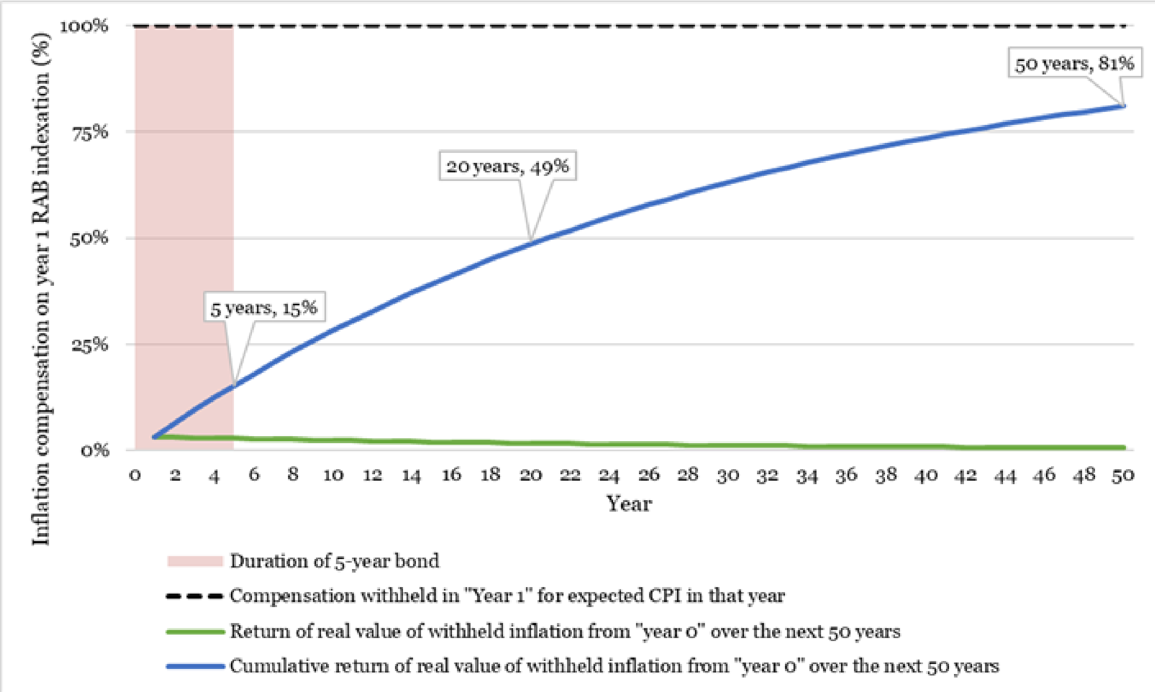
indicates that less than half (49%) of the real value of withheld inflation compensation from "year 0" has been returned in actual cash-flows.

Figure 4-1: Rate at which $2 inflation compensation withheld in "Year 1" is returned over subsequent years



66. Figure 4-2 shows the same result as Figure 4-1, but represents the blue line in terms of percentage of recovery for inflation compensation withheld from "year 0".

Figure 4-2: Rate at which $2 inflation compensation withheld in "Year 1" is returned over subsequent years (%)



67. Of course, bond holders must be fully compensated for expected inflation when their bond matures. If an EDB funds itself consistent with the IMs cost of debt benchmark, it will be issuing 5 year debt. This 5 year horizon is illustrated via the pink shaded areas of Figure 4-1 and Figure 4-2. If the EDB is borrowing at a tenor of 5 years this implies that the EDB must fully compensate lenders by the end of 5 years (and, typically for nominal bond holders, in the year inflation is expected to occur). Figure 4-2 shows that by the end of 5 years, however, EDBs would only have recovered 15% of their Year 1 inflation compensation.

68. Even this 15% figure is misleadingly high. It represents the amount of cash compensation provided by the IMs for inflation that occurs in the first year of a 5 year bond's life. Naturally, much less compensation is provided for inflation that occurs in the last year of the bond's life. On average, there are 2.5 years between the date that inflation occurs and the maturity of a 5 year bond. Adjusted for this fact, the 15% figure falls to 8%. That is, the IMs only provide compensation for 8% of the inflation that occurs during a 5 year bond's life in the form of cash (the remaining 92% is provided in later years).

69. By contrast, by the maturity of a bond, bond holders demand 100% of the compensation for inflation during the life of a bond. This 100% vs 8% represents the backloading of IMs inflation compensation relative to the time frame in which EDBs must compensate bond holders for inflation.

70. It must be noted that this is a cash-flow mismatch, not a present value mismatch. Subject to being able to attract borrowers at the IMs assumed cost of debt, an EDB should be able to fund the mismatch in inflation costs/compensation by borrowing against the growing IMs RAB. That is, the EDB can borrow against the inflation indexed RAB to pay the inflation component of existing interest costs.

4.2 Stress on financeability resulting from deferred inflation compensation in DPP3

71. There are, however, limits to the ability of an EDB to fund new borrowing to pay current interest costs. This is especially true if there are other pressures placed on its credit metrics. In DPP3, there are three separate sources of pressure on cash-flows for EDBs relative to DPP2. These are the pressures associated with:

a. backloading of compensation for inflation in the IMs relative to the compensation paid in debt contracts (discussed above);

b. capex that exceeds depreciation of the RAB (positive net capex); and

c. the current low return on equity environment due to low risk free rates which have resulted in a very significant (over 40%)[12] reduction in the cost of equity related DPP cash flows from DPP2 to DPP3.

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

75. S&P focusses on three sets of ratios: core ratios; supplementary coverage ratios; and supplementary payback ratios. S&P's focus is, as the name suggests, on the core ratios.

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

4.3 Would issuing inflation-indexed debt alleviate pressure on credit metrics?

79. Issuing CPI indexed debt, even if a market existed for it (discussed further in section 5), would not alter the current mismatch between when EDBs must pay debt holders cash compensation for inflation and when the IMs provide compensation for inflation in cash-flows.

80. The reason for this is very simple. The IMs spread compensation for inflation in "year *t*" over the subsequent 50+ years (less than half of total compensation for inflation in "year *t*" is provided over the next 20 years). By contrast, debt holders demand compensation for inflation by the final maturity date of their debt.

81. An EDB attempting to match the IMs cost of debt needs to issue 5 year debt. It follows that an EDB must pay bond holders for inflation that occurs during a bond's life by, on average, 2.5 years after the inflation occurs (i.e., half the 5 year bond's life).

82. The difference in time profiles (2.5 years for EDBs to pay debt holders and 50+ years for EDBs to receive cash compensation for inflation) is the same whether the EDB issues nominal or CPI indexed debt. Issuing CPI indexed debt does not allow an EDB to delay compensating bond holders beyond the maturity of that debt.

83. Moreover, even within a 5 year period there is no difference between nominal and CPI indexed debt in terms of the profile of inflation compensation paid to bond holders. In fact, for an evenly staggered (i.e., trailing average) portfolio of debt, the time profile of expected payments to debt holders is identical – irrespective of whether the portfolio is made up of nominal or CPI indexed debt.

84. An individual CPI indexed bond will have backloaded inflation payments relative to an otherwise identical individual nominal bond where that nominal bond pays a coupon which includes compensation for expected inflation in the year it is expected to occur.[15] However, a portfolio of CPI indexed debt will not have more backloaded inflation related payments than an otherwise identical portfolio of nominal debts.

[redacted]

15 This is an important technical caveat. There is no 'rule' which states that a nominal bond needs to pay compensation of inflation via the coupon. Nominal bonds can, and often do, have 100% of all compensation backloaded to the final maturity of the bond. Such bonds are known as "zero coupon bonds". For example, a bond that promises to pay the bond holder a nominal value $100 in five years (and zero coupons in between) might be issued for $90 (2.1% yield to maturity). All payments, including compensation for inflation are backloaded to the last day of the bond. This is more backloaded than the

85. This is because 100% of cumulative inflation compensation over the life of a CPI indexed bond must be paid in the year it matures. If a portfolio is comprised of *T* bond tranches each with a tenor of *T* years then, every year:

- A nominal bond portfolio will payout coupons on T bond tranches all of which include compensation for one (1.0) year of expected inflation. This involves *T* (=*T*×1.0) years' worth of inflation compensation;
- A CPI indexed bond portfolio will payout the indexed face value of one bond tranche that includes "*T* years" of past actual inflation (i.e., over the life of that bond now maturing). This also involves *T* (=1.0×*T*) years' worth of inflation compensation.

86. If, on average, actual inflation equals expected inflation then these values will be the same. That is, the same amount of inflation compensation will be paid to bond holders each year irrespective of whether the portfolio is 100% nominal or 100% CPI indexed debt.

87. This reasoning is illustrated in Appendix B for the specific example of a 5 year trailing average debt portfolio (as per the IMs cost of debt) – although the same logic applies to a portfolio with shorter or longer tenors.

88. The fact that the profile of expected cash-flows are identical in both the nominal and CPI indexed portfolios demonstrates that the use of CPI indexed debt provides no benefit in matching the profile of debt payments to the IMs profile of compensation for debt costs. It follows that issuing CPI indexed debt would not alter the pressure on credit metrics outlined in the previous section.

typical CPI indexed bond which does pay a coupon. This illustrates that it is not whether a bond is CPI indexed or nominal that determines how backloaded payments are – it is the level of the coupon. The level of the coupon is typically lower for CPI indexed bonds but this is not always the case.

5 Market for inflation-indexed debt

89. This section examines the efficiency/viability of a privately owned EDB issuing debt that is indexed to New Zealand CPI. The analysis undertaken suggests that such a strategy is likely to result in substantially higher expected costs than issuing nominal debt. Given that the IMs estimate the compensation for debt based on the observed issuance and yields on nominal corporate debt, issuing CPI indexed debt would be expected to result in costs that exceed IMs compensation. This may reflect a number of factors but it is likely that a partial explanation is that foreign lenders have little desire to lend in real NZD terms.

90. This is consistent with the fact that no privately owned corporation in New Zealand has issued inflation-indexed bonds, and the empirical evidence suggests that, even for the New Zealand Government (and 100% Government owned and AA rated entities), interest costs on inflation-indexed bonds are likely to be higher than for nominal bonds.

91. Section 3.2 already established that issuing CPI indexed debt would result in worse (not better) alignment of costs with IMs compensation. Combined with the result of this section, the implication is that issuing CPI indexed debt would:

- Raise expected costs for an EDB; and
- Raise risks for an EDB.

92. On this basis, I conclude that it would not be rational for an EDB to raise CPI indexed debt in New Zealand.

5.1 Privately owned corporations in New Zealand do not issue CPI indexed debt

93. The market for CPI indexed debt in New Zealand is small, with a Bloomberg search identifying only eight such bonds in its database,[16] including three that have already matured as of 18 February 2021.[17] These eight bonds include:

- Six bonds issued by the New Zealand Government (2 matured);
- One bond issued by Transpower New Zealand (matured); and
- One bond issued by Housing New Zealand Ltd/Kāinga Ora.

[16] I used Bloomberg's SRCH function to identify all NZD inflation-linked notes that list New Zealand as its country of risk.

[17] In contrast, Bloomberg records 169 inflation-linked AUD bonds issued by Australian firms, including 106 matured bonds as at 18 February 2021.

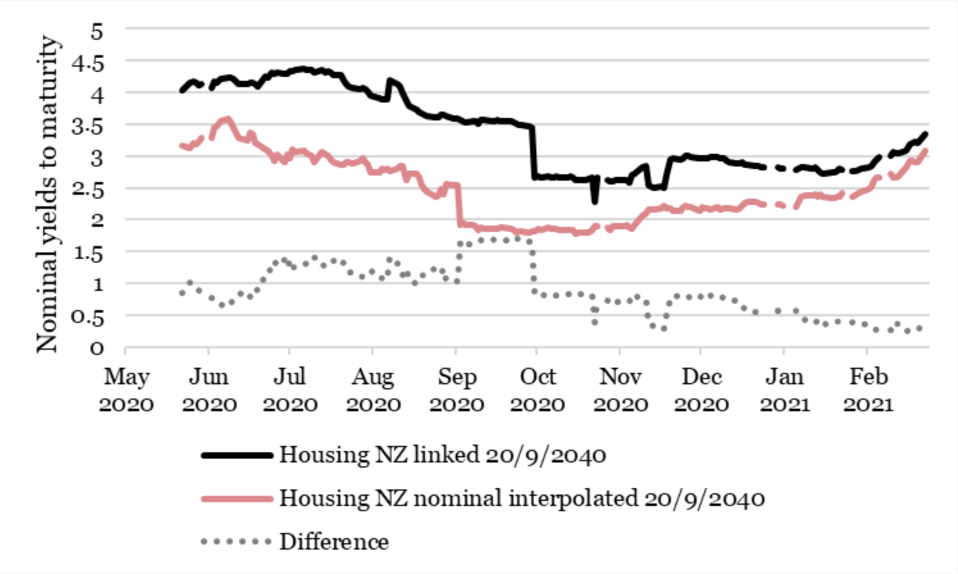
94. It is notable that the two CPI indexed corporate bonds were issued by a state-owned enterprise (Transpower – AA- S&P credit rating) and a Crown entity (Housing New Zealand – AA+ S&P credit rating). No privately owned corporation in New Zealand has ever issued CPI indexed bonds.

5.2 Relative cost of Kāinga Ora real and nominal debt issues

95. The inflation-adjusted yields observed for Housing NZ's CPI indexed bond suggest that its inflation-indexed debt is expected to cost more than nominal debt (assuming that the current IMs method for estimating inflation expectations are accurate). Figure 5-1 compares the IMs inflation expectations adjusted (real yield plus expected inflation)[18] yields on the 20/9/2040 Housing New Zealand CPI indexed bond against interpolated yields on nominal Housing New Zealand bonds with similar maturity. The adjusted yields on the CPI indexed bond have exceeded the interpolated nominal yields ever since the bond was issued. The same observations can be made for CPI indexed bonds issued by the New Zealand government, as will be shown in section 5.4.

18 IMs expected inflation is derived using the IM method. That is, I use inflation forecasts from the RBNZ for the first 2 or 3 years before assuming a glide path towards 2% inflation up to 5 years. Inflation in all subsequent years is assumed to remain at 2%. I round the residual maturity of each bond to the nearest whole number. For example, the inflation-indexed yield of a bond with 5.2 years residual maturity will be adjusted using 5-year inflation.

Figure 5-1: Housing NZ inflation linked bond 20/9/2040



Source: Bloomberg, NZCC, RBNZ, CEG analysis; Yields on interpolated series prior to 2 September 2020 obtained from bonds maturing on 18 October 2028 and 24 April 2030 (extrapolation), after which the extrapolation was carried out on bonds maturing on 24 April 2030 and 10 September 2035

5.3 Conclusions based on Transpower and Kāinga Ora CPI indexed debt issuance

96. The above comments from stakeholders directly involved with arranging the CPI indexed bonds issued by Transpower and Housing New Zealand provide considerable insight into the market for NZD CPI indexed bonds.

97. Both issuers are AA rated 100% government owned entities. Both issuers regard the CPI indexed bond market as a “niche market”. Both issuers cited diversification as a motivation for issuing CPI indexed bonds (diversification of debt portfolio in the case of Transpower and diversification of investor base in the case of Housing New Zealand), but such bonds only make up a small proportion of their portfolios, with the remaining debt still being issued in nominal terms.

98. It is also notable that Transpower’s CPI indexed bond matured in May 2020 and it has so far not issued any additional CPI indexed bonds as of February 2021. This means that the bond issued by Housing New Zealand is currently the only active CPI indexed bond denominated in NZD not issued directly by the New Zealand Government.

5.4 Interest costs on other inflation-indexed debt

99. I now compare the yields observed on CPI indexed bonds (adjusted to nominal yields using IMs inflation assumptions) against those observed on nominal bonds. I start with bonds denominated in NZD before carrying out the same comparison on AUD bonds issued by Australian entities. The methods I used to identify the sample of bonds and to convert CPI indexed yields to nominal yields are set out in Appendix C.

100. The empirical evidence suggests that in majority of cases, inflation-indexed debt has higher expected costs compared to nominal debt.

5.4.1 New Zealand bonds

101. Of the eight NZD CPI indexed bonds mentioned in section 5.1, there is only data available for the five bonds shown in Table 5-1.[19] The chart for the Housing New Zealand bond is shown in Figure 5-1 above. There are currently no NZD CPI indexed bonds issued by privately owned corporations.

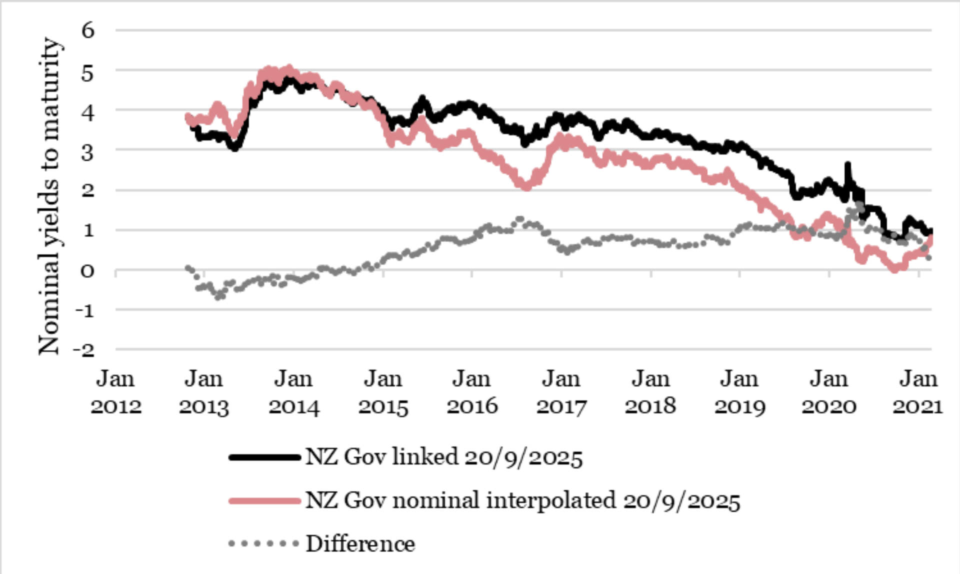
Table 5-1: Sample of CPI indexed NZD bonds

Issuer	Credit rating	Amt issued	Issue date	Maturity	Term (years)
New Zealand Government	AA+	$5.5 billion	31 Oct 2012	20 Sep 2025	12.9
	AA+	$4.5 billion	16 Oct 2013	20 Sep 2030	16.9
	AA+	$4.6 billion	13 Nov 2014	20 Sep 2035	20.9
	AA+	$4.55 billion	10 Mar 2017	20 Sep 2040	23.5
Housing New Zealand	AA+	$3 billion	1 May 2020	20 Sep 2040	20.4

Source: Bloomberg, CEG analysis

19 I do not include the Transpower bond and two New Zealand Government bonds (matured on 15 September 2001 and 15 February 2016) because Bloomberg does not provide any yield data for those instruments.

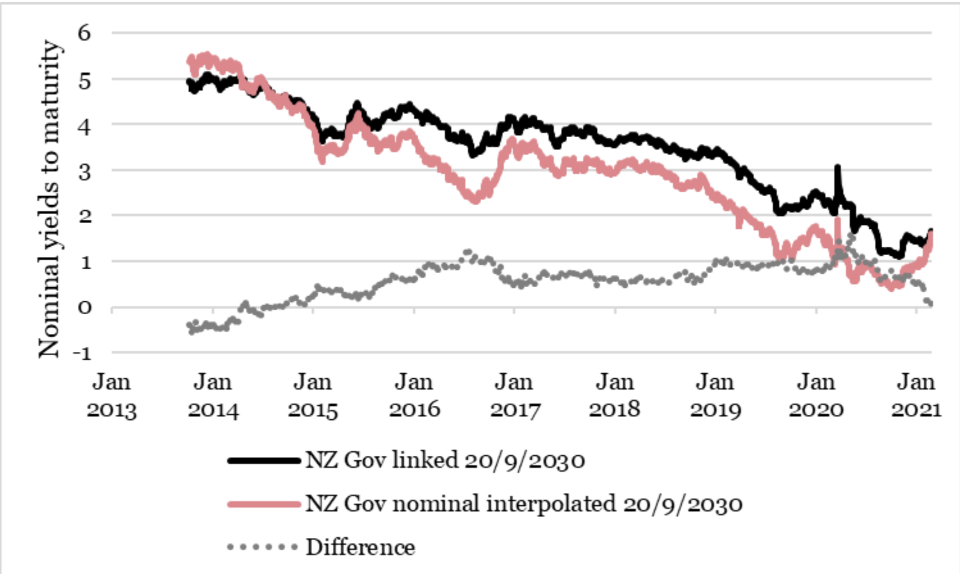
Figure 5-2: NZ government inflation linked bond 20/9/2025



Source: Bloomberg, NZCC, RBNZ, CEG analysis; Yields on interpolated series obtained from bonds with maturities between 15 April 2023 and 15 May 2026

102. Figure 5-2 compares the inflation-adjusted yields on the 20/9/2025 New Zealand Government CPI indexed bond against interpolated nominal yields with the same target maturity. The nominal yield has been materially lower on average than the expected nominal cost of the CPI indexed bond.

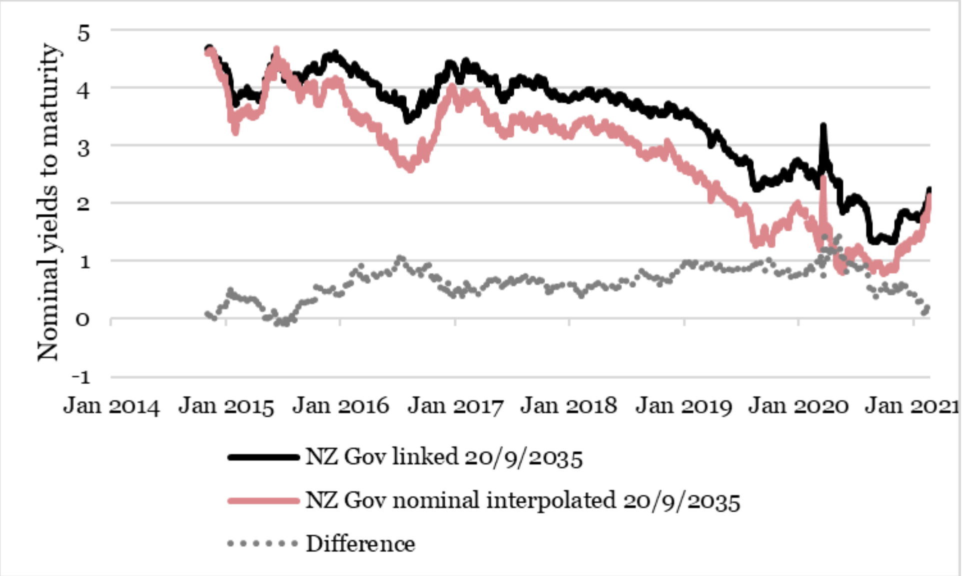
Figure 5-3: NZ government inflation linked bond 20/9/2030



Source: Bloomberg, NZCC, RBNZ, CEG analysis; Yields on interpolated series from 22 October 2015 onwards obtained from bonds with maturities between 15 April 2027 and 14 April 2033

103. Figure 5-3 compares the inflation-adjusted yields on the 20/9/2030 New Zealand Government CPI indexed bond against interpolated nominal yields with the same target maturity. The nominal yield has been materially lower on average than the expected nominal cost of the CPI indexed bond.

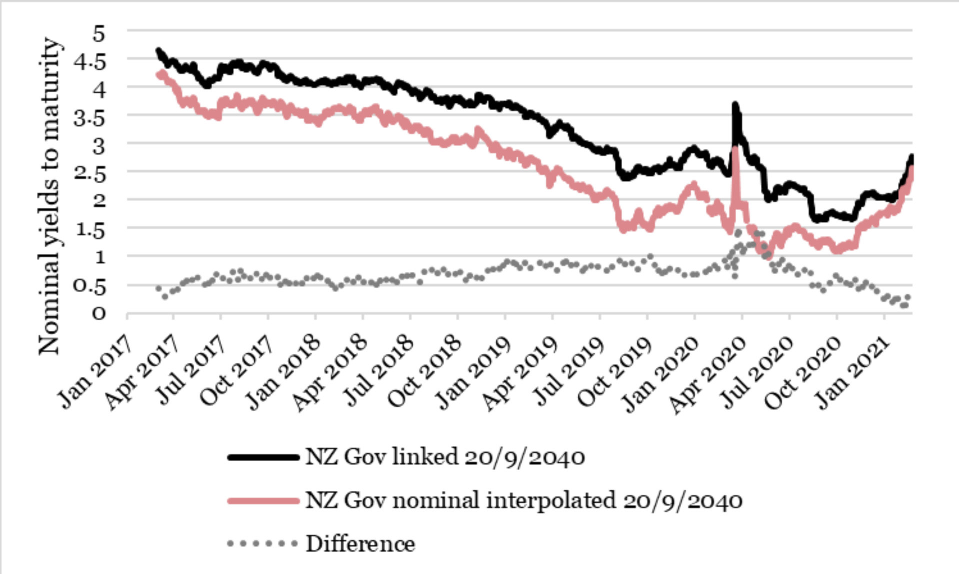
Figure 5-4: NZ government inflation linked bond 20/9/2035



Source: Bloomberg, NZCC, RBNZ, CEG analysis; Yields on interpolated series obtained from30 August 2016 onwards obtained from bonds maturing on 14 April 2033 and 15 April 2037

104. Figure 5-4 compares the inflation-adjusted yields on the 20/9/2035 New Zealand Government CPI indexed bond against interpolated nominal yields with the same target maturity. The nominal yield has been materially lower on average than the expected nominal cost of the CPI indexed bond.

Figure 5-5: NZ government inflation linked bond 20/9/2040



Source: Bloomberg, NZCC, RBNZ, CEG analysis; Yields on interpolated series prior to 15 July 2020 obtained from bonds maturing on 14 April 2033 and 15 April 2037 (extrapolation), after which the interpolation was carried out on bonds maturing on 15 April 2037 and 15 May 2041

105. Figure 5-5 compares the inflation-adjusted yields on the 20/9/2040 New Zealand Government CPI indexed bond against interpolated nominal yields with the same target maturity. The nominal yield has been materially lower on average than the expected nominal cost of the CPI indexed bond.

5.4.2 Australian bonds

106. A search on Bloomberg identified 169 CPI indexed AUD bonds for which Australia is the country of risk. Of these, 92 were issued by government entities, while the remaining 77 were issued by privately owned corporations.[20] No comparison can be carried out for many of them, however, because yield data is not available for those bonds or there are no comparable nominal bonds issued by the same firm. Furthermore, Bloomberg data appears to be unreliable for many CPI indexed bonds as some yield series have several sporadic spikes.

107. I adjust CPI indexed yields into nominal yields by applying the IMs inflation approach to RBA forecasts.

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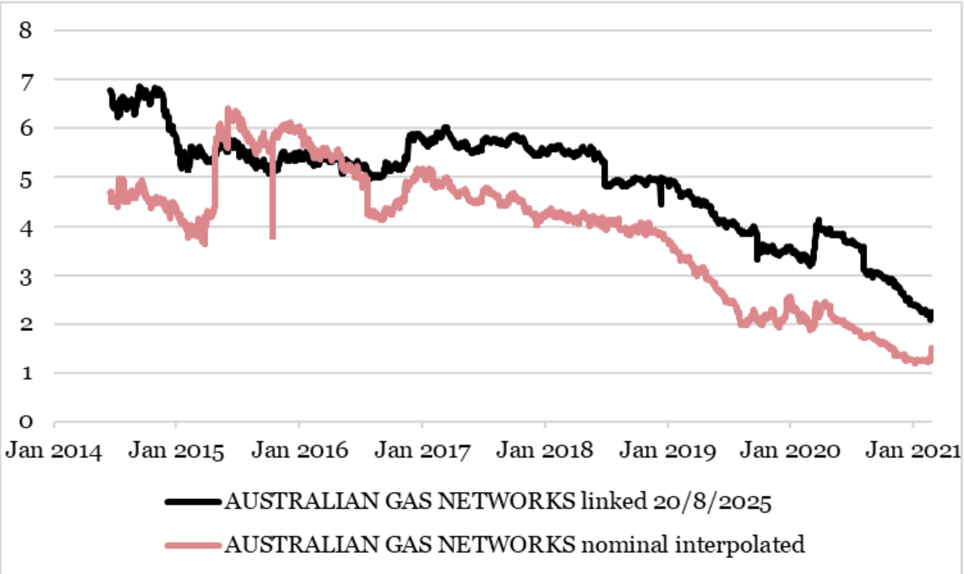
20 I note that Bloomberg treats Australian National University as a corporate issuer, even though the university was formed from Parliamentary legislation.

5.4.2.1 Australian corporate bonds

108. In this section I only show the comparisons for two bonds issued by Australian Gas Networks (Figure 5-6) and Sydney Airport Finance (Figure 5-7) respectively. Similar to the results for New Zealand bonds presented in section 5.4.1, the adjusted yields on both CPI indexed bonds exceed the interpolated yields on nominal bonds issued by the same company. There are short periods where this observation does not hold, but they are uncommon and fleeting.

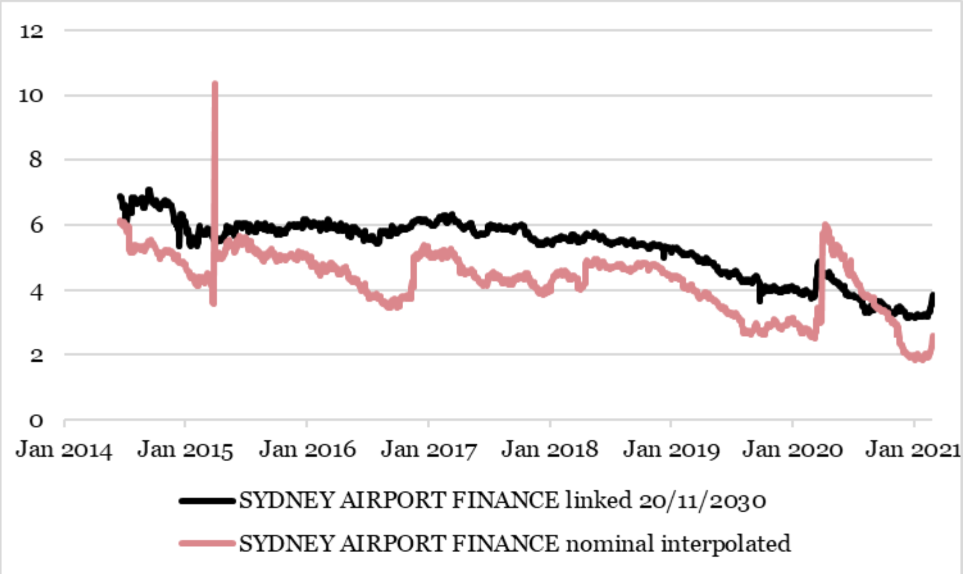
109. Results for other Australian corporate bonds are presented in Appendix D.

Figure 5-6: Australian Gas Networks inflation linked bond 20/8/2025



Source: Bloomberg, NZCC, RBA, CEG analysis

Figure 5-7: Sydney Airport Finance inflation linked bond 20/11/2030



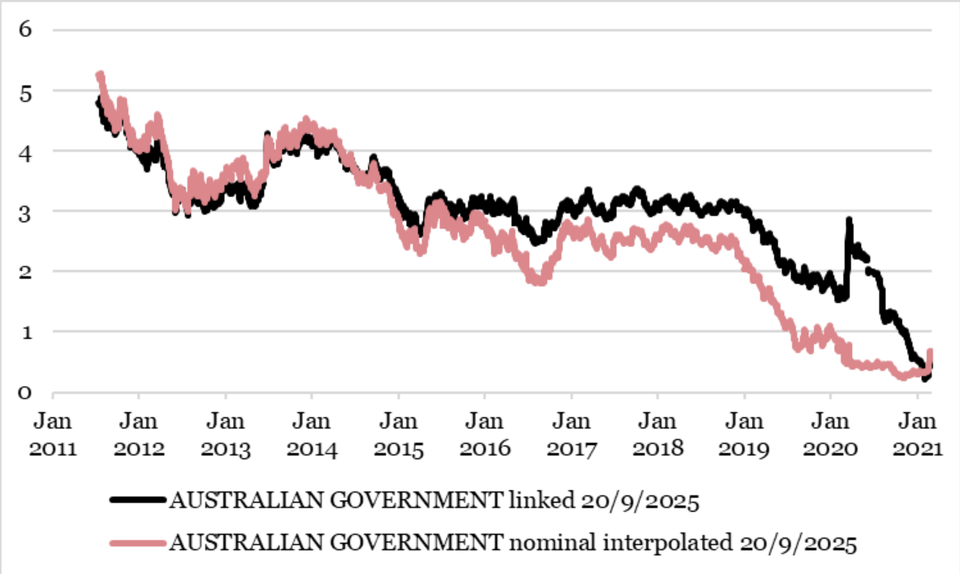
*Source: Bloomberg, NZCC, RBA, CEG analysis; *The spike on 30 March 2015 and 31 March 2015 occurs because of missing data on a nominal bond expiring 11 October 2027.*

5.4.2.2 Australian government bonds

110. In this section I only show the comparisons for two bonds issued by the Australian Government maturing in 2025 (Figure 5-8) and 2030 (Figure 5-9). From 2015 onwards, the adjusted yields on both CPI indexed bonds exceed the interpolated yields on nominal government bonds.

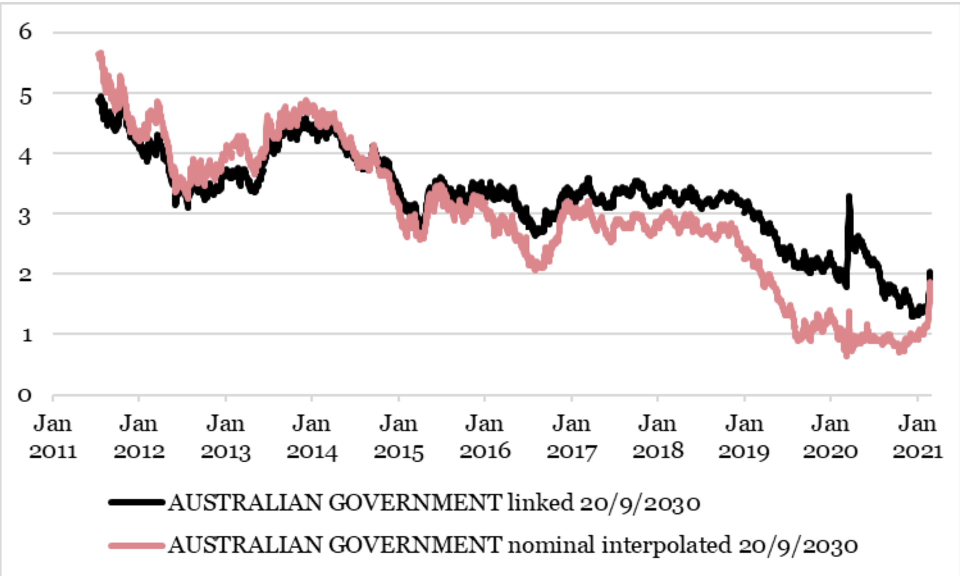
111. Results for other inflation-indexed bonds issued by the Australian Government and state governments are presented in Appendix D.

Figure 5-8: Australian government inflation linked bond 20/9/2025



Source: Bloomberg, NZCC, RBA, CEG analysis

Figure 5-9: Australian government inflation linked bond 20/9/2030



Source: Bloomberg, NZCC, RBA, CEG analysis

5.4.3 Summary

112. The empirical results presented in sections 5.4.1 and 5.4.2 are summarised in Figure 5-10, which shows the average difference between inflation-adjusted yields and

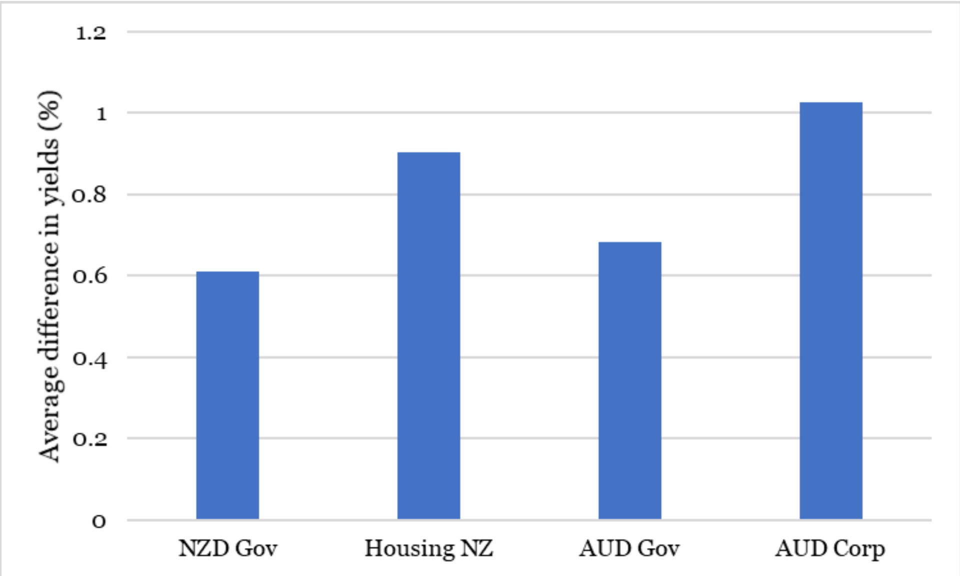
nominal yields for each category of bonds, including the ones in Appendix D.[21] These averages were calculated using the following steps:

i. For each inflation-indexed bond, generate a daily series containing the difference between its inflation-adjusted yield and its interpolated nominal yield, then calculate the average;[22]

ii. Calculate the average difference for each bond category.

113. The chart shows that inflation-adjusted yields exceed the interpolated nominal yields on average for all four categories of bonds. The difference ranges from 0.6% for New Zealand government bonds to 1.0% for Australian corporate bonds.

Figure 5-10: Average difference between inflation-adjusted yields and nominal yields



Source: Bloomberg, CEG analysis

114. The empirical evidence comparing inflation-adjusted yields on inflation-indexed bonds against yields on nominal bonds thus suggests that inflation-indexed debt has higher expected costs. This is true if the IM inflation forecasts are unbiased and

[21] Bloomberg data for several Australian CPI-indexed bonds had poor data quality, in that the series exhibited periodic spikes. The charts for these bonds are shown in Appendix D.3 for completeness, but do not form part of the analysis in this section.

[22] Some issuers only have one matching nominal bond, in which case the nominal yield on that bond is used. Consistent with the charts shown in Appendix D, the calculations exclude data when a bond has less than 6 months' residual maturity.

applies to government bonds issued in New Zealand and Australia, as well as bonds issued by Australian private corporations.

115. If the IM inflation forecasts are biased upwards, however, then this conclusion could be reversed. However, the under-compensation arising from such bias would also not be addressed by issuing inflation-indexed debt.

Appendix A S&P credit ratios

A.1 Formulae for S&P credit ratios

116. The following table details the calculations I undertake to calculate Vector's credit ratio using NZCC's DPP Reset Financial model.[23]

[23] NZCC Electricity Distribution Business Price-Quality Regulation 1 April 2020 DPP Reset Financial model - Final determination, 27 November 2019

Table 5-2: Formulae for S&P credit ratios

	Source/Formula
Revenue	Worksheet 'MAR' Cells D47:H47
Operating Expense	Worksheet 'BBAR' Cells F35:J35
Tax	Worksheet 'BBAR' Cells F42:J42
Depreciation	Worksheet 'BBAR' Cells F17:J17
Opening RAB	Worksheet 'BBAR' Cells F15:J15
Cost of debt	Worksheet 'Inputs' Cell B15
Gearing	Worksheet 'Inputs' Cell B16
Capex	Worksheet 'BAR' Cells F31, G38, H45, I52 and J59
Term credit spread differential allowance	Worksheet 'BBAR' Cells F25:J25
WACC	Worksheet 'Inputs' Cell B14
Cashflow from operations	Revenue – Operating Expenses - Tax
EBITDA	Revenue – Operating Expenses
Interest	Opening RAB*Gearing*Cost of debt + Term credit spread differential allowance
Cost of equity	(WACC-Cost of debt*Gearing)/(1-Gearing)
Dividend	Opening RAB*(1-Gearing)*Cost of equity
Capitalized maintenance Expense	Depreciation
Core ratios	
Adjusted FFO over Debt (higher is better)	$\frac{Cashflow\ from\ operations - Interest - Capitalized\ maintenance\ expense}{Debt}$
Debt/Adjusted EBITDA (lower is better)	$\frac{Debt}{EBITDA - Capitalized\ maintenance\ expense}$
Supplementary payback ratios	
FOCF/Net Debt (higher is better)	$\frac{Cashflow\ from\ operations - Interest - Capex}{Debt}$
CFO/Net Debt (higher is better)	$\frac{Cashflow\ from\ operations - Depreciation - Interest}{Debt}$
DCF/Net Debt (higher is better)	$\frac{Cashflow\ from\ operations - Depreciation - Interest - Dividend}{Debt}$
Supplementary coverage ratio	
Adjusted ICR (higher better)	$\frac{Cashflow\ from\ operations - Capitalized\ maintenance\ expense}{Interest}$
Adjusted EBITDA/Interest (higher is better)	$\frac{EBITDA - Capitalized\ maintenance\ expense}{Interest}$

A.2 Compensating the cost of expected inflation on debt portion of the RAB

117. I examine the impact of compensating the cost of expected inflation on the debt portion of the RAB on Vector's cashflow by adjusting the expected inflation in the IMs[24]. I reduce the expected inflation by applying 42%[25] weight on 0% inflation and applying the remaining 58% weight on the originally adopted expected inflation numbers. The following tables show the inflation adjustments and the impact of the adjustment on Vector's financeability ratios.

Table 5-3: Adjustment to Forecast changes in CPI used for revaluations[26]

	2020/21	2021/22	2022/23	2023/24	2024/25
Original	1.90%	2.00%	2.00%	2.00%	2.00%
Adjusted	1.10%	1.16%	1.16%	1.16%	1.16%

[redacted]

118. The tables demonstrate that compensating for the debt related cost of expected inflation as it occurs significantly improves the S&P financial metrics. [redacted]

24 NZCC Electricity Distribution Business Price-Quality Regulation 1 April 2020 DPP Reset Financial model - Final determination, 27 November 2019

25 42% is the leverage applied in the IMs.

26 Row 7 in "Inputs" worksheet in NZCC Electricity Distribution Business Price-Quality Regulation 1 April 2020 DPP Reset Financial model - Final determination, 27 November 2019

Appendix B Equivalence of nominal and CPI indexed debt portfolio cashflows

119. Table 5-4 shows the underlying principal of two stylised debt portfolios while Table 5-5 contains their corresponding cash flows.

120. The left side of each table shows a CPI indexed portfolio that begins with the issue of a single 5-year CPI indexed bond (A1) in year 0 with 3% CPI indexed coupon and $100 principal that grows with 2% inflation in each year. In each subsequent year, the portfolio issues one additional 5-year CPI indexed bond with a higher underlying principal that also grows with 2% inflation, meaning that bond B1 issued in year 1 has $102 initial principal and bond C1 issued in year 2 has $104.04 initial principal. As each bond matures starting from year 5 onwards, the portfolio rolls over the principal into a new 5-year CPI indexed bond. This is highlighted yellow for bond A1, which matures in year 5 and the underlying principle of $110.4 is rolled over into newly issued bond F1.

121. The right side of each table depicts a nominal portfolio with 5% nominal coupons. The underlying principal of each bond remains constant until maturity, but the bond issued in each year has a higher initial principal that is set to ensure that the total outstanding principal in the nominal portfolio is equal to that of the CPI indexed portfolio at any point in time.[27] For example, bond B2 is issued with an initial principal of $104.0 so that the total principal for the nominal portfolio in year 1 ($204.0) is equal to that of the CPI indexed portfolio in the same year. When bond A2 matures in year 5 (highlighted yellow), the principal is rolled over into bond F2, whose principal is set to ensure that the total outstanding principal for the nominal portfolio in year 5 ($552.0) is equal to that of the CPI indexed portfolio.

122. Table 5-5 shows the cash flows of each bond in the two debt portfolios. Although the cash flows for each bond differs across the two portfolios, their aggregate cash flows when summed across the entire portfolios are nevertheless equal in each year. Furthermore, the IRR of cash flows for both portfolios will both equal 5%, assuming that maturing bonds continue to be rolled over into new bond issues.

[27] This is equivalent to an assumption that if both portfolios were to recall all of their bonds at the same time, the underlying principal that must be repaid will always be the same across both portfolios.

Table 5-4: Underlying principal of stylised debt portfolios

	Bonds in CPI indexed portfolio												Bonds in nominal portfolio											
	A1	B1	C1	D1	E1	F1	G1	H1	I1	J1	K1	Sum	A2	B2	C2	D2	E2	F2	G2	H2	I2	J2	K2	Sum
0	100.0											100.0	100.0											100.0
1	102.0	102.0										204.0	100.0	104.0										204.0
2	104.0	104.0	104.0									312.1	100.0	104.0	108.1									312.1
3	106.1	106.1	106.1	106.1								424.5	100.0	104.0	108.1	112.4								424.5
4	108.2	108.2	108.2	108.2	108.2							541.2	100.0	104.0	108.1	112.4	116.7							541.2
5	110.4	110.4	110.4	110.4	110.4	110.4						552.0	100.0	104.0	108.1	112.4	116.7	110.8						552.0
6		112.6	112.6	112.6	112.6	112.6	112.6					563.1		104.0	108.1	112.4	116.7	110.8	115.0					563.1
7			114.9	114.9	114.9	114.9	114.9	114.9				574.3			108.1	112.4	116.7	110.8	115.0	119.4				574.3
8				117.2	117.2	117.2	117.2	117.2	117.2			585.8				112.4	116.7	110.8	115.0	119.4	123.9			585.8
9					119.5	119.5	119.5	119.5	119.5	119.5		597.5					116.7	110.8	115.0	119.4	123.9	128.4		597.5
10						121.9	121.9	121.9	121.9	121.9	121.9	609.5						110.8	115.0	119.4	123.9	128.4	122.8	609.5

Sum of underlying principal excludes bonds maturing in that year (highlighted yellow)

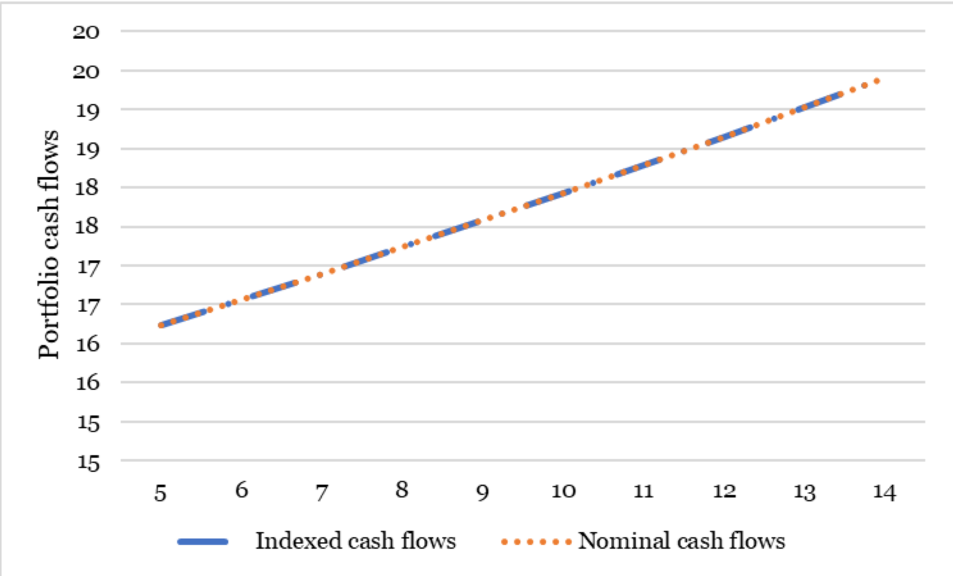
Table 5-5: Cash flows of stylised debt portfolios

	Bonds in CPI indexed portfolio												Bonds in nominal portfolio											
	A1	B1	C1	D1	E1	F1	G1	H1	I1	J1	K1	Sum	A2	B2	C2	D2	E2	F2	G2	H2	I2	J2	K2	Sum
0	-100											-100	-100											-100
1	3.0	-102										-99	5.0	-104										-99
2	3.1	3.1	-104									-98	5.0	5.2	-108									-98
3	3.1	3.1	3.1	-106								-97	5.0	5.2	5.4	-112								-97
4	3.2	3.2	3.2	3.2	-108							-96	5.0	5.2	5.4	5.6	-117							-96
5	114	3.2	3.2	3.2	3.2	-110						16	105	5.2	5.4	5.6	5.8	-111						16
6		116	3.3	3.3	3.3	3.3	-113					17		109	5.4	5.6	5.8	5.5	-115					17
7			118	3.4	3.4	3.4	3.4	-115				17			114	5.6	5.8	5.5	5.8	-119				17
8				121	3.4	3.4	3.4	3.4	-117			17				118	5.8	5.5	5.8	6.0	-124			17
9					123	3.5	3.5	3.5	3.5	-120		18					123	5.5	5.8	6.0	6.2	-128		18
10						125	3.6	3.6	3.6	3.6	-122	18						116	5.8	6.0	6.2	6.4	-123	18

Maturing bonds highlighted yellow; IRR is 5% for both portfolios, assuming that maturing bonds continue to be rolled over.

123. Figure 5-11 shows the cash flows for the two portfolios from years 5 to 14, retaining the same mechanism that maturing bonds are immediately rolled over into a newly issued bond in each portfolio. The newly issued bond in the CPI indexed portfolio retains the same principal as the maturing bond, while the new bond in the nominal portfolio has a higher principal that is set to ensure that the total outstanding principal across the portfolio is the same as that of the CPI indexed portfolio. It can be seen that the cash flows are identical across the two portfolios over time.

Figure 5-11: Cash flows for staggered portfolios of 5-year nominal and inflation-indexed bonds



Appendix C Method for identifying bonds and adjusting inflation-indexed yields

C.1 Identifying sample of bonds

124. The sample of inflation-indexed bonds were obtained using Bloomberg's SRCH function with the following filters (duplicate bonds consolidated):

- Maturity: On or after 1 January 2010;
- Security type: Inflation-Linked Note;
- Currency: NZD (AUD for the Australian sample); and
- Country of risk: New Zealand (Australia for the Australian sample).

125. Individual searches were then carried out to identify nominal bonds issued by each issuer of the inflation-indexed bonds identified above.

C.2 Adjusting inflation-indexed yields to nominal yields

126. I convert the yields of CPI indexed bonds into nominal terms using IMs inflation assumptions. This involves the following steps:

i. Use Bloomberg to obtain historical yields to maturity for each CPI indexed NZD bond;

ii. Generate **inflation-adjusted yields** by adding IMs inflation forecasts to the raw yields obtained in step i;[28]

iii. For each CPI indexed NZD bond, collect a sample of nominal bonds issued by the same issuer, then linearly interpolate the yields of those bonds to estimate a nominal yield curve for each issuer;[29] and

28 That is, I use inflation forecasts from the RBNZ for the first 2 or 3 years before assuming a glide path towards 2% inflation up to 5 years. Inflation in all subsequent years are assumed to remain at 2%. I round the residual maturity of each bond to the nearest whole number. For example, the inflation-indexed yield of a bond with 5.2 years residual maturity will be adjusted using 5-year inflation.

29 I use linear extrapolation whenever the inflation-linked bond has the longest maturity in the issuer's debt portfolio.

iv. For each CPI indexed bond, compare the inflation-adjusted yields obtained in step ii against the corresponding nominal yields at the target residual maturity based on the yield curves derived in step iii.

Appendix D Australian inflation-indexed bonds

127. The full set of charts for Australian inflation-indexed bonds are shown in Appendix D.1 for Australian corporate bonds and Appendix D.2 for Australian government bonds. I exclude charts with less than 1 year of data.

128. The charts do not include yield data when a bond has less than 6 months' residual maturity because the Bloomberg data behaves oddly when the bond is close to maturity. This is consistent with the practices adopted by the RBA and West Australian ERA, which estimate yield curves excluding bonds with <1 year and <2 years residual maturities respectively.[30] I note as well that indexed bonds use lagged CPI when inflating their underlying principals and coupons, meaning that their yields no longer approximate expected inflation once the bond is close to maturity. Instead, those yields reflect past inflation that has already occurred.

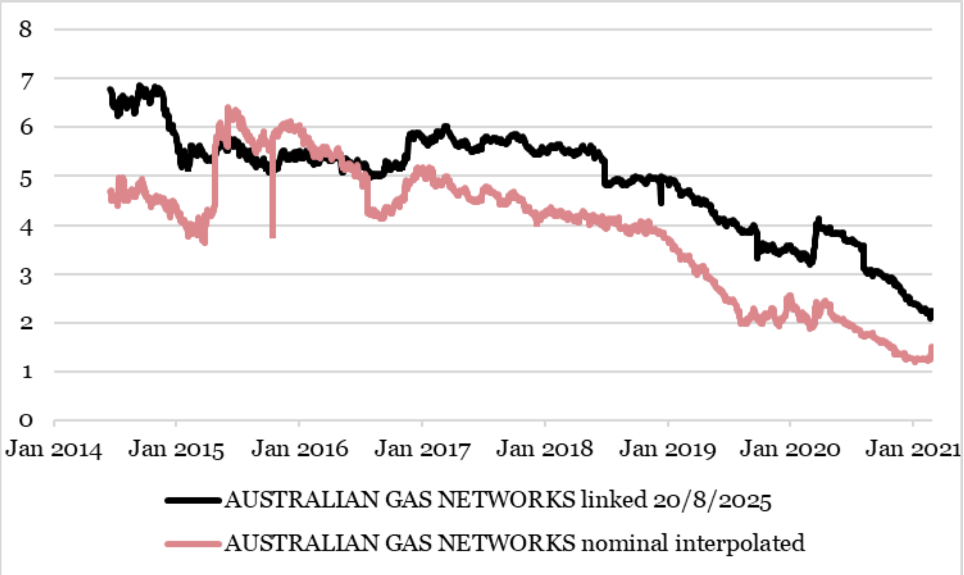
129. I note that several inflation-indexed bonds appear to have low data quality. For example, there are periodic spikes in the yields of the Praeco Pty Ltd bond that matured on 15 August 2020. Such observations are inconsistent with the behaviour that I would expect from reliable estimates. The charts for these bonds are shown in Appendix D.3 for completeness, but do not form part of the analysis in section 5.

130. Notwithstanding such data quality issues, the charts are consistent with the observations made in section 5.4, namely that the inflation-adjusted yields on inflation-indexed bonds tend to be higher than the interpolated nominal yields observed on bonds from the same issuer.

[30] See: RBA, New Measures of Australian Corporate Credit Spreads, Bulletin, December Quarter 2013, p. 17; ERA, Final Rate of Return Guidelines (2018), 18 December 2018, p. 24.

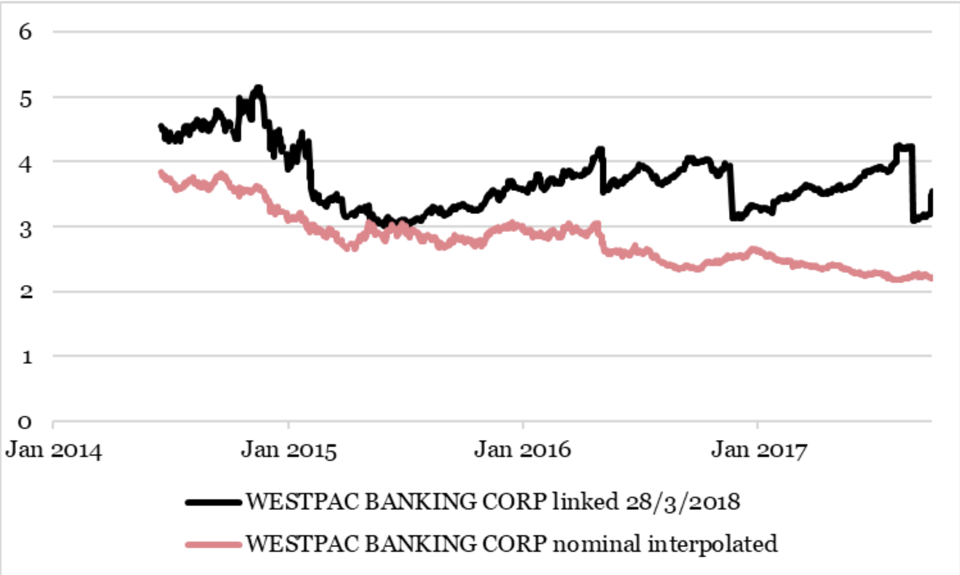
D.1 Australian corporate bonds

Figure 5-12: Australian Gas Networks inflation linked bond 20/8/2025



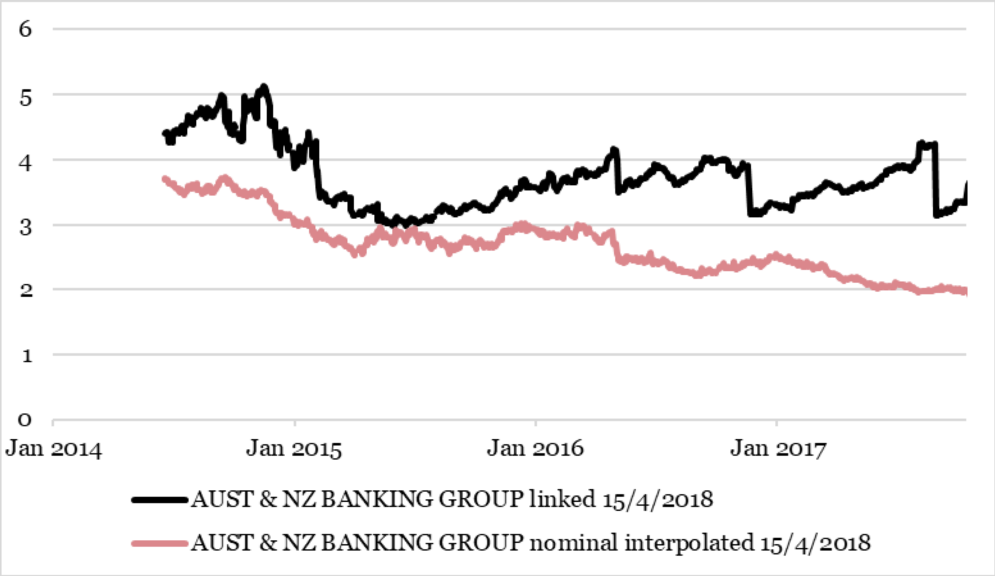
Source: Bloomberg, NZCC, RBA, CEG analysis

Figure 5-13: Westpac Banking Corp 28/3/2018



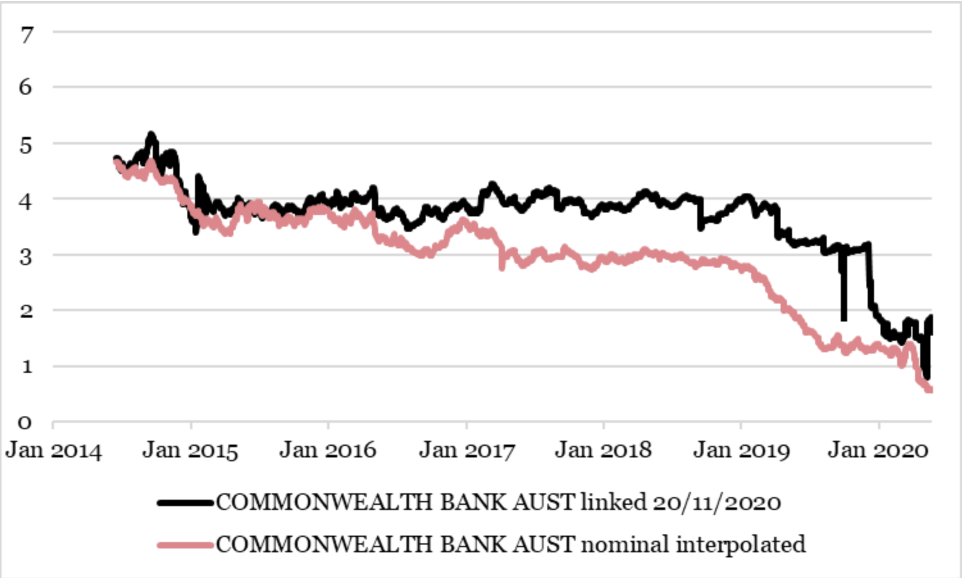
Source: Bloomberg, NZCC, RBA, CEG analysis

Figure 5-14: Australia & New Zealand Banking Group 15/4/2018



Source: Bloomberg, NZCC, RBA, CEG analysis

Figure 5-15: Commonwealth Bank Australia 20/11/2020

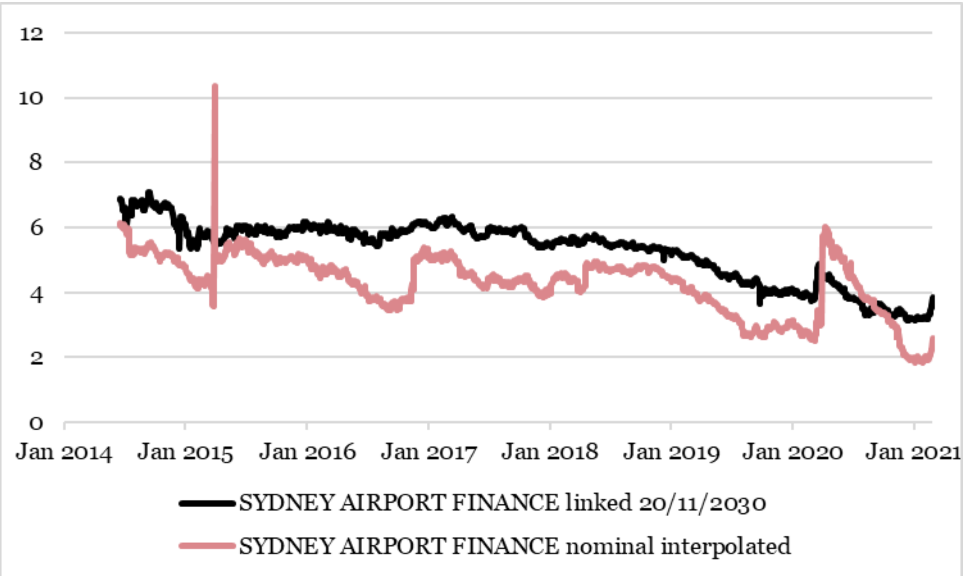


Source: Bloomberg, NZCC, RBA, CEG analysis

Figure 5-16: Sydney Airport Finance 20/11/2020

Source: Bloomberg, NZCC, RBA, CEG analysis

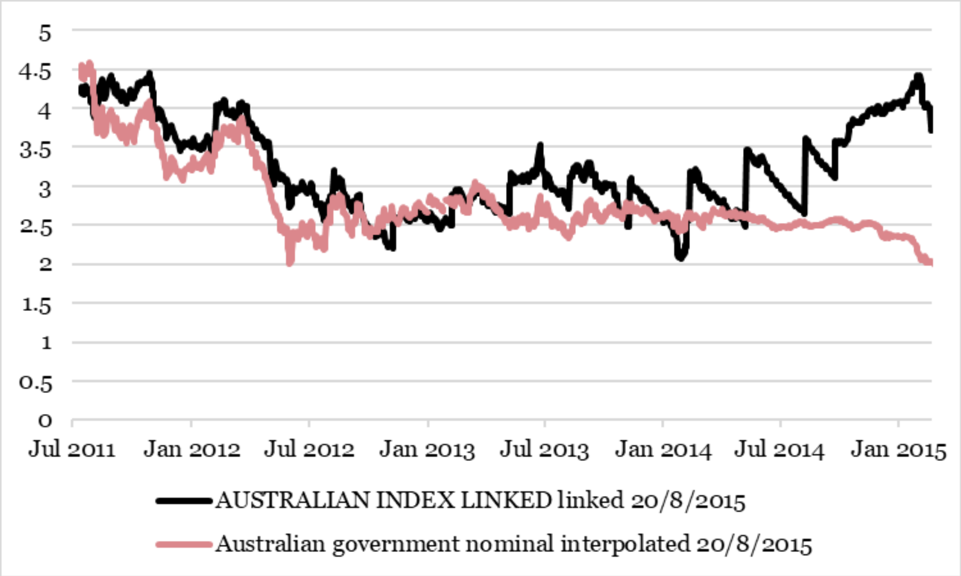
Figure 5-17: Sydney Airport Finance inflation linked bond 20/11/2030



*Source: Bloomberg, NZCC, RBA, CEG analysis; *The spike on 30 March 2015 and 31 March 2015 occurs because of missing data on a nominal bond expiring 11 October 2027.*

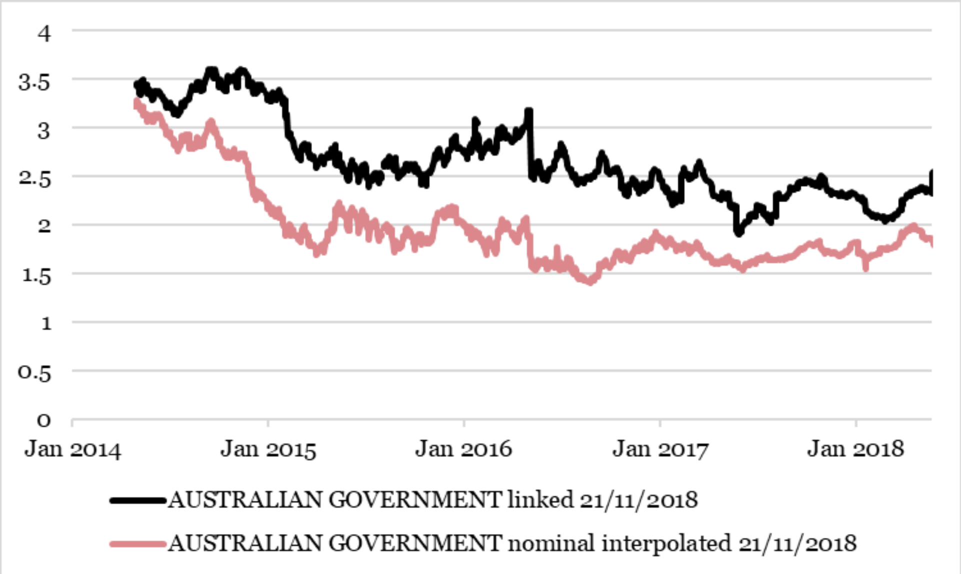
D.2 Australian government bonds

Figure 5-18: Australian Government 20/8/2015



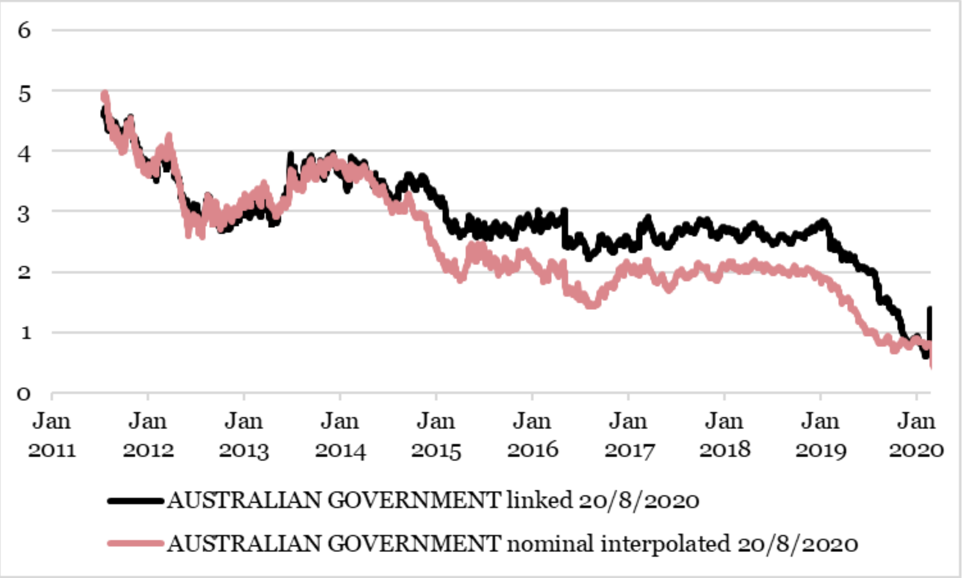
Source: Bloomberg, NZCC, RBA, CEG analysis

Figure 5-19: Australian Government 21/11/2018



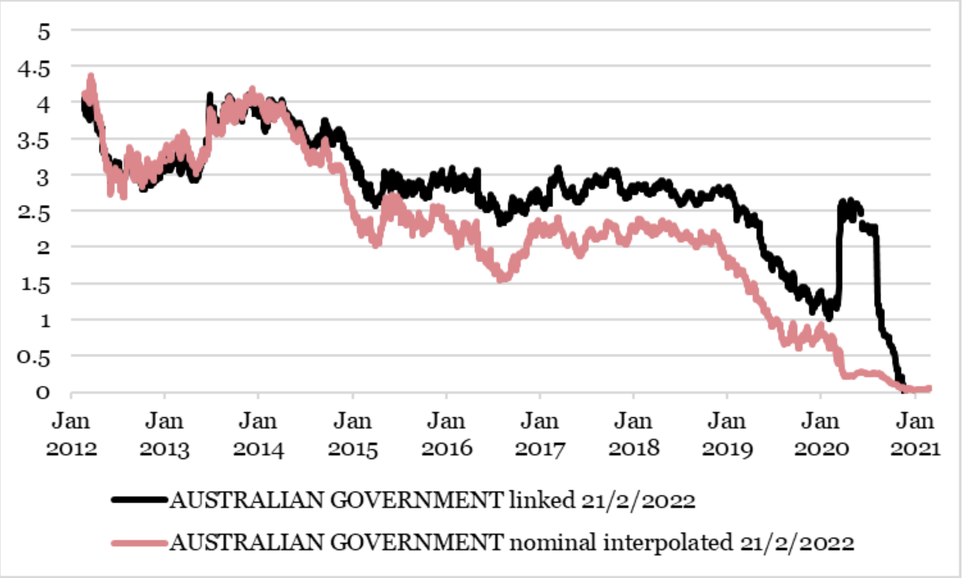
Source: Bloomberg, NZCC, RBA, CEG analysis

Figure 5-20: Australian Government 20/8/2020



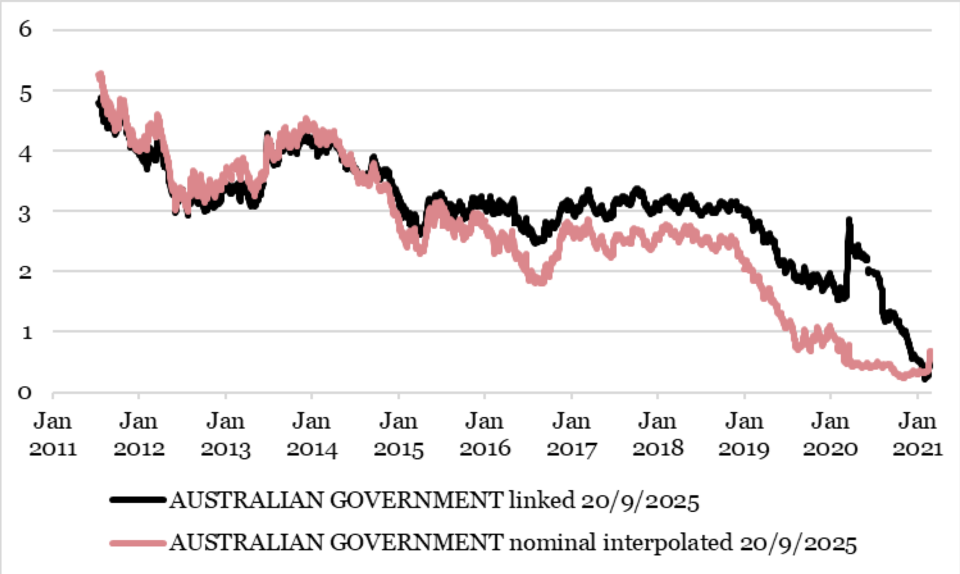
Source: Bloomberg, NZCC, RBA, CEG analysis

Figure 5-21: Australian Government 21/2/2022



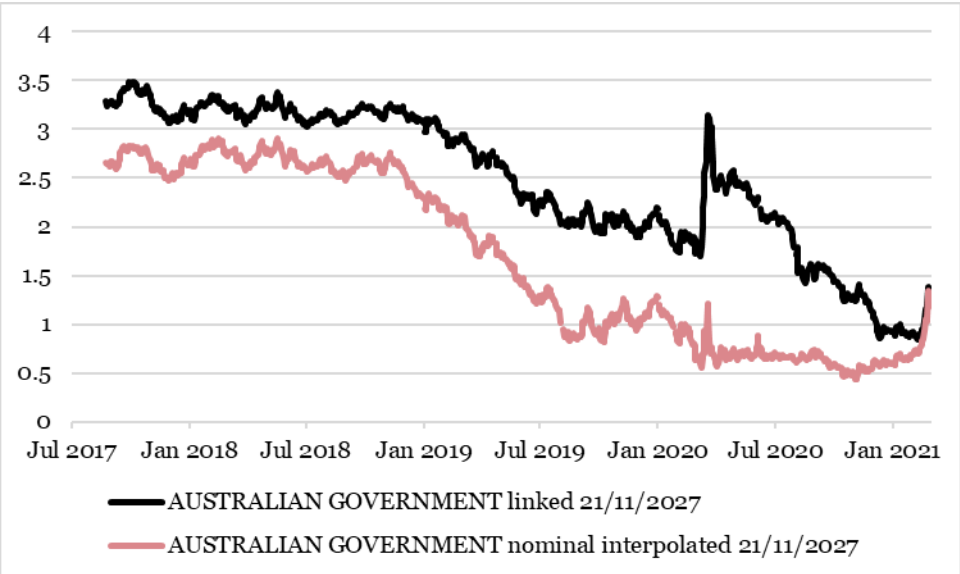
Source: Bloomberg, NZCC, RBA, CEG analysis

Figure 5-22: Australian government inflation linked bond 20/9/2025



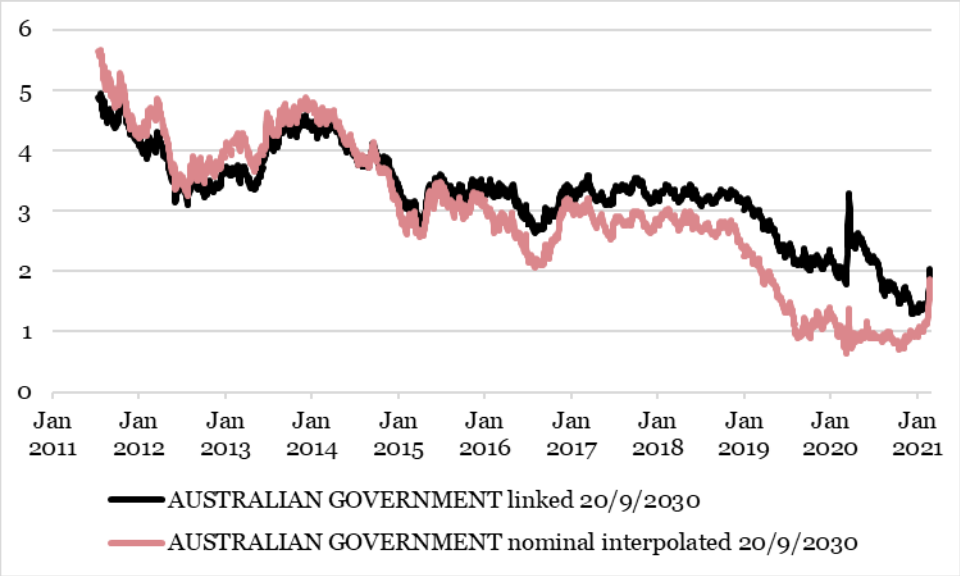
Source: Bloomberg, NZCC, RBA, CEG analysis

Figure 5-23: Australian Government 21/11/2027



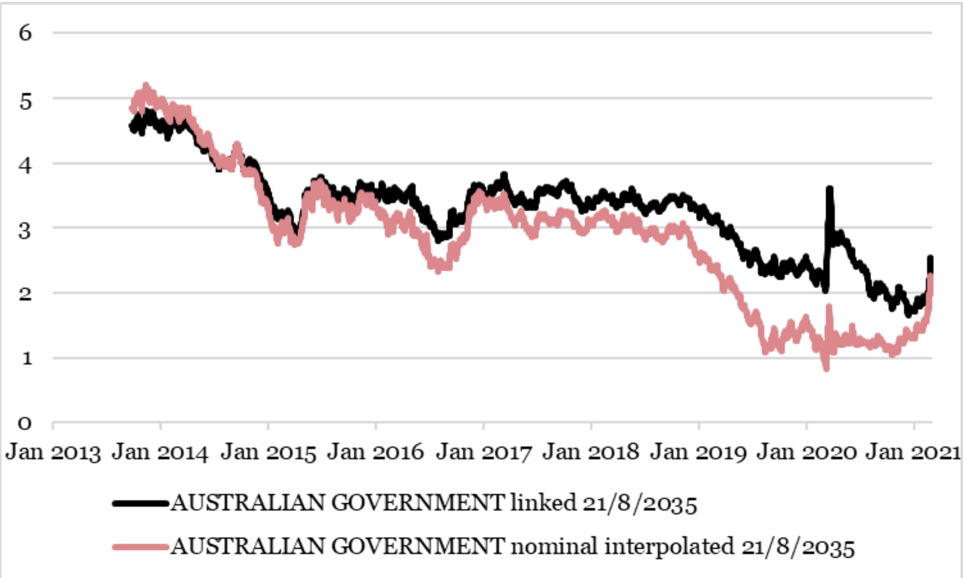
Source: Bloomberg, NZCC, RBA, CEG analysis

Figure 5-24: Australian government inflation linked bond 20/9/2030



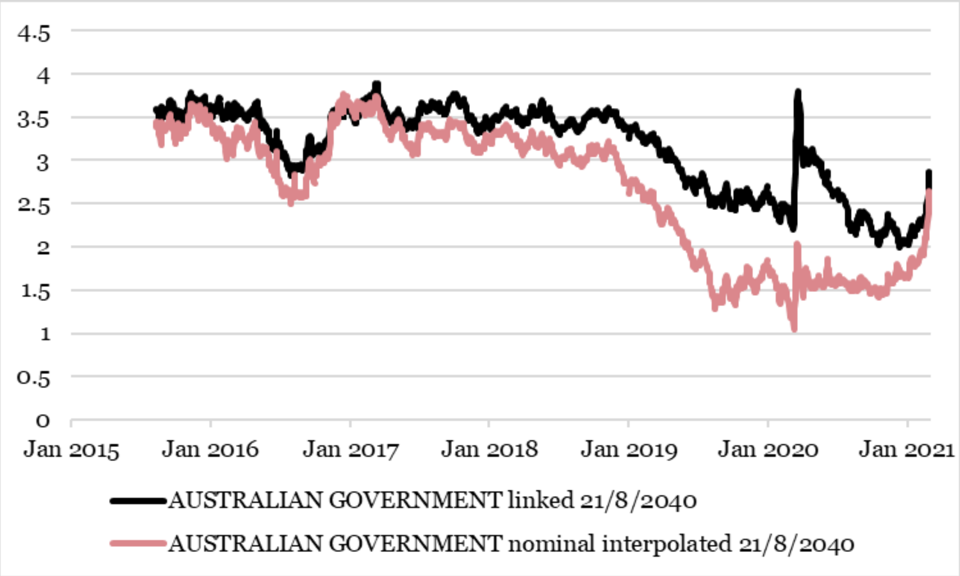
Source: Bloomberg, NZCC, RBA, CEG analysis

Figure 5-25: Australian Government 21/8/2035



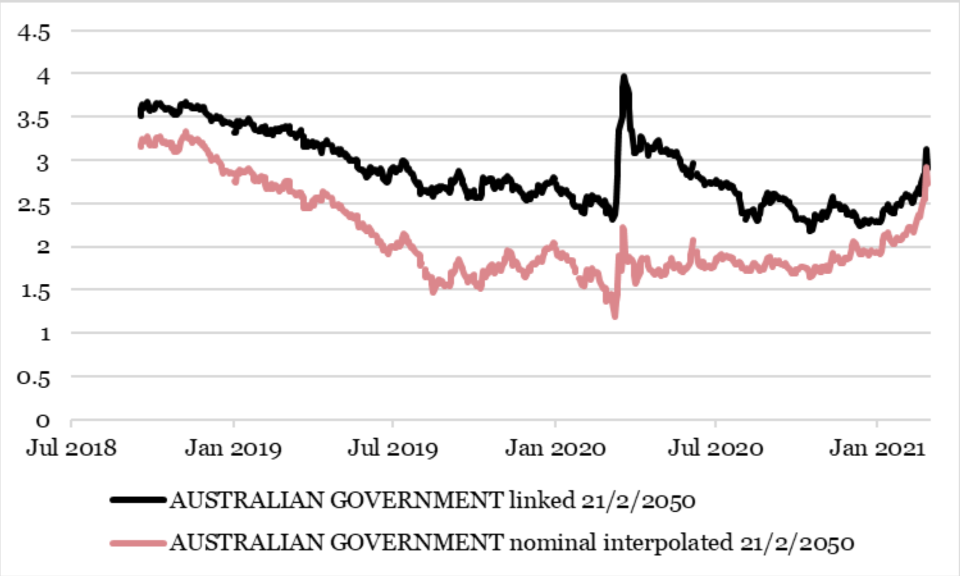
Source: Bloomberg, NZCC, RBA, CEG analysis

Figure 5-26: Australian Government 21/8/2040



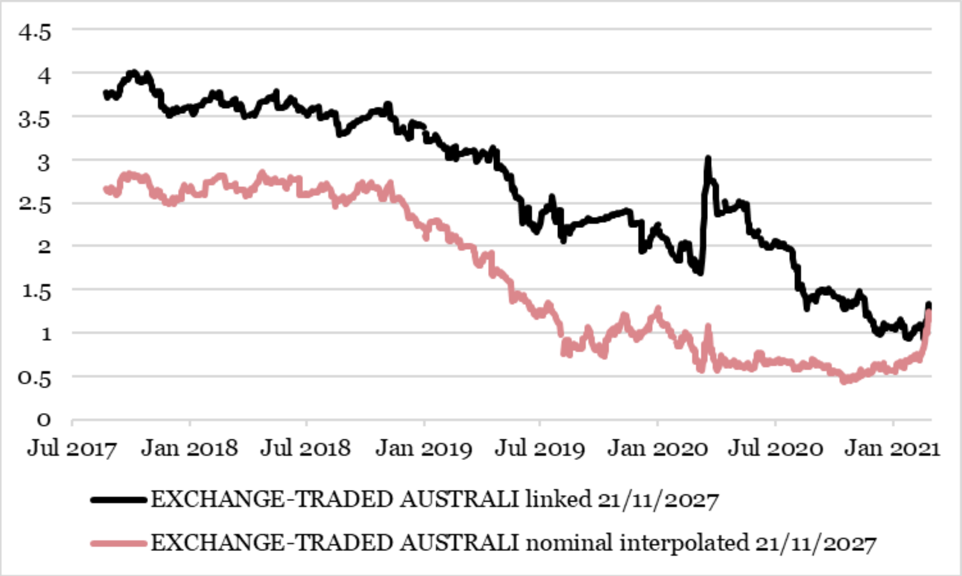
Source: Bloomberg, NZCC, RBA, CEG analysis

Figure 5-27: Australian Government 21/2/2050



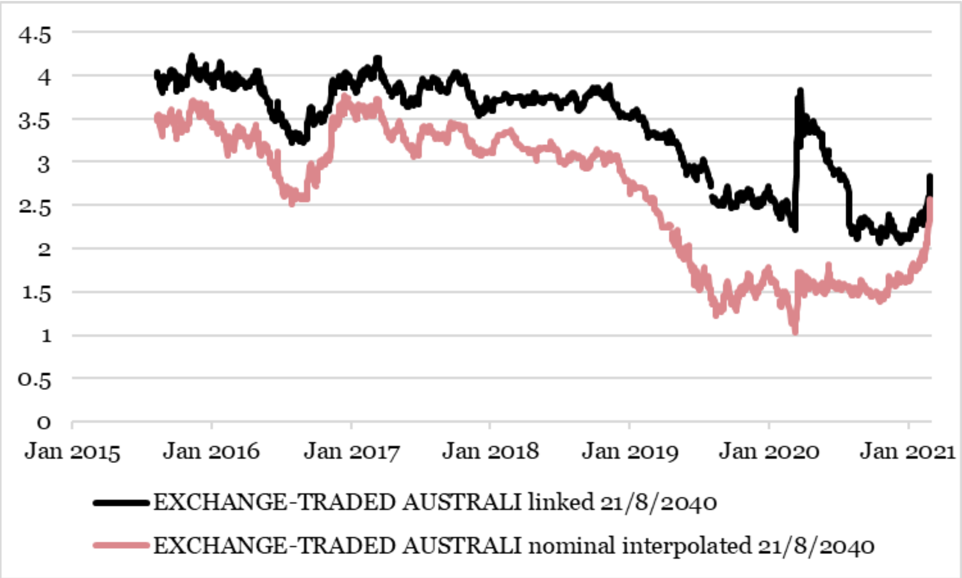
Source: Bloomberg, NZCC, RBA, CEG analysis

Figure 5-28: Australian Government 21/11/2027



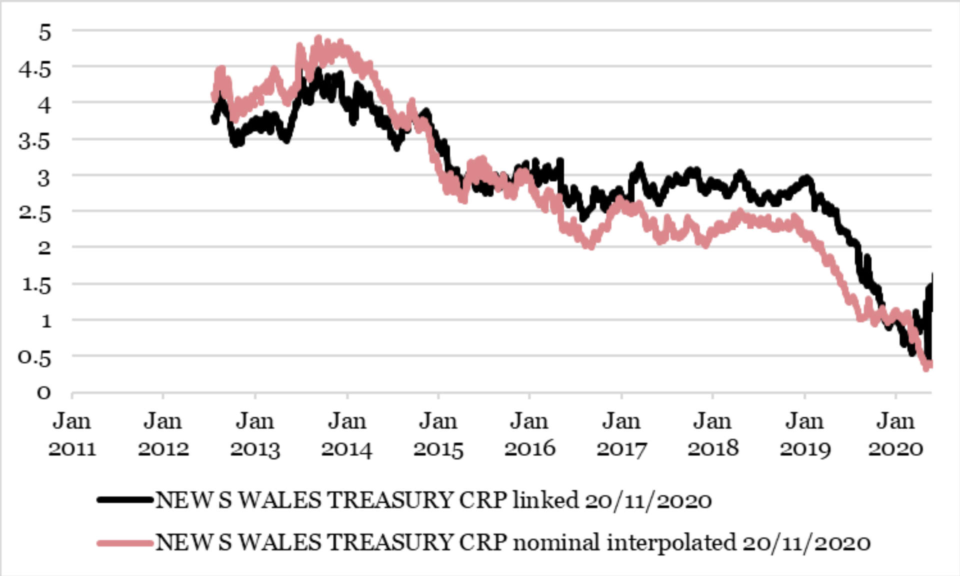
Source: Bloomberg, NZCC, RBA, CEG analysis

Figure 5-29: Australian Government 21/8/2040



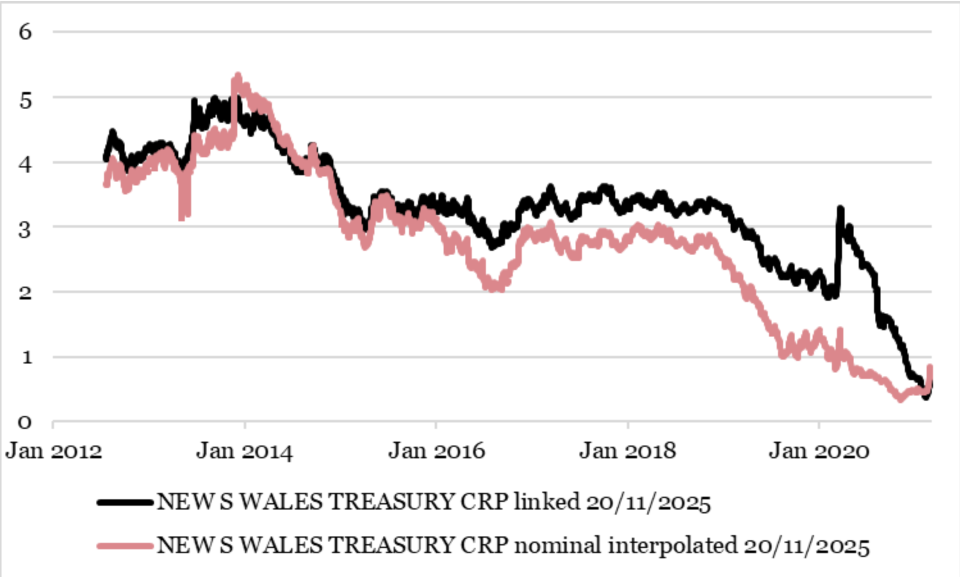
Source: Bloomberg, NZCC, RBA, CEG analysis

Figure 5-30: NSW Treasury 20/11/2020



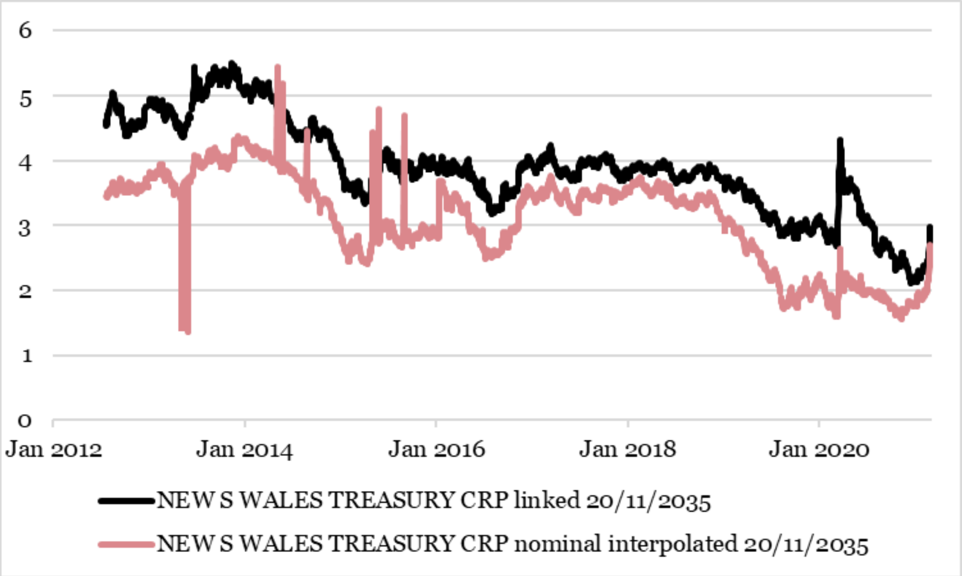
Source: Bloomberg, NZCC, RBA, CEG analysis

Figure 5-31: NSW Treasury 20/11/2025



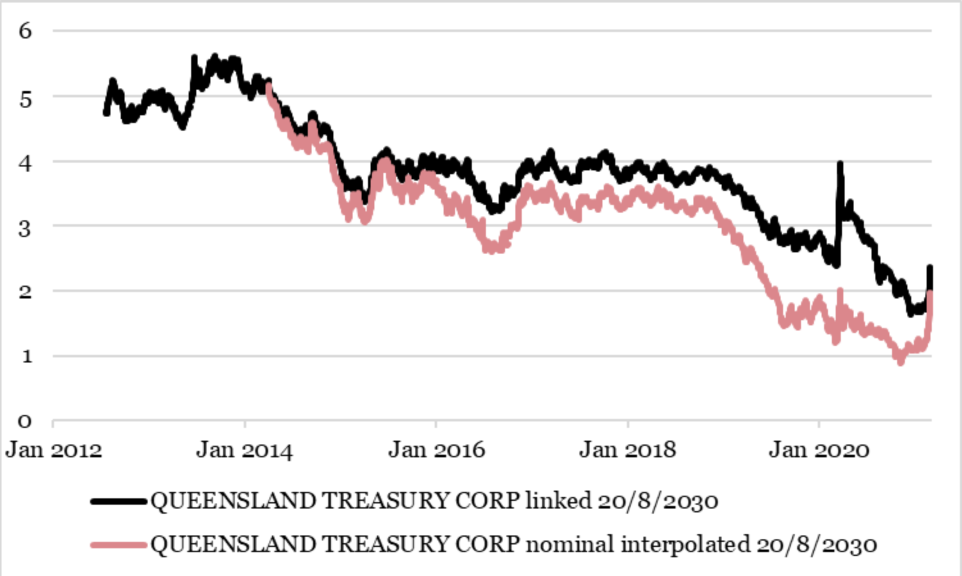
Source: Bloomberg, NZCC, RBA, CEG analysis

Figure 5-32: NSW Treasury 20/11/2035



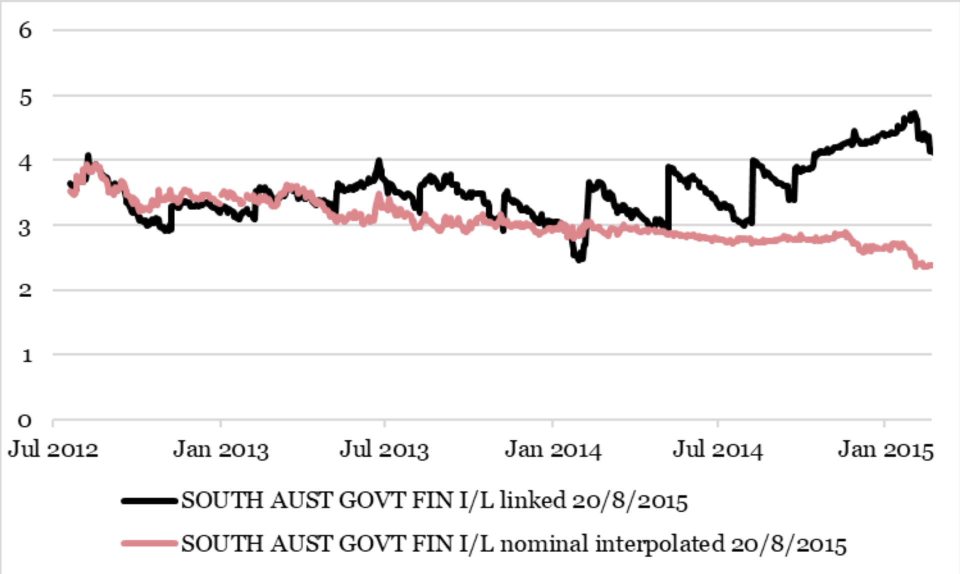
Source: Bloomberg, NZCC, RBA, CEG analysis

Figure 5-33: Queensland Treasury 20/8/2030



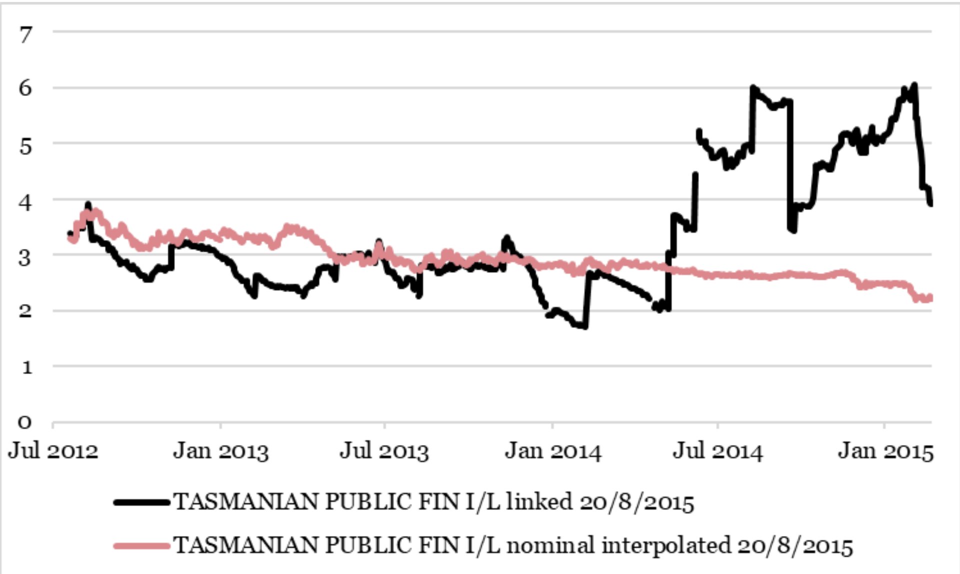
Source: Bloomberg, NZCC, RBA, CEG analysis

Figure 5-34: South Australian Government 20/8/2015



Source: Bloomberg, NZCC, RBA, CEG analysis

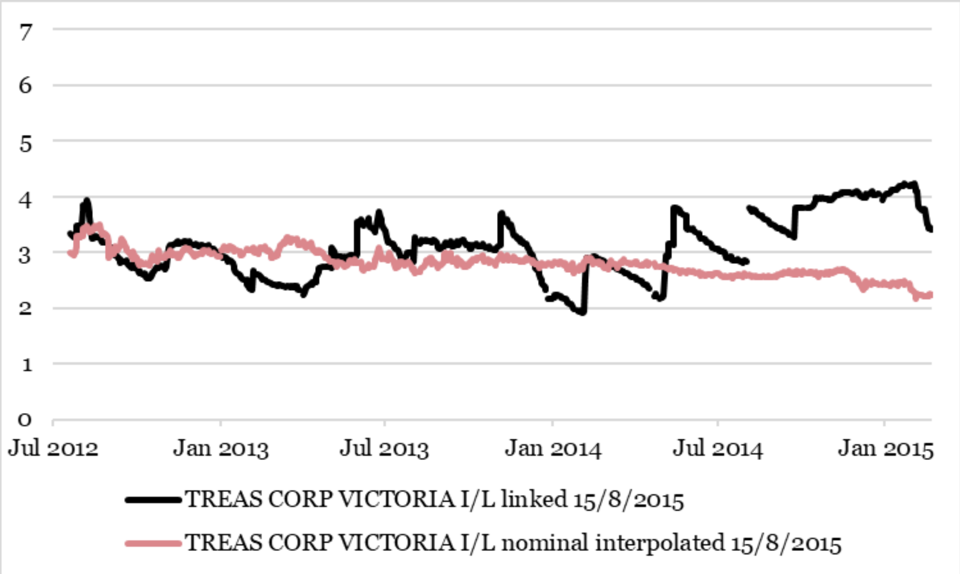
Figure 5-35: Tasmanian Public Finance 20/8/2015



Source: Bloomberg, NZCC, RBA, CEG analysis

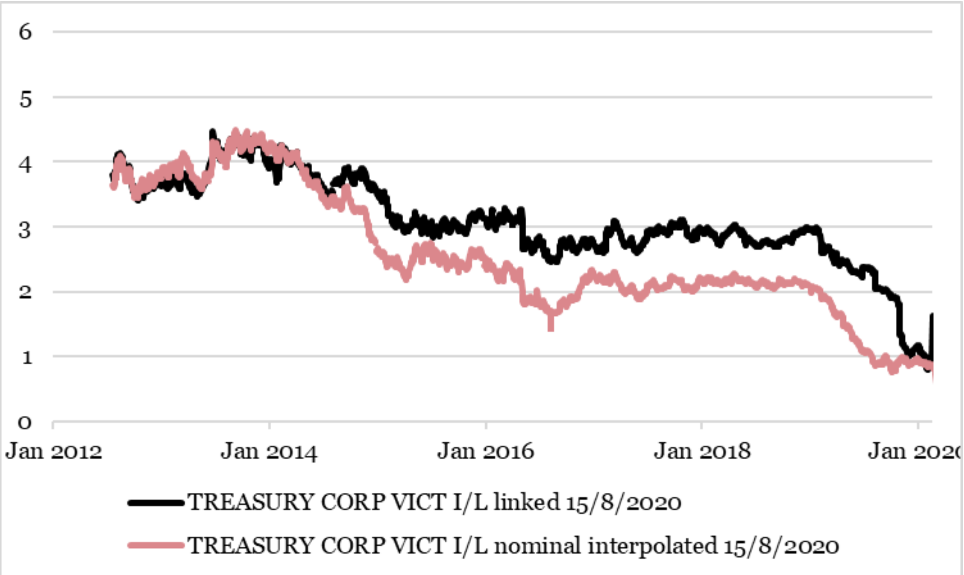
COMPETITION
ECONOMISTS
GROUP

Figure 5-36: Victoria Treasury 15/8/2015



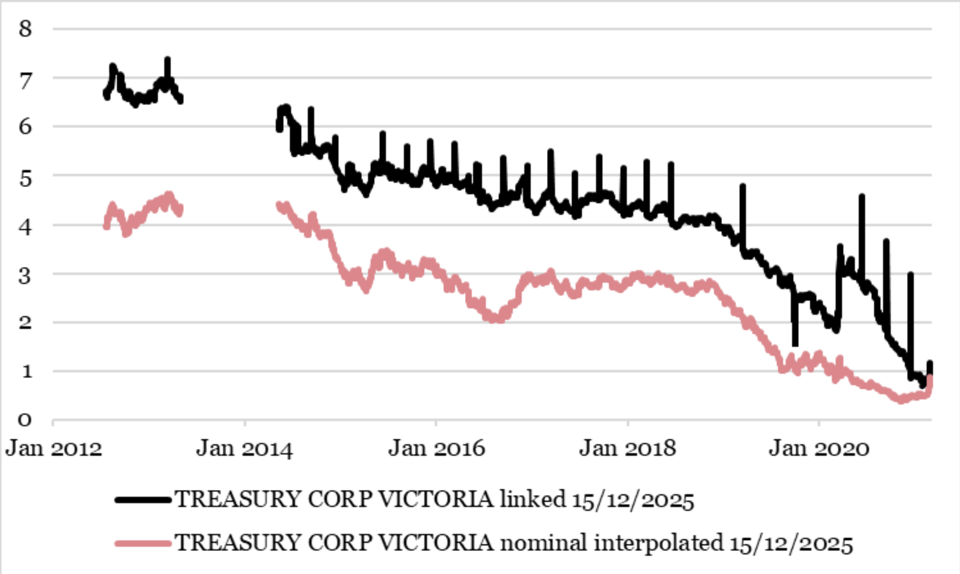
Source: Bloomberg, NZCC, RBA, CEG analysis

Figure 5-37: Victoria Treasury Corp 15/8/2020



Source: Bloomberg, NZCC, RBA, CEG analysis

Figure 5-38: Victoria Treasury Corp 15/12/2025

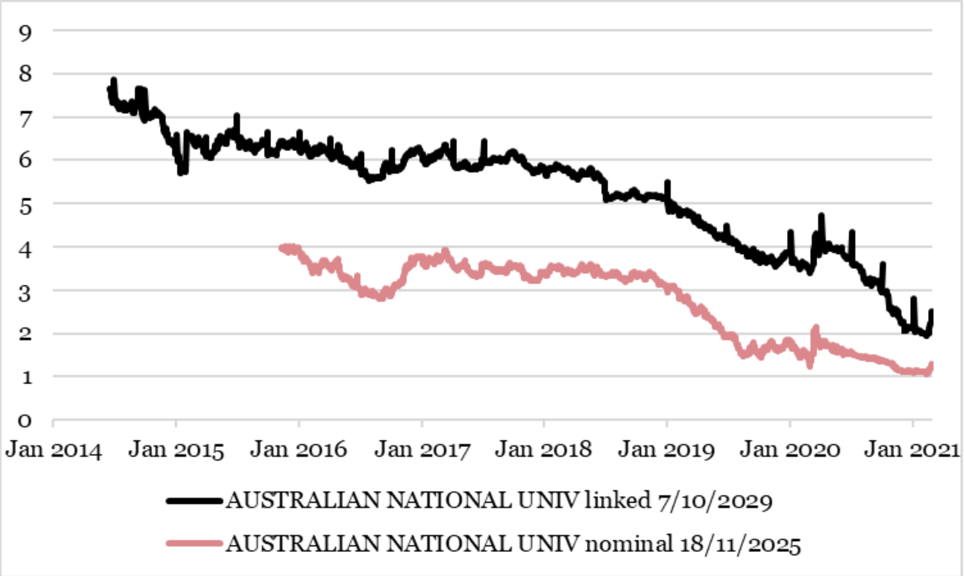


Source: Bloomberg, NZCC, RBA, CEG analysis

Figure 5-39: Victoria Treasury Corp 15/12/2030

Source: Bloomberg, NZCC, RBA, CEG analysis

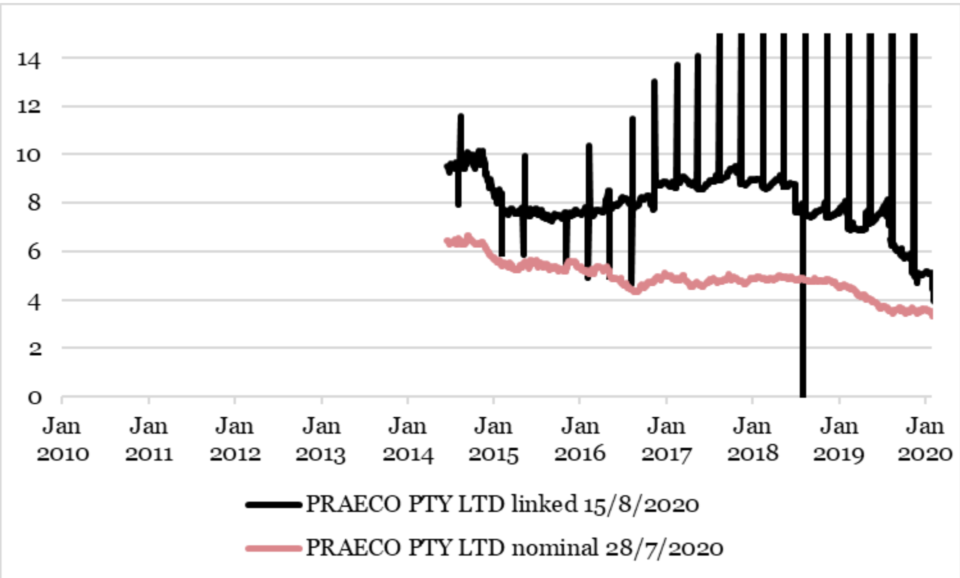
Figure 5-40: Australian National University 7/10/2029



Source: Bloomberg, NZCC, RBA, CEG analysis; The search only found one nominal bond maturing 18/11/2025; Bloomberg's SRCH function classifies this as a corporate bond, but I include it as a government bond since Australian National University was formed through a Parliamentary Act.

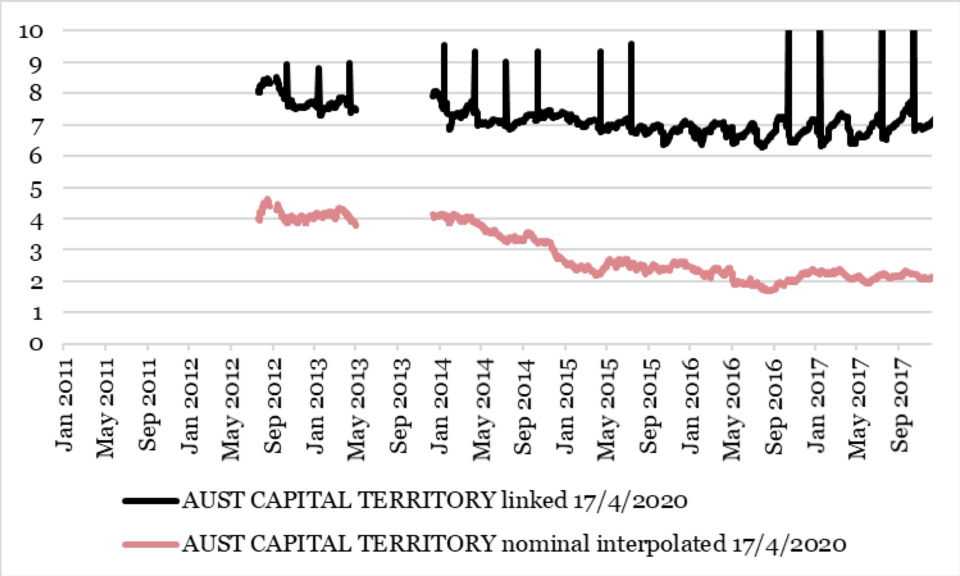
D.3 Excluded bonds

Figure 5-41: Praeco Pty Ltd 15/8/2020



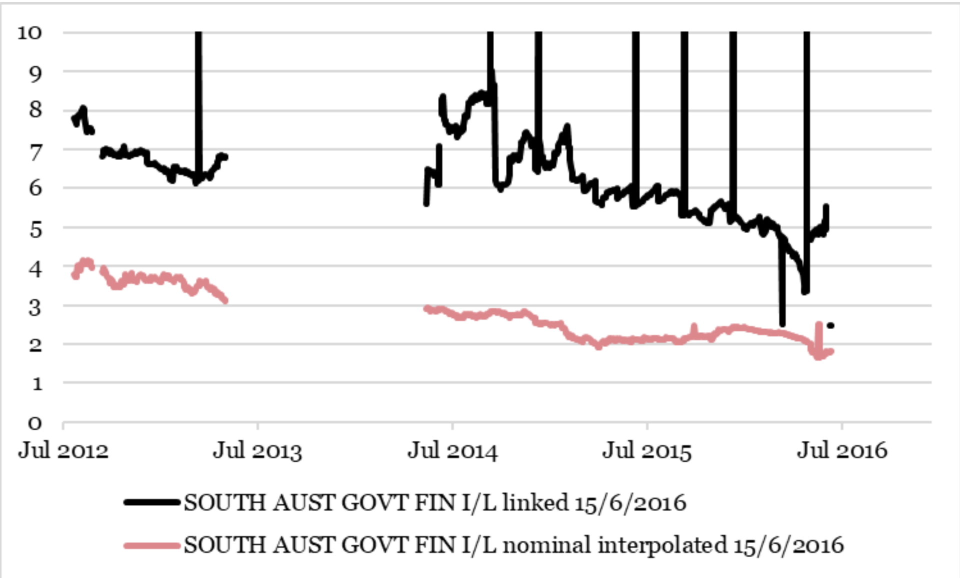
Source: Bloomberg, NZCC, RBA, CEG analysis; Large spikes in yields on the inflation-linked bond originate from Bloomberg's raw data; The search only identified one nominal bond maturing 28/7/2020

Figure 5-42: Australian Capital Territory 17/4/2020



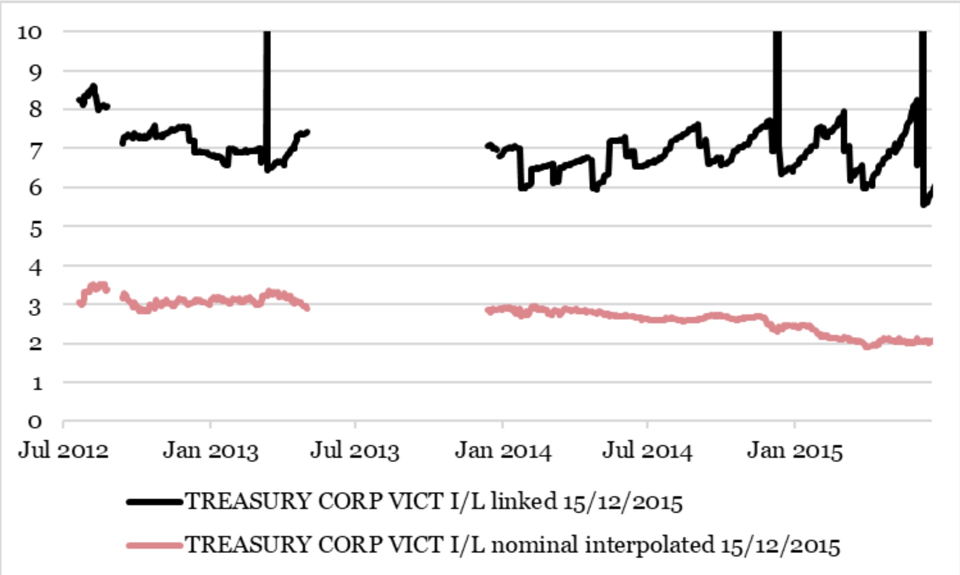
Source: Bloomberg, NZCC, RBA, CEG analysis; interpolated nominal yields only extend to June 2018

Figure 5-43: South Australian Government 15/6/2016



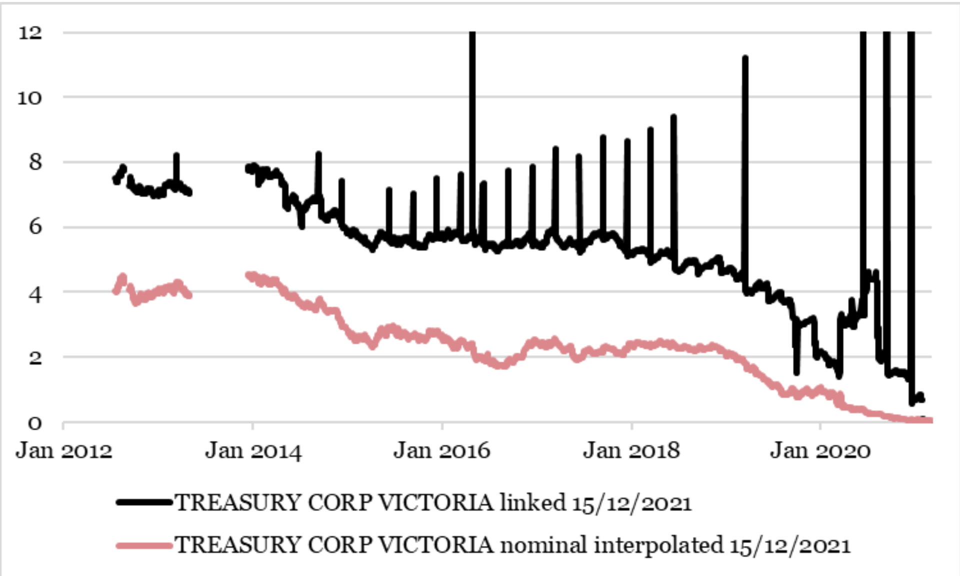
Source: Bloomberg, NZCC, RBA, CEG analysis

Figure 5-44: Victoria Treasury 15/12/2015



Source: Bloomberg, NZCC, RBA, CEG analysis

Figure 5-45: Victoria Treasury Corp 15/12/2021



Source: Bloomberg, NZCC, RBA, CEG analysis; Large spikes in yields on the inflation-linked bond originate from Bloomberg's raw data