



TE TAI ŌHANGA  
THE TREASURY

# Risk-Free Discount Rates and CPI inflation review

Assumptions for Accounting Valuations

29 June 2021

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# Table of Contents

Executive Summary ..... 1

Introduction..... 2

Short- to medium-term risk-free discount rates ..... 5

Short to medium-term inflation ..... 13

Appendix A Summary of methodology ..... 20

Appendix B CPI forecasts at 31 December 2020 ..... 22



# Executive Summary

## Purpose

The purpose of this paper is to document the review of the short to medium term assumptions for the 2020/21 year end and identify whether any adjustments should be made to the methodology adopted to determine the risk-free discount rates and Consumer Price Index (CPI) inflation assumptions for use in certain accounting valuations that are reported to the Crown for consolidation in the Financial Statements of the Government.

The review is a limited scope review of the methodology. Consequently the review focuses on whether there is sufficient evidence that the methodology should be adjusted due to the expected impacts of COVID-19 on the inputs and economy at 30 June 2021. Any adjustments and for how long those should apply will be documented.

## Summary of recommendations

While Covid-19 continues to have a significant impact on the market and the economic outlook, we have not found any reason to adjust the methodology or make any adjustments to risk-free rates sooner than the three-yearly review. There is also no indication that the approach to setting inflation should change.

For further detail on each step of the methodology framework, see the *Methodology for Risk-free Discount Rates and CPI Assumptions for Accounting and Valuation Purposes – July 2019*. A summary of the steps and key parameters are also shown in Appendix A - Summary of methodology.

# Introduction

## Purpose and use of this report

The purpose of this paper is to document the review of the short to medium term assumptions for the 2020/21 year end and identify whether any adjustments should be made to the methodology adopted to determine the risk-free discount rates and Consumer Price Index (CPI) inflation assumptions for use in certain accounting valuations that are reported to the Crown for consolidation purposes. A similar review was conducted in July 2020 to consider the economic shock of Covid-19 and the response of the Reserve Bank on rates at 30 June 2020. This paper is an update to the July 2020 paper.

This review is limited in scope and only considers the short to medium term assumptions adopted in determining the:

- short to medium-term risk-free discount rates
- short to medium-term CPI inflation.

Long-term assumptions and the bridging assumption are not considered in this paper. The previous in-depth review of the methodology was performed in May 2019 and involved a consultation process with feedback from a selected group of stakeholders. The next in-depth review of the methodology is expected to be performed in 2022.

## Context

This report should be read in conjunction with the report *Methodology for Risk-free Discount Rates and CPI Assumptions for Accounting and Valuation Purposes – July 2019* (2019 methodology review), dated 21 May 2019 and the paper *Risk-free Discount Rates and CPI inflation review* (July 2020 review), dated 6 July 2020.

The 2019 methodology review noted that there were circumstances which may lead to a need to review the methodology before three years. Despite the review conducted in July 2020, we believe that due to the on-going impacts of Covid-19, another review is required, specifically for rates and assumptions at 30 June 2021.

## Background

### Novel coronavirus (Covid-19)

The World Health Organisation declared the novel coronavirus (Covid-19) a pandemic in March 2020. This global pandemic has had a significant negative impact on the New Zealand economy, with the country entering varying degrees of lockdown multiple times. Although New Zealand has been largely successful with the elimination strategy and Covid-19 vaccines have started rolling out, the on-going impacts of Covid-19 cannot be ignored as countries around the globe continue to experience waves of resurgence and borders remain closed.

The Government has implemented a range of initiatives in response to Covid-19, to assist and support economic activity and with the aim of lowering borrowing costs to households and businesses. These initiatives include:

- wage subsidy
- Covid-19 leave support scheme
- small business cashflow loan, and
- business finance guarantee scheme loans.

These initiatives, costing roughly \$30 billion<sup>1</sup>, have supported economic activities throughout the majority of the 2020 calendar year and masked the full economic impacts of Covid-19. As at May 2021, most of these initiatives have either terminated or the uptake has significantly reduced.

In response to the Covid-19 pandemic, the Reserve Bank of New Zealand (RBNZ) announced the following changes to monetary policy:

- the Official Cash Rate (OCR) would be lowered from 1% to 0.25% in March 2020 and would remain at this level for at least the next 12 months<sup>2</sup>
- a Large Scale Asset Purchases (LSAP) programme in which RBNZ would buy-back up to \$100 billion of New Zealand Government Bonds, Local Government Funding Agency (LGFA) Bonds and New Zealand Government Inflation-Indexed Bonds in the secondary market by June 2022<sup>3</sup>.

During the latest meeting on 14 April 2021<sup>4</sup>, the Monetary Policy Committee reached a consensus to:

- hold the OCR at 0.25%
- maintain the existing LSAP programme of a maximum of \$100 billion by June 2022, and
- maintain the existing Funding for Lending Programme conditions.

As at April 2021, RBNZ, through the LSAP programme, has bought back \$48.1 billion of New Zealand Nominal Government Bonds, \$2.2 billion of New Zealand Government Inflation-Indexed Bonds and \$1.8 billion of New Zealand Local Government Funding Agency Bonds.

As a result of the various initiatives from the Government and monetary policy from RBNZ, interest rates dropped significantly during the 2020 calendar year, even further than the reducing trend observed in the previous few years, and have only recently started to recover in the first quarter of the 2021 calendar year.

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<sup>1</sup> <https://www.treasury.govt.nz/information-and-services/new-zealand-economy/covid-19-economic-response/asures>

<sup>2</sup> <https://www.rbnz.govt.nz/news/2020/03/ocr-reduced-to-025-percent-for-next-12-months>

<sup>3</sup> <https://www.rbnz.govt.nz/news/2020/08/further-easing-in-monetary-policy-delivered>

<sup>4</sup> <https://www.rbnz.govt.nz/news/2021/04/monetary-stimulus-continued>

## Risk-Free Discount Rates and CPI inflation

A number of government reporting entities use discounted cash flow models to value various assets and liabilities to be reported in general purpose financial statements. These valuations are typically attempting to measure obligations or rights incurred on or before balance date, where the settlement of those obligations or receipt of payments will occur sometime after balance date.

To ensure consistency and efficiency across accounting valuations reported in the Financial Statements of the Government, the Treasury produce a central table of risk-free discount rates and CPI inflation assumptions that must be used for reporting to the Crown for consolidation purposes. Specifically, these assumptions must be used for:

- valuing insurance claims liabilities under PBE IFRS 4 *Insurance Contracts*
- valuing employee benefits such as pension obligations, long service leave and retiring leave under PBE IPSAS 39 *Employee Benefits*
- building a fair value discount rate for valuing student loans.

For valuing some assets, the standards require risk-adjusted discount rates and in practice these are typically built up from risk-free discount rates with adjustments for risk. Therefore, the main objective of the 2019 methodology is to determine a suitable risk-free yield curve for discounting cash flows of long durations in accordance with the relevant accounting standards. One of the challenges is that the risk-free discount rates cannot be directly observed and so are usually proxied by the return on a very safe asset. When selecting the risk-free discount rate, the first step is to identify a suitable observable proxy and then to determine if any adjustments to that proxy are required.

In the July 2020 review, we implemented one minor technical change to fitting the short-term discount rates; to move from using OCR as the starting point for the nominal yield curve to using the short-term Treasury Bank bill rates (T-bills). This allows a much more realistic curve to be fit in the first few months when the OCR is different to the T-bill rates.

The purpose of this paper is to identify whether further adjustments, relating to short to medium term assumptions, should be made to the 2019 methodology as a result of Covid-19 and the Reserve Bank's LSAP programme.



# Short- to medium-term risk-free discount rates

Short to medium term assumptions for risk-free discount rates relate to the period in which market yields are available in New Zealand to proxy risk-free nominal discount rates. This is currently 20 years, through to 2041. After this, the bridging and long-term assumptions apply.

The current methodology uses Treasury bills (T-bills) and nominal Government bonds to determine risk-free discount rates through to the end of the nominal Government bond yield curve.

We recommend the current methodology is maintained, as the short to medium-term assumption are derived from market data, which can be observed from an open, active and orderly market.

## Nominal risk-free discount rates for the first year

The 2019 methodology review paper stated:

*Treasury bills are liquid and so Treasury bill data can be used to determine risk-free discount rates for the first six months without any adjustment. At present there is no expectation that this will change and therefore we have not considered in this paper any impacts of possible (but unlikely) future liquidity issues for Treasury bills.*

*The overnight cash rate and Treasury bill rates for 1, 2, 3 and 6 months are readily available. These are used for curve fitting, with the Treasury bill rates weighted by market value.*

In March 2020, RBNZ lowered the Official Cash Rate (OCR) from 1% pa to 0.25% pa and indicated the OCR would remain at this level for at least the next 12 months. Subsequently, the methodology was changed to using the T-bill rates as the starting point, due to the OCR no longer being very close to the Treasury bill rates which made it difficult to fit a sensible curve at short durations.

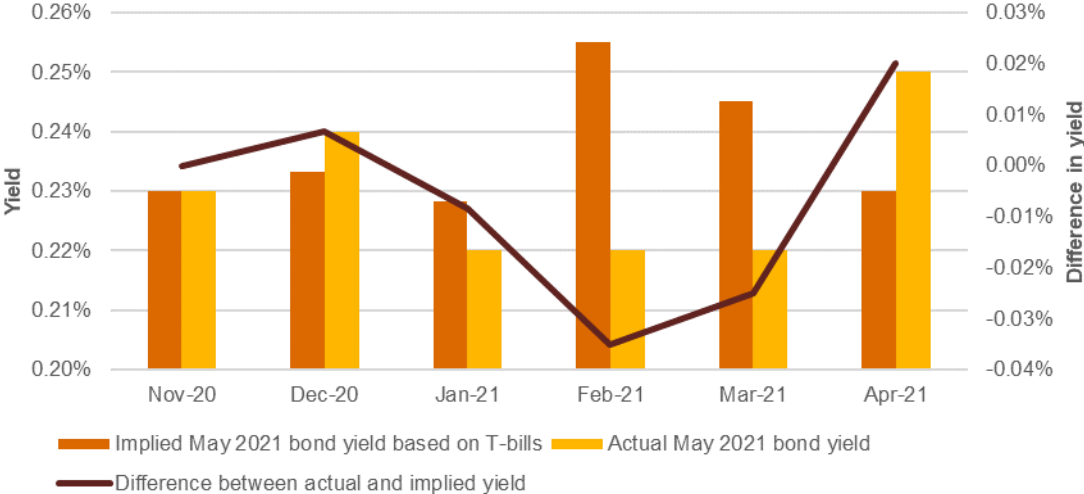
As at 30 April 2021, the OCR remained at 0.25% pa. Therefore, this change in methodology remains appropriate.

## T-bill rates and May 2021 Government bond yield

The May 2021 nominal Government bond is reaching its maturity date. It is therefore possible to compare the yield on the May 2021 Government bond in the months prior to maturity against the T-bill rates.

The following chart compares the May 2021 Government bond yield against the expected May 2021 Government bond yield using a weighted average of the 1-month, 2-month, 3-month and 6-month T-bill rates, with the weighting determined by the time remaining to the May 2021 bond maturity at each date.

**Figure 1: Comparison of T-bill rates and May 2021 Government bond yield**



Although the actual May 2021 Government bond yields are not an exact match against the implied yield based on T-bill rates, the absolute differences are relatively small (less than 0.05% pa). This further supports the current methodology of using T-bills and nominal Government bonds to determine risk-free discount rates through to the end of the nominal Government bond yield curve.

**Nominal risk-free rates in the short to medium-term**

The 2019 methodology review, which included an extensive review of international literature and discussions, indicated a number of different sources for risk-free discount rates, including Government bond rates, bank SWAP rates and corporate bond rates (with or without adjustments).

The relevant accounting standards infer the appropriate starting point is Government bonds, unless there is not a deep market in Government bonds, or the market in Government bonds does not reflect the time value of money.

Aspects which are indicative of a market which is deep, liquid and transparent are:

- high trading volumes and turnovers – note the converse does not necessarily imply the market is not deep, liquid and transparent, as an asset may be easily traded even if it is not frequently traded
- low bid-ask spread
- existence of appropriate supervision which ensures that large transactions will only affect prices according to the natural trends of the market, and not because of any spurious influence
- the way in which market prices are collected which gives reassurance that the influence of large transactions or unusual trades is likely to be immaterial.

Similarly, the IPSASB in their Conceptual Framework, published 2014, describes open, active and orderly markets as having the following characteristics:

- there are no barriers that prevent an entity from transacting in the market

- they are active so there is sufficient frequency and volume of transactions to provide price information
- they are orderly, with many well-informed buyers and sellers acting without compulsion, so there is assurance of “fairness” in determining current prices-including that prices do not represent distress sales.

An orderly market is one that is run in a reliable, secure, accurate and efficient manner. Such markets deal in assets that are identical and therefore mutually interchangeable, such as commodities, currencies and securities where prices are publicly available. In practice few, if any, markets fully exhibit all of these characteristics, but some may approach an orderly market as described.

## Amount on issue and turnover

The amount of nominal Government bonds on issue and turnover are as follows.

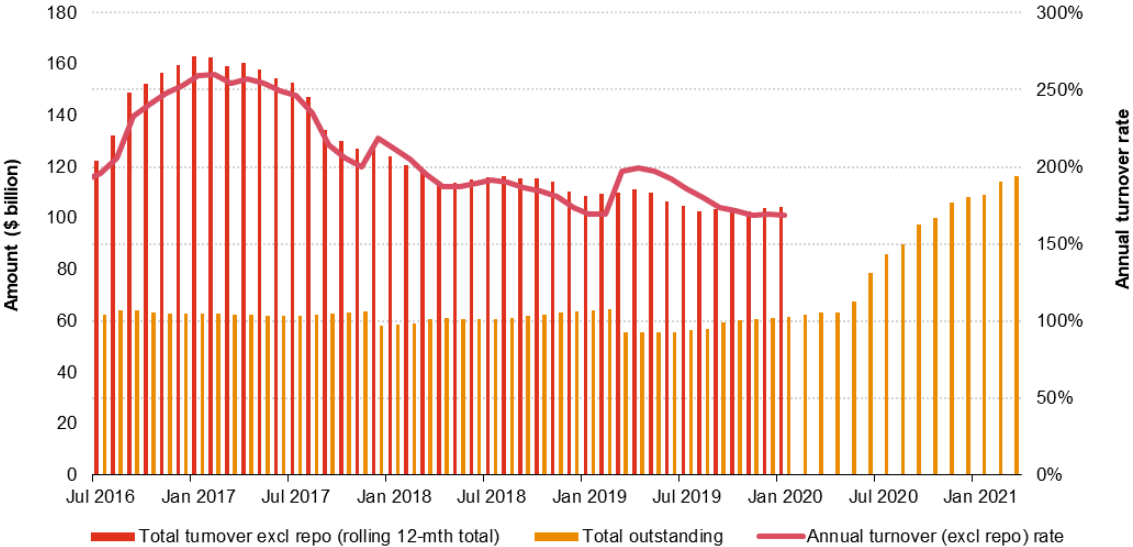
**Table 1: Nominal Government bonds on issue (30 April 2021) by maturity**

Maturity	Coupon (% pa)	Total issue as at 30 April 2021 (\$m)	Amount held by RBNZ as at 30 April 2021 (\$m)	Total amount bought back under LSAP as at 30 April 2021 (\$m)	Available (net of RBNZ) as at 30 April 2021 (\$m)	Available (net of RBNZ) as at 30 April 2019 (\$m)
15-May-2021	6.00%	11,309	250	1,300	9,759	11,059
15-Apr-2023	5.50%	16,195	250	7,051	8,894	8,945
15-May-2024	0.50%	10,950	150	4,450	6,350	N/A
15-Apr-2025	2.75%	13,600	250	5,783	7,567	6,850
15-May-2026	0.50%	3,650	150	300	3,200	N/A
15-Apr-2027	4.50%	12,150	250	6,470	5,430	5,700
15-May-2028	0.25%	4,350	150	640	3,560	N/A
20-Apr-2029	3.00%	13,450	250	6,810	6,390	5,000
15-May-2031	1.50%	9,850	150	5,176	4,524	N/A
14-Apr-2033	3.50%	7,500	250	3,640	3,610	4,450
15-Apr-2037	2.75%	8,850	250	4,483	4,117	5,150
15-May-2041	1.75%	5,850	150	2,000	3,700	N/A
<b>Total</b>		<b>117,704</b>	<b>2,500</b>	<b>48,103</b>	<b>67,101</b>	<b>47,154</b>

There was \$118 billion of nominal Government bonds available at 30 April 2021. As shown in the chart below, the amount of nominal Government bonds on issue has increased significantly over the past year, due to an increase in government borrowing in order to support the initiatives discussed in the Background section above. The Government also has an extensive borrowing program in place to support various initiatives, as detailed in the latest budget released on 20 May 2021. This will be funded by the issuance of more bonds, in particular:

- a new New Zealand nominal Government bond maturing in 15 May 2032, launched in June 2021, and
- a new New Zealand nominal Government bond maturing in 2051, expected to be launched by December 2021.

**Figure 2: Total nominal Government bonds on issue and turnover**

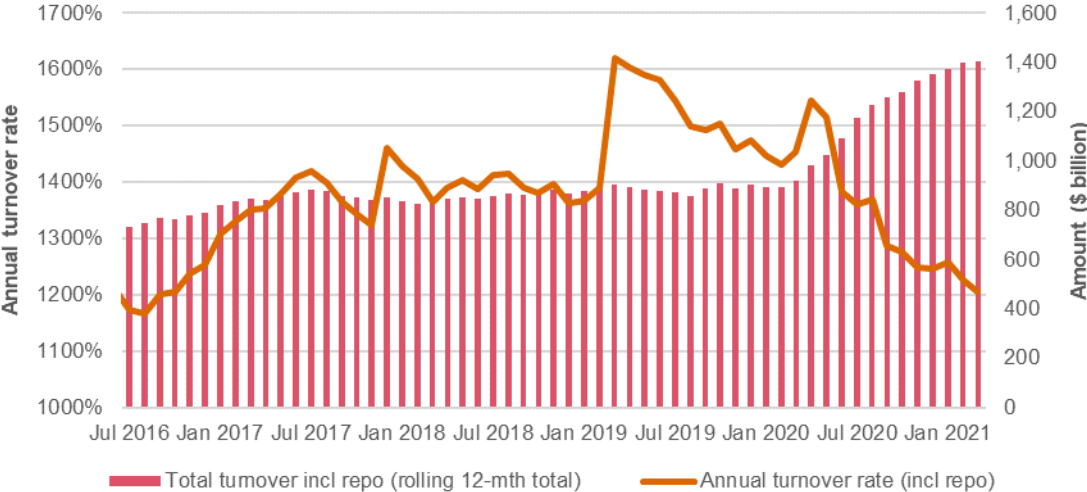


The Australian Group of 100 adopted a minimum amount outstanding for an individual security of AUD100 million as indicative of meeting the deep, liquid and transparent criteria. All nominal Government bonds on issue as at 30 April 2021, across all maturities, meet this criteria.

Milliman adopted a 50 basis point criteria for liquidity when assessing whether AA Corporate bonds are liquid. The Australian Group of 100 commented Sweden and Norway use corporate bonds for IAS 19 purposes, which requires a deep and liquid market in corporate bonds, and that their liquidity ratio was about 50%. The chart above indicates the liquidity of nominal Government bonds (annual turnover excluding repo rate) is significantly greater than this for periods up to January 2020.

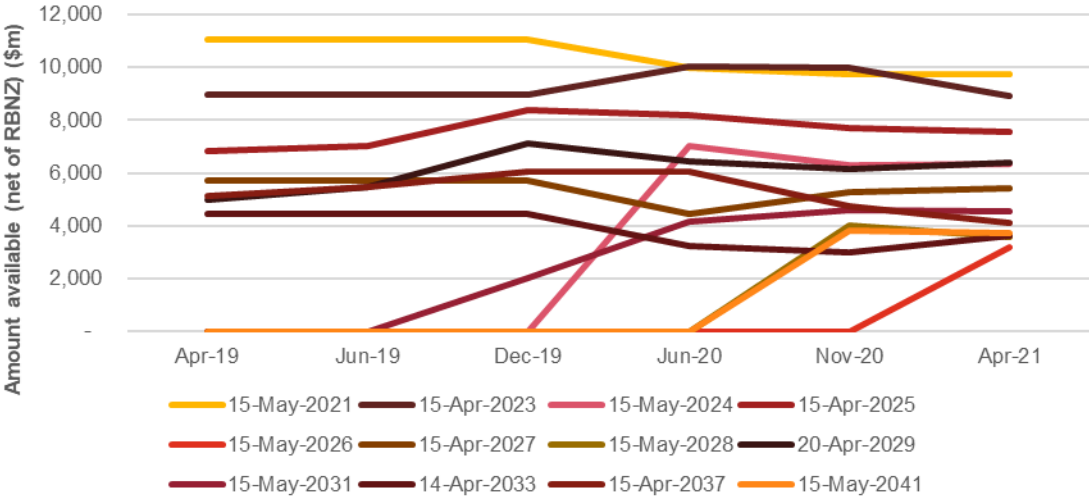
While turnover (excluding repo) is not externally available following January 2020, the chart below indicates that while the total turnover (including repo) rates have decreased, the absolute turnover amount has increased. Therefore, we believe the annual turnover (excluding repo) rate for periods following January 2020 is unlikely to be below 50% and that the nominal Government bond market remains deep, liquid and transparent.

**Figure 3: Annual turnover (incl repo) rate**



In addition, the chart below demonstrates that the total amount available (net of RBNZ) since April 2019 has remained relatively constant, with slight decreases for specific bonds. However, this is more than offset by the amount from newly issued bonds. Therefore the “free-float” amount of bonds on the market has not been impacted by LSAP and the nominal Government bond market remains deep, liquid and transparent.

**Figure 4: Amount available (net of RBNZ) by bond**



**Bid-ask spreads**

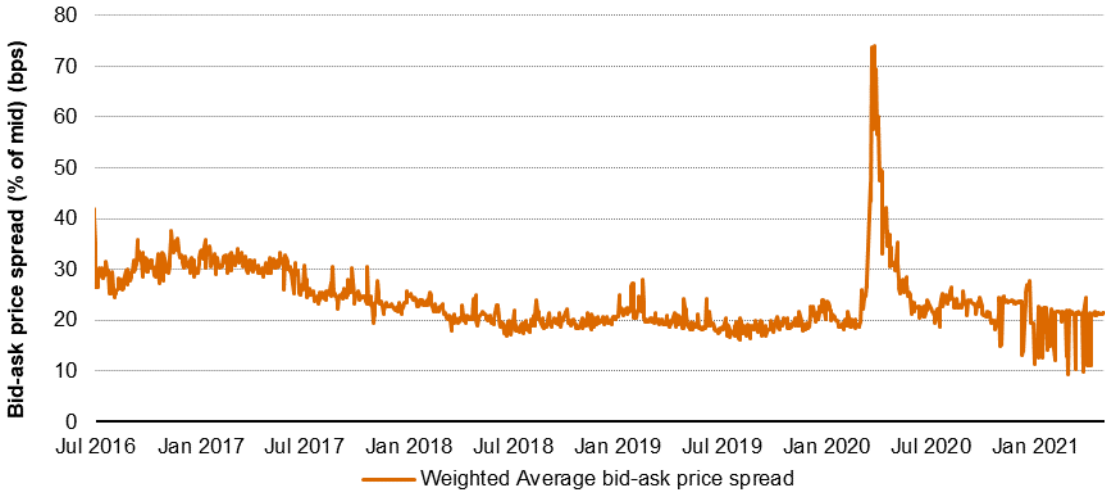
Another key change in the market over the past year has been the LSAP, announced in March 2020, where the Reserve Bank aims to buy back approximately \$100 billion of New Zealand Government bonds by June 2022. The aim of this buy-back is to lower interest rates, and a secondary impact is lowering government bond yields.

As at 30 April 2021, the Reserve Bank had purchased back \$48.1 billion of nominal Government bonds, over the one year period since the initial announcement.

The chart below shows the amount by which the ask price exceeds the bid price for nominal Government bonds, as a percentage of the mid-point of the ask and bid prices. The ask and bid prices have been obtained from Bloomberg. Shown below is the weighted average bid-

ask price spread (% of mid) of all nominal Government bonds on issue maturing in at least 2021, weighted by amount outstanding.

**Figure 5: Nominal Government bonds – weighted average bid-ask price spread (% of mid)**



The chart above shows the markets immediate response to the LSAP announcement on 23 March 2020, with bid-ask price spreads (shown as a percentage of the mid-point of the ask and bid prices) spiking as many sellers expected higher prices with the increased demand from the Reserve Bank. Since then, the bid-ask spread has quickly reverted to earlier historic levels, around 20 basis points (bps), or less.

The Australian G100 paper written by Milliman adopts a difference of less than 50 bps in the bid-ask price spread (% of mid) as indicative of a liquid market. The experience over the past year does suggest that the bid-ask spread is more volatile day to day compared to pre-announcement periods, however, even taking into account the volatility range, the bid-ask spread is still well below 50 bps, indicating the nominal Government bond market remains liquid.

**Discussion with the Treasury market experts**

In respect of NZGB trading volumes and liquidity over the past 12 to 18 months, market experts in the Treasury commented that over the past year demand has remained strong and that “liquidity has not fundamentally changed.” They also indicated that the turnover amount (excluding repo) increased from March 2020 to November 2020 and increased compared to the position as at December 2019. However, as the total amount outstanding has also increased significantly, the turnover rate has potentially stayed relatively the same compared to December 2019.

Anecdotal feedback the Treasury has received from investors is that, if anything, the LSAP has aided market liquidity.

**Bank SWAPs compared to Government bonds**

The alternative proxy for short-to-medium-term risk-free discount rates is bank SWAPs, with or without a scarcity adjustment. The 2019 methodology review concluded that bank SWAPs are not a better alternative source for risk-free discount rates than Government bonds.

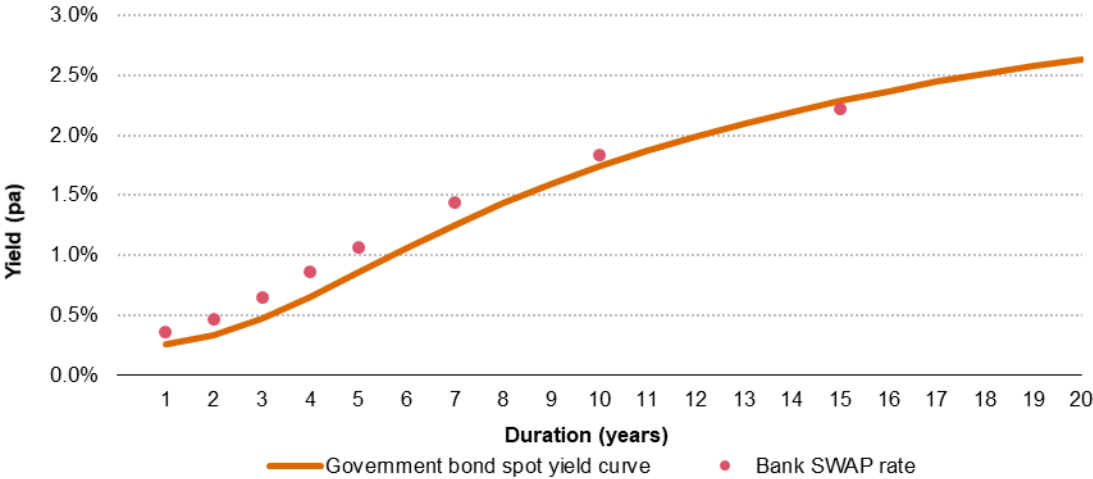
Bank SWAPS are used to indicate whether the basic risk-free rates using nominal bonds are required to be adjusted for risk or scarcity and in either case the size of the adjustment if

required. As discussed in the 2019 methodology review, the reason for making market adjustments is based on the premise that the true risk-free discount rate lies somewhere between the market for Government bonds and bank SWAPs. The adjustments can be summarised as:

- a scarcity discount adjustment to apply to Government bond rates (will increase the yield)
- a credit risk adjustment to apply to bank SWAP rates (will reduce the yield).

The 2019 methodology review concluded that over recent years the bank SWAP spread has been small, indicating any scarcity adjustment would be small, and concluded that it is reasonable to make no scarcity adjustment at present. This is also consistent with our findings in the July 2020 review.

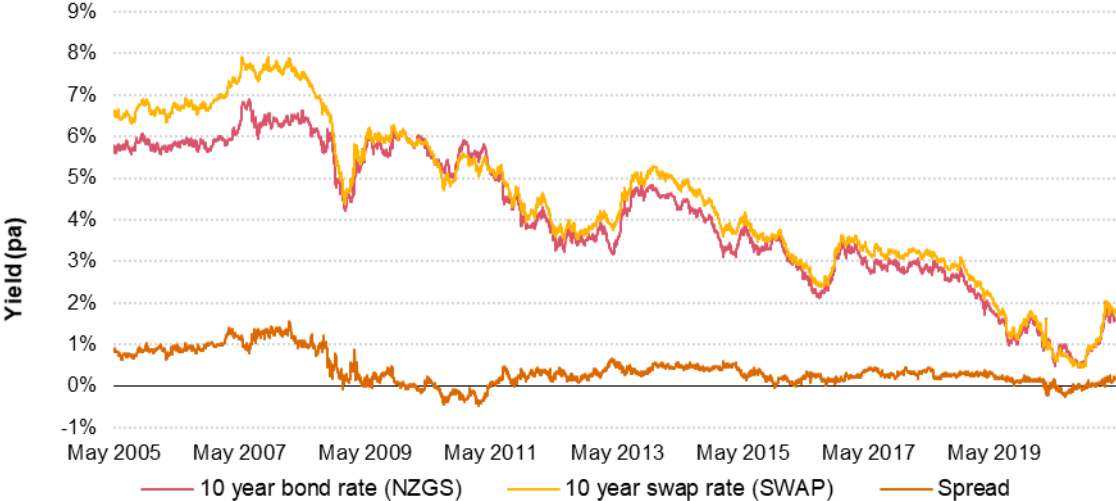
**Figure 6: Government bond spot yield curves and bank SWAP rates (30 April 2021)**



The above chart compares the bank SWAP rates as at 30 April 2021 to the Treasury spot yield curve which uses Government bonds. This shows very clearly that the rates are close, which further suggests that Government bonds remain a good source for determining the risk-free rates, and consistent with our 2019 conclusion, it is reasonable to make no scarcity adjustment.

The difference between bank SWAP rates and government bond rates is known as the bank SWAP spread. Historically bank SWAP rates have been higher than Government bond rates, however this spread essentially reduced to zero or slightly negative during calendar year 2020 and has recently reverted back to slightly positive, as shown in the following chart.

**Figure 7: 10-year bank SWAP spread**



Last data point is 30 April 2021.

The last time the spread was negative was during the years following the Global Financial Crisis. This was due to the Government effectively guaranteeing bank SWAPs at that time with the Government wholesale bank guarantee schemes 2008 to 2010. The Government has recently announced introducing a scheme to protect deposits of up to \$100,000 in banks and financial institutions, expected to be in place in 2023 (although a bill has not yet been introduced in Parliament).

If Government bonds in recent months were artificially low due to unusually high demand or the effects of the LSAP, we would expect the bank SWAP spread to be higher than pre-COVID levels. Because this is not the case, we conclude that the yields on Government bonds are not artificially low because of the LSAP. This also indicates Government bond rates are still an appropriate risk-free measure.

## Conclusion

Overall, we are of the view that the Government bond market can continue to be considered 'deep, liquid, and transparent' (or in the words of the IPSASB conceptual framework, the market can be considered sufficiently open, active and orderly to be able to rely on market prices). There remains a risk of reduced liquidity in the secondary market where the Reserve Bank is actively purchasing bonds, but in our view, this does not change our conclusion that the nominal bond market overall is deep, liquid and transparent.



# Short to medium-term inflation

There are two main sources of short to medium-term inflation information; inflation forecasts and breakeven inflation determined from the relationship of the market price of inflation-indexed Government bonds to the market price of nominal Government bonds.

The current process to determine short to medium-term inflation is to determine the rate of breakeven inflation through to the date of the earlier of the last nominal or last inflation-indexed Government bond (2040 at present) and add an inflation-indexed price adjustment of 0.30%. We then give a 50% weighting to each of the adjusted breakeven inflation and forecast inflation. Forecast inflation is selected using forecasts for the short-term (4 years) and the RBNZ mid-range target of 2.0% pa for the medium term.

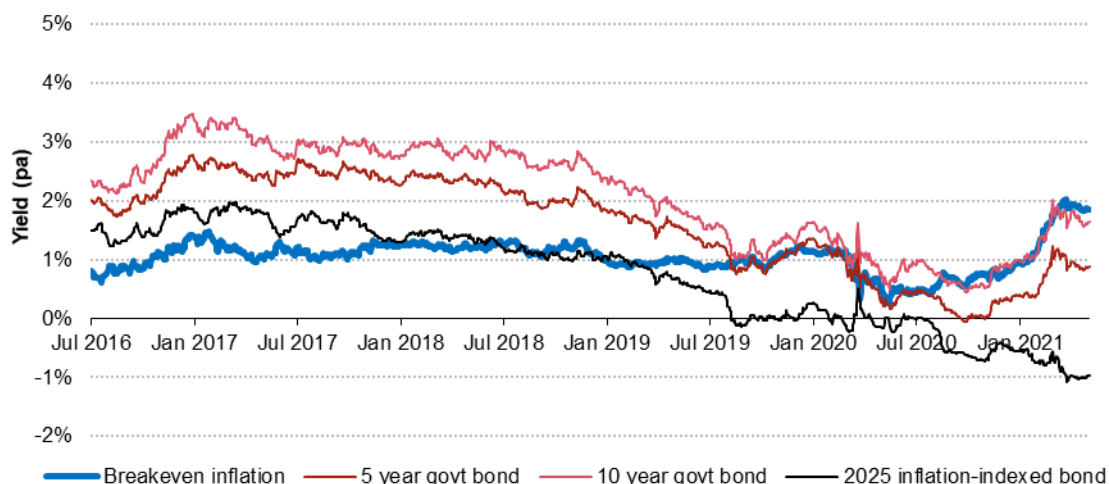
The current methodology specifies a review of the short-term forecasts every 6 months and we have included the December 2020 review in Appendix B This has resulted in lower than 2% pa forecast inflation for the first four years. The next inflation review will be as at 30 June 2021.

## Breakeven inflation

### Breakeven inflation implied by inflation-indexed bond yields

The following chart shows an estimate of the breakeven inflation implied by the 2025 bond since March 2014 using a weighted average of the 5 and 10 year Government bond yields, with the weighting determined by the time remaining to 2025 at each date. The exact breakeven is complicated to determine but should move up and down in a similar fashion to the estimate shown.

**Figure 8: Estimated breakeven inflation from 2025 inflation-indexed bond**



The chart indicates the breakeven inflation has been well below 1% pa for majority of the 2020 calendar year and has recently increased rapidly to around 2% pa, in the first quarter of 2021.

The rapid increase in breakeven inflation over the first quarter of 2021 is also observed in breakeven inflation determined from the relationship of the market price of inflation-indexed Government bonds to the market price of nominal Government bonds, see page 19.

**Table 2: Breakeven inflation based on inflation-indexed Government bonds**

Month	2020 Inflation-indexed bond	2025 Inflation-indexed bond	2035 Inflation-indexed bond	2040 Inflation indexed bond	Breakeven inflation across all bonds
November 2020	0.77%	1.48%	1.72%	1.63%	1.29%
December 2020	0.99%	1.75%	2.03%	2.10%	1.57%
January 2021	1.15%	1.96%	2.00%	1.96%	1.68%
February 2021	1.55%	2.11%	1.99%	0.87%	1.75%
March 2021	1.76%	2.16%	1.66%	1.42%	1.83%
April 2021	1.57%	1.74%	1.50%	0.77%	1.52%

Note: these breakeven inflation rates are from the maturity of the next shorter bond through to the maturity date of the bond.

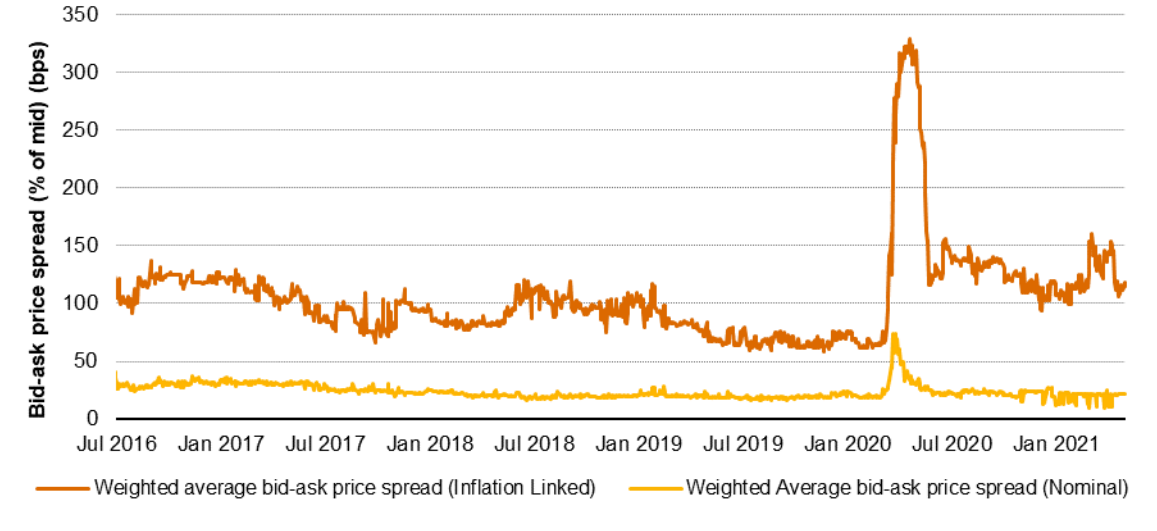
**Amount on issue**

As at 30 April 2021, there was \$18.2 billion of index-linked bonds available (net of RBNZ) and the amount on issue has been increasing. However, while there is a relatively large amount of bonds on issue, demand for index-linked bonds in New Zealand is much lower than for nominal bonds and this results in lower liquidity. The Reserve Bank has purchased back \$2.2 billion index-linked bonds since the LSAP programme announcement in March 2020.

**Bid-ask spread**

The announcement and subsequent buy back have had a very drastic impact on bid-ask spreads, as shown below.

**Figure 9: Bid-ask price spread (% of mid), inflation-indexed bonds and nominal bonds**



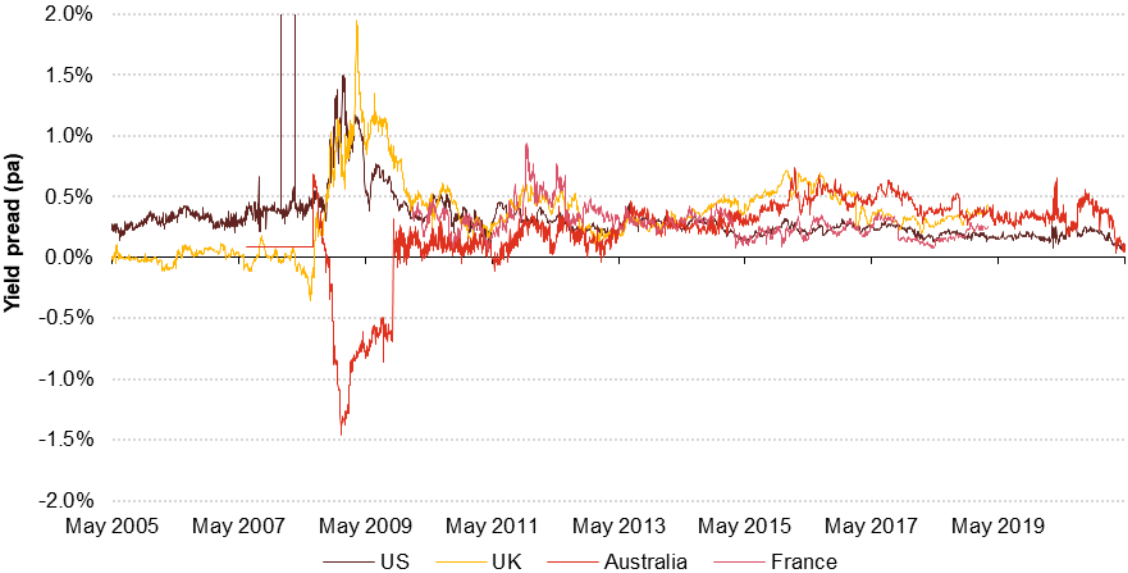
In 2020 discussion with Treasury market experts, concerns were expressed again that compared to nominal bonds, the inflation-indexed bond market was not deep, demand was low (although the LSAP may improve this marginally) and the market was considered less liquid.

This is also observed in the chart above, where unlike the bid-ask spread of nominal bonds, the LSAP programme has appeared to have had a sustained impact on the inflation-indexed bond market, resulting in a higher bid-ask spread compared to pre-announcement periods.

**Index-linked price adjustment**

As part of the 2019 methodology review, we introduced the index-linked price adjustment to account for this illiquidity of the index-linked bonds. We look at the spread between 10-year inflation swaps and 10 year breakeven inflation as a proxy for this adjustment, considering data for the United States, United Kingdom, France and Australia (equivalent information is not available for New Zealand). Inflation swaps are generally considered liquid, although it must be noted that there may not be a large number of investors in inflation swaps in each case.

**Figure 10: 10-year inflation swaps less 10-year breakeven inflation**



Long term average still remains at 0.3% pa. There has been a drop in the recent past.

Based on the information above, we recommend maintaining the 30 basis point adjustment for breakeven inflation. Inflation-indexed bonds remain less liquid than nominal Government bonds and so it is reasonable to assume that breakeven inflation determined from comparing the yields on inflation-indexed Government bonds and nominal Government bonds will be less than investors’ true expectations for inflation.

**Discussion with the Treasury market experts**

We talked to some market experts in the Treasury to get their views on the impact of the LSAP on demand, trading volumes and liquidity of the inflation-indexed Government bond market. In particular, discussions revolved around the conflicting results shown in the increase in bid-ask spread over the last 12 to 18 months, along with the decrease in the

spread observed between 10-year inflation swaps and 10-year breakeven inflation for Australia and US.

Based on observations from the Treasury market experts, there is no clear evidence that liquidity for the inflation-indexed market is worse than that 1 year or 18 months ago. However, it remains lower than for nominal government bonds (consistent with other sovereigns). Therefore, the consensus was that the current 30 basis point adjustment for breakeven inflation remains appropriate despite the increase in bid-ask spread.

For the drop in spread between 10-year inflation swaps and 10-year breakeven inflation for Australia and US, it was noted that the quantitative easing program in Australia does not include inflation-indexed bonds and that the proportion of inflation-indexed bonds in Australia (on a relative basis) is smaller than in New Zealand. Therefore the recent reduction in spread between 10-year inflation swaps and 10-year breakeven inflation for Australia may not be applicable or relevant for the New Zealand inflation-indexed bond market.

## Forecast inflation

The final component of the short to medium term inflation assumption is forecast inflation. Forecast inflation is selected using forecasts for the short-term (4 years) and the RBNZ mid-range target of 2.0% pa for the medium term.

The Half Year Economic and Fiscal Update (HYEFU), published by the Treasury in December 2020, stated: “Inflation is expected to ease in the coming quarters owing to relatively weak domestic demand and subdued import price inflation, before increasing gradually towards the mid-point of the Reserve Bank of New Zealand’s inflation target range of 1% to 3%.”

Inflation forecasts in the HYEFU put CPI inflation (% annual change) at 1.4% in 2021, rising to 2.1% by 2025. The longer term 10-year expectations remain at 2% pa.

Other than forecasts from the Treasury, there are four other sources of readily available CPI inflation forecasts: RBNZ, the New Zealand Institute of Economic Research (NZIER) Quarterly Predictions, the NZIER Consensus Forecasts and the Aon Economists Survey. The Aon Economist Survey ceased to be available following June 2017.

All available CPI inflation forecasts are considered as part of the six-monthly short-term CPI forecasts review. This will include the Treasury’s latest CPI forecast published as part of Budget 2021 in May. The Treasury is now forecasting CPI inflation is to rise in the near term to 2.4% as a result of temporary price pressures, before falling below 2.0% in 2022 as spare capacity in the economy remains. Annual inflation is forecast to rise from 2023, reaching 2.0% in early 2024. The Treasury also notes inflation is considerably higher over the latest forecast period compared with HYEFU December 2020, as the more resilient labour market supports wage growth and boosts domestic demand.

**Table 3: The Treasury CPI forecast**

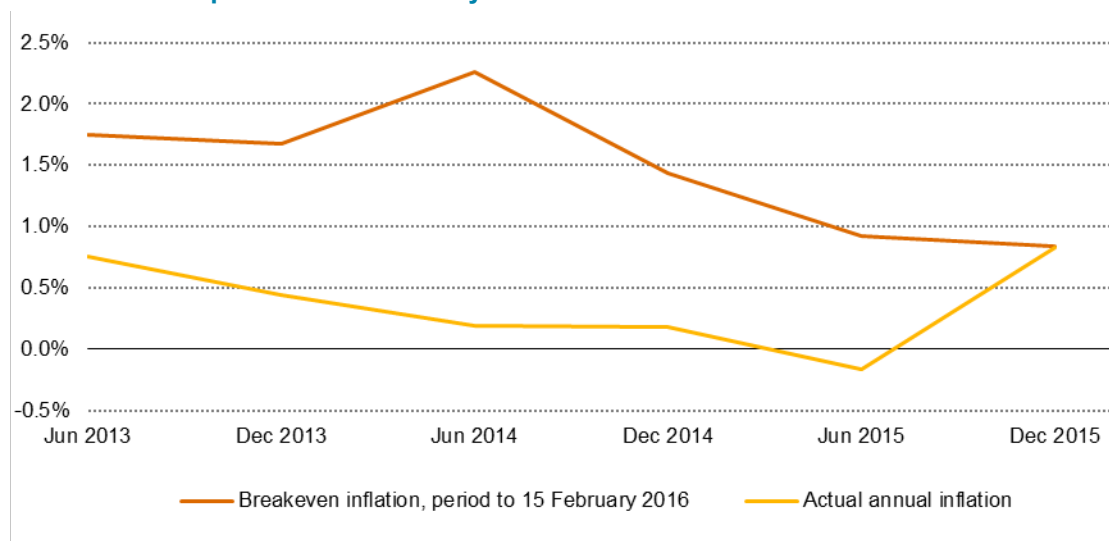
CPI forecast (% pa)	2021	2022	2023	2024	2025
BEFU 2021	2.4	1.7	1.8	2.0	2.1
HYEFU 2020	1.4	1.2	1.4	1.8	2.1

## Back-testing of inflation

### Breakeven inflation compared to actual inflation

The 2016 bond is the only bond which can be fully back-tested as it is the only New Zealand Inflation-indexed bond which has matured to date. The chart below compares the inflation rate predicted by the 2016 bond to 15 February 2016 (maturity date) with actual inflation to that date. Note that we only calculate inflation at June and December, hence the closest data point we have to the maturity of the 2016 Inflation-indexed bond is at 31 December 2015 (1.5 months before maturity).

**Figure 11: Breakeven inflation determined from 2016 inflation-linked bond compared to actual inflation for the period to 15 February**

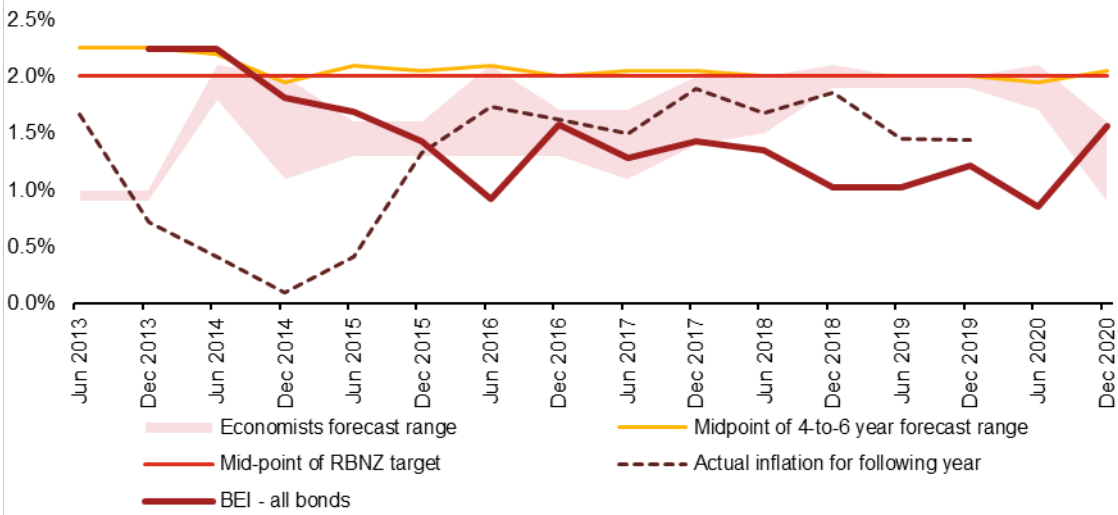


For this period, the breakeven inflation was higher than actual inflation and indicated that the breakeven inflation alone is not a good predictor of actual inflation.

### Short term forecasts compared to inflation

Each forecast source provides their forecasts of forward annual inflation for the next one to four years. In the chart below, the range from these one-year forecasts, for the immediate year, at each considered point in time are shown, along with the actual inflation for the following year at each point.

**Figure 12: One-year inflation forecasts and expectations and actual annualized CPI for the following year**



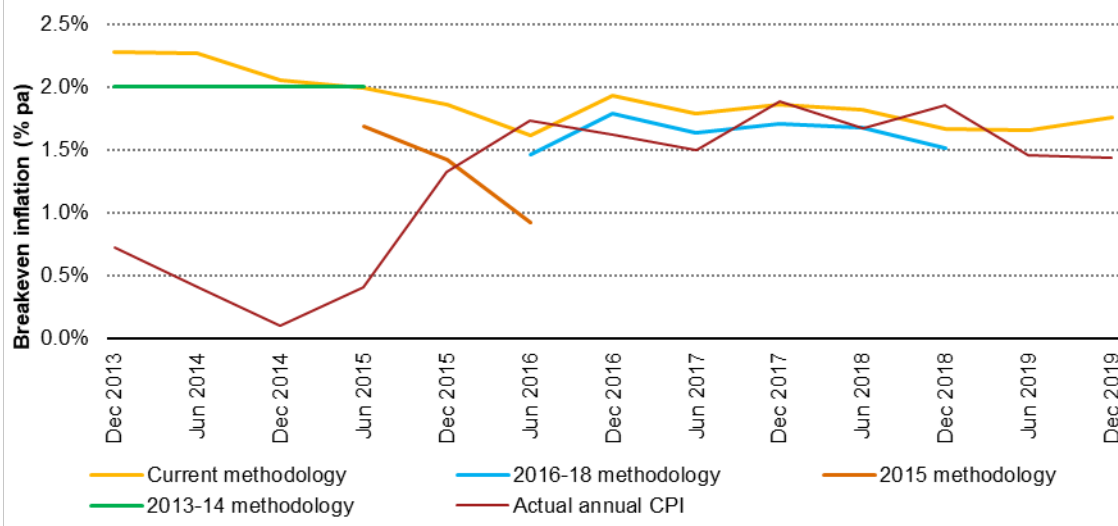
From December 2015 to December 2018, the short-term forecasts have been reasonably accurate in predicting actual inflation. From December 2018 onwards, the actual inflation has been between the short-term forecasts and the breakeven inflation, supporting the current methodology of a 50/50 weighting between breakeven and forecast inflation.

**Current methodology compared to inflation**

Over the period since 30 June 2013, the actual methodology to calculate the short to medium term CPI inflation has changed:

- 30 June 2013 to 31 December 2014; consensus forecast used (which remained at 2.0% pa)
- 30 June 2015 to 31 December 2015; breakeven forecast used
- 30 June 2016 to 31 December 2018; 50% weighting to each of consensus forecast and breakeven forecast
- 30 June 2019; 50% weighting to each of consensus forecast and an adjusted breakeven forecast (inflation-indexed illiquidity adjustment of 0.30% pa)

**Figure 13: Comparison of methodologies for breakeven inflation**



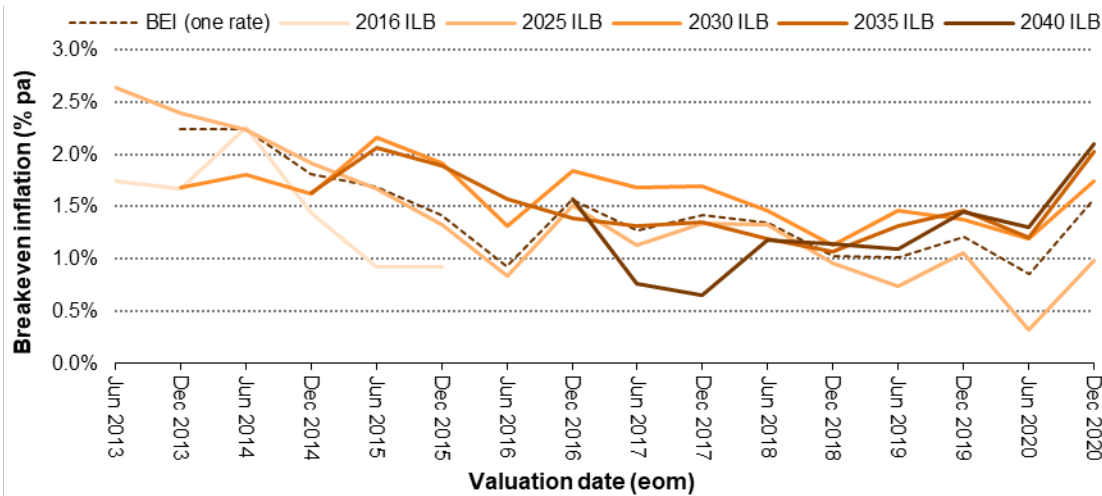
Other than the period of low inflation that New Zealand experienced in 2014 to 2015, the forecasted CPI under the current methodology is comparable to the actual CPI.

## Term structure

Breakeven inflation is defined as the future inflation that is required to make the yield on an inflation-indexed bond equivalent to the yield on a nominal bond of the same duration. As there are several inflation-indexed bonds, it is possible to determine the breakeven inflation for different periods in the future.

The following chart shows the breakeven inflation based on inflation-indexed bonds of different maturities. Note: these breakeven inflation rates are from the maturity of the next shorter bond through to the maturity date of the bond.

**Figure 14: Breakeven inflation**



From the chart above, it is clear that as the 2040 inflation-indexed bond has increased in size (>\$4 billion as at 30 April 2021), the breakeven inflation for the period 2035-2040 has steadily increased. As a result, there are now weak signs of potential term structure based on the breakeven inflation at June 2020 and December 2020. This should be monitored and reviewed in the next in-depth review in 2022.

## Conclusion

Overall, we are of the view that the current short to medium term assumptions and methodologies remain appropriate and do not recommend any changes until the next in-depth review in 2022.

# Appendix A Summary of methodology

**Table 4: Seven step framework for determining the Treasury risk-free discount rates and CPI assumptions**

Assumption	Step	
Short to medium-term assumptions	1	Determine the smoothed market forward rate curve with reference to Treasury bills and nominal Government bond yields
	2	Determine any adjustments required to the nominal Government bond yields to give short to medium-term risk-free discount rates
	3	Determine short to medium-term CPI inflation assumptions
Long-term assumptions	4	Determine the long-term real risk-free discount rate
	5	Determine the long-term nominal risk-free discount rate
	6	Determine the long-term CPI inflation from the above, cross-checked against available market and historical data
Assumptions for bridging the short to medium and long-term	7	Determine the method of blending short to medium-term and long-term rates



## Methodology parameters

The following is a table of the long-term parameters using the framework and methodology summarised above:

**Table 5: Modelling parameters**

Item	Value	Comment
Adjustment to nominal New Zealand Government bonds	0	No adjustment required
Amount of New Zealand Government bond on issue to be included	\$4 billion	Proxy for meeting liquidity requirement
Inflation-indexed price adjustment used to adjust breakeven inflation	0.30%	Based on international data
Weighting given to inflation forecasts	50%	
Weighting given to breakeven inflation	50%	
Long-term real return	2.30%	Compound 2.25%
Long-term nominal discount rate	4.30%	
Long-term CPI inflation	2.0%	
End of market observations (nominal discount rates and CPI inflation)	End of nominal yield curve	Currently 15 April 2041
Start of long-term assumptions	End of nominal yield curve plus 10 years (15 April 2051)	At 30 April 2021, this is 2053 or 12 years, because of the slope maximum
Bridging assumption		Linear between the end of market and the start of long-term with a maximum slope of 0.05% per year of duration

## Appendix B CPI forecasts at 31 December 2020

In this section we examine the short-term (4 years) CPI forecasts.

When calculating the CPI inflation assumption, we give a 50% weighting to each of the adjusted breakeven inflation and forecast inflation. Forecast inflation is selected using forecasts for the short-term (4 years) and the RBNZ mid-range target of 2.0% pa for the medium term. Every six months (30 June and 31 December) the forecast inflation is determined, and the methodology is reviewed three-yearly.

For periods prior to December 2019, short-term inflation forecasts have been very close to the medium-term assumption of 2.0%, and so we have used a flat forecast inflation assumption of 2.0%.

However, the economic environment changed considerably during the 2020 calendar year as many countries, including New Zealand, were expecting their largest economic downturns in living memory due to the anticipated economic impacts of Covid-19. The table of CPI inflation forecasts, updated as at June 2020, is shown following.

**Table 6: Forecasts of CPI inflation (June 2020 CPI review)**

Source (date of release)	Year ending	2021 (% pa)	2022 (% pa)	2023 (% pa)	2024 (% pa)
NZIER Consensus Forecasts (June 2020)	March	0.2	1.1	1.6	-
NZIER Quarterly Predictions (May 2020)	March	0.8	1.4	1.6	1.3
Treasury (May 2020, BEFU)	June	0.8	1.5	1.8	1.9
RBNZ inflation expectations survey (April 2019)	June	0.7	1.2	-	-
RBNZ Monetary Policy Statement (May 2020)	June	0.5	1.0	2.0	-

Although the final impacts of Covid-19 remain highly uncertain, the range of initiatives implemented by the Government has supported economic activity, resulting in less severe economic impact from Covid-19 compared to that previously anticipated. This coupled with loose monetary policies from RBNZ has resulted in economists expecting a higher inflationary environment for the 2021/2022 year. The table of CPI inflation forecasts, updated as at December 2020, is shown following.

**Table 7: Forecasts of CPI inflation (December 2020 CPI review)**

Source (date of release)	Year ending	2022 (% pa)	2023 (% pa)	2024 (% pa)	2025 (% pa)
NZIER Consensus Forecasts (December 2020)	March	1.1	1.6	1.9	-
NZIER Quarterly Predictions (December 2020)	March	1.0	1.8	1.7	2.0
Treasury (December 2020, HYEUFU)	June	1.2	1.4	1.8	2.1
RBNZ inflation expectations survey (November 2020)	December	1.6	1.9	-	-
RBNZ Monetary Policy Statement (November 2020)	March	0.9	1.5	-	-

The above table clearly shows that expectations for inflation in the short-term are lower than the medium-term assumption of 2.0%. The forecasts are around 1.0% for the 2021/2022 year, between 1.4% and 1.9% for the 2022/2023 year, 1.7% and 1.9% for the 2023/2024, and between 2.0% and 2.1% for the 2024/2025 year.

Selecting an appropriate assumption is highly subjective and it is important to remember that no assumption will ever be correct, especially in such a volatile economic environment. We typically put the most weight on the consensus forecasts, and note that based on the latest data, RBNZ inflation expectations survey forecasts are higher than the other forecasts due to differences in year end.

Under the current methodology, 50% of the forecast inflation will be included in the overall Treasury CPI inflation assumption, as it is weighted 50/50 with the adjusted breakeven inflation.

The selected short-term forecast inflation assumptions are shown in the following table, along with the previous assumption. These assumptions will apply from the 31 December 2020 rates and will be reassessed in June 2021, in accordance with the published methodology.

**Table 8: Forecast inflation chosen assumptions**

	2021 (% pa)	2022 (% pa)	2023 (% pa)	2024 (% pa)
Previous assumption	0.5	1.2	1.7	1.7
Selected assumption	1.1	1.6	1.9	2.0
Adjusted 31 December breakeven inflation	1.87	1.87	1.87	1.87
Resulting CPI (50/50 weighted)	1.48	1.73	1.88	1.93