TE TAI ŌHANGA
THE TREASURY

Risk-Free Discount Rates and CPI inflation

Assumptions for Accounting Valuations

6 July 2020

New Zealand Government

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Purpose

The purpose of this paper is to identify whether further adjustments, due to the economic impact of Covid-19, 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.

Conclusion

While Covid-19 has had 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.

As mentioned in the 2019 Risk-Free Discount Rates and CPI inflation report, due to the long-term over which the bridging assumptions apply and consequently the relatively low significance of the long-term assumptions, we do not consider that these assumptions need adjusting sooner than three years from the 2019 review. We have also considered the approach taken by the European Insurance Regulator (EIOPA) in forming this conclusion.

We propose one minor technical change to fitting the short-term discount rates; we have moved from using OCR as the starting point for the nominal yield curve to using the short-term Treasury Bank bill rates. This allows a much more realistic curve to be fit in the first few months when the OCR is different to the Treasury bill rates. Otherwise, as the short to medium-term assumptions are based directly on market information, we consider that these adjust automatically to any change in the market.

For further detail on each step of the methodology framework, see the 2019 Risk-Free Discount Rates and CPI inflation report. A summary of the steps and key parameters are also shown in Appendix B - Summary of methodology.

A sample table of annual rates from year one to year 65 determined using this methodology, as at 30 June 2020, is shown in Appendix C – Table of rates as at 30 June 2020.

Introduction

Purpose and use of this report

The purpose of this paper is to identify whether further 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. The previous in-depth review of the methodology was performed one year ago, in May 2019 and it involved a consultation process with feedback from a selected group of stakeholders. We are not undertaking such an in-depth review this year, but instead we are conducting a limited scope review to consider the economic shock of Covid-19 and the response of the Reserve Bank on rates at 30 June 2020.

Context

This report should be read in conjunction with The Treasury's report *Methodology for Risk-free Discount Rates and CPI Assumptions for Accounting and Valuation Purposes – July 2019* ('the 2019 methodology review', or 'the review'), dated 21 May 2019.

The 2019 methodology review noted that there were circumstances which may lead to a need to review the methodology before three years. We believe the current global pandemic and the response by the Reserve Bank of New Zealand is significant enough to investigate whether any change is required to the methodology, specifically for rates and assumptions at 30 June 2020.

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, and will continue to have, a significant negative impact on the New Zealand economy. The New Zealand 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.

In response to the Covid-19 pandemic, the Reserve Bank of New Zealand has announced the following changes to Monetary Policy:

- the Official Cash Rate (OCR) was lowered from 1% to 0.25% in March 2020 and will remain at this level for at least the next 12 months
- the Reserve Bank has announced a Large Scale Asset Purchases (LSAP) programme in which they will buy-back up to $60 billion of New Zealand Government Bonds, Local Government Funding Agency (LGFA) Bonds and New Zealand Government Inflation-Indexed Bonds in the secondary market.

Interest rates have dropped even further than the reducing trend of the last few years.

Risk-Free Discount Rates and CPI inflation

A number of Crown 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.

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

Accounting and actuarial standards

A full review of the accounting and actuarial standards relating to setting discount rates and CPI inflation assumptions can be found in Appendix A - Literature review, of the 2019 methodology review. Since last year, we are not aware of any new literature published that is relevant to this review.

Short to medium-term assumptions

Short to medium-term assumptions for risk free discount rates and CPI inflation means durations up until the end of the nominal yield curve. This is currently 17 years, through to 2037. After this, the bridging and long-term assumptions apply.

This section considers the assumptions for both nominal and real risk-free discount rates and CPI inflation, for the period up to 17 years (the end of the nominal yield curve). Overall, we recommend the current methodology and assumptions are maintained, as the short to medium-term assumptions are derived directly from market data, which can be observed from an open, active and orderly market.

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, and
- 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.

Below is our analysis of the most recent market data and our conclusion on the reliability of it.

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. the Official Cash Rate (OCR) was lowered from 1% to 0.25%, and will remain at this level for at least the next 12 months. We have moved from using OCR as the starting point to using the Treasury Bank bill rates, due to the OCR no longer being very close to the Treasury bill rates which makes it difficult to fit a sensible curve at short durations.

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

The 2019 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.

Government bonds and the Large Scale Asset Purchase programmed

There is currently $61.6b of nominal Government bonds available, with maturity dates ranging from 2021 through to 2037, see Appendix B - Market data for details. Since the 2019 review, there is one new Government bond on issue maturing 15 May 2031. Overall, the amount of nominal Government bonds on issue has been relatively stable over recent years, but with the Government response to Covid-19, borrowing is forecast to grow. The following statement was released by the Treasury's New Zealand Debt Management on Budget day (14 May 2020)[1].

> *"In conjunction with the Budget Economic and Fiscal Update 2020, the Treasury has updated the forecast core Crown borrowing programme. The next update is expected to occur alongside the Pre-Election Economic and Fiscal Update (PREFU) 2020, published August 2020.*
>
> *The impact of COVID-19 on the Crown's fiscal outlook is unprecedented, and requires substantial increases to the forecast borrowing programme, relative to that forecast at the Half Year Economic and Fiscal Update (HYEFU) 2019.*
>
> *The forecast 2020/21 New Zealand Government Bond (NZGB) programme is now set at NZ$60 billion. This is NZ$50 billion higher than forecast at the HYEFU 2019. The forecast bond programmes for the 2021/2022, 2022/2023 and 2023/2024 years have also been revised higher, to NZ$40 billion, NZ$35 billion and NZ$30 billion respectively.*
>
> *Treasury Bills on issue are forecast to be NZ$10 billion at 30 June 2021, and at 30 June of each year in the forecast period."*

Another key change in the market over the past few months has been the Large Scale Asset Purchase programme (LSAP), announced in March 2020, where the Reserve Bank is buying back approximately $30b of New Zealand Government bonds over a 12-month period (about 10% of annual GDP). The aim of this buy-back is to lower interest rates, and a secondary impact is lowering government bond yields. Studies have found that Government bond purchases worth 10 percent of GDP have, on average, lowered 10-year government bond yields by around 50 basis points[2].

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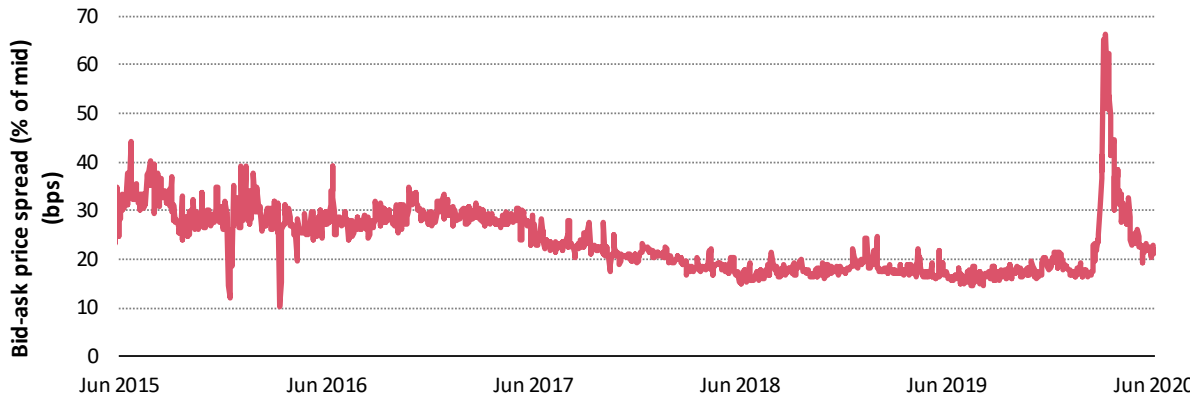
1 https://debtmanagement.treasury.govt.nz/investor-resources/202021-new-zealand-government-bond-programme-set-nz60-billion

2 Retrieved from RBNZ website (https://www.rbnz.govt.nz/monetary-policy/unconventional-monetary-policy/large-scale-asset-purchases) on 2 June 2020: *"The evidence shows LSAP proved effective in providing much needed support, lowering long-term interest rates and exchange rates, and underpinning economic growth and inflation. Studies found the government bond purchases worth 10 percent of GDP have, on average, lowered 10-year government bond yields by around 50 basis points."*

Refer to Appendix D for further discussion of asset purchases (quantitative easing) generally by central banks.

As at 25 May 2020, the Reserve Bank had purchased back $12.4 billion of nominal Government bonds, over two months. The following chart shows the markets immediate response to the 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 want to sell with the increased demand from the Reserve Bank. However, we can observe that the spreads have dropped off again in the months following.

Figure 1: Nominal Government bonds – weighted average bid-ask price spread (% of mid)



Weighted average bid-ask price spread (% of mid) of all nominal Government bonds on issue, weighted by amount outstanding. Data retrieved from Bloomberg. Last data point is at 17 June 2020.

The Australian G100 paper written by Milliman adopts a difference of less than 50 basis points in the bid-ask price spread (% of mid) as indicative of a liquid market, and we note this is the case for nominal Government bonds in the graph, except for the spike in early March.

Discussion with the Treasury 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 nominal Government bond market.

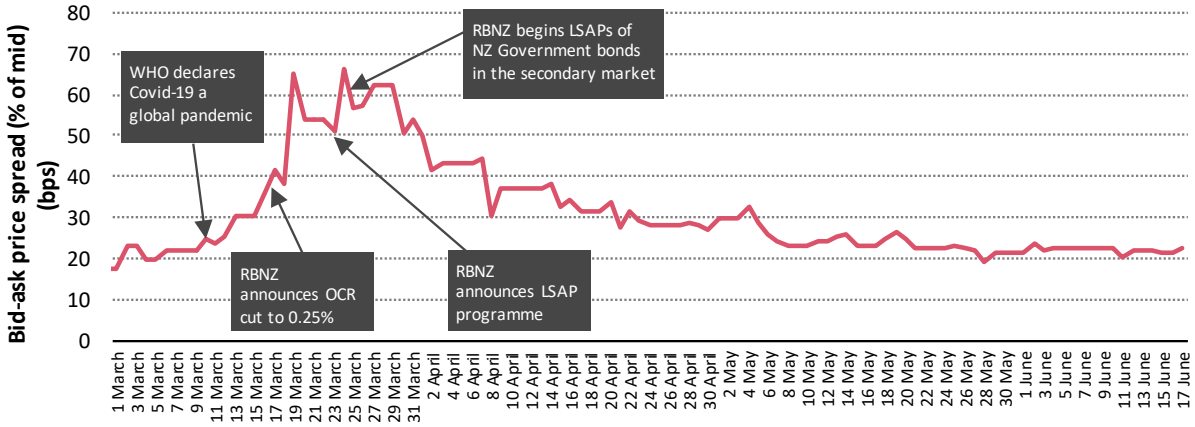
The overall consensus was that there has clearly been an impact on demand, liquidity and the shape of the yield curve, but it was not possible to quantify the impact with certainty. Specifically discussed was empirical evidence from other countries with similar buy-back programmes indicating an impact on yields through a ‘stock’ rather than a ‘flow’ effect – ie, the movement in yields occurs at the announcement, rather than ongoing operationalization of the bond purchases.

A 2015 PwC UK study on the importance of liquidity in financial markets defined liquidity as “a multi-dimensional concept, generally referring to the ability to execute large transactions with limited price impact… tends to be associated with low transaction costs and immediacy in execution.”

Discussants agreed that liquidity in the secondary bond market has fallen somewhat due to LSAP. They also noted this could occur in countries where LSAPs are undertaken, because it may become more difficult to buy bonds in the secondary market. However all discussants agreed any fall in liquidity in the New Zealand’s market has not fallen enough to impact the quality of pricing information. This begs the question, at what point would it impact the quality of the market? One way to consider this would be to look at how long bid-ask prices stay high during or following the buy-back program. Figure 2 below shows that the spread

dropped back to the level it was at before the announcement quite quickly. This indicates that the pricing is still reliable. The government has an extensive program of issuing additional tranches of bonds, which will quickly return market liquidity back to normal, this will reduce the need for the market to make a liquidity or scarcity adjustment to price.

Figure 2: Nominal Government bonds weighted average bid-ask price spread since 1/3/2020



Data retrieved from Bloomberg. Last data point is at 17 June 2020.

Additionally, the long-term bank SWAP rates are considered by many of the discussants to be less reliable than Government bonds, especially in the current environment, which furthers the argument that Government bonds remain the best proxy for risk-free discount rates. However, we have compared the Government bond rates to bank swap rates in the section below, to check whether any scarcity discount adjustment should apply to Government bond rates (which would increase the yield).

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). In fact, the increase in borrowing and the LSAP means that total turnover in the market is currently much higher. However, there is 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.

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.

In last year's in-depth review, we concluded that bank SWAPs are not a better alternative source for risk-free discount rates than Government bonds. There has been no change in the SWAP market since then that would lead us to change our conclusion this year.

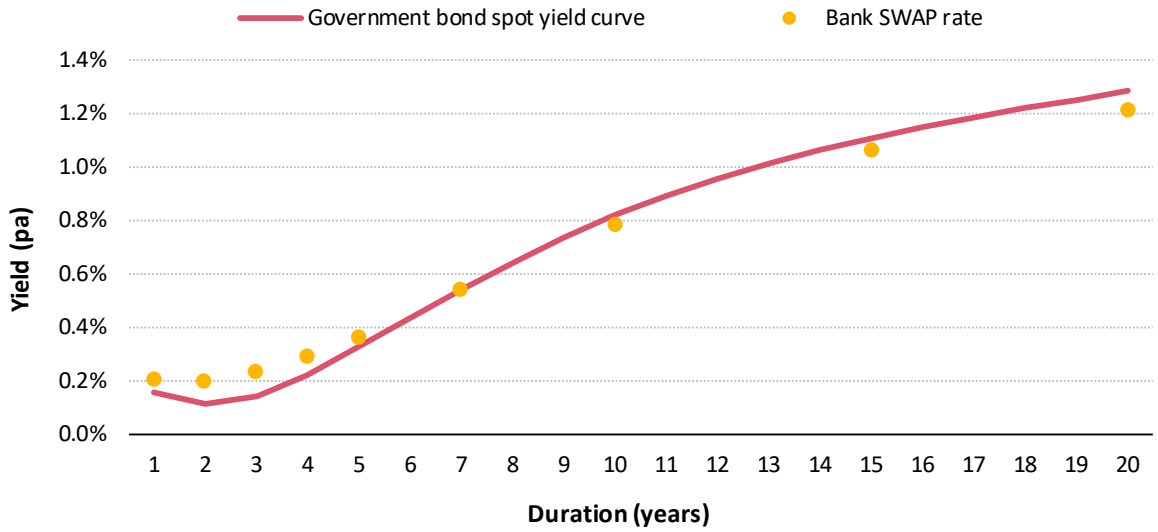
However, we also use bank SWAPS to determine whether the basic risk-free rates using nominal bonds are required to be adjusted for risk, or adjusted for scarcity in either case, and the size of the adjustment if required.

As discussed in the 2019 report, the reason for making market adjustments is based on the theory 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).

In our 2019 in-depth review, we concluded that over recent years the bank SWAP spread has been small, indicating any scarcity adjustment would be small, and we have concluded that it is reasonable to make no scarcity adjustment at present.

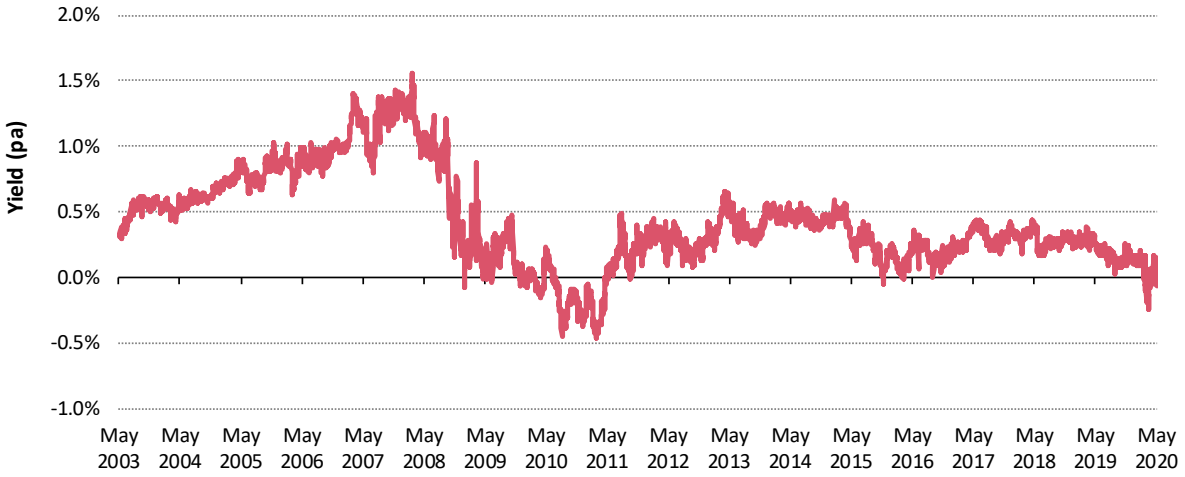
Figure 3: Government bond spot yield curves and bank SWAP rates (30 April 2020)



The above graph compares the bank SWAP rates as at 30 April 2020 to the Treasury spot yield curve which uses Government bonds. This shows very clearly that the rates are very 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 has essentially reduced to zero or slightly negative in 2020 (as shown in the following graph).

Figure 4: 10-year bank SWAP spread



Last data point is 20 May 2020.

We can observe that the last time the spread was negative was during the years following the Global Financial Crisis, due to the Government effectively guaranteeing bank SWAPs at that time with the Government wholesale bank guarantee schemes 2008 to 2010.

If Government bonds in recent months were artificially low due to unusually high demand or the effects of the LSAP, we would expect to see the bank SWAP spread rise. 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.

Short to medium-term inflation adjustment

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.

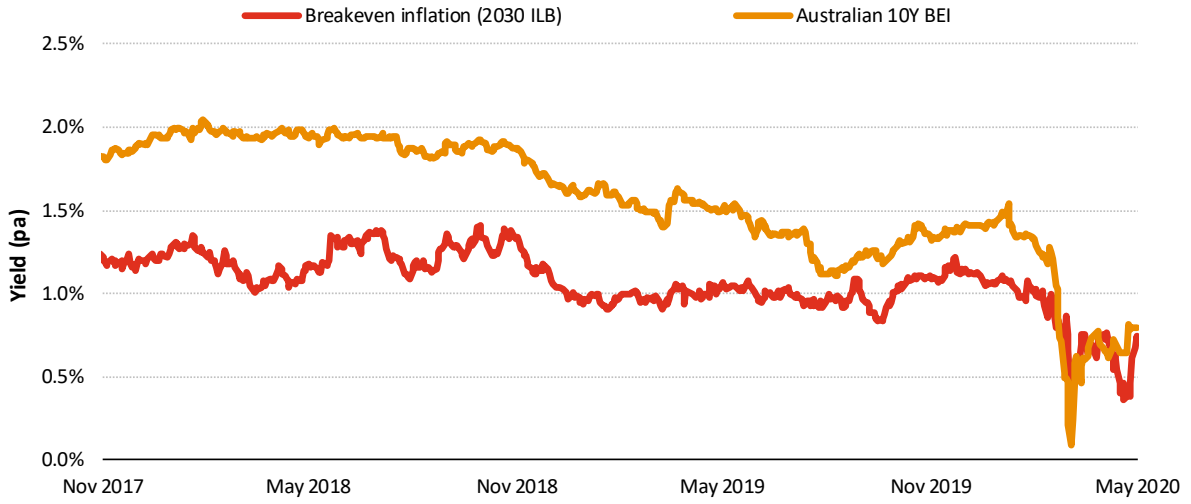
The current process to determine short to medium-term inflation is to determine the rate of breakeven inflation through to the date of the earlier of the last nominal or last inflation-indexed Government bond (2037 at present) and add an inflation-indexed price adjustment of 0.30%. We then give a 50% 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 June 2020 review in Appendix E. This has resulted in lower forecast inflation for the first four years.

Break-even inflation implied by inflation-indexed bond yields

The following graph shows an estimate of the breakeven inflation implied by the 2030 index-linked bond and the 10 year Government bond over the past 2.5 years (20 October 2017 to 20 May 2020). The exact breakeven is complicated to determine exactly but should move up and down in a similar fashion to the estimate shown. This estimate of New Zealand breakeven inflation is then compared to the Australian 10-year breakeven inflation (retrieved from Bloomberg).

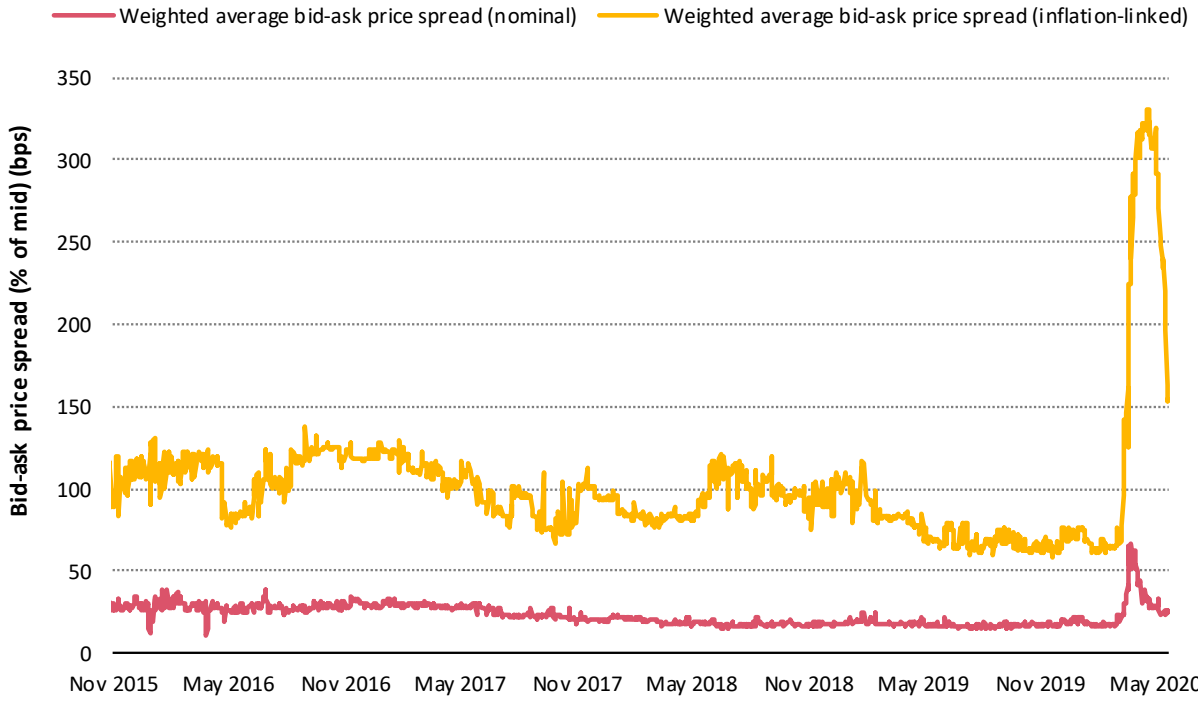
Figure 5: Estimated New Zealand BEI from 2030 inflation-indexed bond compared to Australian 10-year BEI



This shows that BEI has been relatively similar in New Zealand and Australia, and is sitting a bit below 1% pa.

There is currently $17b of index-linked bonds available (net of RBNZ, see table in Appendix A) 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 also purchased back $145 million index-linked bonds over the past two months as part of the LSAP programme, and the impact of this announcement is shown below and has had a very drastic impact on bid-ask spreads.

Figure 6: Bid-ask price spread (% of mid), inflation-indexed bonds compared to nominal bonds



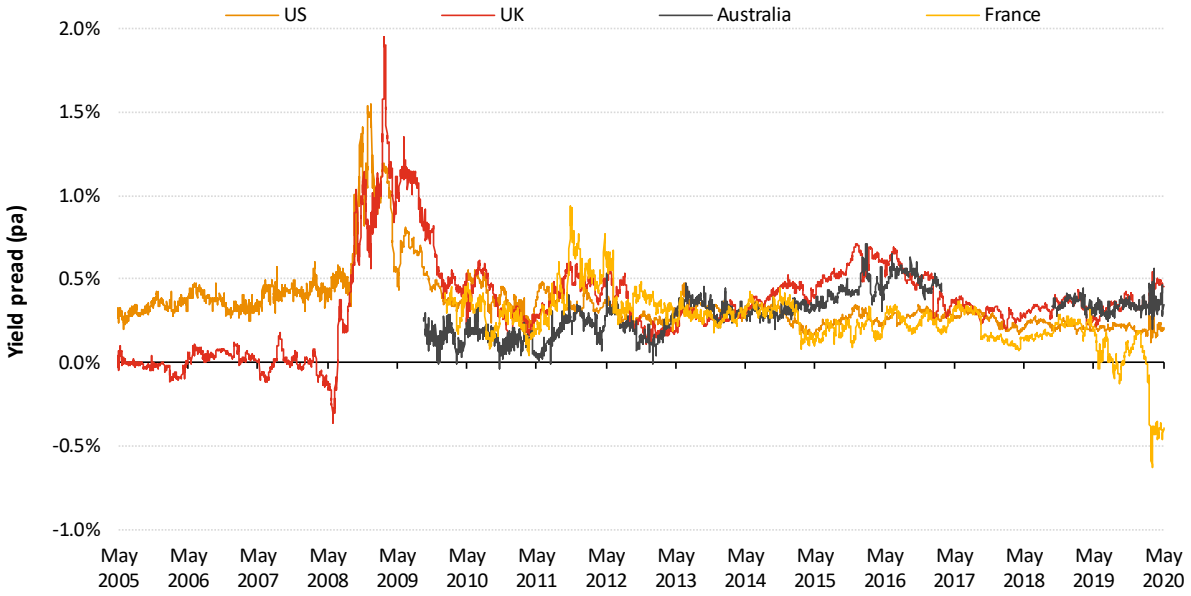
Last data point is 20 May 2020.

In our recent discussion with Treasury 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 have improved this marginally) and the market is considered less liquid.

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 7: 10 year inflation swaps less 10 year breakeven inflation



Last data point is at 20 May 2020.

The above graph shows that spread in April 2020 is relatively similar to that in April 2019, with the exception of France. The positive spread of about 30 basis points illustrates the idea that given inflation-indexed bonds are less liquid than nominal bonds, there is a downward bias in derived breakeven inflation expectations.

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.

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 Budget Economic and Fiscal Update (BEFU), published by The Treasury in May 2020, stated: “In the near term, the inflation outlook is particularly uncertain as prices for different goods and services are buffeted by a mix of falls in demand, or in some instances driven higher by temporary shortages. On balance, weaker demand is likely to mean inflation falls considerably.”

Inflation forecasts in the BEFU put CPI inflation (% annual change) at 0.8% in 2021, rising to 1.9% by 2024. The longer term 10-year expectations remain at 2%.

Long-term assumptions

In this context, long-term rates are rates for durations longer than the New Zealand market yields available (currently this is for longer than 17 years). Due to the long-term over which the bridging assumptions apply and the relatively low significance of the long-term assumptions, we do not consider that these need adjusting sooner than three years from the 2019 review.

Some commentators may prefer a more regular review of the longer-term rates (downward) and in turn a much shorter bridging period between the rates at 2037 and the long-term rates. However, we believe reviewing the long-term rates once every three years is still appropriate and balances different perspectives. The long-term over which the bridging assumptions apply in the current methodology is one of the key reasons why changing the long-term assumptions outside of the three-yearly review cycle would not have any significant impact.

Long-term inflation

The long-term inflation assumption is 2%.

EIOPA has adopted currency-specific expected inflation rates based on announced inflation targets, and these take the values 1.0% pa, 2.0% pa, 3.0% pa or 4.0% pa. The expected inflation rate adopted by EIOPA for New Zealand in 2020 is 2.0% pa and the majority of economies are 2.0% pa.

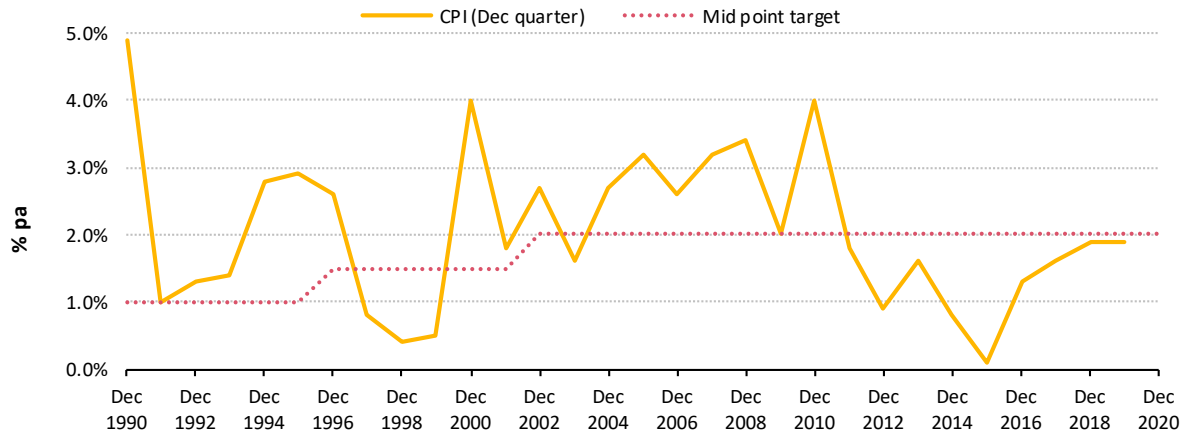
CPI inflation in New Zealand has been relatively stable since the introduction of the Reserve Bank Act with inflation targets (1989/90). The RBNZ inflation targets have been as follows and targeting the 2% midpoint remains unchanged:

Table 1: RBNZ inflation targets

	Range	Mid-point (% pa)
March 1990 to August 1996	0% pa to 2% pa	1.0
September 1996 to November 2002	0% pa to 3% pa	1.5
December 2002 to current	1% pa to 3% pa	2.0

Historical CPI inflation

The following chart shows the historical CPI inflation and the RBNZ target.



Historically CPI inflation experience has generally been above the midpoint of the target range. However, in the last seven years, the CPI increase has mostly been below the midpoint of the target range.

Over the longer term, CPI inflation has been reasonably close to the RBNZ target.

Overall, we recommend maintaining the long-term assumption of 2.0% pa, and this will be reviewed in more depth as part of the next full methodology review.

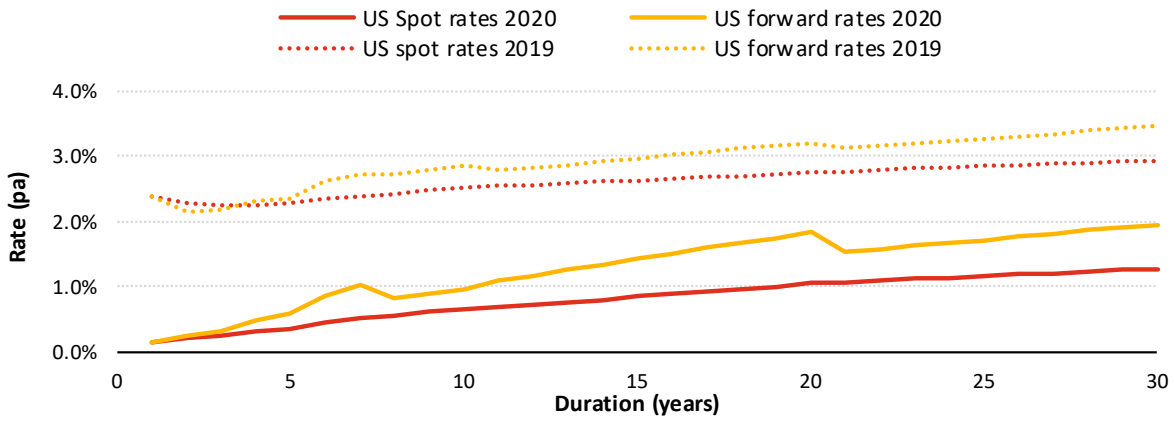
Bridging assumption

As mentioned earlier, the long-term over which the bridging assumptions apply is one of the key reasons why changing the long-term assumptions outside of the three-yearly review cycle would not have any significant impact.

For the 30 April 2020 rates, we do not reach the long-term rate until 68 years due to the low ending point of the nominal yield curve at year 2037, and the bridging assumption which links the end point of the nominal yield curve to the long-term assumption with a slope of 0.05% pa. Ultimately, this means that the actual long-term rate (after the 'end' of the bridge) is not particularly significant.

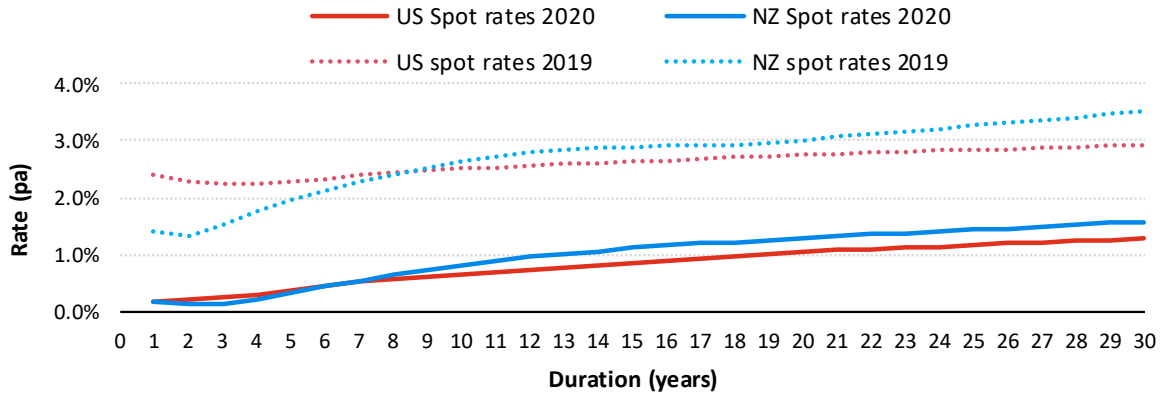
We first check the slope of the bridging assumption by looking at the US observable yield curve (out to 30 years) and the slope of the implied forward curve. We use the slope of the US forward curve to inform the slope for the bridge in our New Zealand forward yield curve, as there is no observable yield curve for New Zealand past 17 years.

Figure 8: US Treasury Nominal yield curve 30 April 2020



In this figure, the spot rates for maturities not published by the US Treasury have been interpolated between observable points using a straight line and as a result the curves are not smooth. The forward rates increase by 0.86% pa from 10 years to 20 years and by 0.12% pa from 20 years to 30 years implying a slope of about 0.024% pa. Note that at the last review this was slightly more, at 0.029%.

Figure 9: Comparison of New Zealand observable and projected yield curve and US observable yield curve



The graph above shows the New Zealand nominal spot rate at 30 April 2020 calculated using a slope 0.05%, compared to the US spot rates. This demonstrates that the current maximum slope assumption of 0.05% pa for the New Zealand yield curve still seems a reasonable upper bound to adopt. Between the longest New Zealand bond (17 years) and the longest US bond (30 years) the slope of the resulting spot rates is very similar as it was at the last review.

Long-term risk-free discount rate assumption

The methodology first determines a real long-term assumption, which is then combined with the long-term CPI inflation assumption to reach the long-term nominal assumption. We have updated the analysis used to determine the long-term nominal assumption, to see if there is any significant change in the last year.

EIOPA

EIOPA also adopts a single long-term real return assumption, which they refer to as the ultimate forward rate (UFR). This is calculated by finding the simple arithmetic mean of the annual real rates since 1961, for 12 large economies. The UFR for use in 2020 is calculated

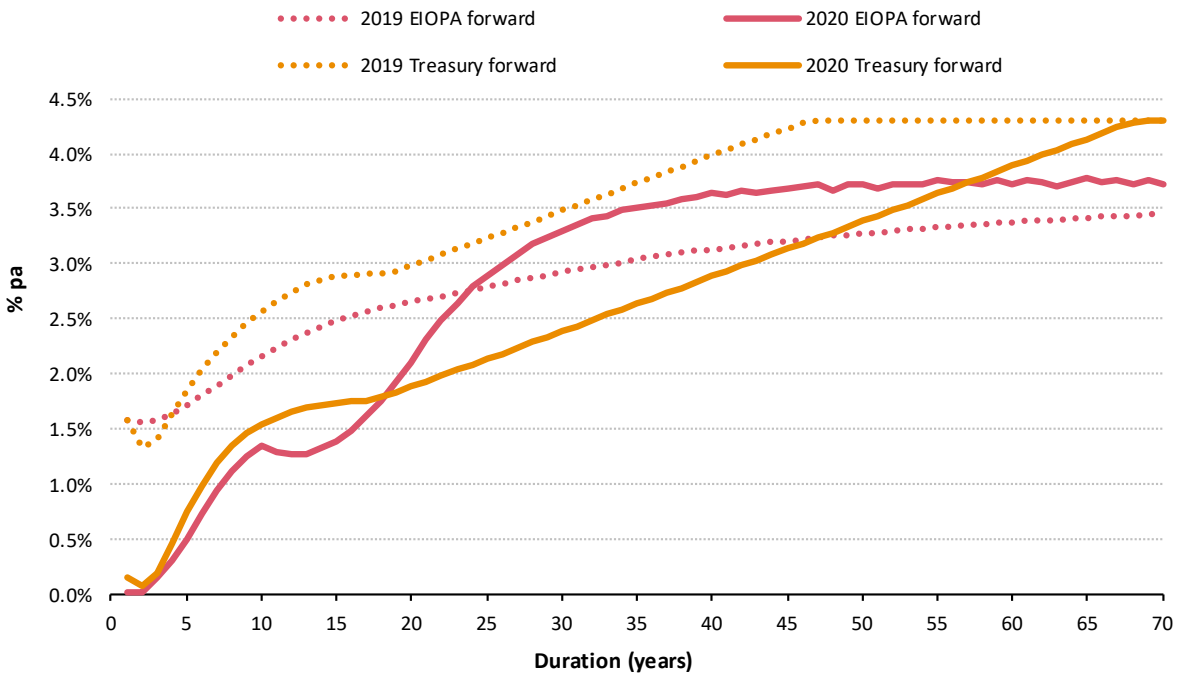
as 1.55% pa (1.60% pa in 2019). The annual change to the UFR is limited to increase or decrease by no more than 15 basis points, so that stability is maintained. For example, for New Zealand, the UFR is calculated as 3.55% pa (2.0% pa inflation plus 1.55% pa expected future short-term real rates), however the UFR applicable in 2020 is 3.75% pa due to the constraint on the rate of change (decreased 15 basis points from 3.90% pa in 2019).

The same assumption is used for all economies world-wide, and in our view it is reasonable to expect New Zealand to continue to attract a premium over the UK and the EU. For this reason, and because EIOPA includes no term premium, we are comfortable with a rate that is higher. One of the potential issues with a long-term rate is the volatility introduced by changing it. It would be reasonable for us to also reduce our long-term assumption by about 15 basis points per year if necessary when it is time to review it. In 2019 we reduced the real long-term rate from 2.75% pa to 2.3% pa, a 45 basis point decrease from the previous three-yearly review.

The following chart shows the EIOPA and Treasury forward rates at 30 April 2020, compared to those at 30 April 2019. This clearly shows the different interpolation methodologies employed, and demonstrates that while the EIOPA UFR is lower than our current long-term assumption of 2.3% pa, the EIOPA forward is significantly higher for the medium to long-term period, due to their lumpier bridging method.

Compared to last year, the New Zealand Treasury forward curve has moved more significantly in response to the reduced interest rates than the EIOPA curve, despite having a higher long- term forward rate.

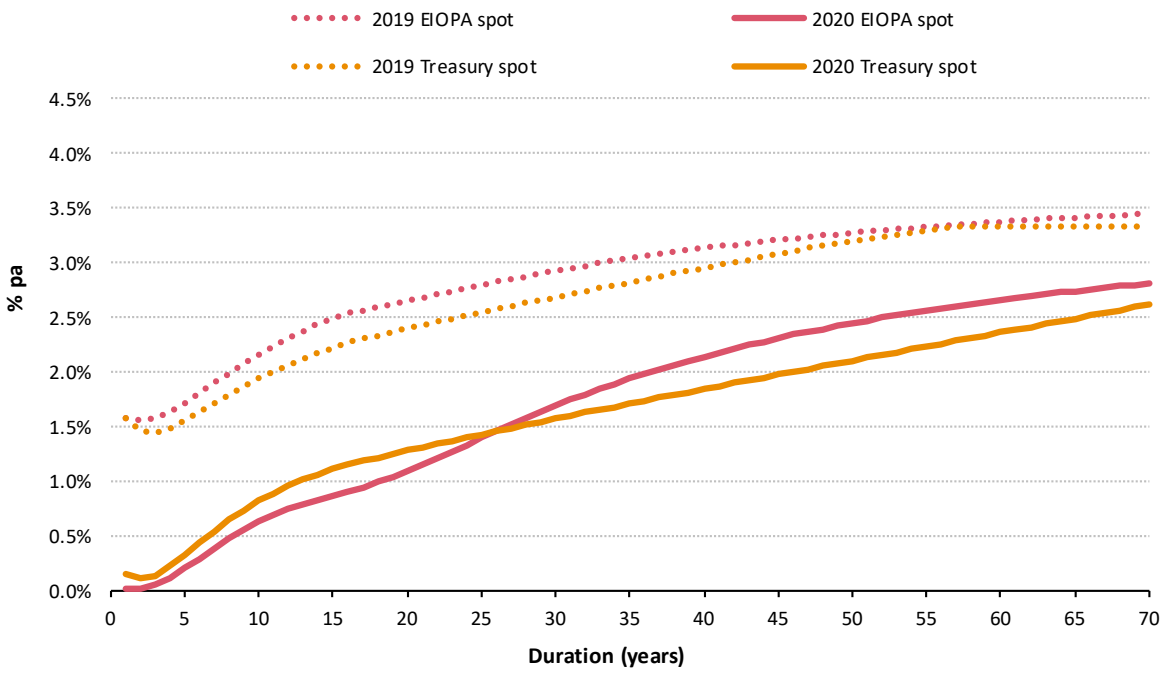
Figure 10: EIOPA forward yield curve at 30 April 2020 and 30 April 2019



The EIOPA curve change between 2019 and 2020 results in higher forward rates from about 24 years despite the significant drop in observable rates.

In order to assess the impact on present values, it is more useful to look at the spot rate curves. The graphs of the EIOPA New Zealand spot rates and the Treasury New Zealand spot rate curves show that despite the significant differences in the forward curves, the resulting spot curves are reasonably similar.

Figure 11: EIOPA spot yield curve at 30 April 2020 and 30 April 2019

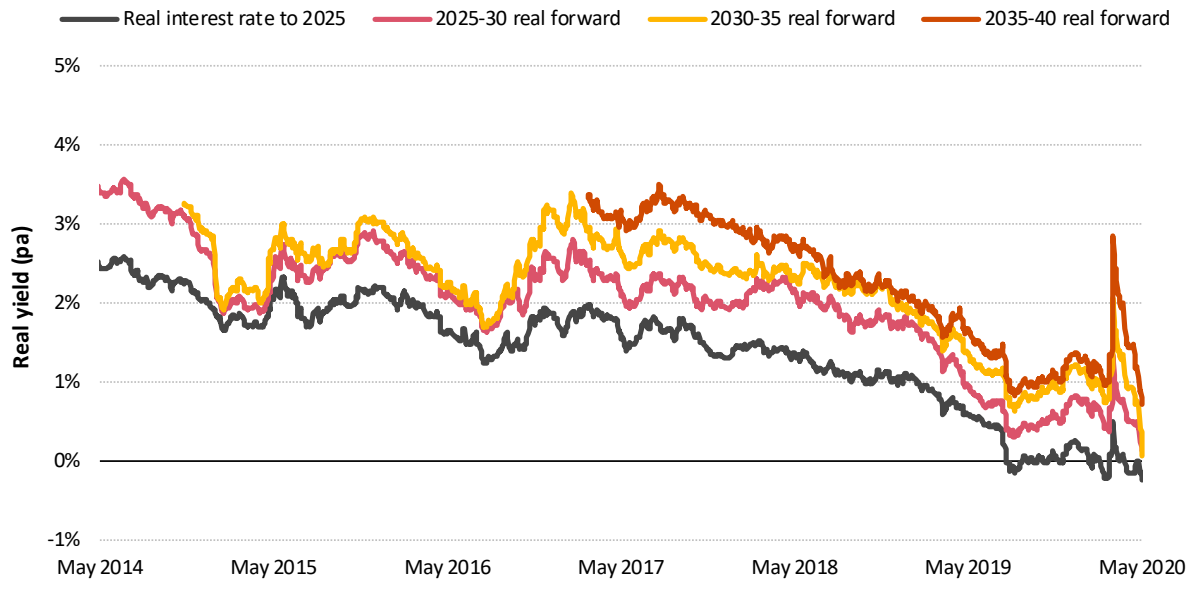


Inflation-indexed bonds

Inflation-indexed bonds can be useful evidence of the market's view of real rates of return. The first inflation indexed bond was issued in January 2014. At 30 April 2020, the inflation-indexed bonds on issue were: $5.45 billion maturing on 20 September 2025, $4.45 billion maturing on 20 September 2030, $4.25 billion maturing on 20 September 2035 and $4.25 billion maturing on 20 September 2040.

The following chart shows the real return on the 2025 inflation-indexed bond and the forward rates implied by the 2025, 2030, 2035 and 2040 inflation-indexed bonds. This demonstrates that even before the Covid-19 related impacts (shown by the spike in early 2020), expectations for real forward rates have been decreasing and now sit below our assumption of 2.3% pa. The yield on the 2020 index-linked bond first dropped below zero in August 2019.

Figure 12: New Zealand real forward interest rates, determined from inflation-indexed bonds to 30 April 2020

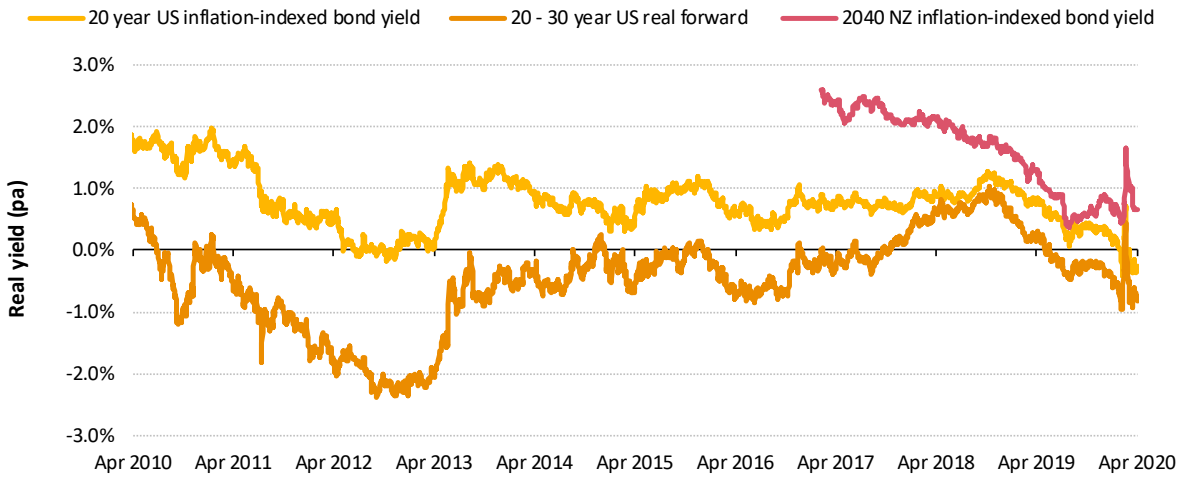


Last data point is 20 May 2020.

US

There is no New Zealand data on real forward rates beyond 2040 (20 years at present). A 30 year inflation-indexed bond was first issued in February 2010 by the US Treasury, which allows the US forward real rate for between 20 and 30 years to be determined.

Figure 13: US 20 year inflation-indexed bond yields, US 20 - 30 year forward yields, and the New Zealand 2040 inflation-indexed bond yield



Last data point is 30 April 2020.

The difference in returns between New Zealand and the US has been narrowing significantly over the last couple of years but it is reasonable to expect that New Zealand real returns will attract a greater premium over US rates in the foreseeable future than is indicated by the most recent data and it is reasonable to expect longer term forward rate to be higher than this.

Nominal long-term rates and international observations

Germany, Japan, UK and USA all have 30 year nominal Government bonds. This data could be useful to indicate the yield which would apply to a hypothetical New Zealand 30 year bond, although clearly a direct relationship would not be expected as there are differences in the contractual terms, credit quality, expected economic conditions including expected inflation and exchange rate risk, and supply and demand.

Table 2: International long-term spot rates

	Germany	Japan	USA	UK
10 year spot rate	-0.47%	-0.01%	0.69%	0.23%
30 year spot rate	-0.06%	0.45%	1.41%	0.61%
Difference	0.41%	0.46%	0.72%	0.38%

Data taken on 20 May 2020

The data above indicates significant consistency in the differences for all countries other than the US. As New Zealand is a smaller economy than any of the above, a higher differential would be expected. Smaller economies are expected to have a greater term premium than the larger economies due to factors such as having a more limited liquidity, more limited supply and greater exchange rate risk. The yield on the New Zealand 10-year bond is 0.79% at 30 April 2020, and the current 30 April 2020 nominal spot yield curve gives a rate of 1.57% at 30 years. This is a differential of 0.78%, which is roughly as expected based on the international differentials.

The Treasury Long Term Fiscal Model Methodology

The Treasury last reviewed its assumption for the long-term value of the annual nominal rate of return for the 10-year government bond in 2015. The assumption was set at 5.3% nominal and 3.3% real. In 2019 this reduced to 5.0% nominal and 3.0% real as a consequence of reducing Labour productivity growth from 1.5% to 1.2%. The Treasury is soon to begin another review of this assumption, with the intention to undertake this review every 3-5 years. This is further reason for us not to change our long-term assumption until after this review takes place and we can considered the Treasury's updated analysis in our next scheduled methodology review.

Summary

We have looked in to the impact of new information over the last 12 months on the long-term assumptions and have concluded the following:

- there is no reason to change the long-term inflation of 2%
- the bridging assumption is working well and makes the long-term nominal and real assumptions relatively immaterial.

The long term real and long-term nominal continue to be under pressure from observable rates, but we like the EIOPA approach of limiting the change to 0.15% per annum. This would fit with the 0.45% reduction in long-term nominal at the last review and imply that we might be headed for a similar reduction when we review the rates in two years' time.

On balance we are still comfortable with how the bridging and long-term rates operate together. The bridging makes the long-term rate largely immaterial. If the long-term rate was reduced the spot yield curve would move further below the EIOPA curve at long durations.

Overall, we recommend maintaining the current long-term assumptions. These will be reviewed again as part of the next full methodology review, which will take place in at least 2022.

Appendix A Market data

Amount on issue and turnover

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

Table 3: Nominal Government bonds on issue (30 April 2020) by maturity

Maturity	Coupon (% pa)	Total Issue ($m)	Available (net of RBNZ) ($m)
15-May-2021	6.00%	11,309	11,059
15-Apr-2023	5.50%	9,895	9,645
15-Apr-2025	2.75%	9,750	9,500
15-Apr-2027	4.50%	6,200	5,950
20-Apr-2029	3.00%	7,850	7,600
15-May-2031	1.50%	6,400	6,250
14-Apr-2033	3.50%	4,900	4,650
15-Apr-2037	2.75%	7,200	6,950
Total		**63,504**	**61,604**

Table 4: Inflation-indexed Government bond maturities on issue (30 April 2020)

Maturity	Coupon (% pa)	Total Issue ($m)	Available (net of RBNZ) ($m)
20-Sep-2025 CPI Indexed	2.00%	5,450	5,200
20-Sep-2030 CPI Indexed	3.00%	4,450	4,200
20-Sep-2035 CPI Indexed	2.50%	4,250	4,000
20-Sep-2040 CPI Indexed	2.50%	4,250	4,000
Total		**18,400**	**17,400**

Appendix B Summary of methodology

Table 5: 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 6: 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 break-even 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 2037
Start of long-term assumptions	End of nominal yield curve plus 10 years (15 April 2047)	At 30 April this is 2089 or 69 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 C Table of rates as at 30 June 2020

The assumptions below are as at 30 June 2020 based on the current methodology.

Table 7: Table based on market rates at 30 June 2020

This table is duration based and is to be used for valuations as at 30 June 2020

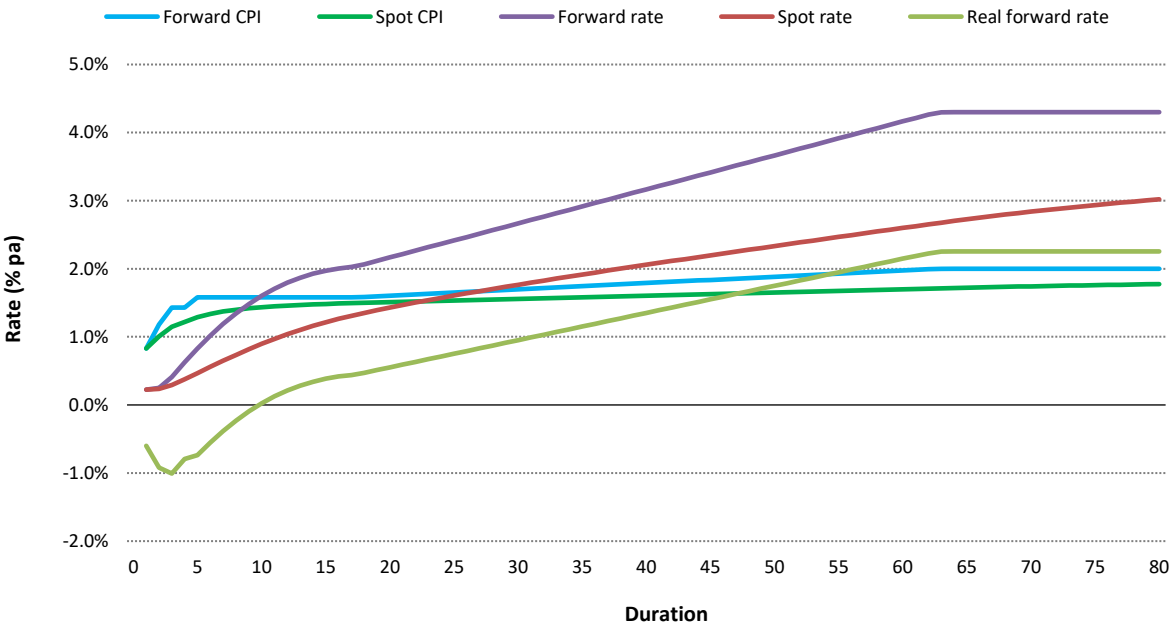
Year (30 April)	Forward CPI (% pa)	Spot CPI (% pa)	Forward rate (% pa)	Spot rate (% pa)	Real rate (% pa)
1	0.83%	0.83%	0.22%	0.22%	-0.60%
2	1.18%	1.00%	0.25%	0.24%	-0.92%
3	1.43%	1.15%	0.41%	0.29%	-1.01%
4	1.43%	1.22%	0.63%	0.38%	-0.79%
5	1.58%	1.29%	0.83%	0.47%	-0.74%
6	1.58%	1.34%	1.02%	0.56%	-0.55%
7	1.58%	1.37%	1.19%	0.65%	-0.38%
8	1.58%	1.40%	1.35%	0.74%	-0.23%
9	1.58%	1.42%	1.48%	0.82%	-0.10%
10	1.58%	1.43%	1.60%	0.90%	0.02%
11	1.58%	1.45%	1.71%	0.97%	0.13%
12	1.58%	1.46%	1.80%	1.04%	0.21%
13	1.58%	1.47%	1.87%	1.10%	0.28%
14	1.58%	1.48%	1.93%	1.16%	0.34%
15	1.58%	1.48%	1.97%	1.22%	0.39%
16	1.58%	1.49%	2.00%	1.26%	0.42%
17	1.58%	1.49%	2.03%	1.31%	0.44%
18	1.59%	1.50%	2.07%	1.35%	0.47%
19	1.60%	1.50%	2.12%	1.39%	0.51%
20	1.61%	1.51%	2.17%	1.43%	0.55%
21	1.61%	1.51%	2.22%	1.47%	0.59%
22	1.62%	1.52%	2.27%	1.50%	0.63%
23	1.63%	1.52%	2.32%	1.54%	0.67%
24	1.64%	1.53%	2.37%	1.57%	0.71%
25	1.65%	1.53%	2.42%	1.61%	0.75%

Year (30 April)	Forward CPI (% pa)	Spot CPI (% pa)	Forward rate (% pa)	Spot rate (% pa)	Real rate (% pa)
26	1.66%	1.54%	2.47%	1.64%	0.79%
27	1.67%	1.54%	2.52%	1.67%	0.83%
28	1.68%	1.55%	2.57%	1.70%	0.87%
29	1.69%	1.55%	2.62%	1.74%	0.91%
30	1.70%	1.56%	2.67%	1.77%	0.95%
31	1.71%	1.56%	2.72%	1.80%	0.99%
32	1.72%	1.57%	2.77%	1.83%	1.03%
33	1.73%	1.57%	2.82%	1.86%	1.07%
34	1.73%	1.58%	2.87%	1.89%	1.11%
35	1.74%	1.58%	2.92%	1.92%	1.15%
36	1.75%	1.59%	2.97%	1.94%	1.19%
37	1.76%	1.59%	3.02%	1.97%	1.23%
38	1.77%	1.60%	3.07%	2.00%	1.27%
39	1.78%	1.60%	3.12%	2.03%	1.31%
40	1.79%	1.61%	3.17%	2.06%	1.35%
41	1.80%	1.61%	3.22%	2.09%	1.39%
42	1.81%	1.62%	3.27%	2.11%	1.43%
43	1.82%	1.62%	3.32%	2.14%	1.47%
44	1.83%	1.63%	3.37%	2.17%	1.51%
45	1.84%	1.63%	3.42%	2.20%	1.55%
46	1.85%	1.63%	3.47%	2.22%	1.59%
47	1.85%	1.64%	3.52%	2.25%	1.63%
48	1.86%	1.64%	3.57%	2.28%	1.67%
49	1.87%	1.65%	3.62%	2.31%	1.71%
50	1.88%	1.65%	3.67%	2.33%	1.75%
51	1.89%	1.66%	3.72%	2.36%	1.79%
52	1.90%	1.66%	3.77%	2.39%	1.83%
53	1.91%	1.67%	3.82%	2.41%	1.87%
54	1.92%	1.67%	3.87%	2.44%	1.91%
55	1.93%	1.68%	3.91%	2.47%	1.95%
56	1.94%	1.68%	3.96%	2.49%	1.99%
57	1.95%	1.69%	4.01%	2.52%	2.03%

Year (30 April)	Forward CPI (% pa)	Spot CPI (% pa)	Forward rate (% pa)	Spot rate (% pa)	Real rate (% pa)
58	1.96%	1.69%	4.06%	2.55%	2.07%
59	1.97%	1.70%	4.11%	2.57%	2.11%
60	1.97%	1.70%	4.16%	2.60%	2.15%
61	1.98%	1.70%	4.21%	2.63%	2.19%
62	1.99%	1.71%	4.26%	2.65%	2.23%
63	2.00%	1.71%	4.30%	2.68%	2.25%
64	2.00%	1.72%	4.30%	2.70%	2.25%
65	2.00%	1.72%	4.30%	2.73%	2.25%
66	2.00%	1.73%	4.30%	2.75%	2.25%
67	2.00%	1.73%	4.30%	2.77%	2.25%
68	2.00%	1.73%	4.30%	2.80%	2.25%
69	2.00%	1.74%	4.30%	2.82%	2.25%
70	2.00%	1.74%	4.30%	2.84%	2.25%
71	2.00%	1.75%	4.30%	2.86%	2.25%
72	2.00%	1.75%	4.30%	2.88%	2.25%
73	2.00%	1.75%	4.30%	2.90%	2.25%
74	2.00%	1.76%	4.30%	2.92%	2.25%
75	2.00%	1.76%	4.30%	2.94%	2.25%
76	2.00%	1.76%	4.30%	2.95%	2.25%
77	2.00%	1.77%	4.30%	2.97%	2.25%
78	2.00%	1.77%	4.30%	2.99%	2.25%
79	2.00%	1.77%	4.30%	3.00%	2.25%
80	2.00%	1.77%	4.30%	3.02%	2.25%

The resulting fitted rates are plotted below:

Figure 14: Yield curve, real rate and forward and spot CPI inflation rates at 30 June 2020



Appendix D Asset purchases (quantitative easing)

Extract from the Reserve Bank of Australia website, explaining asset purchases (quantitative easing)[3]:

> *"Asset purchases – also known as quantitative easing (QE) – involves the outright purchase of assets by the central bank from the private sector with the central bank paying for these assets by creating 'central bank reserves'. (This has been popularly referred to as 'printing money'.) Asset purchases have long been a feature of central bank operations (and were once the main tool for influencing the policy interest rate). However, since the GFC, asset purchases have been on an unprecedented scale and led to a very large expansion of central bank balance sheets. Furthermore, as part of their asset purchase programs, central banks have bought a wide range of assets from the private sector (whereas in the past, they bought only government securities), though the main asset type has remained government securities.*
>
> *The precise goal of asset purchases by the central bank has varied across countries, but a common theme has been the desire to lower interest rates on risk-free assets (such as government securities) across different terms to maturity of those assets. In this way, asset purchases can lower a range of interest rates other than the policy interest rate (which may already be as low as it can practically go – ie, be at its effective lower bound). Asset purchases also reinforce market expectations that policy interest rates are going to stay low for a long time, with this signalling channel adding to downward pressure on bond yields, especially longer-term yields.*
>
> *Typically, when a central bank undertakes asset purchases, it can either set a target for the quantity of assets it will purchase (at any price) or a target for the price of an asset (purchasing whatever quantity of assets will achieve that price), whereby the price of an asset is equivalent to its interest rate."*

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3 Retrieved from the Reserve Bank of Australia website: https://www.rba.gov.au/education/resources/explainers/unconventional-monetary-policy.html

Appendix E CPI forecasts at 30 June 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.

In recent years, 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%. The table below shows forecasts of CPI inflation at the December 2019 CPI review supporting this assumption. Note that we consider The Treasury's own inflation forecasts, as well as forecasts produced by New Zealand Institute of Economic Research (NZIER) and the Reserve Bank of New Zealand (RBNZ).

Table 8: Forecasts of CPI inflation (December 2019 CPI review)

Source (date of release)	Year ending	2020 (% pa)	2021 (% pa)	2022 (% pa)	2023 (% pa)
NZIER Consensus Forecasts (December 2019)	March	2.1	1.8	1.9	1.9
NZIER Quarterly Predictions (November 2019)	March	2.0	2.0	2.1	2.0
Treasury (December 2019, HYEFU)	June	1.9	1.9	2.0	2.0
RBNZ inflation expectations survey (December 2019)	December	1.7	1.8	-	-
RBNZ Monetary Policy Statement (November 2019)	March	2.1	1.7	2.1	-

The economic environment has changed considerably since December 2019. Many countries, including New Zealand, are expecting their largest economic downturns in living memory. The final impact of COVID-19 and related response measures on the New Zealand economy remains highly uncertain. The table of CPI inflation forecasts, updated as at June 2020, is shown following.

Table 9: 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	-

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 consistently below 1.0% for 2021, between 1.0% and 1.5% for 2022, 1.6% and 2.0% for 2023, and between 1.3% and 1.9% for 2024. The relatively wide ranges of these forecasts indicate the uncertain outlook.

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, Treasury BEFU forecasts are higher than the other forecasts. Consequently we have selected assumptions that are slightly higher than the consensus forecasts, and assumed that 2024 is the same as 2023.

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 30 June 2020 rates and will be reassessed in December 2020, in accordance with the published methodology.

Table 10: Forecast inflation chosen assumptions

	2021 (% pa)	2022 (% pa)	2023 (% pa)	2024 (% pa)
Previous assumption	2.0	2.0	2.0	2.0
Selected assumption	0.5	1.2	1.7	1.7
Adjusted 30 June breakeven inflation	1.16	1.16	1.16	1.16
Resulting CPI (50/50 weighted)	0.83	1.18	1.43	1.43