TE TAI ŌHANGA
THE TREASURY

Risk-Free Discount Rates and CPI Inflation

Assumptions for Accounting Valuations

June 2022

Te Kāwanatanga o Aotearoa
New Zealand Government

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Summary

Purpose

The purpose of this paper is to document the review of 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 three years ago, in May 2019.

Background

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.

Actuarial valuations for financial reporting require many other demographic and financial assumptions. Those other assumptions are generally specific to the obligation and best determined by the separate Government agency, which is responsible for reporting them, rather than determined centrally by The Treasury.

Overall framework

The framework for determining The Treasury risk-free discount rates and CPI inflation assumptions can be summarised in eight steps and thirteen parameters as follows. The framework of applying eight steps has been kept unchanged since 2010, although the assumptions under each step and parameters are subject to review and have changed over time in some cases.

Table 1: Eight step framework for determining the Treasury risk-free discount rates and CPI assumptions

Period	Step	Proposed process
Short to medium-term assumptions Short-term: up to four years Medium-term: five to 29 years (until 15 May 2051, the latest maturity date of a Government nominal bond)	1	Determine risk-free discount rates for the first month from the yield on one month Overnight Index Swaps (OIS). Use OIS rates as additional data points in the first year.
	2	Determine any adjustments required to the nominal Government bond yields to give short to medium-term risk-free discount rates.
	3	Determine the smoothed market forward rate curve with reference to OIS and nominal Government bond yields
	4	Determine short to medium-term CPI inflation assumptions.
Long-term assumptions Long-term: greater than 39 years (or later if maximum slope applies)	5	Determine the long-term real risk-free discount rate.
	6	Determine the long-term nominal risk-free discount rate.
	7	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	8	Determine the method of blending short to medium-term and long-term rates.

Table 2: Modelling parameters

	Modelling parameter	Proposed/current value
1	Adjustment to nominal New Zealand Government bonds	None
2	Criteria for determining whether nominal New Zealand Government bonds meet liquidity criteria	New nominal Government bonds included immediately, provided the yield on those bonds is consistent with the yield on the established Government bonds, or after one month.
3	Criteria for determining whether index-linked New Zealand Government bonds meet liquidity criteria	$4 billion
4	Liquidity adjustment to breakeven inflation	0.30%

	Modelling parameter	Proposed/current value
5	Inflation risk premium adjustment to breakeven inflation	-0.30%
6	Weighting given to inflation forecasts: weighting given to breakeven inflation	50:50
7	Long-term real return	2.30% pa (compound 2.25%)
8	Long-term CPI inflation	2.0% pa
9	Long-term nominal discount rate (forward rate)	4.30% pa
10	End of market observations (nominal discount rates and CPI inflation)	End of nominal yield curve (currently 15 May 2051)
11	Start of long-term assumptions	Greater of end of nominal yield curve plus 10 years (currently 15 May 2061) or as determined by the maximum slope of the bridging assumption
12	Bridging assumption – nominal discount rates	Linear between the end of market and the start of long-term with a maximum slope of 0.05% per year of duration
13	Bridging assumption – inflation	Linear between six months prior to the maturity date of the last inflation-indexed government bond and the end of the bridging period for nominal rates

A sample table of annual rates from year one to year 46 determined using this methodology, as at 31 May 2022, is shown in Appendix E – Sample table of rates as at 31 May 2022.

The methodology and the reasons supporting the methodology for each of these eight steps and the parameters is discussed further in the body of the report. Below is a summary of the methodology and principles that will be applied from 30 June 2022 until revised.

Risk-free nominal discount rates until the latest maturity of a liquid nominal Government bond, currently 2051 (Steps 1 to 3)

Overnight Index Swaps (OIS) and nominal Government bonds will be used to determine nominal risk-free discount rates over the period for which there are liquid nominal Government bonds.

The relevant accounting and actuarial standards acknowledge that reference to Government bonds in determining a proxy for risk-free discount rates is a good starting point. The use of Government bonds is also widely accepted by current practice in New Zealand. OIS will be used for the first month, where there is no Government bond to base the risk-free discount rates on.

At present, each of the nominal Government bonds and OIS are liquid and so can be used directly to determine risk-free discount rates without any adjustment. At present there is no expectation that this will change in the period until the methodology is reviewed, ie, prior to June 2025. The process for assessing any required adjustments to the nominal Government bond yields to proxy short to medium-term risk-free discount rates in the future is described in Appendix C – Process for adjusting market data.

The process for fitting discount rates for each year to the available data is described in Appendix D - Forward rate yield curve fitting methodology.

Short to medium-term CPI inflation (Steps 4 to 6)

There are two main sources of short to medium-term inflation information: inflation forecasts and breakeven inflation.

Forecast inflation is available for up to four years. Previously, forecast inflation has been relatively close to the long-term inflation assumption of 2.0% pa. Given the current economic environment with recent inflation at 7% pa and expected to remain materially higher than 2.0% pa for some time, this will not necessarily be the case in the next few years. Market commentary indicates an expectation that inflation will be back to the long-term rate within four years. Therefore, we have retained the previous approach of determining forecast inflation for each of the next four years and setting forecast inflation equal to the long-term assumption after that.

Breakeven inflation is determined from the relationship of the market price of inflation-indexed Government bonds to the market price of nominal Government bonds. It 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. Breakeven inflation may differ from future inflation expectations for a number of reasons, such as differences in the liquidity of the inflation-indexed and nominal Government bonds and inflation risk premium[1].

Liquidity adjustment

Inflation-indexed Government bonds are clearly less liquid than nominal Government bonds because there are a limited number of domestic buyers and holdings are heavily concentrated in a single entity. We believe that the evidence strongly suggests inflation-indexed government bonds are not as liquid as nominal government bonds, and so the break-even inflation rates calculated from the inflation-indexed government bonds need to be adjusted to reduce this bias before being used to estimate inflation. The impact of this on breakeven inflation is difficult to determine. Our analysis of international data indicates the average differential between breakeven inflation and inflation swaps is 0.30% pa since 2010 (after the impact of the global financial crisis where the breakeven inflation is lower). This differential can be taken as a proxy for the inflation-indexed price adjustment for liquidity.

Inflation risk premium

The inflation risk premium is very difficult to quantify directly from the market observable data. In the last year there has been a significant turnaround in inflation expectations. Previously there was the risk that New Zealand would continue to

[1] An inflation risk premium could be either positive or negative depending on whether the investor is prepared to pay a premium for protection, or partial protection from inflation being greater than expected or whether the investor considers the risk of inflation being lower than expected is a greater risk.

experience very low inflation and that this would hamper growth, as Japan experienced. The outlook has significantly changed post COVID 19 and the short-term inflation expectations are much higher. There is a significantly heightened awareness of the risks of continued high inflation. This is likely to increase the inflation risk premium. An increase to the inflation risk premium will reduce the breakeven inflation, normalising some of the recent increases observed in the market pricing of breakeven inflation. We assume that the size of this adjustment would broadly be the same as the liquidity adjustment, but the opposite sign, ie -0.30%.

Blending inflation forecasts with breakeven inflation

Breakeven inflation can be determined for the period to September 2025 (2.16% pa at 31 May 2022) and then for five year periods to 2040, matching the duration of the inflation-linked bonds. Due to the high short term inflation, it is sensible to determine a short-term breakeven inflation from the earliest maturing bond and then a medium term breakeven inflation from all of the remaining bonds. If it is a short period (ie one year or less) until the maturity date of the shortest inflation-linked bond, then information from the subsequent bond would be used, in addition, to determine short-term breakeven inflation.

The process to determine short to medium-term inflation rates is:

- every six months
  - assess forecast inflation using forecasts for the short-term (4 years)
  - apply the RBNZ mid-range target of 2.0% pa for the medium term (ie, after year 4 and through to the date of the earlier of the last nominal or last inflation-indexed Government bond (2040 at present)
- at each calculation date
  - determine the rate of breakeven inflation for both the short and medium term, ie, through to the date of the earlier of the maturity date of last nominal or six months prior to the maturity date of the last inflation-indexed Government bond (2040 at present)
  - vary adjusted breakeven inflation over the first four years so that it is a reducing percentage of forecast inflation based on mid-year weights derived using a cubic smoothing approach to blend with the raw breakeven inflation rate at four years, but the compound adjusted breakeven inflation after four years is unaffected
  - adjust the breakeven inflation curve for any liquidity and inflation risk premium (currently assumed to offset each other so no adjustment needed on a net basis)
  - give a 50% weighting to each of the forecast inflation and adjusted breakeven inflation.

Long-term real return (Step 7)

The real risk-free discount rate is the discount rate in excess of inflation and the most critical long-term assumption for accounting valuations with inflation-indexed cash-flows. While models use nominal risk-free discount rates and CPI inflation assumptions, the difference in quantum between them (ie, the real-return assumption) is often the more critical assumption for valuing long-term cashflows. Having said that, these components are important individually. Minimal guidance is given on real rates of return and inflation assumptions in the standards.

The methodology assumes that a single long-term real risk-free forward discount rate (ie, the real rate of interest that an investor would expect to earn from a very safe asset in the long term, after taking into account inflation expectations) can be set and this rate should be stable for a reasonable time.

As there is no observable data for the real (or nominal) long-term risk-free discount rate, judgment is required in selecting the rate that proxies the long-term real risk-free discount rate. Recent historical nominal and real risk-free returns, returns on long-term nominal and inflation-indexed bonds, returns on relevant offshore nominal and inflation-indexed bonds and economic theory are all relevant to selecting the long-term risk-free discount rate. While recent historical experience and trends are taken into consideration, as the rates selected are intended to apply for the next three years and given the extent to which the rates vary over a three-year period, the rates selected should not be overly influenced by the actual rates at the date of this report but seek to reflect the expected level over the next three years.

The review concludes that the long-term real return assumption for accounting valuations should remain at 2.30% pa (2.25% pa compound).

Long-term CPI inflation (Step 8)

The methodology sets a single CPI inflation rate for the long term.

The present volatile economic conditions and high inflation notwithstanding, this rate has been validated by reference to historic levels of CPI inflation and the historic relationship between CPI inflation and the RBNZ inflation targets.

The mid-point of the RBNZ inflation target is currently 2.0% pa. The February 2022 Monetary Policy Statement forecasted annual inflation to return to 2.0% by March 2025, stating that, “annual inflation is expected to peak in early 2022, and then ease over the course of the year, returning to within their target range in mid-2023”. The methodology concludes that a reasonable long-term CPI inflation rate is 2.0% pa.

Long-term nominal discount rate (Step 9)

The methodology sets the long-term nominal forward discount rate to be the sum of the long-term real return plus the long-term CPI inflation assumption. This is 2.30% plus 2.00%, giving a 4.30% pa assumption.

As stated above, these assumptions are unchanged from the previous review.

Bridging the short and long-term (Step 10 to 13)

The nominal Government bond yield curve currently finishes at 2051 (currently 29 years) and the indexed-linked curve for inflation currently finishes at 2040 (currently 18 years). A key judgement is how the nominal Government bond yield and inflation curves should be blended with the long-term assumptions.

The methodology assumes the last point on the observable forward rate yield and forward inflation curves should be linearly interpolated to their respective long-term rates. For the nominal bond yield curve, the linear interpolation commences at the maturity date of the last nominal Government bond and ends 10 years after the maturity date of the last nominal Government bond, subject to a maximum slope of 0.05% per year is used. For the inflation curve, the linear interpolation commences at the maturity date of the last index-linked bond and finishes at the same end point as the interpolation for the nominal curve.

Changes in the framework

Five changes have been made to the framework since 2019.

1. Use of OIS rates instead of Treasury bills for short-term nominal rates

The risk-free discount rates for the first month will be based on the yield on one-month Overnight Indexed Swap (OIS) rate. This rate will then be smoothed into the rates determined from the nominal Government bonds, supplemented by OIS rates as available for durations less than 12 months.

In 2019, risk-free discount rates for the first year were determined with reference to the overnight cash rates and Treasury bills. Inconsistences between the overnight cash rate and Treasury bill rate led to the risk-free discount rates for the first year being determined with reference to Treasury bills in 2019/2020.

This change has been introduced due to the Treasury's view that the OIS market is now a better reflection of a risk-free rate than Treasury Bills as the Treasury Bills market sometimes suffers from low liquidity.

2. Add shape to short-term breakeven inflation

The short-term breakeven inflation from the shortest inflation-linked bond (currently 2025 bond) will be determined first before the medium-term breakeven inflation is calculated. When it is a short period to the maturity date of the shortest inflation-linked bond (ie, one year or less), then information from the subsequent bond would be used in addition, to determine short-term breakeven inflation. Breakeven inflation over the first four years will then be given "shape" to match the forecast inflation. This will be achieved by adjusting breakeven inflation over the first four years so that it is a reducing percentage of forecast inflation over the first four years based on mid-year weights derived using a cubic smoothing approach to blend with the raw breakeven inflation rate at four years, but the compound adjusted breakeven inflation after four years is unaffected. This is to enable projected inflation to better reflect the "shape" of short-term inflation. The approach used will not impact the 50:50 weighting or compound adjusted breakeven inflation at the end of the short-term period (four years).

In earlier years, forecast inflation has been relatively flat with little variation from the 2% pa RBNZ target. Breakeven inflation is also a flat percentage, so introducing some shape in the breakeven inflation was not necessary. The adjustment is to enable the model to adequately reflect short-term inflation which is not expected to be flat over the coming years with price instability as a result of COVID-19 and geopolitical activity.

3. Include an inflation risk premium adjustment in the estimated breakeven inflation

An inflation risk premium is introduced that reduces the breakeven inflation and broadly offset the liquidity adjustment.

In previous reviews, the inflationary outlook was such that the market was more nervous of the risk of a very low inflationary environment in the future (ie, below 2% pa), consistent with economies such as Japan. The outlook has changed materially over the past year with concerns over high inflation in the future dominating. As a result, calculated breakeven inflation from indexed-linked bond data has been rising, a further sign that an inflation risk premium is being priced into the market. While it is difficult to estimate the inflation risk premium in the New Zealand market, overseas data suggests it is broadly in line with any liquidity adjustment and therefore we assume they will be equal and opposite adjustments to breakeven inflation.

This position is expected to continue for the three years until this methodology is reviewed.

4. Change the bridging for inflation to start from the last indexed-linked bond

The bridging period for inflation will start six months prior to the maturity date of the longest dated inflation linked bond and end at the same point as the nominal bridging. The six month prior is due to this being the inflation index point used to determine the maturity proceeds.

Previously the bridging periods have been the same, but now that the observable nominal curve is longer than the observable index-linked curve it makes more sense to start the inflation bridging at the last indexed bond because that is the point where there is no implied market inflation information.

5. Technical adjustment to calculating breakeven inflation

The breakeven inflation calculation needs to know the actual inflation to date. The actual inflation to the end of a quarter is not known until around six weeks later. We will now estimate this actual inflation based on forecasts before determining the breakeven inflation. Previously this was not a material issue with very stable inflation figures, but this is now more important with a volatile short-term inflation outlook.

The impact of the change in methodology is shown in Appendix F.

Reviews and investigations required

The inputs to the model and parameters will be reviewed according to the following table.

Table 3: Timetable for review of inputs

Input	Update based on market data	Review of methodology
Risk-free nominal discount rates until the latest maturity date of a nominal Government bond	At each monthly calculation date	Three yearly
Inclusion of new nominal Government bonds	At each monthly calculation date	Three yearly
Inclusion of new index-linked Government bonds	At each monthly calculation date	Three yearly
Short-term inflation forecasts	30 June and 31 December	Three yearly
Breakeven inflation	At each monthly calculation date	30 June or 31 December
Whether breakeven inflation should follow the rates implied by the individual index-linked bonds	At each monthly calculation date	30 June or 31 December
Whether a longer period is required to transition from short-term inflation assumptions to medium-term inflation assumption	At each monthly calculation date	30 June or 31 December
Inflation-indexed price adjustment	N/A	Three yearly
Long-term real return	N/A	Three yearly
Long-term nominal return	N/A	Three yearly
Long-term CPI inflation	N/A	Three yearly
Bridging methodologies	N/A	Three yearly

We have considered what circumstances might lead to the review of the methodology before three years. As the short to medium-term assumptions are based on market information, we consider that these will adjust automatically to a change in the market. 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 would need adjusting sooner than three years.

Events that might lead to earlier review are:

- The 0.3% inflation-indexed price adjustment for breakeven inflation has been determined based on international experience since 2010. The historic information indicates that that breakeven inflation becomes less reliable in times of extreme market stress, eg, through the Global Financial Crisis, and in these circumstances the quantum of the inflation-indexed price adjustment would need to be reconsidered.
- A change in the RBNZ inflation target could also lead to a circumstance in which the methodology and assumptions need to be reviewed.

The risk-free discount rates and CPI inflation methodology will be reviewed prior to the implementation of PBE IFRS 17.

Background and approach

Background

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 a balance date, where the settlement of those obligations or receipt of payments will occur sometime after a balance date.

This paper focuses mainly on the reporting of insurance liabilities and employee benefit obligations in general purpose financial statements which must comply with relevant accounting standards.

Accounting standards acknowledge that valuing such liabilities is complex because actuarial assumptions are required to measure the obligation. The scope of this paper is limited to determining two financial assumptions used in actuarial valuations for financial statements: risk-free discount rates and CPI inflation assumptions.

The discounting of future cash flows is a technique that can be used for many other purposes and therefore may lead to the use of different financial assumptions than those used in general purpose financial statements. For example, discounting techniques can be used to:

- negotiate a price of an asset or liability in a sales transaction
- determine a specific funding policy and contribution rate
- provide a cost benefit analysis and economic impact appraisal.

These other valuation exercises are not governed by an accounting standard, so the choice of financial assumptions can differ and may be set in a more flexible way or determined by other regulators or industry guidance. In particular, accounting standards do not mandate that a liability is funded in a certain way or that the same financial assumptions used for financial reporting are also used to determine a certain contribution rate. The findings in this paper are not intended to apply to the valuation of traded securities.

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.

Actuarial valuations for financial reporting require many other demographic and financial assumptions. Those other assumptions are generally specific to the obligation and best determined by the separate Government agency, which is responsible for reporting them, rather than determined centrally by The Treasury.

While the scope of this paper is focused on compliance with PBE IFRS 4 and PBE IPSAS 39, the discount rates and CPI inflation assumptions may be applied to other accounting valuations where a risk-free discount rate or CPI inflation assumption is used. In these cases, the rates may be used unadjusted, or as a building block to calculate another assumption at the reporting entity's discretion, depending on the relevant accounting standard being complied with. In particular, we have determined that The Treasury's central risk-free rates are an appropriate building block for determining a fair value discount rate for valuing student loans in compliance with the accounting standard for financial instruments.

Determining the nominal amounts to be settled or received in the future is likely to be impacted by inflation which is specific to the liability or asset being measured. We have only considered inflation as measured by the CPI in this exercise. Each valuation will need to consider the appropriate inflation index to use in relation to this CPI inflation assumption.

The methodology, assumptions and table of rates and CPI inflation assumptions are audited annually to assess that they are compliant with the relevant accounting standards.

PBE IFRS 17 doses not come into effect over the period covered by this review for public sector entities and so the requirements of PBE IFRS 17 have not been taken into consideration. However, the introduction of IFRS 17 has led to a number of papers discussing aspects of determining risk-free discount rates and to the extent that they are relevant, these papers have been taken into consideration.

The methodology adopted to determine risk-free discount rates and CPI inflation assumptions will be reviewed prior to the adoption of PBE IFRS 17.

Approach

A number of valuations recorded in the financial statements of the Government involve valuing cash flows fifty or more years into the future. The principles in PBE IFRS 4 and PBE IPSAS 39 require that discounting should be at a rate that reflects the time value of money ie, the risk-free discount rate for liabilities.

For valuing some assets, such as student loans, the standards require risk-adjusted discount rates and in practice, particularly in absence of an observable market, these are typically built up from risk-free discount rates with adjustments for risk. Therefore, the main objective of this paper 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, in practice, the risk-free discount rates cannot be directly observed; they 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. Therefore, this methodology determines the most appropriate yield that can be observed to provide the best proxy to a New Zealand risk-free discount rate.

Since September 2021, New Zealand market data extends out for 30 years for Government bonds. This removes the previous risk of the maximum being only 18 years. At extreme durations there are no observable market values for interest rates.

Although there has been an increase in inflation-indexed bonds issued since we developed the original methodology, we do not believe this means that the starting point for the methodology should now be the real return determined from inflation-indexed bonds rather than calculating nominal discount rates and inflation separately. In our view, this would not be an appropriate interpretation of the relevant accounting standards and the market in inflation-indexed bonds is not deep compared to the market in nominal Government bonds, which we consider deeper and more liquid. Refer to Appendix B for discussion of the accounting standard interpretation and the chapter on short to medium-term inflation regarding the quality of the inflation-indexed bond market.

Accounting and actuarial standards and other literature

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.

Generally, the accounting standards provide principles but have limited specific guidance in a number of areas, particularly where there are market shortcomings such as mismatches between liability durations and the length of the market yield curves. PBE IPSAS 39 provides more guidance for risk-free discount rates than PBE IFRS 4 but still requires significant judgement around how it is applied in practice.

While the words of PBE IFRS 4 and PBE IPSAS 39 in relation to risk-free discount rates are not exactly the same – see principles and guidance below - we have concluded that both standards require the same risk-free discount rate in substance. Therefore, it is appropriate to determine a single table of risk-free discount rates and CPI inflation assumptions centrally for both insurance liabilities and pension obligations reported in the financial statements of the Government.

Because the standards provide principles and limited application guidance in selecting financial assumptions, significant judgement must be used extensively in this paper to achieve the objectives of general purpose financial statements, which is to provide information about an entity that is useful to readers of those financial statements for accountability purposes and for decision-making purposes.

Some of the key principles and pieces of guidance from PBE IFRS 4 and PBE IPSAS 39 that we have applied in developing this methodology and assumptions are:

- Actuarial assumptions shall be unbiased and mutually compatible [PBE IPSAS 39.77].
- Actuarial assumptions are unbiased if they are neither imprudent nor excessively conservative [PBE IPSAS 39.79].
- Actuarial assumptions are mutually compatible if they reflect the economic relationships between factors such as inflation, rates of salary increase and discount rates. For example, all assumptions that depend on a particular inflation level (such as assumptions about interest rates and salary and benefit increases) in any given future period assume the same inflation level in that period [PBE IPSAS 39.80].

- An entity determines the discount rate and other financial assumptions in nominal (stated) terms, unless estimates in real (inflation-adjusted) terms are more reliable, for example, in a hyperinflationary economy (see PBE IPSAS 10 *Financial Reporting in Hyperinflationary Economies*), or where the benefit is inflation-indexed, and there is a deep market in inflation-indexed bonds of the same currency and term [PBE IPSAS 39.81].
- Financial assumptions shall be based on market expectations, at the end of the reporting period, for the period over which the obligations are to be settled [PBE IPSAS 39.82].
- The rate used to discount post-employment benefit obligations (both funded and unfunded) shall reflect the time value of money. The currency and term of the financial instrument selected to reflect the time value of money shall be consistent with the currency and estimated term of the post-employment benefit obligations [PBE IPSAS 39.85].
- The discount rate reflects the time value of money but not the actuarial or investment risk. Furthermore, the discount rate does not reflect the entity-specific credit risk borne by the entity's creditors, nor does it reflect the risk that future experience may differ from actuarial assumptions [PBE IPSAS 39.86].
- The discount rate reflects the estimated timing of benefit payments. In practice, an entity often achieves this by applying a single weighted average discount rate that reflects the estimated timing and amount of benefit payments, and the currency in which the benefits are to be paid [PBE IPSAS 39.87].
- In some jurisdictions, market yields at the end of the reporting period on Government bonds will provide the best approximation of the time value of money. However, there may be jurisdictions in which this is not the case, for example, jurisdictions where there is no deep market in Government bonds, or in which market yields at the end of the reporting period on Government bonds do not reflect the time value of money [PBE IPSAS 39.88].
- There may also be circumstances where there is no deep market in government bonds or high-quality corporate bonds with a sufficiently long maturity to match the estimated maturity of all the benefit payments. In such circumstances, an entity uses current market rates of the appropriate term to discount shorter term payments and estimates the discount rate for longer maturities by extrapolating current market rates along the yield curve [PBE IPSAS 39.88].
- The outstanding claims liability shall be discounted for the time value of money using risk-free discount rates that are based on current observable, objective rates that relate to the nature, structure and term of the future obligations [PBE IFRS 4.D6.1].
- The discount rates proposed are not intended to reflect risks inherent in the liability cash flows, which might be allowed for by a reduction in the discount rate in a fair value measurement, nor are they intended to reflect the insurance and other non-financial risks and uncertainties reflected in the outstanding claims liability [PBE IFRS 4.D6.1.1].
- Typically, government bond rates may be appropriate discount rates, or they may be an appropriate starting point in determining such discount rates [PBE IFRS 4.D6.1.2].

Short to medium term nominal risk-free discount rates

Introduction

The purpose of this section is to describe the methodology and the judgments made in determining the nominal risk-free discount rates until the last date for which there is New Zealand market data (end of the observable yield curve). This covers nominal risk-free discount rates defined as short and medium term.

In practice, the nominal risk-free discount rate cannot be directly observed; it is usually proxied by the return on a very safe, liquid asset. When selecting the nominal risk-free discount rate, the first step is to identify a suitable observable proxy and then to determine if any adjustments are required.

There are a number of sources of risk-free discount rates that an entity could use, and these are discussed in international technical papers. These papers also highlight that there has been considerable debate internationally on the “best” basic risk-free discount rate source and this can vary between jurisdictions. Each international paper is written for a specific purpose and so the choice of reference rate is influenced by that purpose. The different sources for risk-free discount rates indicated by these papers include:

- Government bond rates
- Government bond rates plus an adjustment for scarcity
- bank SWAP rates
- bank SWAP rates minus an adjustment for risk
- corporate bond rates minus an adjustment for risk.

When selecting a proxy, we have been guided by the New Zealand accounting standards, specifically PBE IFRS 4, PBE IPSAS 39 and PBE IFRS 9, that indicate 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. We note that PBE IFRS 9 is being superseded by PBE IPSAS 41 for public sector entities from 1 July 2022 and the requirements for discount rates are unchanged, so this methodology remains valid for accounting valuations carried out under PBE IPSAS 41 as well.

Market data is generally considered reliable, where the market is deep, liquid and transparent. Aspects which are indicative of a market which is deep, liquid and transparent (DLT) are:

- high trading volumes and turnovers – note the converse does not necessarily imply the market is not DLT 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.

After reviewing the international papers and examining the current market in New Zealand, we have formed a view that the alternatives proposed, bank SWAPs and corporate bond rates, do not provide a more reliable and relevant source of risk-free discount rates in New Zealand than Government bonds. There are now New Zealand Government bonds with annual maturity dates until 15 April 2029 and maturity dates out to 15 May 2051 (end of the yield curve).

We recognise that, in Europe, the bank SWAP rate is regarded as a more appropriate starting point. However, Europe has the complication of multiple Sovereigns issuing debt in a common currency and Sovereigns with lower credit ratings which are not relevant in New Zealand. Therefore, this current European view is not automatically applicable to the New Zealand context.

The analysis is shown under three headings:

- Nominal Government bonds and other nominal risk-free discount rate proxies
- Period until the maturity of the first nominal Government bond
- Liability liquidity adjustment to the risk-free discount rate.

Nominal Government bonds and other nominal risk-free discount rate proxies

This section considers Government bonds, as this determines whether Government bonds are used. We then consider whether bank SWAP rates are a better basis for determining risk-free discount rates than Government bonds. Finally, we consider corporate bonds.

Government bonds

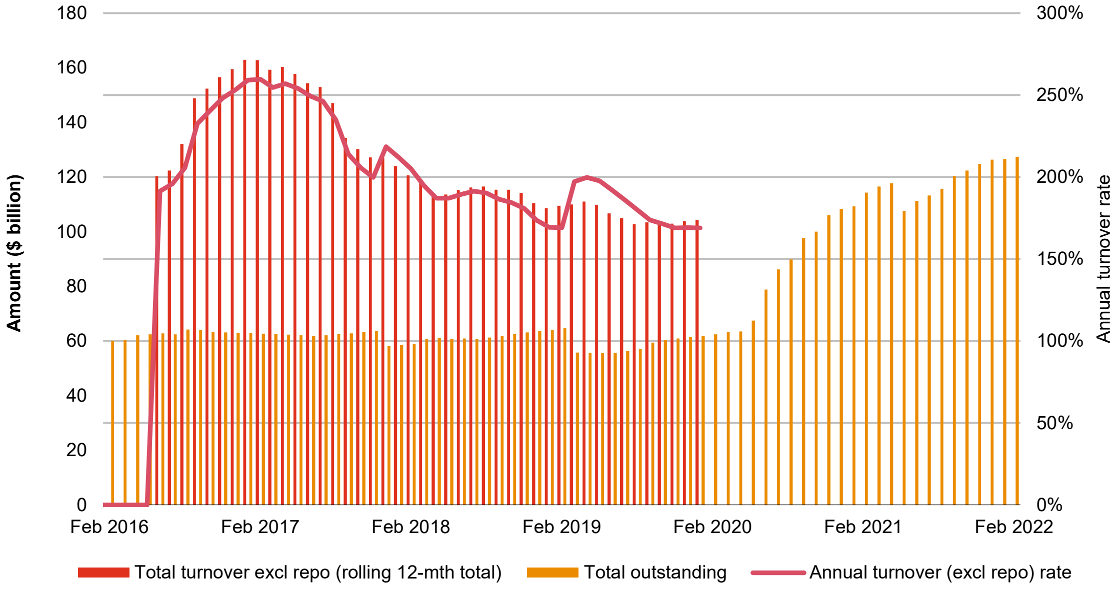
Amount on issue and turnover

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

Table 4: Nominal Government bonds on issue (31 March 2022) by maturity

Maturity	Coupon (% pa)	Total Issue ($m)	Available (net of RBNZ) ($m)
15-Apr-2023	5.50	16,195	8,474
15-May-2024	0.50	13,950	8,670
15-Apr-2025	2.75	13,700	7,087
15-May-2026	0.50	6,150	5,070
15-Apr-2027	4.50	12,650	5,870
15-May-2028	0.25	6,150	5,070
20-Apr-2029	3.00	14,050	6,800
15-May-2031	1.50	12,050	6,684
15-May-2032	2.00	4,100	3,950
14-Apr-2033	3.50	8,500	4,470
15-Apr-2037	2.75	10,550	5,737
15-May-2041	1.75	6,450	4,200
15-May-2051	2.75	3,850	3,700
Total		128,345	75,782

Figure 1: Total nominal Government bonds on issue and turnover



The total issue of nominal Government bonds is $128 billion, however the free-float amount available net of amounts held or brought back under LSAP by RBNZ is $76 billion. The amount of nominal Government bonds on issue was relatively stable, at about $60 billion, until mid-2020. Since then, the total outstanding has doubled although the amount less RBNZ holdings has not increased as much.

The Australian Group of 100 adopted a minimum amount outstanding for an individual security of AUD100 million as indicative of meeting the DLT criteria. Each issue meets this criterion.

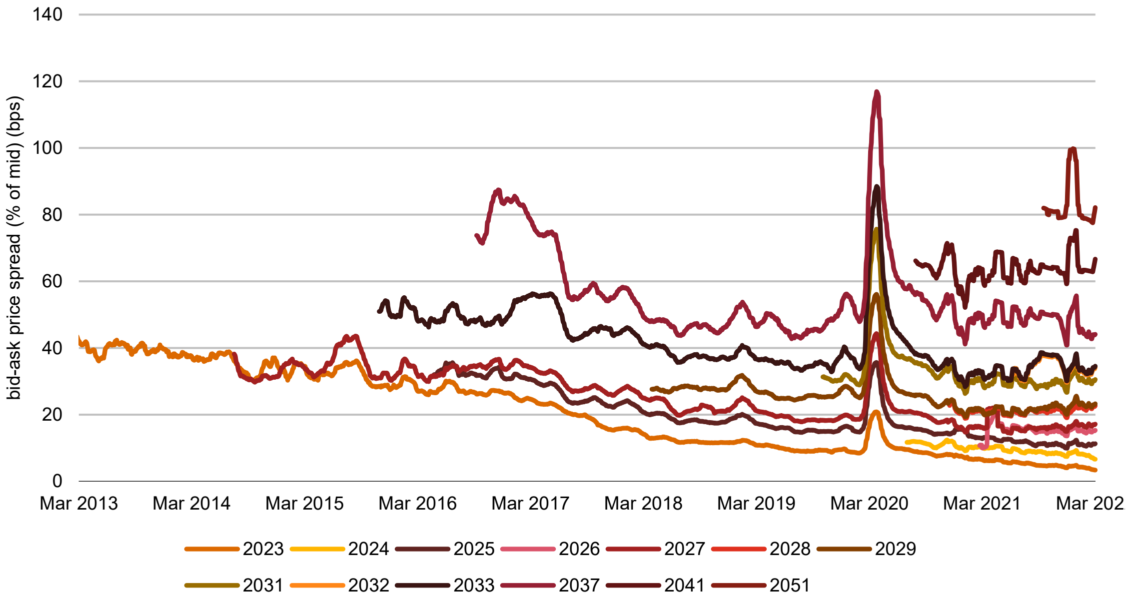
While comparable turnover data is not available after March 2020, discussions with market participants indicate turnover has remained strong.

Bid-ask spreads

The figure 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.

The Australian G100 paper written by Milliman adopts a difference of less than 50 basis points (bps) in the bid-ask price spread (% of mid) as indicative of a liquid market. The figure below shows that except for 10 days from 19th March till 1st April 2020, the difference has been below this threshold for all the bonds except the 2037, 2041 and 2051.

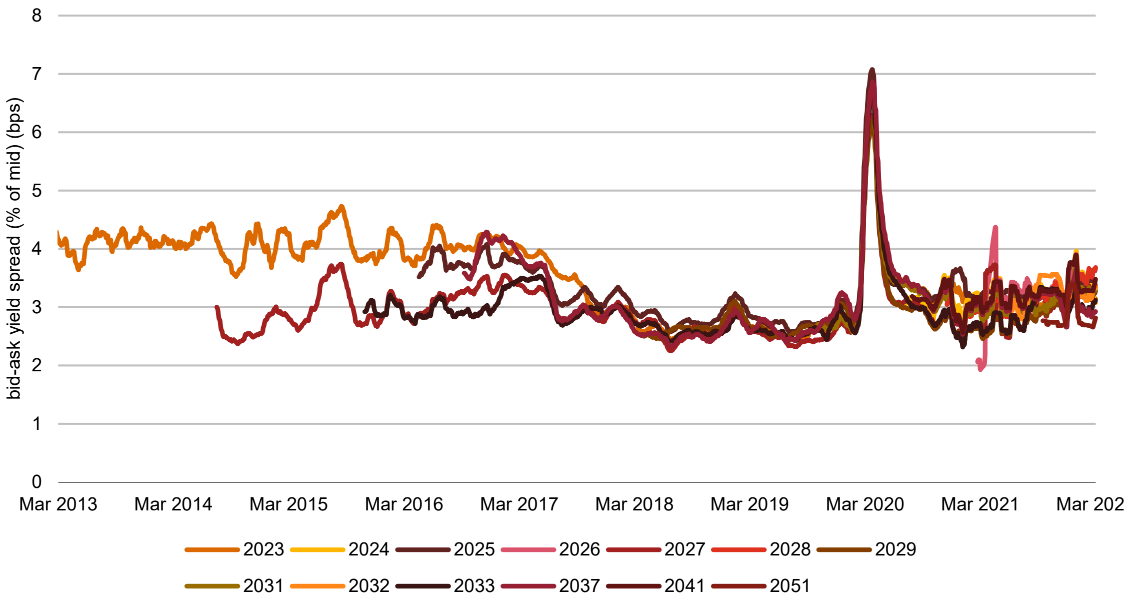
Figure 2: Nominal Government bonds – bid-ask price spread 30-day average (% of mid) (bps)



However, the bid-offer spread for the market price of a bond also depends on the term of the bond, with longer term bonds automatically having a higher differential in bid/office price even when the bid/offer yield differential is the same.

The following figure shows an estimate of the bid/offer spreads for the yield of a bond. This shows that all the nominal Government bonds have a similar and low bid/offer spread in terms of yield.

Figure 3: Nominal Government bonds – bid-ask estimated yield spread 30-day average (% of mid) (bps)



Overall, this indicates a liquid market for New Zealand nominal Government bonds.

Outlook for the New Zealand Government bond market

The Treasury's funding strategy aims to balance three key goals:

- considering the overall structure of the Crown's balance sheet
- capturing and simulating investor demand
- promoting well-functioning and liquid New Zealand Government Securities markets.

The latest forecast show Government bond issuances being largely offset by bond maturities and the planned repurchases under the LSAP, so the Government bond market is likely to remain at a similar level of liquidity in the near future.

Bank SWAPs compared to Government bonds

The purpose of this section is to determine if bank SWAPs are a better alternative source for risk-free discount rates than Government bonds and whether the basic rates are required to be adjusted for risk or adjusted for scarcity in either case and the size of the adjustment if required.

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).

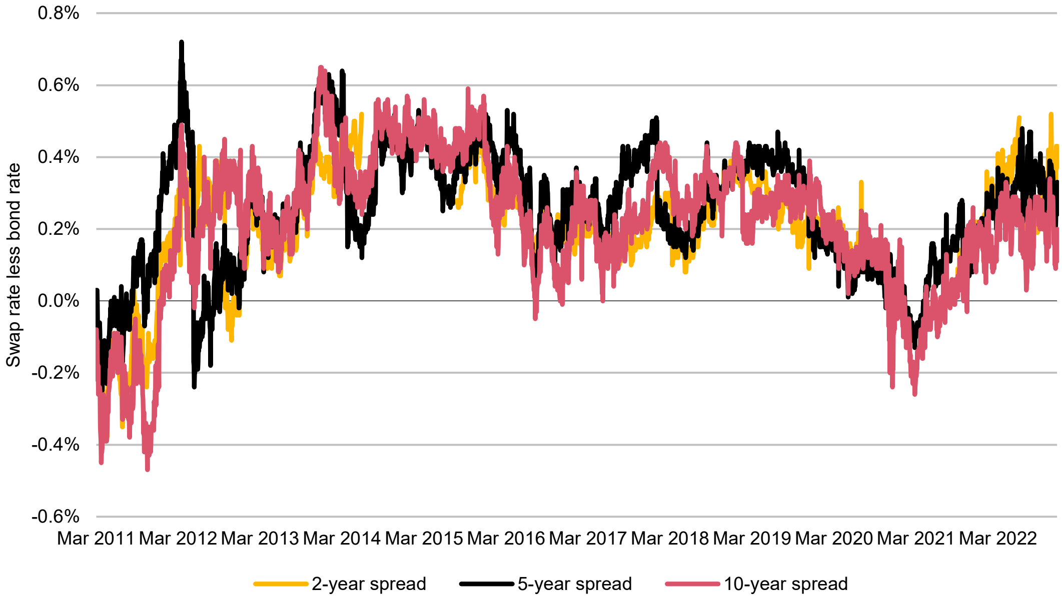
The most useful market information on scarcity discount and credit risk adjustments is the bank SWAP spread, which is the difference between bank SWAP rates and Government bond rates. "Bank SWAP rates" is the commonly used description of the quoted market rates used to price a variety of interest rate SWAP instruments between two parties. In this paper we only consider the quoted market in New Zealand dollars and refer to the rates as bank SWAP rates.

The bank SWAP spread gives guidance on the total of the scarcity discount and the credit risk adjustments but not the split between the two. It is extremely difficult to accurately decompose the spread into its components.

The figure below shows how the bank SWAP spread has varied since 2010. It shows that there is minimal difference in SWAP spread by term.

However, from 2003 until the 2008 Global Financial Crisis, the spread increased. This was largely due to the fact that there was a large demand for Government bonds and limited availability, as a lot of bonds were tightly held and the New Zealand Government were paying off debt, driving the yields on Government bonds down. This demonstrates that the spread is not always small.

Figure 4: Bank SWAP yields less NZ Government bond yields, 2-, 5-, and 10-year spreads



The bank SWAP spread is a good measure of the sum of the upwards adjustment to Government bonds (the scarcity adjustment) and the downwards adjustment to bank SWAP rates (the risk adjustment). Because the sum is small, we can conclude that both the scarcity and the risk adjustments are small at present, and no adjustment is required.

In Appendix C – process for adjusting market data, we set out a process to adjust market data, if necessary.

Corporate bonds

The purpose of this section is to determine if corporate bond rates adjusted for risk are a better alternative source for risk-free discount rates than Government bonds adjusted for scarcity.

The corporate bond market in New Zealand is nowhere near as extensive as in other countries and the available bonds cover a wide range of credit ratings. It is generally accepted that New Zealand does not have a high-quality corporate bond market. Furthermore, even if we did believe the corporate bond market was a viable starting point, the adjustments required for removing risk are not straight forward to determine and requires reference to other “risk-free” assets. For these reasons we have eliminated corporate bonds as a viable option as a reference to risk-free discount rates in New Zealand. This position has not changed since the previous review in 2019.

Period until the maturity of the first nominal Government bond

There are nominal Government bonds in annual tranches until 2029. Government bonds are generally repurchased by the DMO, rather than allowed to reach maturity. Nominal Government bonds are also issued with either April or May maturities. As a result, the first Government bond maturity date is typically at least a year away.

However, there are other instruments which can be used to determine nominal risk-free discount rates for this period.

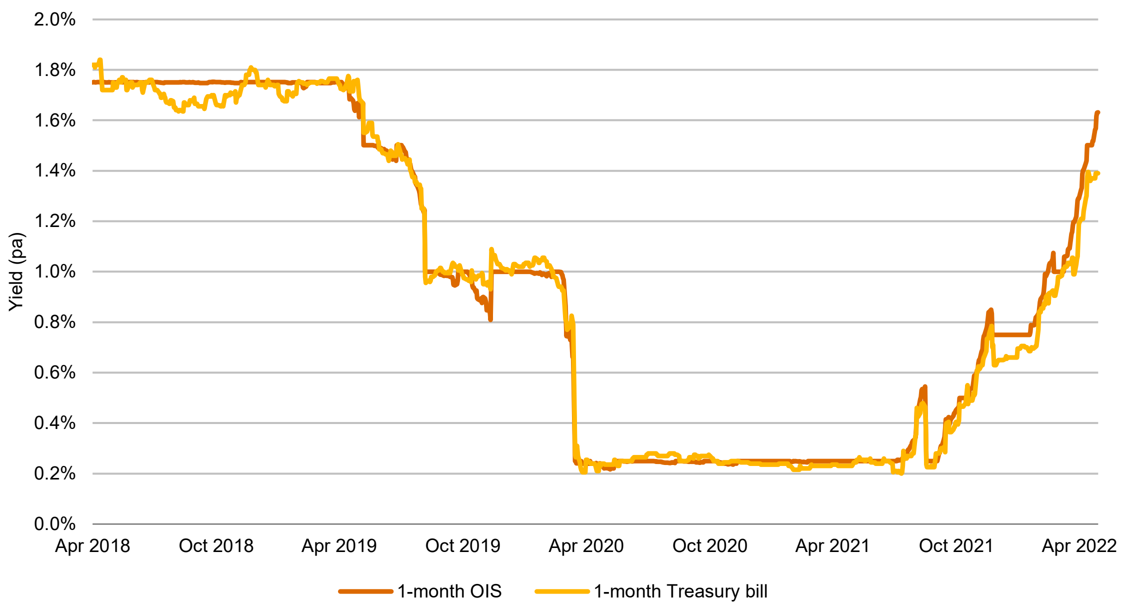
Historically, Treasury Bills have been used. Treasury bills on issue are forecast to reduce, noting, the actual level of T-Bills on issue may vary from forecast, based on short-term cash needs and an assessment of relative costs.

Table 5: Forecasts borrowings – Treasury bills

30 June	2022	2023	2024	2025	2026
Forecast Treasury Bills on issue (NZ$ billion)	3.4	3.0	3.0	3.0	3.0

Market participants have indicated that Overnight index swaps (OIS) are now significantly more liquid than Treasury bills and so a more reliable source of risk-free discount rates. They comment that OIS have a high turnover. Treasury bills, on the other hand, are often held to maturity. The Bank of International Settlements triennial survey reports that the daily average turnover of OIS in April 2019 was $12.8b NZD (in USD). Further, the 2021 EIOPA technical documentation stated that the NZD is one of seven currencies whose OIS meet the deep, liquid, and transparent criteria. This evidence suggests that OIS have higher liquidity than Treasury bills, and as such are the more appropriate instrument to use for the period until the maturity of the first nominal Government bond.

Figure 5: Comparison of one month OIS and Treasury bills



Based on this input, the methodology has been changed to use OIS for the very short-term rates instead of the Treasury bill rates.

Liability liquidity adjustment to the risk-free discount rate

An additional adjustment that can be made to the risk-free discount rates is a liability liquidity adjustment, to reflect the nature of the liquidity of liabilities. The accounting standards, specifically PBE IFRS 4, state risk-free discount rates should be based on current observable, objective rates that relate to the nature, structure and term of the future obligations. Some argued that the liquidity of the liabilities is part of the nature. The argument is that if liabilities are illiquid, then the provider can invest in illiquid risk-free assets that will return a slightly higher yield and thus an illiquidity adjustment to increase the Government bond rates is required.

The criteria that the liabilities must meet to be considered illiquid are that the liabilities must be certain and not able to be redeemed immediately at no cost. APRA's interpretation of this is that this adjustment is only applicable to insurance annuity contracts. The size of a typical adjustment is generally less than the spread between government bond and bank SWAPs.

This adjustment is specific to the nature of the liabilities and in aggregate the Crown liabilities would not meet the APRA definition of illiquid liabilities. A liability liquidity (or illiquidity) adjustment for specific liabilities would require very solid evidence as the strong preference is to have one set of rates applying to all liabilities.

PBE IFRS 17 is not part of the scope of this review. However, it is worthwhile noting that it splits discount rates into a risk-free rate, based on a similar definition to PBE IFRS 4, plus an explicit illiquidity premium for any illiquidity characteristics of the liabilities. This further supports the fact that risk-free discount rates under PBE IFRS 4 should not have any adjustment for illiquidity of the liabilities.

Conclusion

The New Zealand accounting standards suggest Government bonds are a suitable risk-free proxy. This is subject to markets being deep and reflecting the time-value of money. In our opinion, there is a deep market for nominal New Zealand Government bonds which reflects the time value of money. Consequently, we believe it is appropriate to determine nominal risk-free discount rates using nominal Government bond data through to the end of the nominal Government bond yield curve. **This methodology remains unchanged from the previous methodology.**

We have considered other forms of risk-free proxies and whether adjustments for smaller issuances, scarcity or liquidity are needed. We have **retained the previous methodology of making no adjustments to Government bond data** on the basis that:

- there is no advantage in moving to a different risk-free proxy such as SWAPs
- small issuances will be given a lower weighting by weighting each bond by the lesser of market value and $4 billion
- over recent years, the bank SWAP spread has been small and we have concluded that it is reasonable to make no scarcity adjustment to Government bond rates, and

- our interpretation remains that the Government bond rates should have no further adjustment for illiquidity because illiquidity adjustments are rare and there is a strong preference to have the same risk-free rates for all Crown liabilities.

The smoothing process will smooth out variations in yields for bonds of similar maturity. The details of the curve fitting and smoothing are described in Appendix D – forward rate yield curve fitting methodology.

For short term nominal rates, Overnight Index Swaps (OIS) have been adopted instead of Treasury bills for the starting point of the nominal risk-free discount rates, ie, for the period before the earliest maturity of a nominal Government bond, as market commentary indicates OIS are more liquid that Treasury bills. **This represents a change to the previous methodology.**

Due to the Government's practice of buying back Government bonds in the year before they mature, there can be inconsistencies in the market for these short-term rates. If there is a significant disparity between OIS rates and the yield on the shortest nominal Government bond, then it could be appropriate to adopt OIS rates in lieu of the yield on the shortest-term nominal Government bond. This will be considered at each valuation date.

Inflation for the short to medium term

Introduction

To value insurance and defined benefit pension obligations it is necessary to make assumptions as to future inflation. Inflation in this paper means CPI inflation. CPI measures the relative price of consumer goods and services purchased by households at different dates. Statistics New Zealand determines and report actual CPI.

Short to medium-term CPI inflation currently means up until the end of the nominal observable yield curve. The end of the nominal observable yield curve is currently 29 years, through to 2051. In the bridging section of this report, we consider an alternate definition of medium term for inflation purposes based on the inflation-linked observable yield curve. Irrespective of the definition, after the end point of the medium-term inflation, bridging to the long-term assumptions applies.

While the insurance and employee benefit accounting standards provide guidance about the discount rate to be applied, there is no guidance on how the inflation assumption should be determined other than that the accounting standard for employee benefits states; "*Actuarial assumptions shall be unbiased and mutually compatible*" and "*Actuarial assumptions are mutually compatible if they reflect the economic relationships between factors such as inflation, rates of salary increase, and discount rates*" [PBE IPSAS 39 para 77 and 80]. This means that actuarial assumptions used should be unbiased and internally consistency with other actuarial assumptions used within the defined benefit pension liability valuation.

International Standard of Actuarial Practice 3 (ISAP 3) provides guidance to actuaries when performing actuarial services in connection with International Accounting Standard 19 - Employee Benefits, which has a lot of similarities to PBE IPSAS 39 – Employee Benefits. ISAP 3 has a number of comments on how to determine inflation assumptions. It indicates that both market-implied expectations and other information should be considered, including:

- changes in price indices
- yields on nominal and inflation-indexed debt (taking into account the effect of any significant supply-demand imbalances)
- forecasts of inflation
- central bank monetary policy
- analyses prepared by experts.

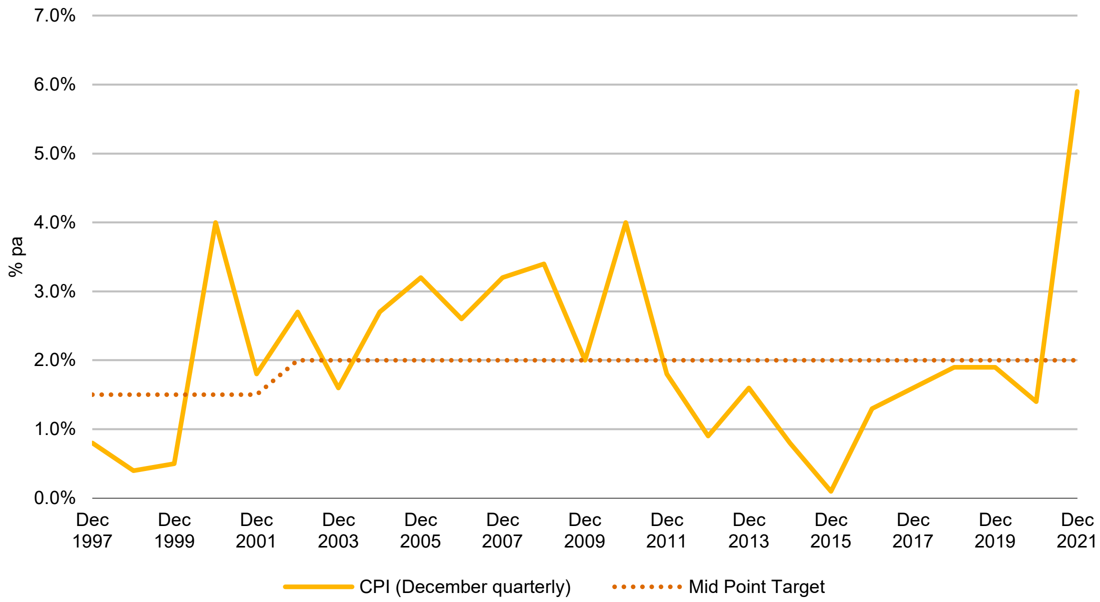
The analysis is shown under four headings.

- historical CPI inflation, which is shown relative to the Reserve Bank of New Zealand (RBNZ) targets
- forecasters' views of CPI inflation, with those forecasters including experts
- break-even inflation implied by the inflation-indexed bond yields
- term structure.

Historical CPI inflation

The following figure shows the historical CPI inflation and the RBNZ target. As is shown below, the inflationary environment has shifted materially in the past year, which is attributed to supply chain issues and other cost pressures as a result of ongoing impacts from the COVID-19 pandemic.

Figure 6: Historical CPI inflation rates



Since RBNZ inflation targets were introduced, CPI inflation has been reasonably close to the target and the medium to long-term forecast inflation is consistent with future inflation being close to the target, with the exception of the last few months. The Reserve Bank target is also the assumption adopted by EIOPA.

Forecasters' views of CPI inflation

The readily available CPI inflation forecasts are summarised in the following table. All of these forecasts are published at different times of the year and for different projection periods. The first forecast is a consensus forecasts produced by New Zealand Institute of Economic Research (NZIER). The figures quoted are an average of the views compiled from a survey of financial and economic agencies, who could reasonably be considered experts. The fourth forecast is an average from a survey conducted by the Reserve Bank of New Zealand (RBNZ) of business managers and professionals, in the belief that market expectation of business managers is a key determinant of future inflation.

Figure 7: Forecasts of CPI inflation as at May 2022

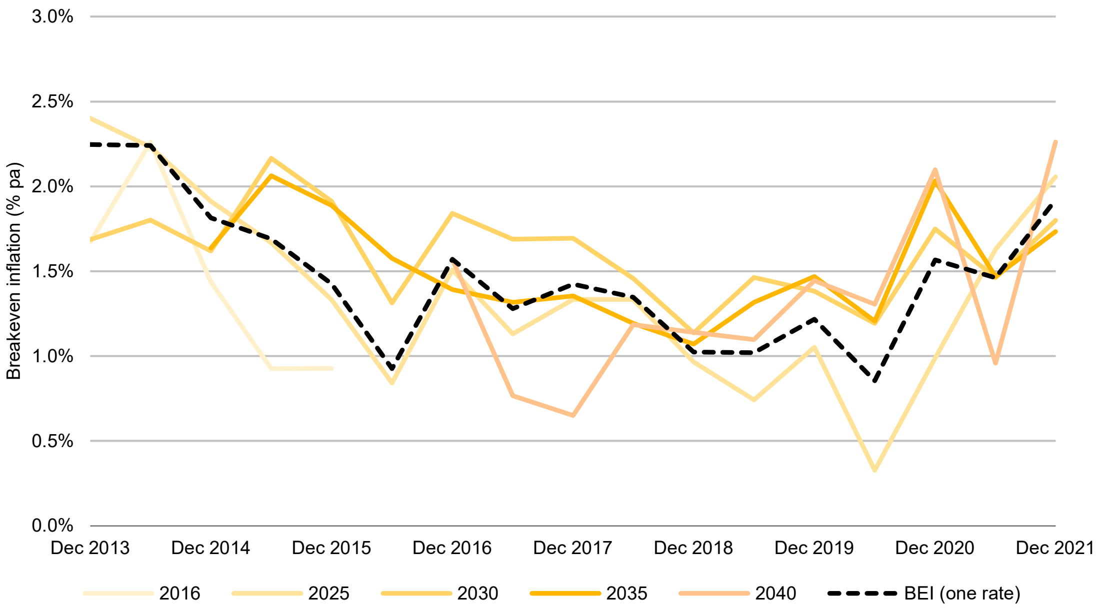
Source (date of release)	Year	2022 (% pa)	2023 (% pa)	2024 (% pa)	2025 (% pa)	2025 (% pa)
NZIER Consensus Forecast (21 March 2022)	June	6.5	2.9	2.4	2.4	
RBNZ Survey of Expectations (12 May 2022)	June		4.9	3.3		
Treasury (19 May 2022, BEFU)	June	6.7	5.2	3.6	2.7	2.2
RBNZ Monetary Policy Statement (25 May 2022)	June	7.0	3.5	2.3	1.9	
ASB Quarterly Economic Forecast (23 May 2022)	June	6.9				
BNZ Quarterly Forecasts (24 May 2022)	June	6.9				

Selecting an appropriate assumption for each of the next four years is 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.

Break-even inflation implied by inflation-indexed bond yields

The following graph shows the breakeven inflation implied by inflation-indexed Government bonds since March 2017. The breakeven line shows the average inflation assumed from the calculation date to 2040.

Figure 8: Breakeven inflation implied by inflation-indexed bond yield



This graph indicates the breakeven inflation is heavily influenced by short-term inflation expectations. Throughout this period, with the exception of the last couple of months, forecast inflation has been reasonably close to 2.0% and consistently higher than breakeven inflation.

There are a number of reasons why forecast inflation and breakeven inflation may differ:

- If inflation-indexed bonds are less liquid than nominal bonds, ie, a higher expected yield is demanded by the same investor on inflation-indexed Government bonds than on nominal Government bonds to compensate for the lower liquidity of inflation-indexed Government bonds, then this difference in liquidity will result in break-even inflation being lower than expected inflation. We refer to this difference between breakeven inflation and expected inflation as the inflation-indexed price adjustment.
- Breakeven inflation may differ due to an inflation risk premium. This risk premium could be positive (increasing breakeven inflation compared to forecast inflation) or negative (reducing breakeven inflation). It has been commented (internationally) that the premium tends to be positive when the main concern is inflation shocks (upwards) and negative when the main concern is demand shocks and protecting the nominal return.

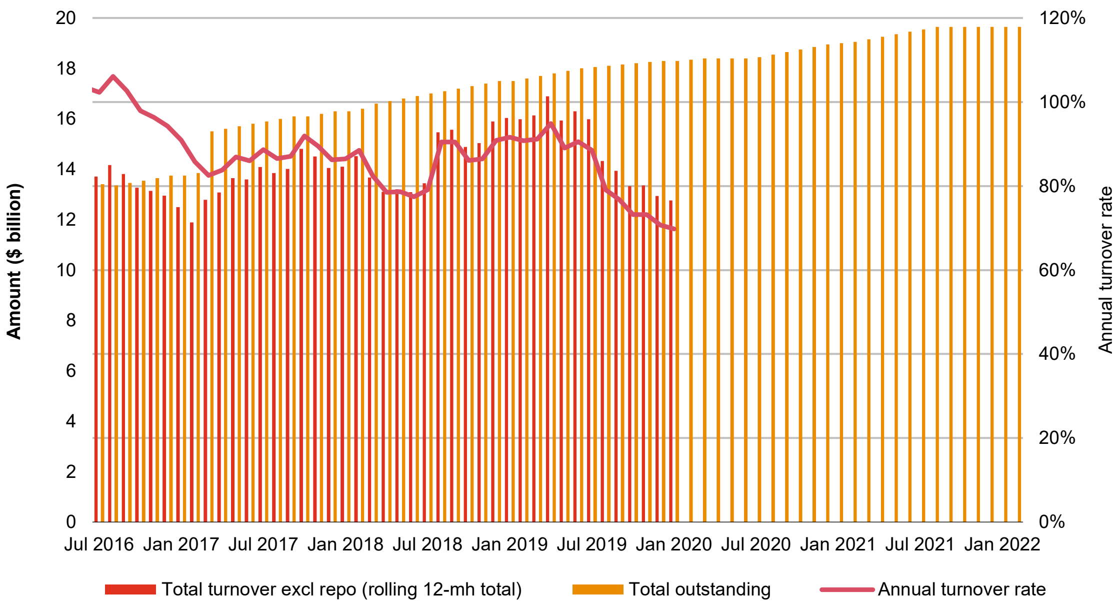
Table 4: Nominal Government bonds on issue (31 March 2022) by maturity looked at the amounts on issue and turnover of nominal bonds, as an indicator of liquidity. The equivalent information for inflation-indexed bonds is shown below.

Table 6: Inflation-indexed Government bond maturities on issue (31 March 2022)

Maturity	Coupon (% pa)	Total Issue ($m)	Available (net of RBNZ) ($m)
20-Sep-2025 CPI Indexed	2.00	5,450	4,585
20-Sep-2030 CPI Indexed	3.00	4,530	3,710
20-Sep-2035 CPI Indexed	2.50	4,550	3,898
20-Sep-2040 CPI Indexed	2.50	5,200	4,370
Total		19,730	16,563

There are $19.7 billion total issue, and $16.5 billion free-float net of RBNZ, of indexed stocks available. The amounts available, (net of RBNZ holdings) per bond is similar to the amounts available for nominal bonds. The amount of inflation-indexed Government bond on issue has been increasing, as shown in the figure below. The Australian Group of 100 adopted a minimum amount outstanding for an individual security of AUD100 million as indicative of meeting the DLT criteria. Each issue meets this criterion.

Figure 9: Inflation-indexed Government bonds on issue and turnover

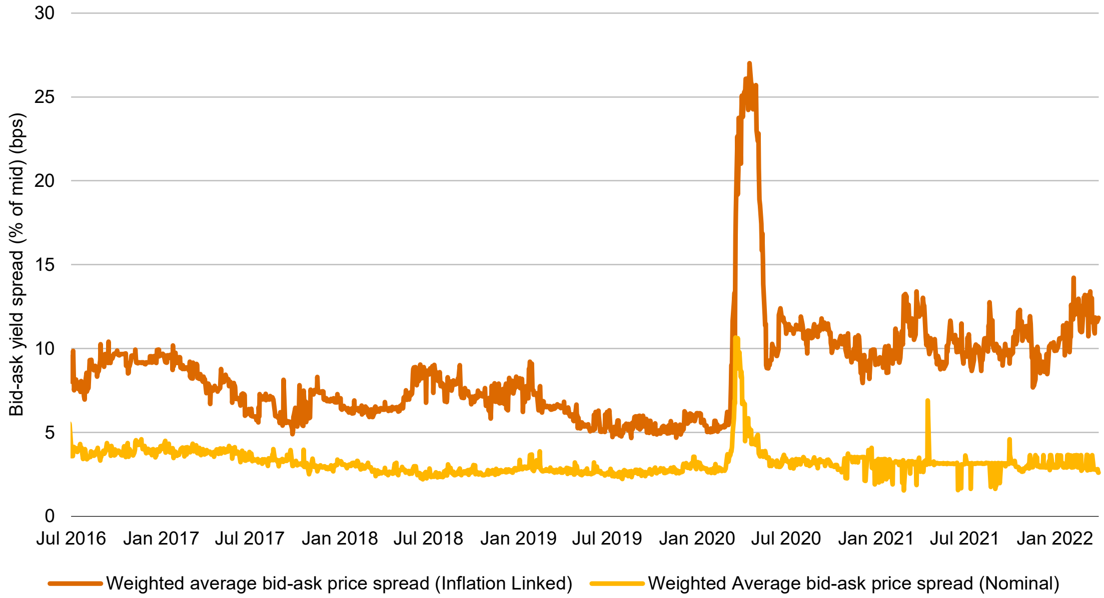


However, there are a limited number of buyers, and significant concentration of holdings with ACC. Inflation-indexed bonds do not feature prominently in fixed interest indices and benchmarks and are unlikely to have made it into fund managers' asset allocation policies. As at 30 June 2021, ACC owned 70% of the inflation-indexed bonds (source ACC 2021 Annual Report). ACC is a long-term investor in inflation linked Government bonds and as a consequence the actual amount available for actively trading is significantly less than indicated by the figure above.

As with nominal Government bonds, comparable turnover data is not available for after March 2020.

Higher bid/offer spreads are indicative of a less liquid market. The following figure compares the estimated bid/offer yield spreads for nominal and inflation-linked Government bonds. This indicates the bid/offer spread for index-linked Government bonds is significantly higher than for nominal Government bonds, indicating the index-linked Government bonds are less liquid.

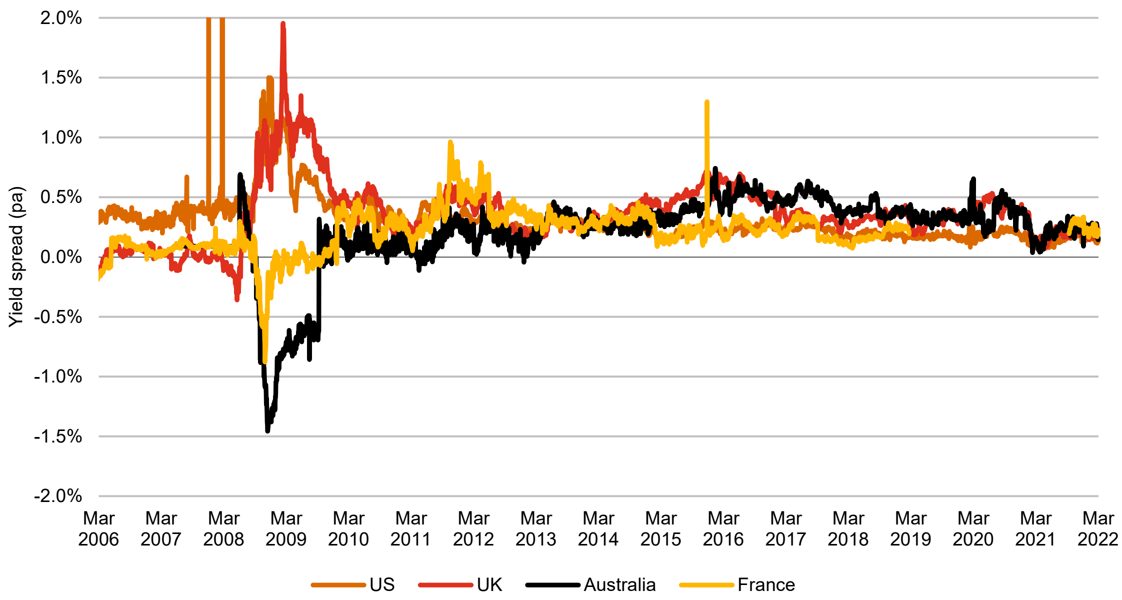
Figure 10: Estimated bid-ask estimated yield spread (% of mid), inflation-indexed bonds compared to nominal bonds



All of the above and particularly the high concentration of holdings by ACC, indicate that inflation-indexed bonds are 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. The next question is how large this difference is.

The figure below shows a comparison of the spread between 10-year inflation swaps and 10-year breakeven inflation for the United States, United Kingdom, France, and Australia. Inflation swaps are generally considered liquid, although it must be noted that there may not be many investors in inflation swaps in each case. This shows that since 2008, breakeven inflation estimates have been consistently below inflation swaps for all four economies, illustrating the idea that given inflation-indexed bonds are less liquid than nominal bonds, there is a downward bias in derived breakeven inflation expectations. Although, one cannot assume that the difference between these two rates is due solely to a difference in liquidity since there may also be a liquidity premium in the inflation swaps.

Figure 11: 10-year inflation swaps less 10-year breakeven inflation



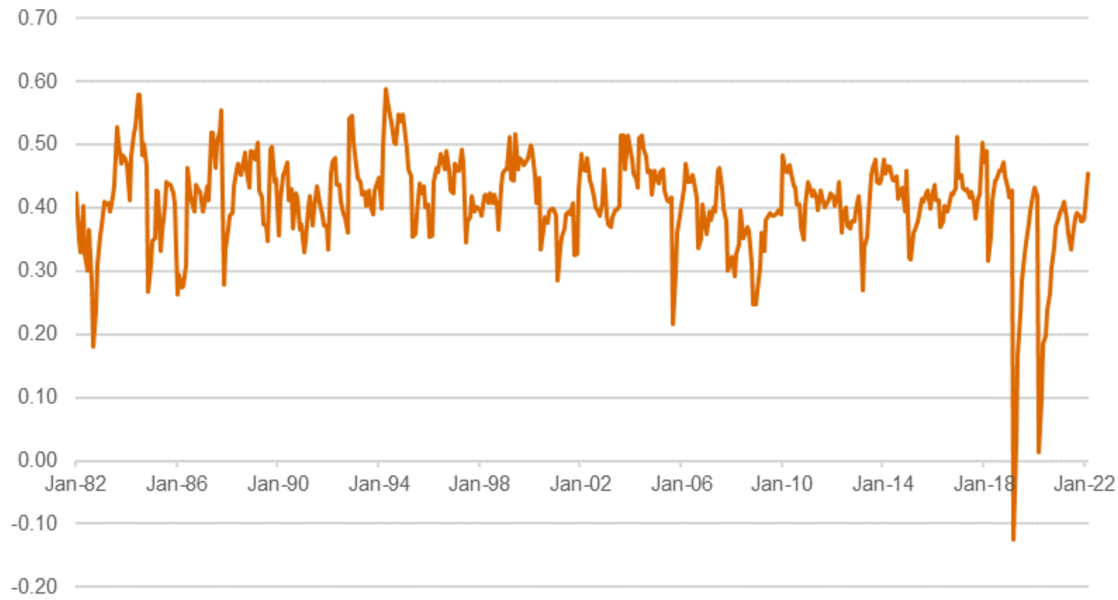
This figure shows a relatively high consistency between the different countries between 2010 and 2019. The average difference in the decade from 2010 until February 2019 was 0.30% pa. Since then, US break-even inflation has remained steady at 0.15%, whereas both the Australian and UK figures have decreased from 0.35% to now be equal with the US at 0.15%. The impact of the global financial crisis post 2008 is also apparent and indicates break-even inflation is potentially not a good estimate of inflation when financial markets are under extreme stress.

Equivalent information is not available for New Zealand. The equivalent New Zealand margin would depend on the relative liquidity of inflation-indexed bonds to nominal bonds compared to the relative liquidity in the other countries. Given the liquidity information above, it is reasonable to assume the difference is likely to be at least as large.

The figure above compares inflation swaps with breakeven inflation and so the comparison would not incorporate the inflation risk premium. In New Zealand there are few institutions with inflation-indexed liabilities actively seeking investment in inflation-indexed bonds (ACC being the notable exception), whereas these are prevalent in the UK. The impact of the inflation risk premium is difficult to quantify but may explain the difference between forecast inflation and break-even inflation plus inflation-indexed price adjustment.

In addition, it is worthwhile to consider any evidence of an inflation risk premium. The following figure from the US Federal Reserve Bank of Cleveland shows the observations from US inflation SWAPs.

Figure 12: US ten-year and inflation risk premia



The figure shows that in the US the historic inflation risk premium is of similar magnitude to the previous graph of inflation SWAPs less breakeven inflation. A positive inflation risk premium indicates that the breakeven inflation is too high, and the market is pricing in a greater risk of higher inflation in the future. The previous liquidity adjustment indicates that breakeven inflation is too low. The two effects are both uncertain but are largely offsetting.

The previous methodology did not include an inflation risk premium. However, in the last year there has been a significant turnaround in inflation expectations. Previously there was the risk that New Zealand would continue to experience very low inflation and that this would hamper growth as Japan has experienced. The outlook has significantly changed post COVID-19, and the short-term inflation expectations are much higher. There is a significantly heightened awareness of the risks of continued high inflation. This is likely to increase the inflation risk premium. An increase to the inflation risk premium will reduce the breakeven inflation. We propose that the size of this adjustment is the same as the liquidity adjustment, but the opposite sign, the net adjustment is then zero.

Given that the liquidity risk premium has been kept at 0.3%, we propose that there is an offsetting adjustment for inflation risk premium of -0.30%.

We have made enquiries as to the common practices for setting inflation assumptions internationally. Note the number of countries that have similar accounting standards and comparable liabilities is limited.

- The European Union follows the guidance set by EIOPA where the inflation is a flat rate set by reference to inflation targets, 2.0% pa in the case of New Zealand and is 2% for the majority of countries, with some “low inflation” and “high inflation” exceptions.

- Australia has similar availability of index linked instruments to NZ. The Actuaries Institute has issued an information note on discount rates and inflation assumptions for General Insurance in 2017. This has resulted in two alternative approaches; firstly, to use breakeven inflation with appropriate liquidity adjustments, secondly to use solely forecast inflation. Some of the Australian Government workers' compensation schemes we are aware of use a combination of forecast inflation and breakeven inflation or comment that they take breakeven inflation into consideration. As far as we are aware, none use solely breakeven inflation.

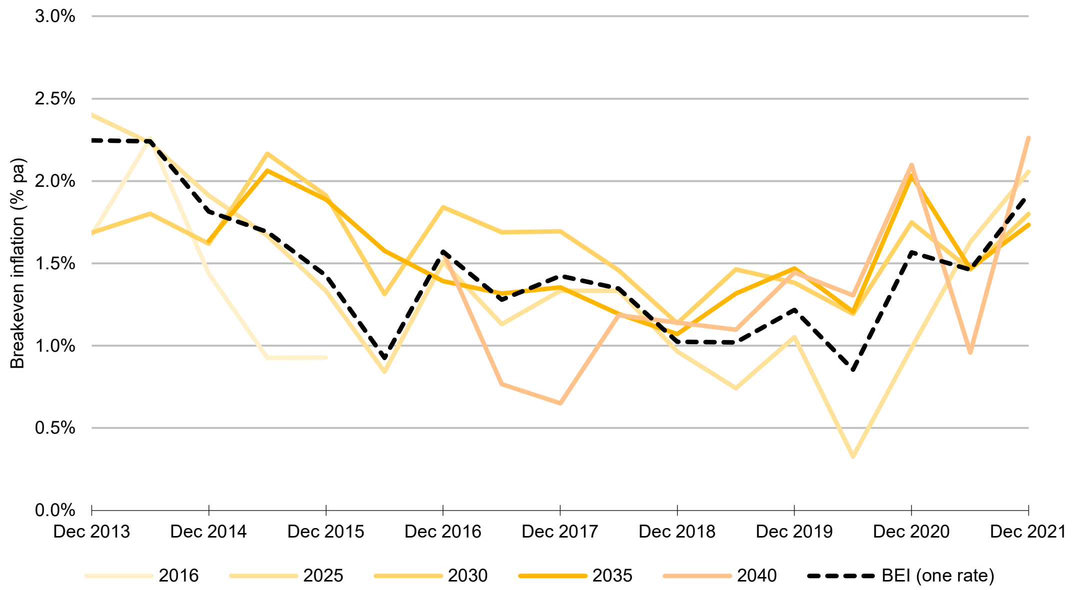
As far as we are aware, in other countries, it would be unusual to use an unadjusted breakeven inflation. However, we believe that there has been a material shift in inflation expectations over the past year as a result of supply chain issues and other cost pressures that has meant there is now reason to believe that an inflation risk premium is priced into the indexed-linked bond market. This is the result of a greater concern for periods of high inflation in the future compared to low inflation in the future. As we are unable to quantify the liquidity and inflation risk premium adjustments accurately using New Zealand data, it is reasonable to assume that the broadly offset each other like they do in the US.

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 break-even inflation for different periods in the future. The following figure shows the breakeven inflation over the previous eight years.

In this figure the 2016 line shows breakeven inflation from the calculation date to 2016, the 2025 line shows breakeven inflation from the later or the calculation date and 2016 to 2025 and the other lines show breakeven inflation for 2025 to 2030, 2030 to 2035 and 2035 to 2040.

Figure 13: Breakeven inflation: each inflation-indexed bond and overall rate



This figure shows that there has been no consistent pattern from short to long-term inflation and there has no consistent pattern to expected future inflation for the future periods, eg, the inflation expected for between 2035 and 2040 has varied from 0.8% pa to 2.3% pa. Further, *Figure 11: 10-year inflation swaps less 10-year breakeven inflation* indicates that break-even inflation is potentially not a good estimate of inflation when financial markets are under extreme stress. Given the present economic conditions globally and in New Zealand, this cautions us against putting excess weight on breakeven inflation and particularly the small variations between the breakeven inflation determined from individual bonds.

In the past the inflation expectations have been a very consistent 2% pa with not much variance between short or long-term outlooks. As shown above the breakeven inflation has not shown any consistent term structure.

Inflation expectations for the short term are now much higher than 2%. The consensus is that this is mostly short term pressure, and that inflation will return to normal. It is therefore reasonable to assume that this will be reflected in the breakeven inflation. The breakeven inflation for the 2025 bond is expected to be higher. There is already some evidence that this is the case.

It is therefore appropriate to introduce some term structure into the breakeven inflation for the first four years. This will then be consistent with the forecast inflation.

Conclusion

There are two sources of CPI inflation forecasts for the short to medium term. These are market forecasts and breakeven inflation, determined from the difference between yields on nominal Government bonds and yield on real Government bonds.

In our view, there remains to be sufficient evidence that giving full credibility to either forecasts or the market break-even inflation is not appropriate. Both inflation forecasts and breakeven inflation need to be considered because both provide important but slightly different information. It is, however, extremely difficult to quantify exactly how much weight to give to the forecast market information and how much to the market break-even inflation.

Inflation in the short to medium term will therefore be determined as a 50:50 weighting between adjusted breakeven inflation and market forecasts. **This weighting is unchanged from the previous methodology.**

To reflect a volatile short-term outlook in respect of inflation, it is now unreasonable to expect that short-term inflation expectations will be the same as medium-term inflation expectations. Including some information on the term structure and shaping the short-term breakeven inflation is now important to better reflect short-term expectations. To achieve this, the breakeven inflation calculations will consider the breakeven inflation implied by the shortest inflation-indexed bond or, if it is only a short period (ie, one year or less) until the maturity date of the shortest inflation-linked bond, then the breakeven inflation calculations will consider the breakeven inflation implied by the two shortest inflation-linked bonds. The remaining inflation-linked bonds will be combined to set one rate for the remainder of the medium term inflation period. The breakeven inflation will then be set to a reducing proportion of the forecast inflation over the first four years, based on mid-year weights derived using a cubic smoothing approach, to add further shape to the breakeven inflation curve (without changing the compound breakeven inflation at the four year point). The weights are shown below.

Table 7: Weights between raw breakeven forward inflation rate and forecast inflation rate for the first four years

Year	Weight to raw breakeven forward inflation	Weight to forecast inflation rate
1	0.195%	99.805%
2	5.273%	94.727%
3	24.414%	75.586%
4	66.992%	33.008%

The weight applied each year is constant as forecast inflation is set for annual periods. The weight is derived at mid-year weight using a cubic smoothing approach. That is, for the first year, where mid-year is six months from the valuation date, the weights are calculated as $(6/48)^3$ to the raw breakeven forward inflation rate and $1 – (6/48)^3$ to the forecast inflation rate adjusted by a fixed percentage to ensure that the compound breakeven inflation rate at the four year point is unchanged. This is to reduce variability in the breakeven inflation at the four year point and to ensure that the implied real forward rates are economically plausible. **These are two changes from the previous methodology in response to the volatile inflation outlook**. They will both be reviewed at the next methodology review in 2025.

We continue to believe a margin needs to be added to breakeven inflation to allow for the lower liquidity of inflation-indexed Government bonds compared to nominal Government bonds. Due to New Zealand now having a greater risk of higher inflation rather than lower inflation, we also believe that there is likely to be a positive inflation risk premium that reduces breakeven inflation. The net effect of the liquidity adjustment and the inflation risk premium is uncertain and difficult to determine as there is no New Zealand data on either. However, we expect the two to largely offset so that the net impact is close to zero. **This is a change from the previous methodology** and would reduce breakeven inflation by 0.3% pa.

Forecast inflation will be determined as follows:

- every six months
  - assess forecast inflation using forecasts for the short-term (4 years)
  - apply the RBNZ mid-range target of 2.0% pa for the remainder of the medium term (as defined in the long-term inflation section)

Adjusted breakeven inflation will be determined as follows:

- Identify inflation-indexed bonds to use to determine breakeven inflation, being bonds which:
  - Are considered sufficiently liquid. The criteria to determine whether they are sufficiently liquid is that there is at least $4 billion on issue.

- Have a maturity date which is less than or reasonably close to the maturity date of the longest nominal bonds. For example, if an inflation-indexed bond with a maturity later than 2051 were issued and the longest nominal bond is still the 2051 bond, then the longer inflation-indexed bond would not be included.

- Determine the rate of breakeven inflation though to the first inflation-indexed bond being used (currently 2025) by:
  - using the nominal risk-free yield curve
  - incorporating all known inflation information to date and assuming the inflation rate is a flat rate to the end of the first inflation-indexed bond.
- Determine the rate of breakeven inflation though to the last inflation-indexed bond being used (currently 2040) by:
  - using the nominal risk-free yield curve
  - using the short-term breakeven inflation for the shortest bond up until the maturity of the shortest bond
  - assuming the inflation rate is a flat rate from the maturity of the shortest bond to the longest inflation-indexed bond being used. A certain amount of judgement and flexibility in approach is required to achieve a reasonable result. At present, the weightings used are discounted cash flows.
  - vary adjusted breakeven inflation over the first four years so that it is a constant percentage of forecast inflation, but the compound adjusted inflationary impact after four years is unaffected
  - adjust for the illiquidity and inflation risk premium adjustments, which currently are assumed to offset each other and be zero on a net basis.

If in the future, there is credible information that medium term breakeven inflation should follow a different curve or linear trend, then this will be allowed for.

Real long-term risk-free discount rates

Introduction

This section sets out the review of the real long-term risk-free discount rate.

The real long-term risk-free discount rate is considered before the other long-term rates because this is the primary driver of the value of cash flows that are inflated. In addition, it is reasonable to expect the real discount rate to be more robust to changes in long-term inflation outlook than nominal discount rates.

The real risk-free discount rate is the theoretical rate of return of an investment with zero risk, after taking into account the effects of inflation. The real risk-free discount rate represents the real return an investor would expect from an absolutely risk-free investment over a given period of time, ie, the real rate of interest is the amount by which the nominal interest rate is higher than the inflation rate. The long-term real risk-free discount rate is a critical assumption in the valuation of the ACC claims liability and the GSF pension obligation as both of these obligations are indexed to inflation. An increase or decrease of the same amount in both inflation and discount rates together will not change the value of the liabilities significantly.

We believe that determining a single long-term real return is a rational and pragmatic approach to the long end of the yield curve. This approach, in our view, is supported by international commentators in the actuarial profession as described in of this paper.

We have concluded in the earlier discussion of short-term assumptions that the most appropriate proxy for risk-free rates in New Zealand is the yield on Government bonds. Therefore, in this context, it is consistent that the resulting risk-free rate assumed in this methodology is cross-checked against available market data and historical rates of long-term real returns on Government bonds in New Zealand.

The analysis is shown under the following headings.

- New Zealand market data
- US market data and projections
- The Treasury long term projections of the New Zealand Government's interest rate
- EIOPA methodology
- Real GDP growth and the real interest rate.

New Zealand market data

Government bond rates compared to inflation

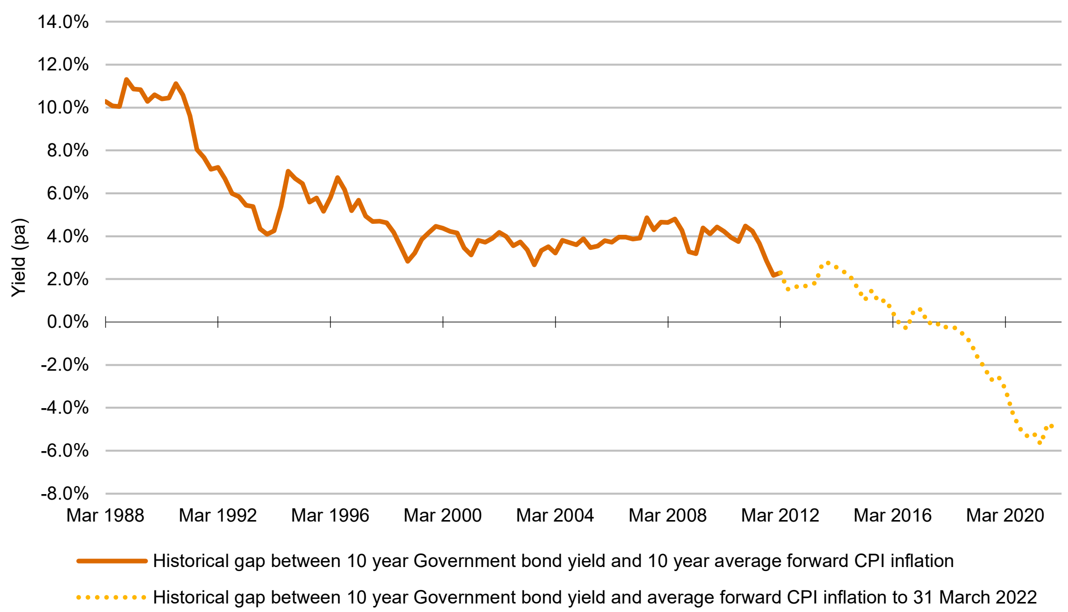
In reviewing the historical real risk-free discount rates, we have looked at the difference between interest rates and inflation rates in the past. There are several ways of considering this. The following figure shows the historical difference between the 10-year Government bond yield at the start of a year and the average inflation experienced over the following ten years.

Up to March 2012, the gap has been calculated as the difference between the 10-year Government bond yield and the average annual CPI inflation over the following 10 years.

After that, CPI inflation is averaged over the period to March 2022. For example, for the data point March 2014, this is the 10 yield Government bond yield at the end of the month, less the average CPI inflation over the following eight years.

Historical real risk-free returns are important inputs into making our judgement because they are a significant factor in setting investor's expectations. In the absence of market data in the long term, current investor expectations become an important starting point. The period of history over which this assessment is made is critical.

Figure 14: 10-year Government bond yield less average inflation in following 10 years



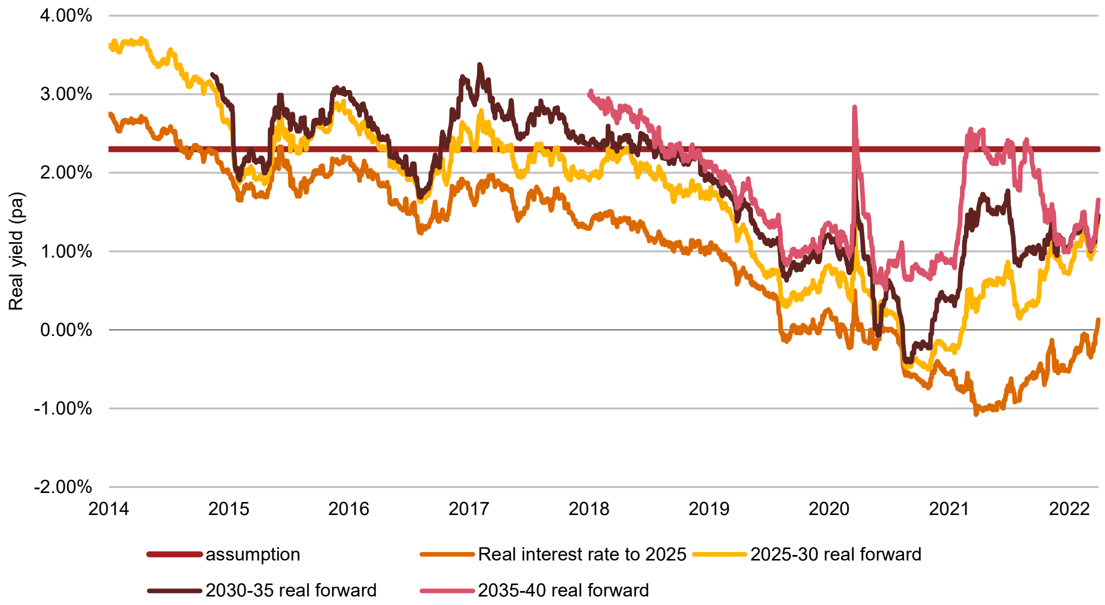
From 1998 to 2012, the difference between 10-year Government bond yields and CPI inflation was generally between 3.0% pa and 4.5% pa. For periods after that, there is not a full 10 years of data to enable a reliable comparison, although there has clearly been a downward trend since 2012.

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 31 March 2022, the inflation-indexed bonds on issue were: $5.5 billion maturing on 20 September 2025, $4.5 billion maturing on 20 September 2030, $4.6 billion maturing on 20 September 2035 and $5.2 billion maturing on 20 September 2040.

The following figure 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.

Figure 15: New Zealand real forward interest rates, determined from inflation-indexed bonds to 31 March 2022



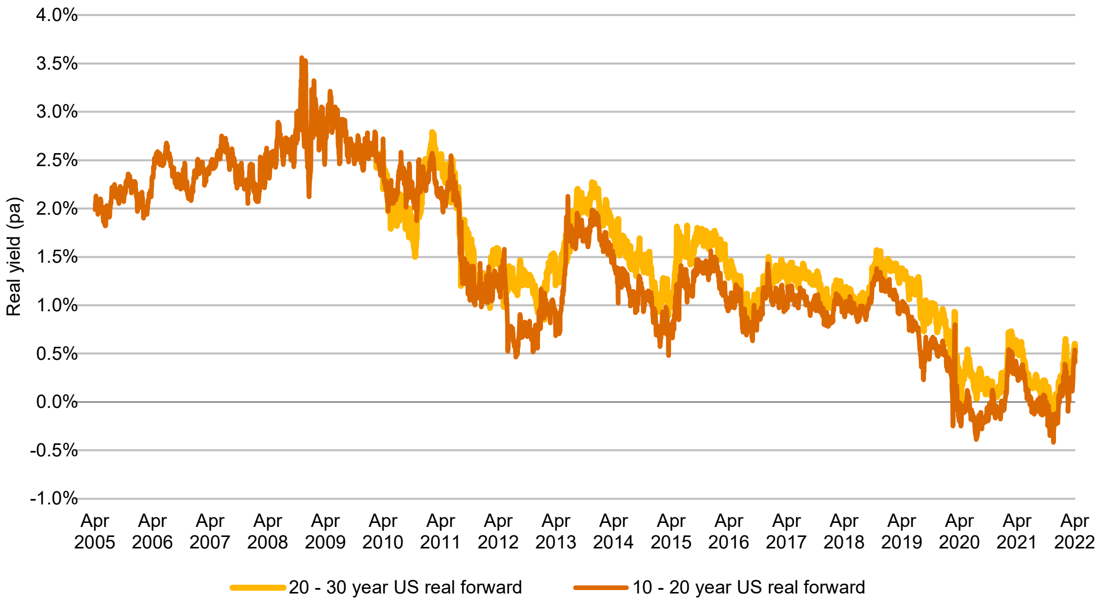
This shows that the longest term real forward rates have generally been in the range of 1.0% pa and 3.5% pa. Rates trended downwards from 2014 to 2020 and have been increasing rapidly over the last year.

The real 2035-40 forward rate has fallen from 3.37% pa when it commenced in March 2017 to 1.66% pa at 31 March 2022 (an average of 1.69% pa). Over the last year, these forward rates have average 1.75% pa and peaked at 2.55% pa. This indicates that the longest term real forward rate has mostly been below the long-term assumption of 2.3% pa but has exceeded this value several times in the last year.

US market data and projections

Using the 10-year, 20-year and 30-year inflation-indexed bonds issued by the US Treasury allows the US forward real rate for between 10 and 20 years and between 20 and 30 years to be determined and these are shown below.

Figure 16: US real forward interest rates, determined from inflation-indexed bonds to 31 March 2022

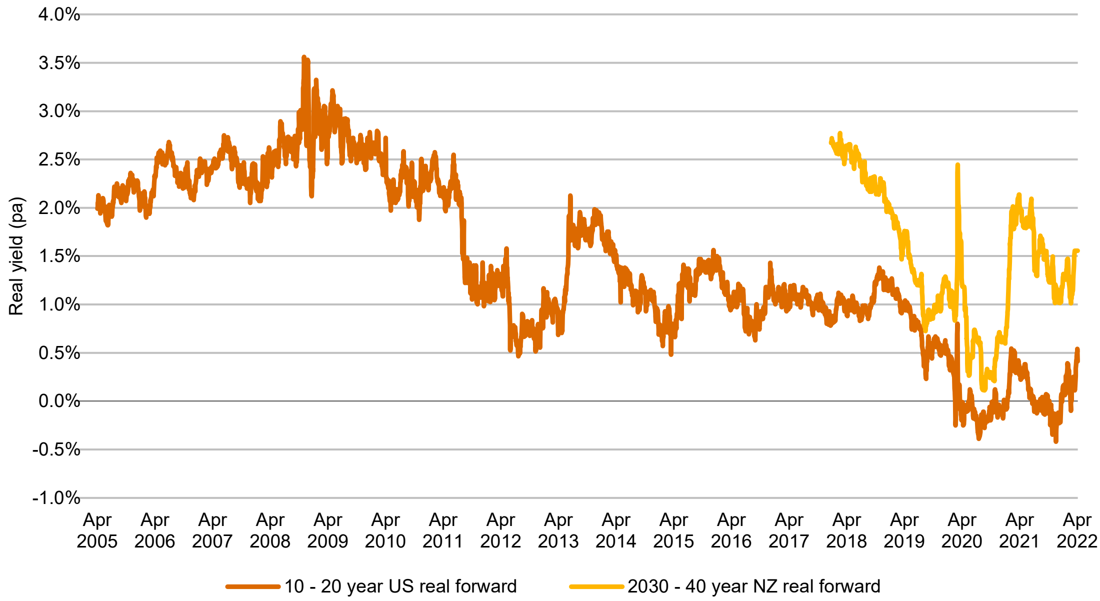


These show a similar term premium as New Zealand bonds and a similar fall and then flattening and indications of increasing in the most recent period.

There is no New Zealand data on real forward rates beyond 2040 (21 years at present).

The same data allows the US forward real rate for between 10 and 20 years to be determined and this is shown below. This is compared to the New Zealand 2030-40 forward rate. Note that at the start of this series, in 2018, the NZ 2030-40 forward rate is a 12-22 year forward rate, and in 2022 the NZ 2030-40 forward rate is an 8-18 year forward rate, thus on average, for the duration of this graph, it is approximately equivalent to the US 10-20 forward rate.

Figure 17: US 10-20 year forward yields, and the NZ 2030-2040 forward yield implied by the inflation-indexed bond rates



This shows that the New Zealand forward rate has been higher than the US forward rate over the past four years. It was significantly higher at the start of 2018, dropping to almost equal from mid-2019 to late-2020, before increasing again to a 1.0% differential at present. This differential is to be expected, given New Zealand is a smaller economy.

The United States Congressional Budget Office projects that real annual returns will increase to 2.70% pa by 2050/2051, in their March 2021 projections. Adding a 1.0% pa risk premium for New Zealand would indicate 3.7% pa long-term real annual return for New Zealand.

The Treasury long-term projections of the New Zealand Government’s interest rate

At least every four years, the Treasury produces a Statement on the Long-term Fiscal Position of the government, looking at least 40 years into the future, to examine the potential effects on our economy of long-term macroeconomic trends. The Treasury published a paper in September 2021 on long-term projections of the New Zealand Government’s interest rate as a background paper for the 2021 Statement on the Long-term Fiscal Position

Broad conclusions of the paper are that:

- interest rates are to remain at historically low levels over the next decade, and then will rise after that but not to the same level as historical averages. Since then interest have risen faster than expected at the time the paper was written
- a long-term stable value of a 10-year nominal government bond rate of around 4.3% is appropriate, consisting of a real rate of 2.3% and inflation rate of 2.0%.

Other relevant comments from the report are:

- the New Zealand Superannuation Fund determines an estimated fund performance in which they determine an expected long run annual return for 90 day Treasury Bills of 4%. This is constructed from 2% inflation, 1.5% country risk premium for New Zealand and a 0.5% global equilibrium cash rate
- long-term forward rates for the US are around 0.5% real at 30 years, May 2021 and US rates are generally 1% lower than NZ rates.

EIOPA methodology

EIOPA has also adopted a single long term real return assumption referred to as the ultimate forward rate (UFR). This is calculated by finding the simple arithmetic mean of the annual real 3-month rates, from 1961 to the year before the recalculation of the UFRs, for 12 economies (Italy, Germany, France, Japan, Switzerland, Denmark, Netherlands, UK, Canada, US, Sweden and Australia). For the calculation of the expected real rate for 2023, the observed real rate of 2021, which is -2.98%, newly enters the calculation. The resulting expected real rate is 1.40%.

For each currency the annual change to the UFR is limited to increase or decrease by no more than 15 basis points, so that stability is maintained. This means that the UFR applicable in 2023 is not necessarily the same as the calculated UFR. For example, for New Zealand the UFR is calculated as 3.40% pa (2.0% pa inflation plus 1.4% pa expected future short-term real rates), however the UFR applicable in 2023 has been kept at 3.45% pa as EIOPA only change the rate if it varies by at least 0.15% pa.

Note that this is the real short-term return expected in the long term, ie, it does not include a term premium.

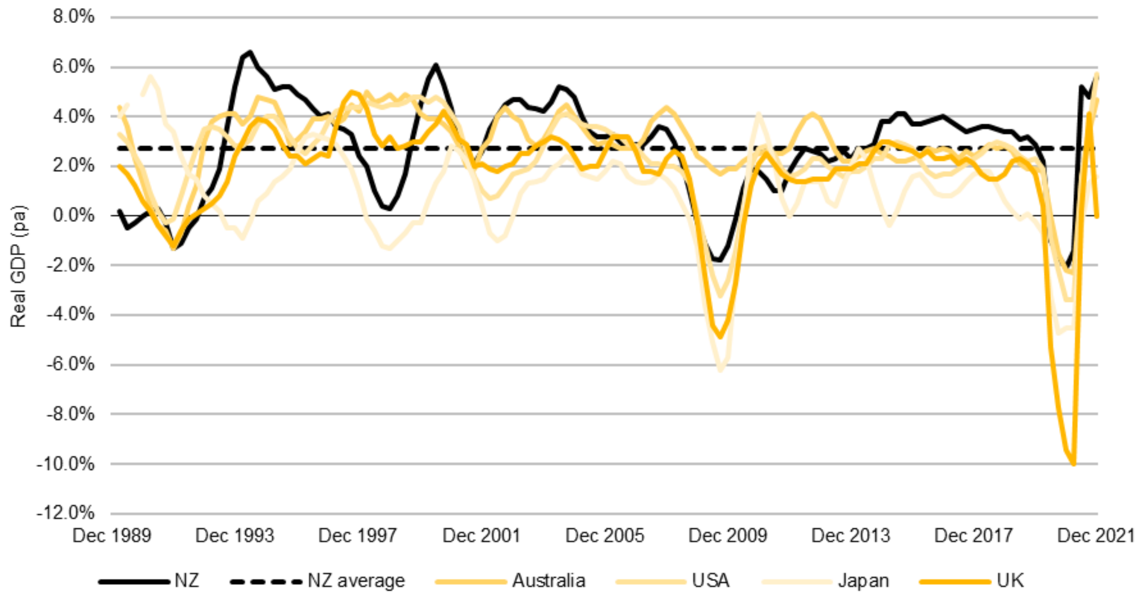
EIOPA uses the same assumption for all economies world-wide. In our view it is reasonable to expect New Zealand to continue to attract a premium over the UK and the EU. For this reason, and also because EIOPA includes no term premium, the long-term real rate of 2.30% pa is reasonable in relation to the EIOPA UFR of 1.40% real.

Real GDP growth and the real interest rate

A prospective approach to determining the nominal long-term rate is to look at real GDP forecasts plus inflation forecasts. According to AASB 17, “based on economic theory, a risk-free interest or discount rate is comprised of the expected inflation rate plus the expected growth in the economy, measured by Gross Domestic Product (GDP) or similar.”

The following graph shows historical real GDP growth rates for New Zealand, Australia, USA, UK and Japan. Overall the real GDP growth rate for New Zealand has been volatile, but has averaged out at 2.7% pa over the 32 year period shown. This is similar to Australia’s average, but higher than the US and much higher than both the UK and Japan.

Figure 18: Historical real GDP growth rates



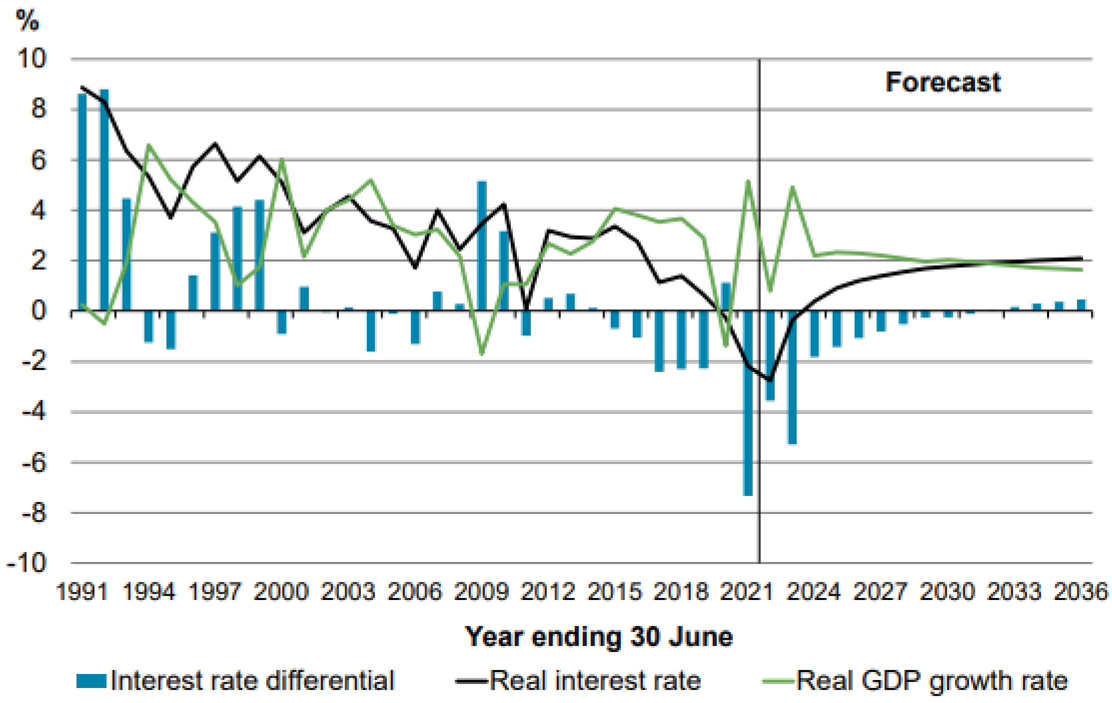
It could be argued that the real GDP growth in New Zealand has been fuelled by significant immigration over this period. The working age population grew from 2.60 million to 4.12 million from 1990 to 2021, largely driven by immigration. This growth was on average 1.5% pa, meaning the average real GDP per capita growth was much less than the 2.7% pa average shown above.

Some of the immigration has contributed to a share of New Zealand's GDP growth. However, how much immigration actually contributes to GDP growth is unclear. Per capita economic measures are sensitive to other population dynamics that are likely to distort the trends.

Furthermore, as debt levels in New Zealand have generally expanded over time, there has been a positive differential between real (GDP) growth and the real interest rate. In May 2022, the Treasury produced a paper summarising work carried out in order to revise and recommend fiscal targets for New Zealand. In this paper, the Treasury analysed the relationship between the real interest rate and real growth rate. The results are shown in the graph below.

The graph clearly shows that there is a strong correlation between real interest rates and real growth rates when the economy is stable, but there are interest rate differentials during periods of instability (early 1990s following the share market crash, late 2000s after the Global Financial Crisis and the past two years due to COVID-19). Over the long-term, the average interest rate differential has been 0.8 pa over the past thirty years, implying that the real interest rate is 0.8 pa higher than the real growth rate, on average.

Figure 19: Real interest rate, real growth rate and the interest rate differential (r-g)[2]



"Note: The real interest rate is the 10-year bond rate adjusted for inflation. The forecast period is based on HYEFU 2021 forecasts, and the projections are from the Fiscal Strategy Model published at HYEFU 2021."

The figure above also implies a medium-term forecast of 2% pa for the real interest rate, although this is based on a forecast of the 10-year bond rate at 2036 and this is not sufficiently long-term for the purposes of determining a long-term real rate of return for 30+ years away.

Conclusion

We believe that determining a single long-term real return is a rational and pragmatic approach to the long end of the yield curve (that is, beyond the last available nominal Government bond, which currently is 29 years). There is no observable data beyond this point. We have looked at what other forecasters have used in long term projections, what market data might infer and economic theory to support our assumption. The range of values from this research indicate a long-term real return of between 1.0% pa and 3.5% pa with some US data sitting outside this range. EIOPA have adopted a 1.4% pa average long-term real rate of return for New Zealand, but they do not allow for any term premium.

The research above indicates that 2.3% pa continues to be a reasonable assumption for the long-term forward real yield (or 2.25% pa compound) for accounting valuation purposes. This is also aligned with Treasury's assumption for the 10-year Government bond yields in the long term, as set out in their September 2021 paper Long-term projections of the New Zealand Government's interest rate. **This long-term real rate of return assumption is unchanged from the previous review.**

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2 Figure from *The Treasury's analysis and recommendations for fiscal rules*, May, 2022, https://www.treasury.govt.nz/publications/guide/treasurys-analysis-and-recommendations-fiscal-rules)

Long-term inflation

Introduction

As noted in previous sections, many of the Crown's obligations or assets valued using estimated future cash payments and receipts are sensitive to various inflation assumptions, including CPI. This is particularly true for estimated future cash flows over long durations, such as ACC's outstanding claims liabilities and the GSF's pension obligations, which are just as sensitive to inflation rates as they are to discount rates, because of the compounding nature of both. Below is a summary and analysis of our view of an appropriate long-term CPI inflation assumption for accounting valuations reported in the financial statements of the Crown.

There is limited discussion in the technical papers of ways in which to set long-term inflation assumptions. EIOPA has adopted currency-specific expected inflation rates based on announced inflation targets. These expected inflation rates can take the values 1.0% pa, 2.0% pa, 3.0% pa or 4.0% pa. The majority of economies are 2.0% pa. The expected inflation rate adopted by EIOPA for New Zealand applicable in 2023 is 2.0%, which is not changed from previous years.

The analysis is shown under the following headings.

- Inflation since the Reserve Bank Act
- New Zealand market information for inflation-indexed bonds
- Long-term inflation assumptions used by private insurers.

Inflation since the Reserve Bank Act

The Reserve Bank Act introduced inflation targets from March 1990. The RBNZ inflation targets have been as follows:

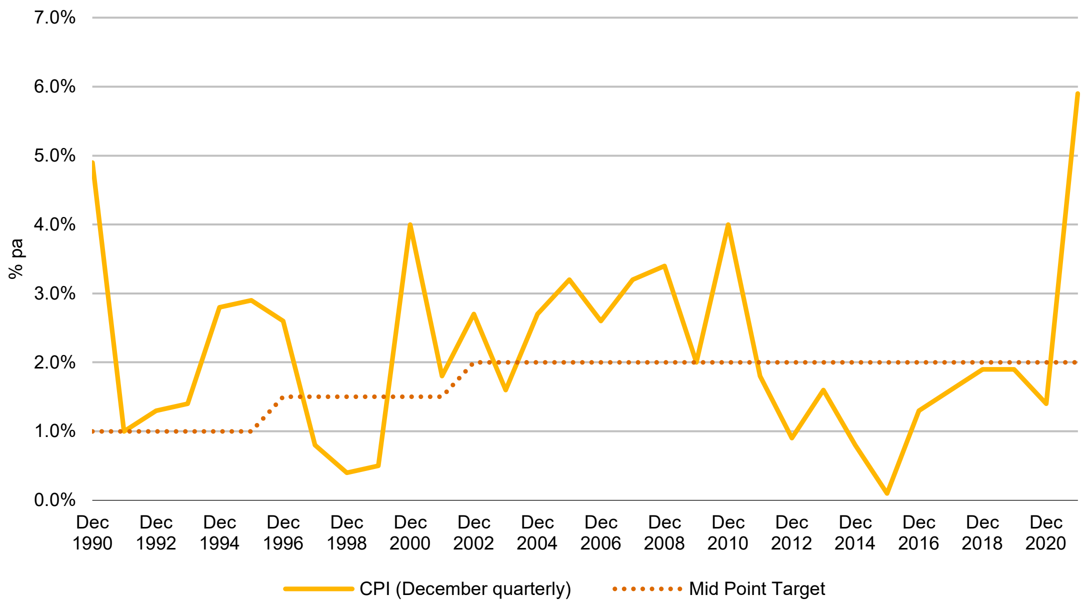
Table 8: RBNZ inflation targets

	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

The current Policy Targets Agreement (PTA), released by the Reserve Bank in February 2019, and the PTA's replacement, the Monetary Policy Remit states "the policy target shall be to keep future annual CPI inflation between 1 and 3 percent over the medium-term, with a focus on keeping future inflation near the 2 percent mid-point."

The figure below shows the year-by-year progression of annual CPI inflation plotted next to the target mid-point. Note that CPI for 2010 was impacted by the increase in GST from 12.5% to 15%.

Figure 20: CPI inflation compared to target midpoint



This shows that then CPI inflation in New Zealand has been relatively stable since the targets were introduced and close to 2.0% since the 2.0% mid-point was introduced 20 years ago. As discussed earlier, CPI increased 6.9 percent in the March 2022 quarter compared with the March 2021 quarter, the largest movement since a 7.6 percent annual increase in the year to the June 1990 quarter. While this is a significant increase and well above 2%, we do not believe this occurrence should impact the long-term CPI assumption (39 years and beyond) for accounting valuations.

Inflation-indexed bonds

As noted above in discussion on the real long-term risk-free discount rates, inflation-indexed Government bonds can be useful evidence of the market's view of real rates of return. At 31 March 2022, $5.5 billion of inflation-indexed bond maturing on 20 September 2025, $4.5 billion of inflation-indexed bond maturing on 20 September 2030, $4.6 billion of inflation-indexed bond maturing on 20 September 2035, and $5.2 billion of inflation-indexed bond maturing on 20 September 2040 had been issued. The break-even inflation from 2030 to 2035 and from 2035 to 2040 implied by the yield on inflation-indexed bonds at 31 May 2022 is 1.67% pa.

For the reasons out-lined earlier (see Short to medium-term inflation section), the inflation-indexed bonds should not be used as the only determinant of inflation.

Inflation assumptions used by private insurers

The accounting standard for private insurers in New Zealand is governed by NZ IFRS 4. The requirements for discount rates are identical to that of PBE IFRS 4. Inflation assumptions are not defined either but would need to be consistent with discount rates to avoid non-sensical results for long-term insurance liabilities (particularly in life insurance).

Therefore, what private insurers assume for long-term inflation is another source of relevant information for determining the long-term inflation assumption. Generally life insurers in New Zealand have also adopted the 2% pa assumption based on the Reserve Bank's midpoint of their target range. Some life insurers have selected a 2.5% pa assumption for the long-term to allow for higher inflation in the short-term but keep the assumption constant, while others have recently moved to a 2% pa long-term assumption with higher inflation assumptions in the short-term.

Overall this supports the current methodology for inflation of a 2% pa long-term assumption with additional considerations in the short-to-medium term.

Conclusion

Determining a long-term CPI Inflation for use in accounting valuations is challenging.

Over the last 20 years since the current RBNZ inflation targets have applied, the average annual CPI inflation has been close to the 2.0% mid-point of the range; the present is a significant exception to this.

The breakeven inflation over 2030 to 2035 and over 2035 to 2040, implied by the break-even yield determined from the inflation-indexed bonds at 31 May 2022, is 1.67% pa. There is consistent market evidence that break-even inflation is consistently below market inflation expectations, although the amount of this difference is not easy to quantify in New Zealand.

Statements made by the Governor of the Reserve Bank indicate a focus on keeping future inflation near the 2% target mid-point. The OCR has been increased recently on more than one occasion to support this policy**.** Monetary policy statements issued by the Reserve Bank Governor have confirmed this as the intention.

Market forecasts by economists indicate an expected future inflation will fall to close to 2.0% pa by 2026. Surveyed market expectations by business managers and professionals indicate an expected future inflation rate of 2.1% pa in 10 years' time. The Treasury uses 2.0% pa for the long-term fiscal projections. Life insurers also generally assume 2.0% pa for long-term inflation assumptions under NZ IFRS 4.

In our view, these indicate a reasonable best estimate of long-term CPI inflation is 2.0% pa, regardless of the recent spike in actual CPI inflation. This is supported by forecasts that suggest it will only take a few years to return to the long term rate. **This long-term assumption remains unchanged from the previous review**.

Nominal long-term risk-free discount rates

Introduction

This section sets out the review of the long-term nominal risk-free discount rate. In this context, long-term rates are rates for durations longer than the New Zealand market yields available plus the bridging period, ie, 40 or more years into the future.

It is worth noting that the existence of 30-year Government bonds in New Zealand has made valuation results less sensitive to the long-term assumption.

It is important that the nominal risk-free discount rate is a robust stand-alone assumption as well as being mutually compatible with other actuarial assumptions such as the real long-term risk-free discount rate and long-term CPI inflation assumption. PBE IPSAS 39.88 provides guidance by stating preparers should estimate the discount rate for longer maturities by extrapolating current market rates along the yield curve. The same standard suggests that the total present value of the defined benefit obligation is unlikely to be particularly sensitive to the discount rate applied to the portion of benefits that is payable beyond the final maturity of the available financial instrument, such as Government bonds or corporate bonds.

Our methodology is to determine a single long-term risk-free discount rate from historical Government bond yields and other available data, which is consistent with the long-term real return assumption and the long-term inflation assumption. In our view the long-term rate methodology has worked well, with some refinements, through some challenging economic circumstances. The EIOPA also uses a similar approach by selecting an ultimate forward rate that will apply in the very long term.

The analysis is shown under the following headings.

– New Zealand market information

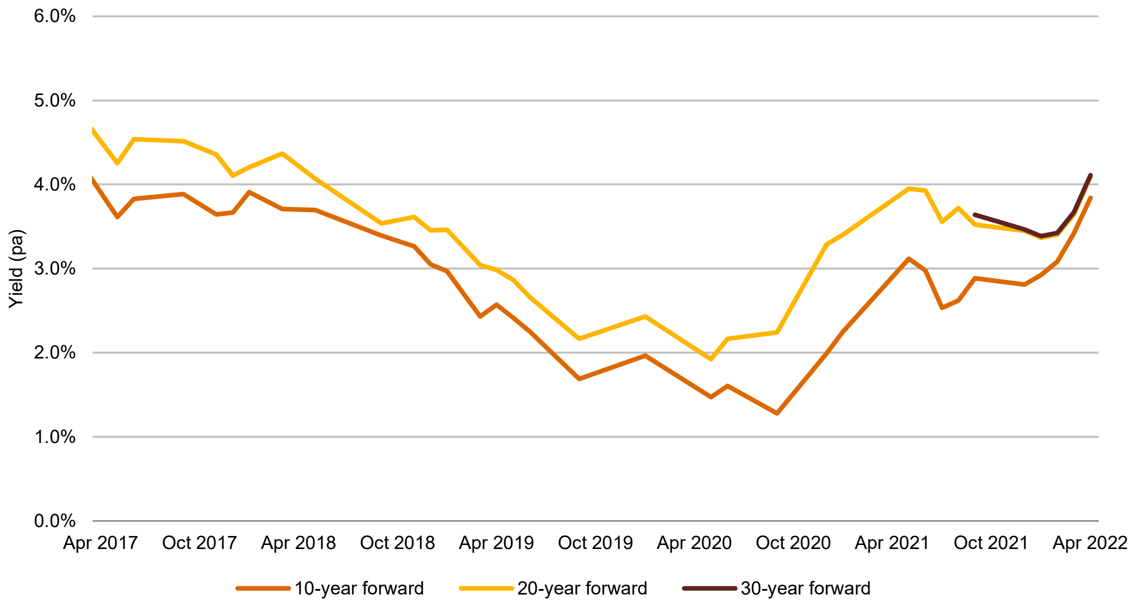
– International observations

– The Treasury long term projections of the New Zealand Government's interest rate.

New Zealand market information

At the time of the last review, the longest dated nominal Government bond was the 2037 bond (18 years to maturity in 2019). Since then, the Government has issued two longer dated nominal Government bonds, the 2041 bond in August 2020 and the 2051 bond in October 2021. This means it is possible to look at the longer term forward rates informed by actual bond prices, and these are shown below. The rates shown are calculated as at 10, 20 and 30 years using the Treasury methodology in force at the time. The 30 year forward rate is only shown from after the 2051 bond was issued.

Figure 21: New Zealand forward rates



This shows that throughout this period, the 20 year forward rate has mostly been 0.4% pa to 0.8% pa higher than the 10 year forward rate, with the differential being less than this in February 2022 to April 2022.

Since the 2051 bond was issued, the 30 year forward rates has been very similar to the 20 Year forward rate, indicating a flat yield curve from year 20 and no further term premium beyond year 20. It is too early to know whether this is just a feature of 2021 to April 2022 or whether it will continue to be the case.

International observations

In September 2021 the New Zealand Government issued its first 30-year bond, maturing in 2051. We are therefore no longer reliant on international comparisons to estimate rates at this duration.

France and the UK both offer 50-year nominal Government bonds. This data could be useful to indicate the yield which would apply to a hypothetical New Zealand 50-year bond. 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. This data indicates the following differences between current yields on 50- and 30-year Government bonds.

Figure 22: UK and France 50-year nominal Government bonds

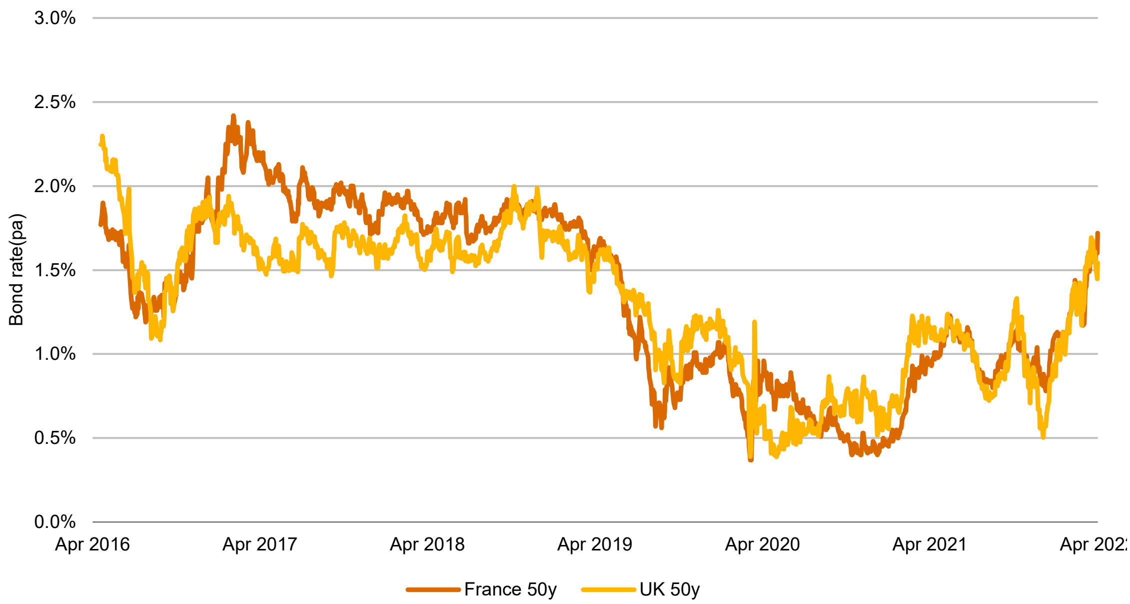
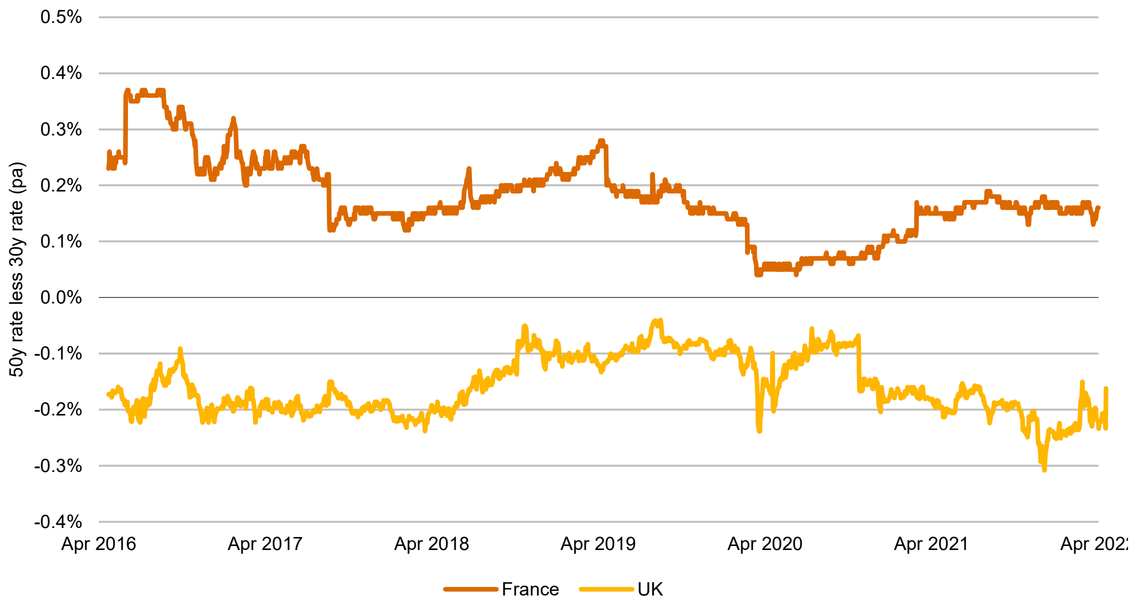


Figure 23: UK and France 50-year less 30-year Government bond rate



This shows the French market has consistently had a term premium of between 0.1% pa and 0.3% pa. The UK on the other hand has consistently had a lower rate for their 50-year bond, likely because of a high demand for the longest-term bonds due to their extensive pension schemes.

As New Zealand is a smaller economy than these two, 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. New Zealand does not have the massive pension schemes and annuity schemes present in the UK to drive demand for long dated Government bonds. For these reasons, we believe it would be reasonable to take the French differential of 0.1% pa to 0.3% pa or more as more indicative. The proposed methodology, as at 31 March 2022, would give a difference between the 50-year spot rate and the 30 year spot rate of 0.25%, which is consistent with the 0.1% to 0.3%pa or more indicated above.

The Treasury long term projections of the New Zealand Government's interest rate

As discussed in the previous section, The Treasury conducted an exercise, involving research, modelling and international comparisons, on this subject in September 2021.

The broad conclusions of the paper are that interest rates are to remain at historically low levels over the next decade, and then will rise after that but not to the same level as historical averages. Since then interest have risen faster than expected at the time the paper was written.

The long-term stable value of a 10-year nominal government bond rate of around 4.3% is recommended as appropriate.

One of the inputs into this conclusion was the 4.3% long-term rate for Crown accounting valuations from 2019, so it is appropriate to summarise some of the other inputs.

The report considers the assumptions used by other international agencies for 10-year bond rates, key points being:

- OECD - 3.4% by 2060
- US Congressional Budget Office (CBO) - 4.9% by 2051
- Australian Treasury – around 5% by 2040
- UK Office of Budget Responsibility – around 4% by 2040
- Canadian Department of Finance – 3.8% by 2040

The report also investigates long-term forward rates for the US and NZ;

- US nominal around 3% at 30 years, May 2021
- NZ nominal around 4% at 20 years, Sept 2021
- US real around 0.5% at 30 years, May 2021
- NZ real around 3% at 20 years, Sept 2021

It is also noted that US rates are generally 1% lower than NZ rates.

In combination, and without the 4.3% from our previous report, these inputs indicate an appropriate long-term nominal rate of at least 4%.

Conclusion

In our view, there is enough evidence that an acceptable range for the long-term nominal return is 3.5% pa to 5.0% pa and that 4.3% pa is a reasonable best estimate. This is the sum of the long-term real rate of 2.3% pa plus the long-term inflation assumption of 2.0% pa. **It has remained unchanged since the previous review**.

Our findings are:

- 20 year forward rates have been in the range of 2.0% pa to 4.0% pa over the last four years. Forward rates have been rising rapidly since September 2020
- EIOPA adopts a long-term assumption for the short-term nominal return of 3.45% pa, in our view it is reasonable to allow for a term premium and a country premium on this.
- the forward rate at the end of the yield curve (29 years) was 3.65% pa as at 31 March 2022.
- international data indicate a 0.16% pa or higher differential between 30- and 50-year spot rates, compared to 0.25% pa on the proposed methodology (31 March 2022)
- As discussed in the previous section, The Treasury conducted an exercise, involving research, modelling and international comparisons, on this subject in September 2021. As a result, in both the Fiscal Strategy Model (FSM) and the Long-Term Fiscal Model (LTFM) The Treasury adopts a long-term Government bond rate of 4.3% pa.

Bridging assumption

Introduction

Given that long-term assumptions are set, there is a need to bridge from the end of the observable rates to the long-term assumptions. The bridge is one of the most subjective areas of the methodology. The accounting standards do not contemplate this requirement and therefore we have used research and discussion papers to outline the broad principles of extrapolation in the Methodology.

In the past we looked at the shape of US yield curves to help inform our analysis of the bridging methodology, however this is no longer relevant since the introduction of the 30-year bond.

The information available to consider bridging all relates to discount rates. In order to ensure a smooth progression of real returns, bridging periods are required for CPI inflation as well as for nominal discount rates. Historically they have been the same bridging period as a result of the last nominal and index-linked bond having similar maturity dates.

Nominal risk-free discount rates

Papers by Mulquiney and Miller (November 2012 and May 2013) and EIOPA referred to in the next section argue that smoothing period for discount rates should be over a long period.

The three main conclusions from Mulquiney and Miller were:

- there is reasonable international market evidence for reversion to a flat long-term forward rate
- the rate of reversion is slow
- linear path reversion is plausible, with other approaches possible.

The EIOPA papers consider a global approach to setting long-term discount rates, and made recommendations on long-term rate and bridging methodology. The extrapolation method used by EIOPA is the Smith-Wilson technique. The impact from using this technique is also investigated.

The Canadian Institute of Actuaries, in their Draft Educational Note on IFRS 17 Discount rates for Life and Health insurance Contracts comments that since forward rates represent future implicit market rate expectations, a short convergence period even as short as one year could be appropriate. On the other hand, since spot rates include both observable market rates and unobservable expectations, a long convergence period is expected, even 30 years. The length of the convergence period would depend on the differential between the forward rate of the last observable point and the ultimate forward rate under the forward rate methodology (a short period would be reasonable with a small differential and vice versa).

Refer to the Literature section for more details on both these papers.

The first two papers recommend periods of more like 40 years to reach the long-term rate. Mulquiney and Miller were bridging from 10 years and EIOPA from 20 years, deemed the last reliable points under their methodologies at the time they were writing. The last paper indicates a shorter period.

The current maximum slope assumption of 0.05% pa for the New Zealand yield curve still seems a reasonable upper bound to adopt. Starting from a 30-year spot rate of 3.49% and applying the 0.05% pa increase to the forward rate, up to a maximum of 4.30% pa, gives a 50-year spot rate of 3.74%.

Therefore, there has been no change made to the bridging methodology for nominal risk-free rates. It remains a linear interpolation over 10 years from the maturity date of the last nominal Government bond, subject to a maximum slope of 0.05% pa.

Inflation

In the previous reviews, the bridging methodology and periods for inflation were matched to that of the bridging for nominal risk-free rates. This was because the maturity dates for the last nominal bond was similar to the maturity date for the last indexed-linked bond.

However, longer dated Government bonds have been issued to extend the maturity date for the nominals. The Government has also committed to adding new nominal bonds to ensure durations of up to 30 years are available. Indexed-linked bonds have not been extended at this stage.

This means that adopting the same bridging methodology for inflation and nominal risk-free rates is no longer appropriate. The end of the observable market for the inflation curve is six months prior to the maturity date of the last indexed-linked bond (currently 2040) and this is materially different to the end of the observable market for the nominal risk-free rate curve (currently 2051). The six month prior is due to this being the inflation index point used to determine the maturity proceeds.

As a result, a change to the bridging methodology for inflation is proposed so that the linear interpolation starts at the maturity date of the last indexed-linked bond and ends at the same point as the bridging for the nominal risk-free rates.

Conclusion

Some international thinking suggests that the length of the transition period could be longer than our currently methodology. One recent paper suggests convergence of forward rates could happen much quicker. Overall, we think it’s appropriate to keep the current methodology because:

- whilst the shortest transition period is 10 years the maximum slope lengthens automatically when the gap is more than 0.5% and the transition period was 14 years as at 31 March 2022
- New Zealand has nominal bonds out for 29 years, which is a longer period than contemplated in most of this literature, meaning the bridging period is less significant

- interest rates have been rising in New Zealand over the past year and this has meant that the yield curve has become flatter, which again reduces the significance of the bridging assumptions
- the Smith-Wilson bridging from EIOPA results in a similar outcome to our much simpler methodology.

This assumption still retains a great deal of subjectivity, and we accept that a number of different options are possible. However, the bridging assumptions are less material now that there are more long dated nominal Government bonds on issue as the liability profiles of liabilities on the Crown balance sheet are typically not longer than 30 years.

We continued to support a straight-line extrapolation of forward rates, as in our view there is no reason to depart from the simplicity of a linear extrapolation. Although other more technically justifiable curves can be fitted, there is no consensus on the best method and a different shape to the extrapolated curve does not have a material impact on the result. It should also be noted that further reductions in slope or extensions in the transition period will have a decreasing marginal impact.

No change has been made to the nominal risk free discount rate bridging methodology since the previous review. However, due to additional nominal bonds being available in the market, the bridging methodology for inflation will start at the end of the maturity date of the last indexed-linked bond and finish at the same point as the bridging for nominal risk-free rates. **This represents a change from the previous review in respect of the starting point for inflation rate bridging.**

Appendix A Literature review

Review of accounting and actuarial standards, and other literature

This section summarises the accounting standards, actuarial standards and other literature referenced in in this paper. The methodology outlined in the main body of this paper is supported by and is consistent with the views documented in this section.

The Financial Statements of the Government of New Zealand are prepared in accordance with the Public Finance Act 1989 and with New Zealand generally accepted accounting practice (NZ GAAP), as defined in the Financial Report Act 2013. For the purposes of external reporting, the Government reporting entity has been designated as a public benefit entity (PBE). Public Benefit entities (PBEs) are reporting entities whose primary objective is to provide goods or service for community or social benefit and where any equity has been provided with a view to supporting that primary objective. The Financial Statements of the Government since 2014/15 have been prepared in accordance with Public Sector PBE Accounting Standards (PBE Standards) – Tier 1.

Overview of the relevant literature

The development of the methodology has focused on the financial reporting requirements of the Government's largest valuations that use present value cash flow models; the ACC Insurance obligation, the Government Superannuation Fund (GSF) pension liability and the Student Loan Scheme's loan assets. The applicable accounting standards for these are PBE IFRS 4 *Insurance Contracts,* PBE IPSAS 39 *Employee Benefits* and PBE IFRS 9 *Financial Instruments* respectively. However, a review of PBE IPSAS 19 *Provisions, Contingent Liabilities and Contingent Assets* is also included because the measurement of some of the Government's provisions also uses present value cash flow techniques.

PBE IFRS 4 and PBE IPSAS 39 specifically require the use of risk-free discount rates and we have specifically focused on implementing and complying with these requirements in developing the methodology for risk-free discount rates and CPI inflation assumptions. The valuation of Student Loans under PBE IFRS 9 requires a risk-adjusted discount rate. At present, given the absence of any market for New Zealand student loan assets and no suitable observable proxy, a risk premium is added the risk-free discount rate to determine an appropriate risk-adjusted discount rate.

However, we have also concluded that the methodology described in this paper would comply with all relevant PBE standards requiring the use of risk-free discount rates. In addition, this analysis may have relevance not only for Student Loans, but other accounting valuations where a net present value is determined by using a risk-free discount rate plus a risk adjustment.

Actuarial Standards are guidance for actuaries to ensure that their work meets certain levels of professional standards. Actuarial standards complement accounting standards in that they provide guidance on how to apply the accounting requirements to valuations using actuarial techniques. The major valuations noted above are all valued by professional actuaries on behalf of the Government and therefore it is appropriate to review actuarial standards as part of this paper.

Relevant actuarial standards have been developed to apply under NZ IFRS, but given the high degree of convergence between NZ IFRS and NZ IAS and PBE standards, no conflicts or inconsistencies are expected to arise between the accounting standards (ie, "what to measure") and the actuarial standards (ie, "how to measure"). However, there are a number of international debates between actuaries on how to value insurance and pension obligations, including debates on how to determine a basic risk-free discount rate. If any conflict or inconsistency between the accounting and actuarial standards were to arise, the accounting standard would need to receive more weighting because the valuations must comply with PBE standards.

There have been many international articles and papers on discount rates written by actuaries and finance professionals over the years. This reflects the importance of discount rates in valuations; small movements in discount rates can have significant impacts on the financial results of entities. The use of discount rates is a very sensitive issue, particularly in Europe and the US where there are large defined benefit pension schemes and insurance obligations on balance sheets. The global financial crisis following 2008 further heightened this sensitivity because all bond markets were extremely volatile and accepted historical norms about the risk-free nature of debt issuances by sovereigns were questioned, particularly in Europe. There has been renewed interest in the subject with the introduction of International Accounting Standard 17 Insurance Contracts, although many of these discussions are theoretical rather than practical and focus on the illiquidity of insurance liabilities.

Literature hierarchy

There is a definite hierarchy in the literature in terms of how much weight should be given to any conclusions or guidance contained in the literature. The hierarchy is:

- New Zealand accounting standards
- New Zealand actuarial standards
- International actuarial standards
- Papers from international bodies.

Note that the actuarial standards do not refer directly to the accounting standards, and both the accounting and actuarial standards have shortcomings. The papers from international bodies are a range of discussion notes and research and also have evolving conclusions. Consequently, not all of the findings in the papers have been given equal weight.

PBE IFRS 17 Insurance Contracts was issued in 2019, as a replacement to PBE IFRS 4. However, its scope was limited to not-for-profit entities. The External Reporting Board has issued an exposure draft, to extend the scope to include public sector PBEs and to incorporate a number of modifications before it is applicable to the public sector. PBE IFRS 17 will not be applicable to the public sector for the period covered by this report.

The guidance in NZ PBE IFRS 17 differs significantly from many aspects of PBE IFRS 4, including certain aspects relating to the calculation of discount rates, and so it is not appropriate to consider as authoritative support for interpretation of the current requirements in PBE IFRS 4. We have however considered certain actuarial papers where the discussion is also relevant to aspects of the methodology set out in this report.

Accounting standards

PBE IFRS 4, PBE IPSAS 39 and other relevant accounting standards require a significant amount of judgment to be applied when determining discount rates for calculating valuations using discounted cash flow models.

Establishing the discounting principles across the relevant standards is vital. If the principles in the accounting standards are clear, selection decisions can be made with confidence. Such selection decisions may include

- choosing a suitable yield curve from New Zealand markets to proxy a risk-free discount rate
- deciding whether any adjustments need to be made to the yield curve selected as a risk-free discount rate proxy
- determining a risk-free discount rate when there are no observable yield curves in the New Zealand markets (usually for longer duration assets and liabilities).

When IFRS was first introduced, risk-free discount rates were very strictly interpreted as being market rates with no adjustment. As best practice has evolved, there has been significant work on how to cope with market shortcomings such as illiquid tranches.

To be compliant with the principle of determining a risk-free discount rate, it may be appropriate to adjust an observable yield curve. An example may be adjustments to Government bond rates by giving less weight to the market rates of very illiquid tranches.

Below is an analysis and interpretation of the applicable accounting standards which the Government’s reported valuations must comply with.

Public Benefit Entity International Financial Reporting Standard 4 Insurance Contracts, issued September and incorporating amendments to 31 January 2021 (PBE IFRS 4)

The discounting requirements in PBE IFRS 4 are specified below.

PBE IFRS 4 Appendix D Financial Reporting of Insurance Activities – Discount Rates

D6.1 The outstanding claims liability shall be discounted for the time value of money using risk-free discount rates that are based on current observable, objective rates that relate to the nature, structure and term of the future obligations.

D6.1.1 The discount rates adopted are not intended to reflect risks inherent in the liability cash flows, which might be allowed for by a reduction in the discount rate in a fair value measurement, nor are they intended to reflect the insurance and other non-financial risks and uncertainties reflected in the outstanding claims liability. The discount rates are not intended to include allowance for the cost of any options or guarantees that are separately measured within the outstanding claims liability.

D6.1.2 Typically, government bond rates may be appropriate discount rates for the purposes of this Appendix, or they may be an appropriate starting point in determining such discount rates.

PBE IFRS 4 Paragraph 12.1 – Definitions

Financial risk is the risk of a possible future change in one or more of a specified interest rate, financial instrument price, commodity price, foreign exchange rate, index of prices or rates, credit rating or credit index or other variable, provided in the case of a non-financial variable that the variable is not specific to a party to the contract.

PBE IFRS 4 Appendix B Definition of an Insurance Contract – Distinction Between Insurance Risk and Other Risks

B9. The definition of financial risk in paragraph 12.1 includes a list of financial and non-financial variables. That list includes non-financial variables that are not specific to a party to the contract, such as an index of earthquake losses in a particular region or an index of temperatures in a particular city. It excludes non-financial variables that are specific to a party to the contract, such as the occurrence or non-occurrence of a fire that damages or destroys an asset of that party. Furthermore, the risk of changes in the fair value of a non-financial asset is not a financial risk if the fair value reflects not only changes in market prices for such assets (a financial variable) but also the condition of a specific non-financial asset held by a party to a contract (a non-financial variable). For example, if a guarantee of the residual value of a specific car exposes the guarantor to the risk of changes in the car's physical condition, that risk is insurance risk, not financial risk.

B11. Under some contracts, an insured event triggers the payment of an amount linked to a price index. Such contracts are insurance contracts, provided the payment that is contingent on the insured event can be significant. For example, a life-contingent annuity linked to a cost-of-living index transfers insurance risk because payment is triggered by an uncertain event—the survival of the annuitant. The link to the price index is an embedded derivative, but it also transfers insurance risk. If the resulting transfer of insurance risk is significant, the embedded derivative meets the definition of an insurance contract, in which case it need not be separated and measured at fair value (see paragraph 7 of this Standard).

Principles:

- risk-free based on current observable, objective rates not intended to reflect risks inherent in the liability cash flow
- typically Government bonds may be appropriate or an appropriate starting point for determining risk-free discount rates.

Unfortunately the standard does not provide any detailed guidance on how to determine the risk-free discount rate where the term of an insurance obligation is longer than the current observable market data or of the meaning of nature and structure. Nor does it give any guidance on how to determine inflation.

Public Benefit Entity International Public Sector Accounting Standard 39 Employee Benefits, issued May 2017 and incorporating amendments to 31 January 2022 (PBE IPSAS 39)

The discounting requirements in PBE IPSAS 39 for long-term employee benefits are shown below.

PBE IPSAS 39 Employee Benefits: Actuarial Assumptions — Discount Rate

85 The rate used to discount post-employment benefit obligations (both funded and unfunded) shall reflect the time value of money. The currency and term of the financial instrument selected to reflect the time value of money shall be consistent with the currency and estimated term of the post-employment benefit obligations.

86 One actuarial assumption that has a material effect is the discount rate. The discount rate reflects the time value of money but not the actuarial or investment risk. Furthermore, the discount rate does not reflect the entity-specific credit risk borne by the entity's creditors, nor does it reflect the risk that future experience may differ from actuarial assumptions.

87 The discount rate reflects the estimated timing of benefit payments. In practice, an entity often achieves this by applying a single weighted average discount rate that reflects the estimated timing and amount of benefit payments, and the currency in which the benefits are to be paid.

88 An entity makes a judgement whether the discount rate that reflects the time value of money is best approximated by reference to market yields at the end of the reporting period on government bonds, high quality corporate bonds, or by another financial instrument. In some jurisdictions, market yields at the end of the reporting period on government bonds will provide the best approximation of the time value of money. However, there may be jurisdictions in which this is not the case, for example, jurisdictions where there is no deep market in government bonds, or in which market yields at the end of the reporting period on government bonds do not reflect the time value of money. In such cases, the reporting entity determines the rate by another method, such as by reference to market yields on high quality corporate bonds. There may also be circumstances where there is no deep market in government bonds or high quality corporate bonds with a sufficiently long maturity to match the estimated maturity of all the benefit payments. In such circumstances, an entity uses current market rates of the appropriate term to discount shorter term payments, and estimates the discount rate for longer maturities by extrapolating current market rates along the yield curve. The total present value of a defined benefit obligation is unlikely to be particularly sensitive to the discount rate applied to the portion of benefits that is payable beyond the final maturity of the available financial instrument, such as government bonds or corporate bonds.

Principles:

- the discount rate reflects the time value of money but not the actuarial or investment risk

- the currency and term of the financial instrument selected to reflect the time value of money shall be consistent with the currency and estimated term of the post-employment benefit obligations

- the discount rate does not reflect entity-specific credit risk or future experience differing from actuarial assumptions

- the yield on Government bonds would be the best measure of the risk-free discount rate unless there is no deep market or where market yields do not reflect the time value of money

- if there is no deep market in bonds with a significantly long maturity, an entity uses current market rates of the appropriate term for short-term payments and estimates the discount rate for longer-term payments by extrapolating current market rates along the yield curve.

PBE IPSAS 39 does not include the amendments made by the International Accounting Standards Board (IASB) to IAS 19 Employee Benefits regarding the use of the market rate on high quality corporate bonds (or where there is no deep market for those bonds, the market rate on government bonds) as the discount rate for measuring defined benefit obligations.

PBE IPSAS 39 provides very little guidance about how to determine inflation assumptions. CPI and salary inflation are important assumptions in both the ACC and GSF valuations. However PBE IPSAS 39 does provide some principles below.

PBE IPSAS 39 Employee Benefits: Actuarial Assumptions

77 Actuarial assumptions shall be unbiased and mutually compatible.

78. Actuarial assumptions are an entity's best estimates of the variables that will determine the ultimate cost of providing post-employment benefits. Actuarial assumptions comprise:…

(b) Financial assumptions, dealing with items such as:

(i) The discount rate (see paragraphs 85–88);

(ii) Benefit levels…

79 Actuarial assumptions are unbiased if they are neither imprudent nor excessively conservative.

80 Actuarial assumptions are mutually compatible if they reflect the economic relationships between factors such as inflation, rates of salary increase, and discount rates. For example, all assumptions that depend on a particular inflation level (such as assumptions about interest rates and salary and benefit increases) in any given future period assume the same inflation level in that period.

81 An entity determines the discount rate and other financial assumptions in nominal (stated) terms, unless estimates in real (inflation-adjusted) terms are more reliable, for example, in a hyperinflationary economy (see PBE IPSAS 10 Financial Reporting in Hyperinflationary Economies), or where the benefit is index-linked, and there is a deep market in index-linked bonds of the same currency and term.

82 Financial assumptions shall be based on market expectations, at the end of the reporting period, for the period over which the obligations are to be settled.

Principles:

- the inflation assumptions should be unbiased, being neither imprudent nor excessively conservative
- the inflation assumption should be the best estimate of the variables which will determine the ultimate cost of benefits
- the discount and inflation rates should reflect the economic relationship between them
- the discount rate and other financial assumptions should be determined in nominal (stated) terms, unless estimates in real (inflation-adjusted) terms are more reliable, for example, in a hyperinflationary economy.

In our view, this standard reinforces the importance of the internal consistency between the discount rate and inflation rate assumption and therefore, the importance of the real rate of return assumption. Determining the real rate of return assumption, particularly in the long term, is a significant issue addressed by the methodology.

Public Benefit Entity International Public Sector Accounting Standard 41 Financial Instruments, issued March 2019 and incorporating amendments to 31 January 2022 (PBE IPSAS 41)

Student loans, which are largely interest-free, will be reported in the Government's accounts in accordance with PBE IPSAS 41. The Government's accounting policy for these loans is to recognise them initially in the accounts at fair value plus transaction costs and subsequently measure them at amortised cost using the effective interest rate method.

As there is no active market for student loans assets, their initial fair value is measured using a valuation technique incorporating the present value of estimated future cash flows. This involves, among other things, determining a risk-adjusted discount rate to calculate the present value. As there are no observable market rates for student loans, nor any suitable yields to proxy in New Zealand, the discount rate is hypothetically derived by establishing a risk-free discount rate and adding an adjustment for credit risk. Therefore, the methodology outlined in this paper is applicable for determining the risk-free component of the Student Loan Scheme discount rate. The discounting requirements in PBE IFRS 9 are specified below.

PBE IPSAS 9 Application Guidance

No active market: valuation technique

AG154. In applying discounted cash flow analysis, an entity uses one or more discount rates equal to the prevailing rates of return for financial instruments having substantially the same terms and characteristics, including the credit quality of the instrument, the remaining term over which the contractual interest rate is fixed, the remaining term to repayment of the principal and the currency in which payments are to be made.

Inputs to valuation techniques

AG155. An appropriate technique for estimating the fair value of a particular financial instrument would incorporate observable market data about the market conditions and other factors that are likely to affect the instrument's fair value. The fair value of a financial instrument will be based on one or more of the following factors (and perhaps others).

(a) The time value of money (ie, interest at the basic or risk-free rate). Basic interest rates can usually be derived from observable government bond prices and are often quoted in financial publications. These rates typically vary with the expected dates of the projected cash flows along a yield curve of interest rates for different time horizons. For practical reasons, an entity may use a well-accepted and readily observable general market rate, such as a swap rate, as the benchmark rate. (If the rate used is not the risk-free interest rate, the credit risk adjustment appropriate to the particular financial instrument is determined on the basis of its credit risk in relation to the credit risk in this benchmark rate). In some countries, the central government's bonds may carry a significant credit risk and may not provide a stable benchmark basic interest rate for instruments denominated in that currency. Some entities in these countries may have a better credit standing and a lower borrowing rate than the central government. In such a case, basic interest rates may be more appropriately determined by reference to interest rates for the highest rated corporate bonds issued in the currency of that jurisdiction

(b) Credit risk. The effect on fair value of credit risk (ie, the premium over the basic interest rate for credit risk) may be derived from observable market prices for traded instruments of different credit quality or from observable interest rates charged by lenders for loans of various credit ratings.

Principles:

- basic interest rates can usually be derived from Government bond prices
- for practical reasons, other well-accepted and readily observable general market rates such as a swap rate can also be used as the benchmark rate
- if Government bonds carry significant credit risk and some entities in that country have a better credit standing and a lower borrowing rate, basic interest rates may be more appropriately determined by referencing interest rates for the highest rated corporate bonds issued in the same currency of that jurisdiction.

Public Benefit Entity International Public Sector Accounting Standard 19 Provisions, Contingent Liabilities and Contingent Assets, issued September 2014 and incorporating amendments to 31 January 2021 (PBE IPSAS 19)

There may be some provisions on the Government's balance sheet that use valuation techniques such as present valuing future cash outflows and therefore the requirements in PBE IPSAS 19 are considered for completeness.

It is likely that entities valuing provisions using cash flow techniques will reflect the risk in adjusting the cash flow and discount at the risk-free discount rate. This is normally easier than adjusting the discount rate for risk, which is complex and often requires significant amounts of judgment.

Therefore, the methodology outlined in this paper should be appropriate for determining a risk-free discount rate where it is required for valuing provisions under PBE IPSAS 19.

The discounting requirements in PBE IPSAS 19 are specified below.

PBE IPSAS 19 – Present value

53 Where the effect of the time value of money is material, the amount of a provision shall be the present value of the expenditures expected to be required to settle the obligation.

54 Because of the time value of money, provisions relating to cash outflows that arise soon after the reporting period are more onerous than those where cash outflows of the same amount arise later. Provisions are therefore discounted, where the effect is material…

56 The discount rate (or rates) shall be a pre-tax rate (or rates) that reflect(s) current market assessments of the time value of money and the risks specific to the liability. The discount rate(s) shall not reflect risks for which future cash flow estimates have been adjusted.

This does not add any additional principles to those discussed earlier.

Conceptual Framework for General Purpose Financial Reporting by Public Sector Entities, published by International Public Sector Accounting Standards Board (IPSASB) 31 October 2014

The following Conceptual Framework published by the International Public Sector Accounting Standards Board comments on the characteristics of open, active and orderly markets.

Chapter 7 – Measurement of Assets and Liabilities in Financial Statements

Market Values in Open, Active and Orderly Markets

7.28 Open, active and orderly markets have the following characteristics:

- There are no barriers that prevent the entity from transacting in that 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 distressed 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.

Actuarial standards

Actuaries apply financial and statistical techniques to value certain assets or liabilities for various purposes, including financial reporting under New Zealand equivalents to IFRS and IPSAS. Therefore, some professional bodies or societies of actuaries issue professional standards, both technical and ethical in nature, which attempt to provide detailed guidance on valuing obligations under accounting standards. These professional standards are therefore generally consistent with accounting standards.

The New Zealand Society of Actuaries (NZSA) issues professional standards for actuaries in New Zealand. There are different standards for general insurance business and superannuation.

General insurance business

NZSA Professional Standard No. 30 Valuation of General Insurance Claims, effective 30 September 2021 (NZSA PS30), applies to valuations of general insurance claims. The standard applies to a Member undertaking any valuation of the Outstanding Claim Liability or Future Claim Liability of Insurance Contracts required under any New Zealand legislation or regulation, excluding life policies. The relevant section is:

NZSA PS30 – Valuations of General Insurance Claims

10.5.2 Discount rates used must be based on risk-free rates of appropriate duration, having regard to the liabilities, as at the Valuation Date.

However, NZSA PS30 does not provide any guidance on how to deal with market shortcomings (eg, when the liability duration exceeds the market observable rates of a portfolio of assets).

Superannuation schemes

NZSA Professional Standard No.40 Valuation of and Funding for Superannuation Schemes applies to actuarial reporting of superannuation schemes but has no specific guidance on discount rates.

ISAP 3 - Actuarial Practice in Relation to IAS 19 Employee Benefits, with conformance changes adopted 1 December 2018

International Standard of Actuarial Practice (ISAP) 3 provides guidance to actuaries when performing actuarial services in connection with International Accounting Standard 19 (IAS 19) Employee Benefits and has a number of comments on how to determine discount and inflation assumptions. Under this standard the starting point is high quality corporate bonds, and the standard is written in this context.

The relevant principles in ISAP 3 are specified below.

ISAP 3 – Section 2. Appropriate Practices – Proportionality

2.3 Proportionality

(a) The actuary may use simplified approaches to recommending assumptions when those assumptions will not materially affect the results or are proportionate for the actuarial services. For example, when a pension plan pays primarily lump sum benefits at termination or retirement, the choice of mortality assumption may have little impact on the liabilities. As a second example, for certain work-related accident or injury benefits, the projected benefit cash flows may be so uncertain as to make a highly refined approach to selecting the discount rate disproportionate.

2.6.1. :

i. With respect to financial assumptions, the actuary should review market-implied expectations and other information at the measurement date. Examples of such information include:

- Corporate or government bond yields;
- Yields on nominal and inflation-indexed debt;
- …..

ISAP 3 – Section 2. Appropriate Practices – Actuarial Assumptions

2.6.3. Discount Rate Assumption – When advising the principal on the selection or reasonableness of the discount rate assumption, the actuary should take into account IAS 19's requirement that the discount rate reflect market yields at the measurement date on high-quality corporate bonds if the market for such bonds is deep or government bonds otherwise, where such bonds are consistent with the currency and estimated term of the employee benefit obligation. The actuary may use a variety of approaches to identify a discount rate assumption that satisfies this requirement, including the following:

a. Full Yield Curve – The actuary may recommend a full spot-rate yield curve for discounting projected benefit cash flows. The actuary may develop an appropriate yield curve from bond yield data at the measurement date. Alternatively, the actuary may apply a third party's yield curve, which the actuary has determined is appropriate for the purpose of selecting an IAS 19 discount rate (or has adjusted so as to make it appropriate). When applying a third party's yield curve, the actuary should be guided by ISAP 1, paragraph 2.3. Reliance on Others.

i. Bond Universe – When developing a yield curve or assessing the appropriateness of a third party's yield curve, the actuary should consider the characteristics of the bond universe used to create the yield curve, including currency and, for corporate bonds, quality. The actuary should also consider whether adjustments are needed to deal with "outliers"—bonds with substantially different yields than the yields on most bonds of similar quality and duration included in the universe—or with bonds that have special characteristics, such as call features.

ii. Curve Fitting, Interpolation, and Extrapolation – When the actuary is constructing the yield curve from the available bond data in the same currency, the actuary should exercise professional judgment in applying appropriate curve-fitting, interpolation, or extrapolation techniques to estimate yields at durations where the actuary considers the bond market data unreliable, or such data do not exist. Such techniques may take into account (with an appropriate spread or other adjustment) other market data sources such as yields on government or lower-rated corporate bonds, the swaps market, or yields on government or corporate bonds in other currencies with market-observable yields at durations beyond the longest duration bond in the same currency as the employee benefits and which the actuary, having applied professional judgment, considers appropriate for this purpose.

An actuary using this approach may also determine a single weighted-average discount rate based on the yield curve (as described in 2.6.3.b.) for the reporting entity's use in the IFRS financial statement disclosures.

b. Single Weighted-Average Discount Rate Based on Yield Curve – The actuary may recommend a single weighted-average discount rate assumption determined by:

i. Projecting cash flows on and after the measurement date of benefits attributed to employee service up to the measurement date;

ii. Applying an appropriate yield curve (as described in 2.6.3.a. above) to determine the present value of the cash flows projected in 2.6.3.b.i.; and

iii. Calculating a single weighted-average discount rate that produces substantially the same present value determined in 2.6.3.b.ii.

c. Single Weighted-Average Discount Rate Based on Bond Model – The actuary may recommend a single weighted-average discount rate assumption determined by:

i. Projecting cash flows on and after the measurement date of benefits attributed to employee service up to the measurement date;

ii. Applying a bond model to identify a portfolio of bonds—appropriately selected from the bond universe described in 2.6.3.a.i. above—that generates substantially the same cash flows projected in 2.6.3.c.i. At durations where the actuary considers the bond market data unreliable or such data do not exist, the actuary should apply techniques as described in 2.6.3.a.ii. above; and

iii. Calculating a single weighted-average yield on the bonds in the portfolio.

When applying a third party's bond model, which the actuary has determined is appropriate (or has adjusted so as to make it appropriate) for the purpose of selecting an IAS 19 discount rate for measuring the cash flows, the actuary should be guided by ISAP 1, paragraph 2.3. Reliance on Others.

d. Alternative Approaches – The actuary may use alternative approaches to those described above. When doing so, the actuary should understand the data and assumptions on which the approach is based and the circumstances in which it can be applied appropriately. The alternative approach should take into account both the duration of the projected benefit cash flows attributed to employee service up to the measurement date and their shape (that is, whether the cash flows over time are smooth or lumpy). Subject to materiality (see 2.2.) and proportionality (see 2.3.), examples of alternative approaches include, but are not limited to:

i. The actuary may recommend a single discount rate that, in the actuary's professional judgment, approximates the weighted-average rate that would be determined under one of the preceding approaches.

ii. The actuary may apply a market index or other reference rate, with adjustments if appropriate. The actuary should have sufficient understanding of the bond data and methodology used to construct the index or reference rate to conclude that it is appropriate for the purpose of selecting an IAS 19 discount rate for measuring the present value of the defined benefit obligation (or has adjusted so as to make it appropriate). When applying a market index or other reference rate, the actuary also should be guided by ISAP 1, paragraph 2.3. Reliance on Others.

2.6.4 General Price Inflation Assumption – When the actuary is advising the principal on the selection or reasonableness of a general price inflation assumption, the actuary should review market-implied expectations and other information at the measurement date. Examples of such information include:

a. Changes in price indices;

b. Implicit price deflators;

c. Yields on nominal and inflation-indexed debt (taking into account the effect of any significant supply-demand imbalances);

d. Forecasts of inflation;

e. Relevant regional factors;

f. Central bank monetary policy;

g. Other relevant economic data; and

h. Analyses prepared by experts.

6.2.2 Change in Process for Developing Assumptions – The actuary generally should apply a consistent process from year to year to develop recommended assumptions for a particular reporting entity. When the actuary considers it appropriate to change the process used to develop a recommended assumption, the actuary should discuss the change with the principal, and should seek guidance from the principal regarding whether to make the change, and if so, what, if any, information about the change should be disclosed in the actuary's report. For example, if the principal determines that the change in the assumption-setting process may be subject to IAS 8, *Accounting Policies, Changes in Accounting Estimates and Errors,* the principal may ask the actuary to disclose the nature of the change and its general effect in the report.

Principles:

- Need to consider whether adjustments are needed to deal with "outliers"— bonds with substantially different yields than the yields on most bonds of similar quality

- When interpolating, or extrapolating to estimate yields at durations where the bond market data unreliable is considered unreliable or data do not exist, other market data sources such as yields on corporate bonds, the swaps market, or yields on government or corporate bonds in other currencies with market-observable yields at durations beyond the longest duration bond may be taken into account.

Actuaries Institute information note

The Actuaries Institute of Australia issued an information note in November 2017 to assist actuaries undertaking a valuation of general insurance claims. It discusses some considerations regarding discount rates, inflation assumptions and the interaction with accounting standards. While the information note is not specifically applicable to New Zealand accounting requirements, the Australian and New Zealand accounting standards are similar in many respects. The information note makes the following comments.

Members should consider the following when determining discount rate and inflation assumptions:

- the principles described in the information note: Discount Rates for APRA Capital Standards issued in December 2012
- methods for extrapolating yield curves, for example, those described by New Zealand Treasury, Mulquiney and Miller and EIOPA.

In circumstances where "economy-wide" inflation assumptions are used, they should be consistent with the nominal discount rates, taking into account break-even inflation rates implied by index-linked bonds, adjusted where appropriate for any difference in the inflation underlying the index-linked bonds and the inflation underlying the liability.

Papers from international bodies

Australia Group of 100 - Milliman discount rate report March 2016

Milliman generates a set of discount rates to be used to discount employee benefit liabilities under Australian Accounting Standard 119 (AASB119). AASB119 requires discount rates to be determined by reference to market yields on high quality corporate bonds, unless there is no deep market in such bonds. While the paper covers neither risk-free discount rates nor inflation assumptions, there are aspects which are relevant to determining risk-free discount rates.

Interpolation

Milliman considered a range of parametric and non-parametric methods for interpolation. Factors noted were:

- there is a trade-off between fit and smoothness
- non-parametric methods such as bootstrapping require the asset calibration set to be very homogenous, so that there is little or no residual pricing variance that can cause forward rates to become discontinuous. Bootstrapping also requires the coupon and maturity payments dates across bonds to be in alignment
- parametric approaches are preferred where the data is heterogeneous

- spline methods are typically more attractive where a heterogeneous calibration set exits and each calibration asset can be considered to exhibit sufficiently similar characteristics
- Weighting options are:
  - weight by market capitalisation – in general, the deeper and more liquid bonds convey more accurate pricing information, and thus it may be desirable that more liquid bonds are given greater weight. If market capitalisation is a reasonable proxy for security depth and liquidity, it may provide a reasonable weighting scheme
  - equal weighting – this has the benefit of simplicity, but makes no allowance for varying degrees of price uncertainty across securities
  - weighting by inverse duration – so longer bonds are assumed to have lower weighting. The rational for this approach is that longer duration bonds are expected to have more volatile prices and greater uncertainty. Hence pricing errors may be expected be, on average, larger for longer duration bonds
  - Combination of approaches – if price uncertainty depends on both maturity and the size of the issue, it may be appropriate to weight using both market capitalisation and duration.

Milliman recommend the Merrill Lynch Exponential Spline (MLES) model, with weightings based on inverse duration and an optimisation process focused on replicating market price, due to the heterogeneity of the calibration set, finding from academic authors and it being similar to the approach used by RBA to derive yield curves on Commonwealth bonds, hence providing consistency with published risk-free rates.

Deep market

Much of the paper is focused on determining whether Australia has a “deep” market in high quality corporate bonds. Factors identified to consider in evaluating whether a particular bond market is deep or not are:

- the size of the outstanding amount on issue and the number of issuers of those bonds – as compared with the total bond market. Small bond issues are unlikely to be liquid securities
- access to observable market yields
- turnover volumes and bid-ask pricing spreads
- macro-economic factors such as the status of initiatives by the government to create or support a deep and liquid bond market
- trends in volumes of bonds traded over time.

Milliman define the liquidity ratio for a bond or market as the annual turnover divided by the amount outstanding. The liquidity ratio for Commonwealth bonds was calculated as 370%, for corporate securities as 55% and for all securities being considered as “liquid” as 86%.

Milliman also assess bonds with a bid-ask price spread (% of mid) less than approximately 0.5% as being liquid and on this basis assessed the AAA corporate bond market as liquid out to 10 years. This bid-ask price spread (% of mid) is defined as the amount by which the ask price exceeds the bid price, divided by the average of the ask and bid price. This calculation is performed for each security individually, and a weighted average is then calculated using the amount outstanding as weights.

A minimum amount outstanding on an individual security of $100 million was selected.

Extrapolation

The constant forward rate and parametric ultimate forward rate methods are the primary extrapolation methods which could be justified. The choice between these is dependent largely upon whether consistency with observed rates at a point in time or liability stability across time is more important. Both methods are entirely consistent with observable market prices – each of the extrapolation methods only applies to maturities beyond the last available data observation.

The advantage of the first method identified is simplicity and the key disadvantage that it can be extremely sensitive to the original data fitted, and where liability exposures are of extremely long duration, this can result in significant balance sheet volatile that is arguably artificial in nature and difficult to mitigate or hedge.

The European Insurance and Occupational Pensions Authority

EIOPA is a level-3 committee of the European Union which is participating in the wider process to develop financial service industry regulations used by the European Union. Consequently, the EIOPA views carry considerable weight internationally. The EIOPA replaced the CEIOPS (Committee of European Insurance and Occupational Pensions Supervisors) in January 2011.

In November 2021, EIOPA published the paper: Technical documentation of the methodology to derive EIOPA’s risk-free interest rate term structures. This paper includes the method used by EIOPA to determine the risk-free interest rate term structure internationally, including for New Zealand. Many of the parameters of the risk-free discount rates are determined by legislation; other are selected to secure the following objectives:

- replicability – the rates should be capable of replication by other interested parties
- market consistency – a common approach between countries and wherever possible, data from deep, liquid, and transparent (DLT) financial markets are used
- stability for insurance undertakings – avoid exacerbating volatility in the value of liabilities through unwarranted changes to the risk-free discount rate.

The EIOPA approach to determining risk-free discount rates, relevant to New Zealand is as follows.

Term

Only risk-free discount rates from 1 year maturity are published.

Bank swaps

The construction of the basic risk risk-free discount rate term structure is based on swaps and/or Government bonds, as set out in Article 44 of the Delegated Regulation. Solvency II prescribes swaps as the first choice of instrument for deriving the relevant risk-free discount rates term structure. Government bonds are only used in currencies where there is not a DLT market in swaps. In New Zealand, swaps are deemed DLT through to 20 years. The swap rates are reduced by the credit risk adjustment.

Deep, liquid and transparent (DLT)

An analysis of the depth, liquidity, and transparency of the swap market is carried out based on evidence from the markets. The purpose of the DLT assessment is focused on ensuring the reliability of market interest rates rather than the need to convert assets into cash. It is accepted that no single metric can be conclusive in assessing the DLT nature of a financial instrument. For example, high trading volumes and turnovers indicate that assets are liquid, while the converse does not necessarily hold true (some assets may be in high demand without being traded often, and hence could easily be liquidated if necessary). For the swap market, the lack of information on real trading volumes means that it is not possible to use some of the main indicators generally used when making DLT assessments of other types of instruments. The main pieces of analysis are:

- volatility analysis – behaviours of the available interest rates for each maturity over the past 105 business days (five months approx.)
- bid-ask spreads.

EIOPA is of the view that the assessment of the depth of a financial market should consider the existence of appropriate supervision; such supervision can be an effective mechanism to ensure that large transactions will only affect prices according to the natural trends of the market, and not because of any spurious influence. Another relevant qualitative consideration for the assessment of market depth is the way in which market prices are collected; market data providers have developed effective methods and controls that can help to give reassurance that the influence of large transactions or unusual trade on process is likely to be immaterial.

EIOPA will update the DLT assessment for the relevant currencies on an annual basis, with changes resulting from the DLT assessment being implement after a warning period of three months.

Credit risk adjustment

The calculation of the credit risk adjustment was developed in accordance with recital 20 and Article 45 of the Delegated Regulation.

Extract from the Delegated Regulation

“Article 45 Adjustment to swap rates for credit risk

The adjustment for credit risk referred to in Article 44(1) shall be determined in a transparent, prudent, reliable and objective manner that is consistent over time. The adjustment shall be determined on the basis of the difference between rates capturing the credit risk reflected in the floating rate of interest rate swaps and overnight indexed swap rates of the same maturity, where both rates are available from deep, liquid and transparent financial markets. The calculation of the adjustment shall be based on 50 percent of the average of that difference over a time period of one year. The adjustment shall not be lower than 10 basis points and not higher than 35 basis points."

This adjustment is applied as a parallel downward shift of the market rates up to the last liquid point (LLP).

Where the risk-free discount rate term structure is based on swap rates and the relevant overnight indexed swap (OIS) rate meets the DLT requirements, the maturity of the OIS rate used to derive the credit risk adjustment is consistent with the tenor of the floating legs of the swap instruments used to determine the term structure (New Zealand; three month). The calculation of the one-year average is based on daily data over the last 12 months. The average is a simple average calculated giving equal weight to all of the observation.

EIOPA does not consider it appropriate to apply hard thresholds purely based on quantitative metrics, because it is necessary to make an appropriate allowance for the characteristics of each individual market and for prevailing financial conditions.

Last liquid point (LLP) and convergence point

The Omnibus II Directive explicitly specifies a convergence period of 40 years for the euro and an LLP of 20 years. The LLP for New Zealand is also taken as 20 years.

For currencies other than euro, the convergence point is taken as the maximum of the LLP + 40 years, and 60 years. The convergence period is therefore the maximum of 60 years – LLP, and so is 40 years.

Ultimate forward rate (UFR)

At the end of March 2017, after extensive consultation, EIOPA presented the changes to the UFR methodology, which were implemented from 2018. The methodology is in accordance with Article 47 of the Delegated Regulation on Solvency II

The UFR is based only on estimates of expected inflation and expected future short-term real rates, ie, it does not include a term premium. This follows the principles in the Solvency II legislative framework which state that the UFR should be stable over time and only be changed as a result of changes in long-term expectations.

EIOPA has adopted currency-specific expected inflation rates based on announced inflation targets. These expected inflation rates can 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 2023 is 2.0% pa.

EIOPA has adopted a single expected real rate for all currencies. This is calculated by finding the simple arithmetic mean of the annual real rates, from 1961 to the year before the recalculation of the UFRs, for 12 economies (Italy, Germany, France, Japan, Switzerland, Denmark, Netherlands, UK, Canada, US, Sweden and Australia). The expected real rate calculated in 2022 for use in 2023 is the average of real rates from 1961 to 2021; this is 1.40% pa, a decrease of 20 basis points since 2019 (1.60% pa).

For each currency the annual change to the UFR is limited to either remain the same or increase or decrease by exactly 15 basis points, so that stability is maintained. This means that the UFR applicable in 2023 is not necessarily the same as the calculated UFR. For example, for New Zealand the UFR is calculated as 3.4% pa (2.0% pa inflation plus 1.4% pa expected future short-term real rates), however the UFR applicable in 2023 is 3.45% pa due to the constraint on the rate on change.

Interpolation and extrapolation

The points on the curve are interpolated between and extrapolated past the LLP based on the Smith-Wilson methodology. The parameters for this are the LLP, the ultimate forward rate, convergence point, and the convergence tolerance.

International Actuarial Association

The IAA is the worldwide association for national professional actuarial associations and their individual actuaries. The IAA exists to encourage the development of a global profession and as such publishes articles and discussion papers for the international actuarial profession to consider.

In 2013, a book titled *Discount Rates in Financial Reporting, A Practical Guide* was published by the IAA. It illustrates different approaches to determine risk-free yield curves along with the factors that should be considered when determining expected inflation rates. We have used this book as guidance in developing our methodology because it is one of the internationally recognised discussion documents on the topic of determining discount rates for valuing insurance contracts.

The IAA's book states that there are a number of different sources for risk-free discount rates. These are detailed below.

Government bond rates

In a politically stable, economically developed country, it is believed that governments have a low probability of defaulting on debt due to:

- taxing power
- ability to expand the money supply
- debt forgiveness and foreign aid.

However, there are considerations that need to be made when choosing to use Government debt yields as risk-free discount rates:

- the debt securities that should be used, eg, Government bond strips, on-the-run vs off-the-run securities
- whether relevant maturities are available in the market

- liquidity of the Government debt market; although the credit risk adjustment may be close or equal to zero, there may still be an liquidity premium due to Government securities being thinly traded. If this is the case, then this premium needs to be backed out. Low bid-ask spreads and high trading volumes would indicate a liquid market
- tax considerations; in some countries, Government debt securities receive special tax treatment. Investors may therefore accept a lower rate of return than the true risk-free discount rate.

Using swap rates to determine risk-free discount rates

A swap rate curve includes some counterparty risk, credit risk, and agency risk in the underlying reference rate. However, they are still often used to calculate the risk-free rates because:

- the counterparty is often a highly rated bank or exchange with a credit risk that is seen as very low. However, post the Global Financial Crisis this perception may need to be scrutinised
- swap contracts are often collateralised, reducing the exposure to a default event
- a credit spread can be taken off the swap rate observed to obtain the risk-free discount rate. This spread could be the published corporate bond spread on a bond with the same credit rating as the swap counterparty
- swap markets are not subject to regulation so they may be a better reflection of market conditions than Government bonds
- there are often more maturities available.

Considerations do still need to be made though, as there are potential disadvantages to using swap rates such as:

- how liquid the swap markets are. A liquidity premium may be present in the swap rates if the market is not sufficiently liquid
- potential for agency risk as evidenced by the 2012 LIBOR scandal
- the credit risk adjustment needs to be carefully evaluated.

Using corporate bond rates to determine risk-free discount rates

In some markets, corporate bonds are widely traded so they may be an appropriate base for developing a risk-free yield curve.

Using option-pricing methods to determine risk-free discount rates

An appropriate base for the risk-free discount rate may not be available in the market, or it may be unclear what the reference rate should be. An alternative approach is to solve for the risk-free discount rate implied by a more readily observed market price.

The approach outlined involves using a historically validated option pricing model (like the Black-Scholes-Merton option-pricing formula for call options) and calculating the risk-free discount rate that results in the option value calculated by the formula being equal to the market-observed price.

Using this method does not require a reference rate to be determined. However, the calculations involved can be complex, there are still some assumptions which need to be made, and the market price of options must be readily observable which could be a problem if the market is not be very deep or liquid as is the case in New Zealand.

The IAA book also discusses models to determine future inflation assumptions.

If the market for nominal and inflation-indexed securities is sufficiently liquid, then it is possible to measure the market expectation of future inflation using the Fisher equation. This involves solving for the implied inflation that would set the returns on an inflation-indexed bond equal to the return on a nominal bond of the same maturity.

In the case where markets for either type of bond are illiquid, care needs to be taken as liquidity premiums may be present. Other sources of information to determine future levels of expected inflation are:

- historical levels of realised inflation
- historical levels of nominal yields
- central bank target inflation rates and ranges
- central bank projections of short-term inflation rates
- economists' surveys of future inflation rates.

Australian Prudential Regulation Authority (APRA)

APRA issued a Discussion Paper - Review of capital standards for general insurers and life insurers on 13 May 2010. Since then they have released a Review Paper on the liquidity premium and two Response Paper's on feedback received about the content in their papers. These papers have useful sections on risk-free discount rates.

APRA – Review of capital standards for general insurance and life insurers (13 May 2010)

Risk-free rates

"For Australian-denominated liabilities, APRA regard the zero coupon spot yield curve of Commonwealth Government Securities (CGS) as the best proxy for risk-free rates. In forming this view, APRA has considered the views of the Reserve Bank of Australia (RBA) on the appropriateness of CGS yields as a proxy for the risk-free rate. The RBA has indicated that no persuasive evidence exists to suggest that the nominal CGS yield curve exhibits any downwards bias or that a shallow market exists."

APRA's conclusion in 2010 was that, for the purposes of capital reporting, the risk-free discount rate should be a term structure derived from Government securities.

Australian Actuaries Institute: AASB 17 Insurance Contracts

The purpose and application of a risk-free discount curve

AASB 17 is almost identical to the international standard, IFRS17. To value future cashflows, AASB 17 expects that the "applicable discount rate should reflect a yield curve for items with no or negligible credit risk, adjusted to reflect the liquidity characteristics of the group of insurance contracts." It allows either a 'bottom-up' or 'top-down' approach to be used, both of which results in a "single illiquid risk-free yield curve that eliminates all uncertainty about the amount and timing of cash flows".

Since insurance contracts are not liquid, the bottom-up approach is to add a liquidity premium to a liquid risk-free yield curve. It involves, "adjusting a liquid risk-free yield curve to reflect the differences between the liquidity characteristics of the financial instruments that underlie the rates observed in the market and the liquidity characteristics of the insurance contracts."

A top-down approach, on the other hand, starts with an illiquid portfolio of assets which ideally has illiquidity characteristics similar to the insurance contacts being valued, it then makes adjustments to remove other factors in the reference portfolio which are not relevant to the insurance contracts.

Risk free rates

Government bond rates may be appropriate or may be an appropriate starting point for determining risk-free rates. Politically stable governments in economically developed countries are believed to have a low probability of defaulting on their debts due to taxing power and ability to expand money supply. Government bonds are arguably the least risky asset for many countries and their yields, in the short-to-medium term, are easily observable.

Note that this is not the case for all governments. Certain governments may be considered to have a material possibility of defaulting, and hence, the yields may not be reliable to derive liquid risk-free rates. The credit rating of the government bonds can be used as an indicator of whether the bonds of a specific government can be considered risk free.

Interest rate swaps are a natural starting point from which to derive risk-free discount rates since they are a primary market instrument for hedging against interest rate risk. This is because the swap rate is the fixed yield required to be exchanged for a series of cash flow payments, based on floating interest rates, for the term to maturity of the swap. As such, its yield is a function of the market's estimate of interest rates for that duration.

However, interest rate swaps contain risk and so their underlying rates require some adjustment to obtain risk-free rates. Firstly, swaps contain a counter-party credit risk – the risk that one of the parties involved in the transaction might default: "a party who is receiving a fixed interest rate of a swap from another party will require a higher fixed interest rate to compensate for the risk of repayment." The swap rate already includes an allowance for this, and therefore will need to be adjusted to remove this allowance. Secondly, "swap rates are typically based on the yield on an underlying reference security and therefore any material credit risk premia within this security should be removed to obtain a risk-free rate."

Estimating inflation

Based on economic theory, a risk-free interest or discount rate is comprised of the expected inflation rate plus the expected growth in the economy, measured by Gross Domestic Product (GDP) or similar. A higher level of expected inflation in the future should increase discount rates with all else being equal.

Historical inflation rates do not necessarily affect the discount rates, other than to the extent that the market perceives a different expected rate of inflation in the long-term.

There are several potential methods that may be suitable for deriving inflation and/or real earning rate expectations. These methods and some aspects to consider in their application are discussed below. The considerations listed may not be exhaustive.

- Market based approaches:
  - Estimating inflation by taking the difference between nominal bond yields and inflation-linked bonds.
  - Inflation swaps / other market instruments.
- Publicly available estimates:
  - Monetary body targets for inflation.
  - Forecasts of economic commentators and / or government bodies.
  - Views of a long-term real risk-free rate.

Publicly available estimates may not be the same as the results of market-based approaches or may not align with realised inflation. If the two estimates are not similar over a horizon, then an evaluation of the causes of difference may be useful. The appropriate adjustments will be based on the cause of the differences.

When does the observable market end?

The determination of the end of the observable market is a function of financial market being considered at the longest part of the curve. For example, if the risk-free curve is based on swap rates then the end of the observable market in the context of swap rates in that currency should be considered.

The following attributes could be looked at to assess whether the market data at the longest durations are both observable and relevant:

- availability of financial instruments
- bid-ask spread
- trade frequency, and
- trade volume.

As an example, in a given market, 1, 3, 5, 7, 10, 20 and 30-year instruments may be available and actively traded. A 50-year instrument may be occasionally issued but does not have any significant trade frequency or volume. Since the 50-year instrument is infrequently traded, the observable yield for the 50-year instrument may include a premium for illiquidity. This would therefore not be considered relevant for construction of a liquid, risk-free curve.

Ultimate rates

A retrospective or prospective approach can be used in the process of setting the ultimate rate. In either case, it is important that the entity articulates its methodology and why its selection of the ultimate rate is plausible based on historical information or future expectations.

A retrospective approach involves looking back over an observed period of time to see what the risk-free interest rates have been, on average. The observed period should be long enough to eliminate cyclical effects, but consideration needs to be given to any major shifts in macroeconomic fundamentals over time. This approach has the advantage of being simple, although the choice of the starting point for the observed period is arbitrary. Retrospective approach examples would be an arithmetic mean (normal underlying distribution) or a geometric mean (lognormal underlying distribution) of the historical nominal interest rate or real rate.

Using a prospective approach, a very simple approach would be repeating the rate at the last liquid point. Another approach would be to make use of well-known economic metrics reflecting market participant future expectations of risk-free interest rates. One example of a prospective approach is to use the central bank inflation target or neutral rate plus an allowance for the long-term GDP growth forecast.

Updating the ultimate spot rate or ultimate forward rate

In many situations, current market prices are available for the risk-free rate up to a last liquid point. If an ultimate forward rate or an ultimate spot rate is used, it may be updated less frequently than in every reporting period, because it’s not an observable market price. Judgement will be required to determine the most appropriate frequency to update the ultimate rates, considering the materiality of those updates on the financial results.

Extrapolation

In constructing a risk-free discount curve, a core principle is that the discount rates are consistent with observable market prices. If liability cash flows extend beyond the point at which the observable market is deemed to end, the discount curve will need to be extended.

The following four approaches could be used to extend the risk-free rate curve:

1. extrapolate the curve assuming a constant forward rate from the last observable and relevant point;
2. extrapolate the curve assuming a constant spot rate from the last observable and relevant point;
3. assume an ultimate forward rate and fit a curve between the end of the observable period and the ultimate forward rate; or
4. assume an ultimate spot rate and fit a curve between the end of the observable period and the ultimate spot rate.

The constant forward and spot rate approaches result in stable yield curves over time. The constant forward rate produces a smooth curve, while the constant spot rate may result in a jump or spike in the forward rate curve. Both of these approaches make the least sense from an economic point of view.

The use of ultimate forward rates makes sense from an economic point of view and produces a smooth curve. While it is realistic in time, it is not necessarily stable over time and so there may be some volatility in the longer durations under this approach.

The use of an ultimate spot rate is most consistent with the Standard since the guidance explicitly requires that the entity might place more weight on long-term estimates than on short-term fluctuations (AASB 17.B82(c)(i)). The ultimate spot rate results in a curve that is more stable in time. However, the discount factors for cash flows with very long durations become entirely stable, which is not very realistic. Using an ultimate spot rate may result in a jump or spike in the forward rate curve as well.

Canadian Institute of Actuaries

The Canadian Institute of Actuaries paper on IFRS17 Discount rates describes methodologies for setting a discount curve under IFRS 17. The paper is written for actuaries applying discounts to life and health insurance contracts and contains various discussion relevant to determining a risk-free discount rate curve.

In application, an adjustment is applied to the risk-free discount curve, such as a liquidity premium to account for the difference in liquidity between, say, the Government bonds used to derive the risk-free curve, and the liquidity of the liabilities being discounted. Our methodology uses this 'bottom-up' approach, producing a liquid risk-free discount curves, which entities can then use by adding a liquidity premium to match their assets/liabilities.

The risk-free discount curve has three segments:

1. Up to the last point of an observable yield curve
2. From the point that the ultimate long-term risk-free rate begins
3. A bridging, or convergence, period between these two points

Setting the last observable point

The last observable point for risk-free discount rates would correspond to the term of the asset with the longest maturity for which there is a quoted price from an active market (ie, a Level 1 input under IFRS 13). IFRS 13 defines an active market as a market in which transactions for an asset take place with sufficient frequency and volume to provide pricing information on an ongoing basis.

To assess whether there is a sufficient frequency of transactions for risk-free assets in the market, factors such as bid-ask spread, trading volume, trade size, and the impact of trades were considered.

In developing risk-free rates for Solvency II application for Euro denominated rates, European Insurance and Occupational Pensions Authority (EIOPA)2 used a residual value criterion to assess whether there was a deep and liquid market (or active market) for debt securities. Under this methodology the amount of assets in excess of a certain term is compared to the total outstanding amount of assets. When the ratio of these two amounts falls below a certain level, the market is considered not to be deep, liquid, and transparent. EIOPA used a 6% criterion.

The ultimate nominal risk-free rate

IFRS 17 does not require a particular estimation technique for determining the long-term rates. However, IFRS 17.B78 and B82 highlight the key principles to follow when performing such estimation:

1. Maximise the use of observable inputs. (Discount rates shall not contradict any available and relevant market data, and any non-market variables shall not contradict observable market variables.)
2. Reflect current market conditions from the perspective of a market participant.
3. Develop unobservable inputs using the best information available in the circumstances.
4. Might place more weight on long-term estimates than on short-term fluctuations.

On this basis, listed below are some characteristics that may be desirable when setting the discount curve beyond the last observable point:

1. Stability: The ultimate interest rate would be more stable over time. That is, on average, one might expect the variability of long-term interest rates to be lower than short-term rates.
2. Smoothness: Interpolated rates would follow a smooth path from the last observable point to the ultimate long-term rate.
3. Simplicity: The approach would be easy to understand and implement.

The paper outlines three approaches to setting the ultimate nominal risk-free rate.

Firstly, the historical nominal rate approach. This approach uses Government bonds to construct an historical average of the long-term risk-free rates. This approach implies that interest rates will revert to their historical average. A term premium may need to be added if there is an upward sloping yield curve. It points out that a disadvantage of this method is that there is little weight given to current market conditions with no forward-looking inputs.

Secondly, the historical real interest rate + inflation target approach. This method assumes independence of real interest rates and inflation. The ultimate real interest rate can be approximated from historical data, but this method also allows forward-looking data to estimate future real interest rates. This approach was proposed and endorsed by EIOPA, who uses 3-month Treasury bills or interbank rates as the short-term nominal rate, less inflation for that time period, and averages this over 12 representative countries over 60 years.

Finally, the eexpected real GDP growth + inflation target approach. The economic rationale behind this is that the long-term nominal interest rate would equal nominal GDP growth rate. This is because the rate at which a business is willing to borrow (the long-term rate) would equal their expected marginal return on investment (in macro, the GDP growth rate). The expected real GDP growth rate can either be based on forecasts or derived from historical real GDP growth. The paper notes that a disadvantage of this approach is that historical inputs may give limited weight to current market conditions.

The bridging period and methods

IFRS17 allows the ultimate rate to be expressed as either a spot rate or a forward rate. Since forward rates represent future implicit market rate expectations, and these are difficult to estimate the last observable point, this paper expects a short convergence period between this point and the point the ultimate forward rate takes effect, even as short as one year. On the other hand, since spot rates include both observable market rates and unobservable expectations, a long convergence period is expected, even 30 years. The length of the convergence period would depend on the differential between the forward rate of the last observable point and the ultimate forward rate under the forward rate methodology (a short period would be reasonable with a small differential and vice versa).

The paper describes five possible methods for the interpolation: Linear interpolation, Cubic-spline interpolation, Monotone convex splines, Smith & Wilson, and Nelson and Siegel. There are four criteria to look for when deciding upon a methodology, and each of the above methods involved trade-offs between them: ease of understanding and implementation, continuity of forwards, positivity/stability of forwards, sensitivity to changes in observable rates.

Linear interpolation has the benefits of being easy to understand and having medium sensitivity to changes in observable rates compared to the cubic-spline interpolation, which has high and unpredictable sensitivity. The linear interpolation can be applied on the spot or forward rates, the log of the rates, the discount factors, or the log of the discount factors.

The Smith & Wilson model is used to derive the discount curve under Solvency II. An advantage of this method is that it gives a good fit to observed market data and generates a smooth and reasonable yield curve. This technique has added complexities to implement relative to simpler techniques such as linear interpolation, for example the judgement required to set the speed of the convergence parameter. A further disadvantage is the lack of ease of understanding.

Nelson and Siegel is a parametrical model for yield curves that can represent the shapes generally associated with various yield curves. It is widely used in practice for fitting the term structure of interest rates. Parameters are fitted via a least squares or similar algorithm. The model generally behaves well at long maturities and parameters can be set to virtually fit any yield curve.

Other international papers

Annex E of the first CEIOPS paper is a discussion of macroeconomic extrapolation methods.

The Swedish and Norwegian markets are similar to New Zealand markets in that there are no Government bonds or SWAP rates long enough to cover the full term of the liabilities. The method discussed in Annex E uses unconditional fixed forward rates after a selected duration. It quotes research done on the macro-economic arguments by Barrie and Hibbert *A Framework for estimating and extrapolating the term structure of interest rates, Sept 2008*.

The following issues, which are of interest to The Treasury in developing our methodology, are discussed under the headings:

- at what maturity should the fixed forward rate be set
- which method should be used to interpolate between the last observable liquid rate and the fixed forward rate.

The Norwegian macroeconomic model that is used for extrapolation uses the forward rates from the yield curve up to year 10 and then smoothes linearly to an unconditional macroeconomic target for all maturities over a given threshold. In the example the target is 4% after 20 years.

The Treasury believes this is a useful reference and clearly articulates principles, adjustments required and the projection of yield curves. Their conclusion about the model described above is that it is:

- adequate from a theoretical point of view; almost all academic literature is based on extrapolating forward rates and not spot rates
- adequate from a practical point of view, as using forward rates is standard in financial pricing and analysis
- very simple to implement and very transparent
- producing a term structure that will be based on assumptions which are cautious, fairly undisputed and robust over time
- forward looking; some of the excessive volatility of the term structure (due to distortions) is taken out at the long end, but a large part of the volatility in the rates is left. The spot rates for a given maturity are an average over all one-period forward rates up to this maturity. Longer periods with very high or very low short-term interest rates (up to 10 years) are thus anticipated, and do not need any frequent adjustments of parameters.

The Dutch Actuarial Association and Actuarial Institute has issued Report in Principles for the Term Structure of Interest Rates (undated but approximately June 2009). This paper addresses similar issues to the other European papers, but does not address the issue of extrapolating the curve. The paper is more of an overview and discusses the same issues as the other papers but there are less useful principles.

The Institute of Actuaries of Australia Life Insurance & Wealth Management Practice Committee Information Note: Risk-free Discount Rates under AASB 1038', March 2010 states:

- Government bonds may provide the rates or be the starting point
- it may be appropriate to allow for shallow market adjustments including scarcity discounts and liquidity premiums
- it may be appropriate to allow for credit risk adjustments (eg, to bank SWAP rates)
- the scarcity discount for indexed bonds may be higher than nominal bonds due to limited supply

- it may be appropriate to adjust for the liquidity of liabilities
- forward rates should be used, if spot rates are used this should be justified.

In summary this supports the methodology framework for short-term rates, but has no guidance on what to do at durations longer than observed rates.

Mulquiney & Miller

Mulquiney & Miller (November 2012 and May 2013) presented a paper at the Actuaries Institute's General Insurance Seminar. They had a number of conclusions including:

- there is reasonable international market evidence for reversion to a flat long-term forward rate. This rate is reached via extrapolation from the end of the observable yield curve.
- the rate of reversion is slow. Mulquiney & Miller believe term 40 is about the minimum point to reversion based on the bond markets examined, with a central estimate closer to term 60. This conclusion rests on the assumption that the unconditional forward rate has been stable over the period 1998 to 2012.
- linear path reversion is plausible, with other approaches possible. Non-linear paths may have implications for term at which the long-term rate can be reached.

Appendix B Use of inflation-indexed bonds

Introduction

In this section we consider whether the starting point for risk-free discount rate should be nominal discount rates (ie, based on nominal Government bond rates) or real discount rates (ie, based on inflation-indexed Government bonds).

This has been considered in previous reviews of the methodology and we are not aware of any new literature in this area. While there are more inflation-indexed bonds on issue than at the time of the previous review, issuances remain significantly smaller than for nominal government bonds and liquidity measures continue to indicate that they are significantly less liquid than nominal government bonds.

We note that:

- the risk-free discount rates apply to all accounting valuations reported in the financial statements of the Government
- the amount of inflation-indexed government bond on offer is significantly less than the value of the liabilities being discounted
- to adopt inflation-indexed Government bonds as the basis for determining inflation would require ignoring all other market information.

PBE IFRS 4

PBE IFRS 4 refers to risk-free discount rates that are based on current observable, objective rates that relate to the nature, structure and term of the future obligations

The accounting standard NZ IFRS 4 Insurance Contracts was issued in 2004 as an interim step in the accounting regulation of the insurance industry worldwide. It permitted the continuation of a wide variety of existing accounting treatments in different jurisdictions but gave some guidance while the International Accounting Standards Board (IASB) and the Financial Accounting Standards Board (FASB) undertook a longer term project in this area.

New Zealand already had insurance standards in effect prior to 2004: FRS-34 Life Insurance Business (1998) and FRS-35 Financial Reporting of Insurance Activities (1999). These standards were developed jointly with the Australian standard setter. On transition to NZ IFRS, it was confirmed that FRS 34 and 35 would continue with no change after NZ IFRS 4 was introduced. On transition, FRS 34 and 35 were attached to IFRS 4 as Appendix C Life Insurance Entities and Appendix D Financial Reporting of Insurance Activities.

There is no Basis of Conclusion for either FRS-34 (Appendix C) or FRS-35 (Appendix D), so there is no Board insights to what the New Zealand and Australian standard setter meant by the term “nature” in the above paragraph. Ken Warren, Principal Accounting Advisor at The Treasury was on the New Zealand standard setting Board, the FRSB, during the latter part of the development of the insurance standard in the late 1990s and provided the following comment: *"The word nature was generally used by the Board to reflect the view that the amount and timing of future cash flows that the insurer expects its existing insurance contracts to generate as it fulfils them, are uncertain and subject to a number of assumptions including inflation. This is reflected in the disclosure requirements under Appendix D headed up "Nature and Extent of Risks Arising from Insurance Contracts".*

The standard setter also appears to have had two separate ideas in mind when measuring an insurance liability under FRS-34 and FRS-35; the estimation of future cash flows associated with the insurance contract, which may include assumptions around inflation, and discounting those estimated cash flows at the risk-free rate to reflect the effects of the time value of money. This is evident from the discussion around determining the nominal cash flows and inflation assumptions in IFRS 4 Appendix D.

Term should clearly be taken into account, and this is done through the use of a forward rate curve.

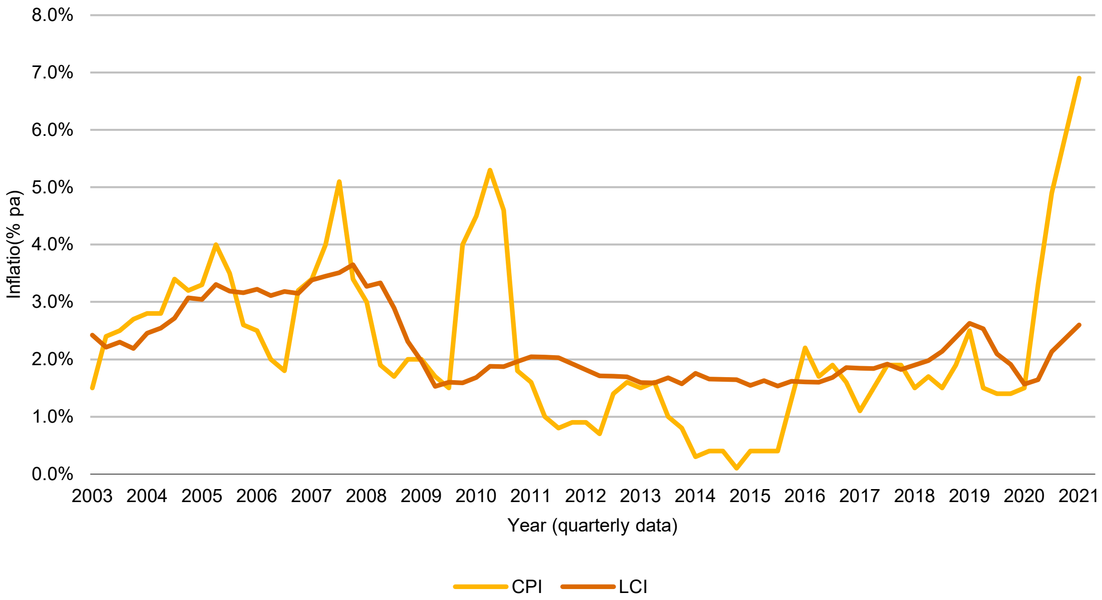
Currency is also taken into account and the discount rates in this report are designed to apply to New Zealand denominated cash-flows.

It has been raised that the fact that the future liabilities increase with inflation means that nature of the liabilities is such that the starting point should be the real return determined from inflation-indexed bonds rather than calculating nominal discount rates and inflation separately (albeit the breakeven inflation is a consideration in determining appropriate assumption for future inflation).

Inflation-indexed bonds did not exist in New Zealand at the time the wording of this standard was drafted and probably did not exist in Australia either and there is no indication in the standard that this was considered, consequently our view is the standard is written with the presumption that risk-free discount rates are nominal risk-free discount rates.

We also note that only a very small proportion of the insurance liabilities are directly indexed to CPI increases. A larger proportion of the liabilities are linked to the increase in the LCI index and there is an assumption that these will tend to move together but the figure below shows there are significant variances between the two. Other long-term liabilities are expected to increase with inflation, but these increases are not specifically tied to any particular index.

Figure 24: Comparison of CPI and LCI inflation



The Australian accident compensation schemes have similar types of liabilities to ACC and value liabilities using the equivalent Australian accounting standard. As far as we can ascertain, each of these schemes adopts a risk-free discount rate based on nominal bond returns and inflation assumptions based primarily on forecasts and none that we have identified start with inflation-indexed bonds, although some use break-even inflation in combination with forecast inflation the inflation estimate.

Consequently, we have concluded that under PBE IFRS 4 the appropriate approach is to consider nominal risk-free discount rates as the starting point rather than the real yield determined from inflation-indexed bonds.

PBE IPSAS 39 – Employee Benefits

PBE IPSAS 39 states that an entity determines the discount rate and other financial assumptions in nominal (stated) terms, unless estimates in real (inflation-adjusted) terms are more reliable, for example, in a hyperinflationary economy (see PBE IPSAS 10 Financial Reporting in Hyperinflationary Economies), or where the benefit is inflation-indexed, and there is a deep market in inflation-indexed bonds of the same currency and term.

The pension benefits of both the Government Superannuation Fund and the DBP Annuitants Scheme are directly indexed to increases in the CPI index. Therefore, it would be appropriate to use discount rates determined from inflation-indexed bonds if the rates are more reliable than those determined from nominal Government bonds. As discussed in the body of the report, the market in inflation-indexed Government bonds is not deep and there is general agreement that the rates are not as reliable as for nominal Government bonds. In addition, there are a limited number of bonds and insufficient bonds to determine a sufficiently comprehensive term structure for the real discount rates.

Consequently, we have concluded that under PBE IPSAS 39 the more appropriate approach is to consider nominal risk-free discount rates as the starting point rather than the real yield determined from inflation-indexed bonds.

Appendix C Process for adjusting nominal Government bond market data

The following is the process for assessing if any adjustments are required to nominal Government bond data before using it for determining nominal risk-free discount rates:

- assess whether any adjustment is required by considering the bank SWAP spread
  - if there is a large bank SWAP spread, quantify the discount
  - quantify the risk premium or any other adjustment to bank SWAP rates
- reconcile the two adjustments and make a judgment on the best approach considering the adequacy of the information available.

Assess whether any adjustment is required

The first step is to investigate that there is any reason for market data to be adjusted. The clearest signal will be obtained from the bank SWAP spread, which should be at levels consistent with long-term recent experience both in New Zealand and other markets.

If both sets of rates are essentially the same, then no adjustment is possible or required. The market is telling us that there is no scarcity of Government bonds and minimal extra risk in bank SWAP rates. Consequently, when these rates are similar, we can be confident that the overall level of the Government bond curve is reasonable and needs no adjustment hence this is the preferred method.

Scarcity discount

A large bank SWAP spread may indicate a scarcity discount on nominal Government bonds.

Firstly, to support the need for a scarcity adjustment, volumes of trading, volumes available, buy sell spreads or price volatility can be looked at to assess if there have been any changes in the market liquidity. This situation occurred in 2007 and 2008 in New Zealand, where there was evidence of a shortage of nominal Government bonds, including the presence of a large bank SWAP spread. Another indicator was the yield on debt used by sovereign backed organisations in New Zealand dollars, for example the World Bank. The difference in yield between Government bonds and these could not be explained adequately by risk and liquidity.

The Australian G100 paper written by Milliman adopts a difference of less than 0.5% in the bid-ask spread (% of mid) as indicative of a liquid market.

It not straightforward to evaluate the size of the market adjustment required and the approach would need to depend on the circumstances at the time. There are a number of sources available, including international fixed interest. It is possible to generate a synthetic US Treasury security in New Zealand dollars by using cross currency SWAPS. The cross-currency SWAPS are reasonably robust as they are an important component or by-product of the global market for bank SWAPS. The difference between the synthetic US Treasury yield curve in NZ dollars and the Government bond yield curve gives an indication of the extent of any adjustment required.

The volume of NZ Government Bonds has increased significantly in the years since 2007 and 2008 to fund recessions from the GFC and COVID 19 as well as the Canterbury earthquakes. At the moment there are no indications of any scarcity.

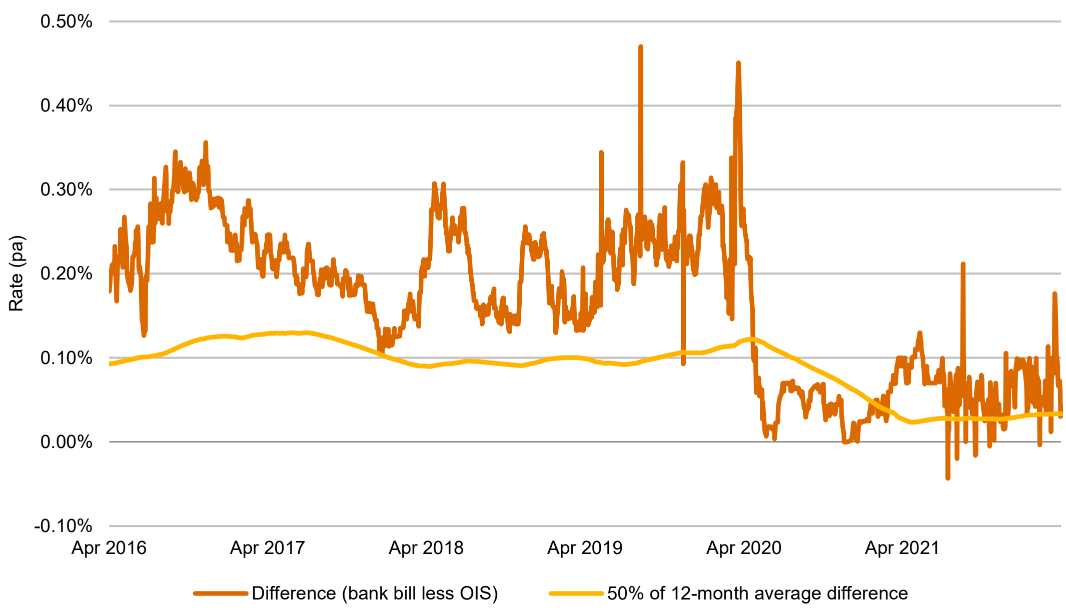
If adjustments are required in future, then a range of options will need to be considered.

Risk premium

The adjustment to bank SWAPs to reflect the risk is also complex and relies on judgement. There is a fairly well developed methodology for decomposing the yields on corporate bonds into components such as default risk, uncertainty of default risk and liquidity. This analysis can be extended to bank SWAP rates where the default risk has two components. The first component is the default risk of the instrument itself which is limited to the coupon payments; the second component is the default risk on the 90 day bank bill that is included in the yields used to price the SWAPS.

The method adopted by EIOPA to credit risk adjust the bank swap rates by reducing them by half of the average difference between the floating reference rate of bank swaps and the overnight indexed swap rate of the same maturity. The minimum adjustment is 10 basis points and the maximum is 35 basis points. This method is outlined in more detail in Section 8 as it is used by EIOPA.

Figure 25: Difference between floating reference rate of bank SWAPs and the overnight indexed SWAP rate



The figure shows that the credit risk adjustment implied by half the average difference between the 90-day bank bill yield and three month overnight indexed swap rate has been below 15 basis points and averaged about 10 basis points until about two years ago. since then, it has dropped to approximately 3 basis points

An alternate method outlined in the IAA paper detailed in Section 8 involves using the corporate bond yield curve and adjusting for credit risk by using a published bond spread. However, the spreads that are published are spreads to the swap rate so the full extent of the credit risk will not be accounted for. The corporate bond market also has sporadic liquidity so would not provide a basis as robust as swap rates or Government bond rates. This approach is unlikely to be reliable in New Zealand.

Reconcile adjustments and decide on the best approach

Ideally the two methods and starting points; Government bonds plus scarcity of bank SWAP less risk will give the same answer. In order to determine which will provide the most robust answer, a judgement will need to be made on the stability of the adjustments and the likely outlook for each market in terms of supply, liquidity and trading.

If both methods are judged to be equally robust, then Government bonds are the preferred starting point.

Appendix D Forward rate yield curve fitting methodology

This appendix describes the process of converting quoted Government bond and Treasury bill yields to a smoothed forward rate yield curve.

Bootstrapping of zero-coupon forward rates

The one-month forward rate is determined from the one-month Treasury bill.

Nominal Government bonds are decomposed into maturity and individual coupon payments to produce a set of equivalent zero-coupon nominal bonds maturing on the 15th of the month

A forward rate is determined for the shortest nominal Government bond, for the period up until the first nominal bond matures. For the period between the first nominal bond and the nominal second bond a forward rate is determined so that the second nominal bond market value is equalled using the previous forward rates as well. This process is repeated to solve for each successive forward rate until all nominal bonds have been valued.

Curve fitting and interpolation

The fitting process will ideally be able to allow for anomalous prices for a particular bond. This is most likely to occur for a bond with less available on the market or bonds for which there is a temporally unusually high or low demand or supply.

The process is to fit a curve of forward rates to the zero-coupon portfolio of available bonds. The parameters of the fitted curve are determined by solving to minimize the least squares differences of the resulting fitted spot rates with the actual market spot rates.

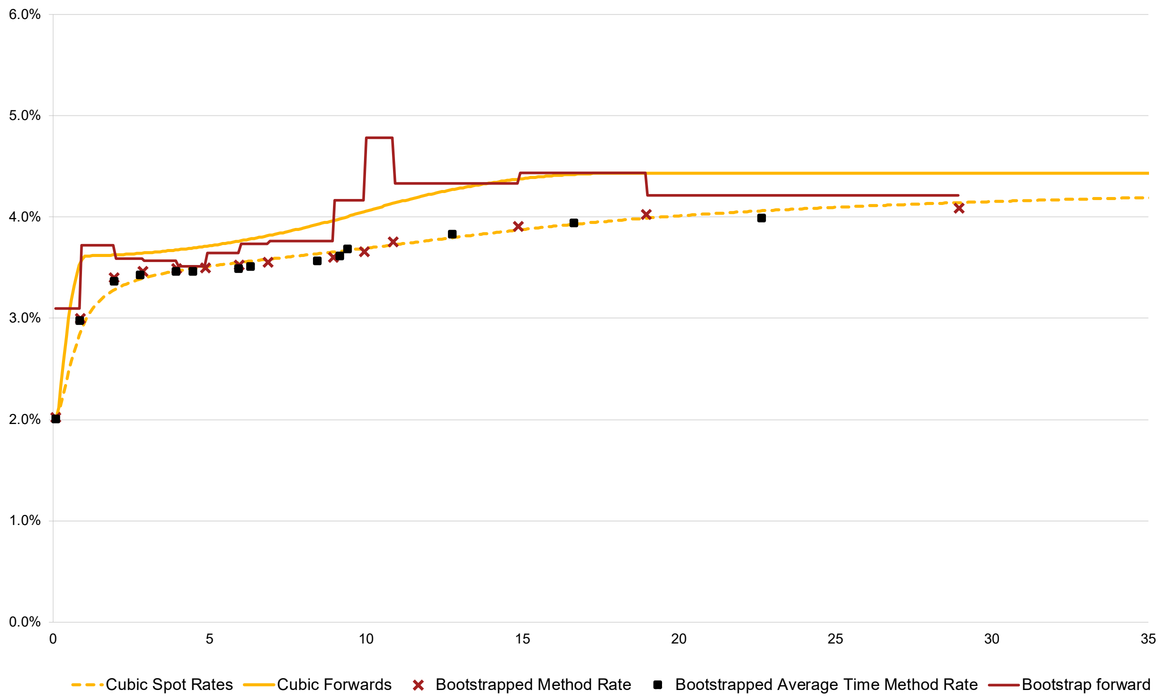
Two-, three- and six-month Treasury bill rates are used in addition to nominal Government bonds.

Market yields are weighted by the lesser of the amount available in the market, which excludes the amounts held by the Reserve Bank of New Zealand (RBNZ) and the Earthquake Commission (which is not usually traded) and $4 billion. This means that implied forward rates automatically give less weight to those bonds which represent a smaller proportion of the tradeable market.

The curve fitted is a cubic spline on the forward rates with 4 knots. This is fairly standard methodology with enough flexibility to fit most yield curves. There is some judgment involved in selecting the position of the knots, but this also gives a little flexibility to cope with any anomalies that may be present in the yield curve without changing the fundamental principles.

The smoothing process in itself is not particularly important as unsmoothed forward rates could be used with a minimal effect on the overall liability; however, the critical factor in the smoothing is how it copes with any market anomalies, particularly at the longer end of the curve, or where there are gaps between maturities.

Table 9: Fitted yield curve – 31 May 2022



Due to the Government's practice of buying back Government bonds in the year before they mature, there can be inconsistencies in the market for these short-term rates. If there is a significant disparity between OIS rates and the yield on the shortest nominal Government bond, then it could be appropriate to adopt OIS rates in lieu the yield on the shortest term nominal Government bond. This needs to be considered at each valuation date.

Appendix E Sample table of rates as at 31 May 2022

The assumptions below are as at 31 May 2022 based on the methodology described in this paper.

Table 10: Table based on market rates at 31 May 2022

	Nominal risk-free discount rate		CPI inflation		Real risk-free discount rate	
Year (31 May)	Forward % pa	Spot % pa	Forward % pa	Spot % pa	Forward % pa	Spot % pa
1	2.96%	2.96%	3.94%	3.94%	-0.94%	-0.94%
2	3.62%	3.29%	2.66%	3.29%	0.94%	0.00%
3	3.64%	3.41%	1.93%	2.84%	1.67%	0.55%
4	3.66%	3.47%	1.82%	2.58%	1.81%	0.86%
5	3.70%	3.52%	1.84%	2.43%	1.83%	1.06%
6	3.74%	3.55%	1.84%	2.33%	1.87%	1.19%
7	3.80%	3.59%	1.84%	2.26%	1.93%	1.30%
8	3.86%	3.62%	1.84%	2.21%	1.99%	1.38%
9	3.93%	3.66%	1.84%	2.17%	2.06%	1.46%
10	4.02%	3.69%	1.84%	2.13%	2.14%	1.53%
11	4.11%	3.73%	1.84%	2.11%	2.23%	1.59%
12	4.19%	3.77%	1.84%	2.08%	2.31%	1.65%
13	4.26%	3.81%	1.84%	2.06%	2.38%	1.71%
14	4.32%	3.84%	1.84%	2.05%	2.43%	1.76%
15	4.36%	3.88%	1.84%	2.03%	2.48%	1.81%
16	4.40%	3.91%	1.84%	2.02%	2.51%	1.85%
17	4.42%	3.94%	1.84%	2.01%	2.54%	1.89%
18	4.43%	3.97%	1.84%	2.00%	2.55%	1.93%
19	4.43%	3.99%	1.84%	1.99%	2.55%	1.96%
20	4.43%	4.01%	1.85%	1.99%	2.54%	1.99%
21	4.43%	4.03%	1.86%	1.98%	2.53%	2.01%
22	4.43%	4.05%	1.86%	1.97%	2.52%	2.04%
23	4.43%	4.07%	1.87%	1.97%	2.51%	2.06%
24	4.43%	4.08%	1.88%	1.97%	2.51%	2.08%
25	4.43%	4.10%	1.89%	1.96%	2.50%	2.09%

	Nominal risk-free discount rate		CPI inflation		Real risk-free discount rate	
Year (31 May)	Forward % pa	Spot % pa	Forward % pa	Spot % pa	Forward % pa	Spot % pa
26	4.43%	4.11%	1.90%	1.96%	2.49%	2.11%
27	4.43%	4.12%	1.90%	1.96%	2.48%	2.12%
28	4.43%	4.13%	1.91%	1.96%	2.47%	2.13%
29	4.43%	4.14%	1.92%	1.96%	2.47%	2.15%
30	4.42%	4.15%	1.93%	1.95%	2.45%	2.16%
31	4.41%	4.16%	1.93%	1.95%	2.43%	2.17%
32	4.40%	4.17%	1.94%	1.95%	2.41%	2.17%
33	4.39%	4.17%	1.95%	1.95%	2.39%	2.18%
34	4.37%	4.18%	1.96%	1.95%	2.37%	2.18%
35	4.36%	4.19%	1.97%	1.95%	2.35%	2.19%
36	4.35%	4.19%	1.97%	1.95%	2.33%	2.19%
37	4.33%	4.19%	1.98%	1.95%	2.31%	2.20%
38	4.32%	4.20%	1.99%	1.96%	2.29%	2.20%
39	4.31%	4.20%	2.00%	1.96%	2.26%	2.20%
40	4.30%	4.20%	2.00%	1.96%	2.25%	2.20%
41	4.30%	4.20%	2.00%	1.96%	2.25%	2.20%
42	4.30%	4.21%	2.00%	1.96%	2.25%	2.20%
43	4.30%	4.21%	2.00%	1.96%	2.25%	2.21%
44	4.30%	4.21%	2.00%	1.96%	2.25%	2.21%
45	4.30%	4.21%	2.00%	1.96%	2.25%	2.21%
46	4.30%	4.22%	2.00%	1.96%	2.25%	2.21%

The resulting fitted rates are plotted below:

Figure 26: Nominal risk-free discount rates at 31 May 2022

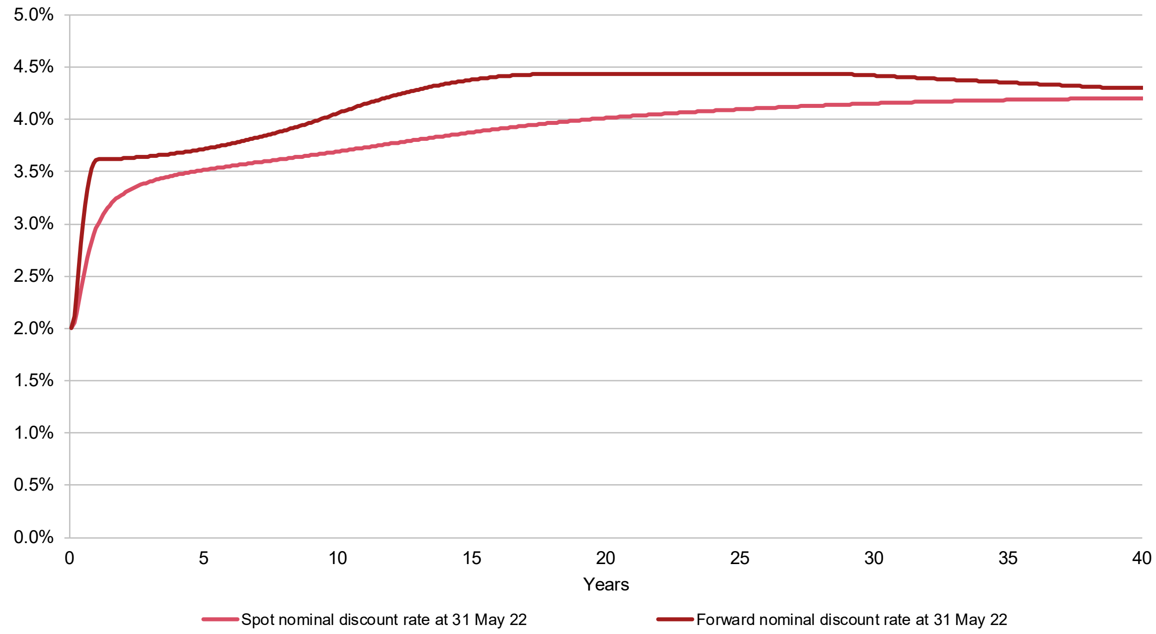
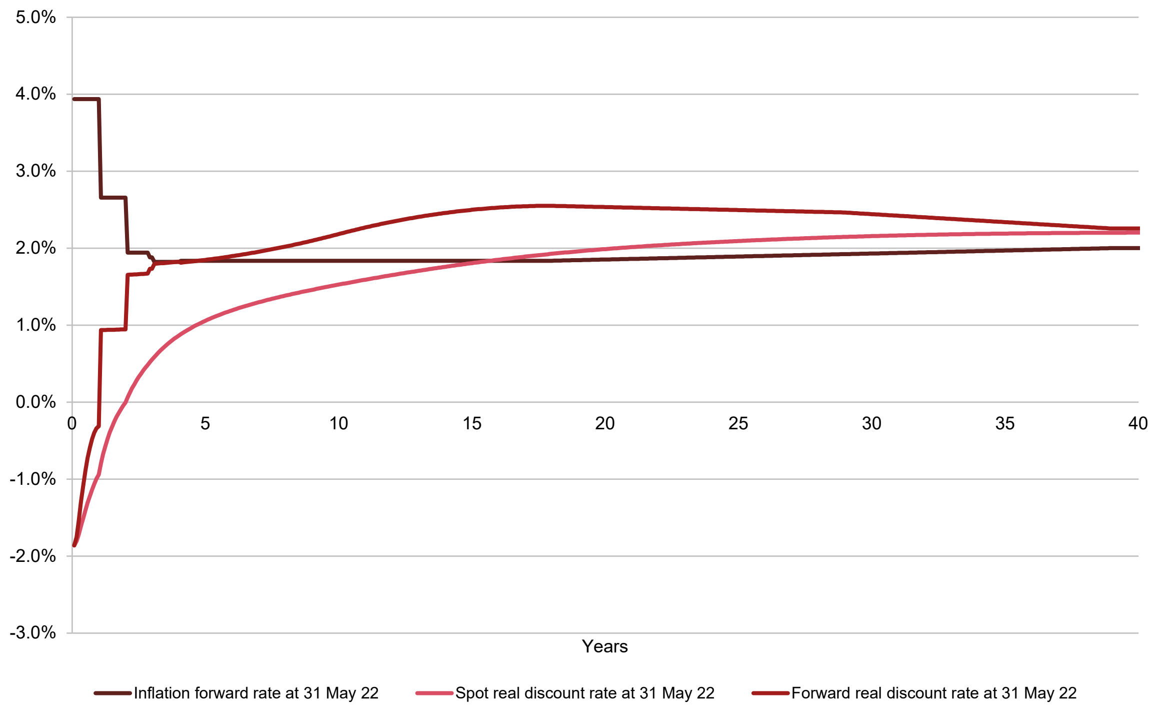


Figure 27: Real risk-free discount rates and CPI inflation rates at 31 May 2022



Appendix F Impact of change in methodology as at 31 May 2022

The assumptions below are as at 31 May 2022 and compare the nominal risk-free discount forward rates and CPI inflation forward rates based on the previous and new methodology.

Table 11: Table based on market rates at 31 May 2022 using the previous and new methodology

	Previous methodology		New methodology	
Year (31 May)	Nominal risk-free discount forward % pa	CPI inflation forward % pa	Nominal risk-free discount forward % pa	CPI inflation forward % pa
1	2.89%	2.63%	2.96%	3.94%
2	3.66%	2.38%	3.62%	2.66%
3	3.66%	2.23%	3.64%	1.93%
4	3.68%	2.18%	3.66%	1.82%
5	3.71%	2.08%	3.70%	1.84%
6	3.75%	2.08%	3.74%	1.84%
7	3.80%	2.08%	3.80%	1.84%
8	3.86%	2.08%	3.86%	1.84%
9	3.93%	2.08%	3.93%	1.84%
10	4.01%	2.08%	4.02%	1.84%
11	4.10%	2.08%	4.11%	1.84%
12	4.19%	2.08%	4.19%	1.84%
13	4.26%	2.08%	4.26%	1.84%
14	4.32%	2.08%	4.32%	1.84%
15	4.36%	2.08%	4.36%	1.84%
16	4.40%	2.08%	4.40%	1.84%
17	4.42%	2.08%	4.42%	1.84%
18	4.43%	2.08%	4.43%	1.84%
19	4.44%	2.08%	4.43%	1.85%
20	4.44%	2.08%	4.43%	1.85%
21	4.44%	2.08%	4.43%	1.86%
22	4.44%	2.08%	4.43%	1.87%
23	4.44%	2.08%	4.43%	1.88%

	Previous methodology		New methodology	
Year (31 May)	Nominal risk-free discount forward % pa	CPI inflation forward % pa	Nominal risk-free discount forward % pa	CPI inflation forward % pa
24	4.44%	2.08%	4.43%	1.88%
25	4.44%	2.08%	4.43%	1.89%
26	4.44%	2.08%	4.43%	1.90%
27	4.44%	2.08%	4.43%	1.91%
28	4.44%	2.08%	4.43%	1.91%
29	4.44%	2.08%	4.43%	1.92%
30	4.43%	2.08%	4.42%	1.93%
31	4.41%	2.07%	4.41%	1.94%
32	4.40%	2.06%	4.40%	1.94%
33	4.39%	2.05%	4.39%	1.95%
34	4.37%	2.04%	4.37%	1.96%
35	4.36%	2.04%	4.36%	1.97%
36	4.35%	2.03%	4.35%	1.97%
37	4.33%	2.02%	4.33%	1.98%
38	4.32%	2.01%	4.32%	1.99%
39	4.31%	2.00%	4.31%	2.00%
40	4.30%	2.00%	4.30%	2.00%
41	4.30%	2.00%	4.30%	2.00%
42	4.30%	2.00%	4.30%	2.00%
43	4.30%	2.00%	4.30%	2.00%
44	4.30%	2.00%	4.30%	2.00%
45	4.30%	2.00%	4.30%	2.00%
46	4.30%	2.00%	4.30%	2.00%

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