Methodology for Risk-free Discount Rates and CPI Assumptions for Accounting Valuation Purposes

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New Zealand Government

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1 Why do we need a discount rate methodology?

1.1 What is the methodology for?

1.1.1 This paper documents the methodology for determining risk-free discount rates and corresponding Consumer Price Index (CPI) assumptions. These assumptions are for use in certain accounting valuations that are reported to the Government for consolidation purposes. The methodology is not intended to apply to the valuation of traded securities.

1.2 Why is the Treasury publishing discount rates now?

1.2.1 The reason we are providing a central methodology and publishing discount rates is to ensure consistency and efficiency across accounting valuations that are reported to the Government. The issue of consistency with regards to risk-free discount rates used in the Government's accounting valuations was highlighted during preparation of the 2009 Financial Statements of the Government.

1.2.2 A number of reporting entities consolidated in the Government's accounts use discounted cash flow models to value various assets and liabilities for financial reporting. These valuations are typically attempting to measure obligation or rights incurred on or before balance date, but the settlement of those obligations or receipt of benefits will occur in the future.

1.3 Who should use these discount rates and CPI assumptions?

1.3.1 The Treasury's central table of risk-free discount rates and CPI assumptions must be used in certain accounting valuations for the purpose of preparing the Financial Statements of the Government. Specifically the table of rates applies to all Government reporting entities submitting valuations to Treasury for:

- valuing insurance claims liabilities under NZ IFRS 4 *Insurance Contracts*
- valuing employee benefits such as pension obligations, long service leave and retiring leave under NZ IAS 19 *Employee Benefits*, and
- building a risk-adjusted discount rate for valuing student loans.

1.3.2 Entities reporting financial results to the Treasury for consolidation purposes include departments, offices of parliament, State-owned enterprises and Crown entities.

1.3.3 As well as the accounting valuations noted above, these rates may be applied to other valuations where a risk-free discount rate or CPI assumption is used. The rates may either be used unadjusted or as a building block to calculate another assumption at the reporting entity's discretion.

1.3.4 You should consider if these discount rates and CPI assumptions are appropriate for your entity's own annual report. Any potential differences in rates used in your own annual accounts and the ones used for Government consolidation purposes should be discussed with the Treasury.

1.4 Why are CPI assumptions for accounting valuations being published?

1.4.1 Determining the nominal amounts to be settled or received in the future is likely to be impacted by inflation that 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 assumption.

1.5 When and where will the discount rates and CPI assumptions be published?

1.5.1 The first table of discount rates and CPI assumptions will be published today for Government accounting valuations as at 30 June 2010. The Treasury also intends to publish these rates and assumptions four times a year for use in future accounting valuations.

1.5.2 The table of discount rates and CPI assumptions will be published on the Treasury's website under "Guidance and Instructions".

1.6 Did the Treasury have help from external experts?

1.6.1 Yes. The Treasury, in developing this methodology, contracted PricewaterhouseCoopers to:

- draft a methodology for determining risk-free discount rates and corresponding CPI assumptions for use in accounting valuations in accordance with generally accepted accounting practice and actuarial standards in New Zealand, and
- issue an exposure draft document to key entities outlining the methodology and rationale for determining risk-free discount rates and corresponding CPI.

1.6.2 In drafting the methodology, the Treasury and PricewaterhouseCoopers consulted with entities that would be most affected by it. Submissions received on the exposure draft were considered as part of finalising this methodology.

1.7 How did the Treasury approach the development of this methodology?

1.7.1 A number of valuations recorded in the financial statements of the Government involve valuing cash flows 50 or more years into the future. The principles in accounting standards generally require that discounting should be at a rate that reflects the time value of money ie, the risk-free rate. Also, for valuing some assets the standards require risk-adjusted discount rates, (often built up from risk-free 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 extreme durations.

1.7.2 One of the challenges is that in practice, the risk-free rate cannot be directly observed; it is usually proxied by the return on a very safe asset. When selecting the risk-free 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 observable yield that provides the best proxy to a New Zealand risk-free rate.

1.7.3 An additional challenge is that New Zealand bonds and bank SWAP yield curves, generally accepted as suitable proxies for risk-free rates, are relatively short in duration compared to some of our obligations and assets. At extreme durations there are no observable market values for interest rates. In New Zealand the longest reliable market yields available are 10 to 12 years for government stock and 15 years for bank SWAP rates. In addition, there is a lack of market data for inflation and therefore, reliance has to be placed on forecasts instead, most of which have a short-term focus of three or at the most five years. For valuations with significant future cash flows, the discount rates and CPI assumptions used can make a significant difference to the value reported.

1.7.4 Given the short-term nature of market data on interest yields in New Zealand and the long-term nature of some of the Government's obligations, we have grouped the methodology under three headings which are:

- short-term assumptions
- long-term assumptions, and
- assumptions for bridging the short and long-term.

1.7.5 We have also established eight distinct steps to determine a table of risk-free discount rates and CPI inflation assumptions that can be applied across extreme durations of cash flows. This overall framework, including these defined steps, is outlined in paragraph 2.1.1.

1.7.6 Under our approach short-term means the period in which market yields are observable in New Zealand to proxy risk-free rates and for CPI, five years. Long-term means the period beyond observable market yields and for CPI greater than five years.

1.7.7 A full review of the accounting and actuarial standards relating to setting discount rates and CPI assumptions can be found in Section 9, *Review of Accounting and Actuarial Standards and Other Literature*. 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.

1.7.8 Reliance and limitations relating to this report are set out in Appendix 1.

2 Summary of Proposed Methodology

2.1 Overall Framework

2.1.1 The framework for determining the Treasury risk-free rates and CPI assumptions can be summarised in eight steps as follows:

Short-term assumptions

1 Determine risk-free discount rates for the first year with reference to Treasury Bills and the Overnight Cash Rate (OCR).

2 Determine the smoothed market forward rate curve with reference to New Zealand government stock yields.

3 Determine any adjustments required to the New Zealand government stock yields to give short-term risk-free discount rates.

4 Determine short-term CPI inflation assumptions.

Long-term assumptions

5 Determine long-term real risk-free discount rates.

6 Determine the long-term nominal risk-free discount rate.

7 Determine long-term CPI inflation from the above, cross-checked against available market and historical data.

Assumptions for bridging the short and long-term

8 Determine the method of blending short-term and long-term rates.

2.2 Proposed Methodology Steps 1 to 8

2.2.1 Each of these eight steps is discussed in detail in the body of the report. Below is a summary of the methodology and principles that apply to each of the eight steps under the Framework. These will be applied consistently at each valuation date.

Short-term risk-free rates (Steps 1 to 3)

2.2.2 Government bonds and Treasury Bills will be the starting point for determining short-term risk-free rates. The relevant accounting and actuarial standards either require reference to government stock, or encourage reference to it in determining a proxy for risk-free rates. The use of government bonds as a suitable risk-free proxy is also widely accepted by current practice in New Zealand.

2.2.3 In the past, adjustments have been required to the government stock yields both internationally and in New Zealand to better proxy risk-free rates. There have been a number of reasons for this, principally a lack of liquidity in the market due mostly to inadequate supply or low levels of trading activity.

2.2.4 At present, government stock and Treasury Bills 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 medium term because of the increased levels of debt issuances forecast by the New Zealand Debt Management Office (NZ DMO) over the next five years.

2.2.5 The process for assessing any required adjustments to New Zealand government bond yields to proxy short-term risk-free rates in the future is described in section 3 of this report.

Short-term CPI inflation (Step 4)

2.2.6 CPI cannot be observed from a market in the same way yields on bonds can be. Instead, Statistics New Zealand publishes the actual CPI quarterly. Therefore, we rely on forecasts of CPI to set the short-term CPI assumption. There are five main sources of readily available CPI forecasts in New Zealand: the Treasury, the Reserve Bank of New Zealand (RBNZ), the New Zealand Institute of Economic Research (NZIER) Quarterly Predictions, the NZIER Consensus Forecasts and the Aon Economists Survey. All of these forecasts are published at different times of the year and for different projection periods. Short-term projection periods for the majority of sources do not go beyond five years.

2.2.7 The Aon and NZIER consensus forecasts, published quarterly, will form the basis of the short-term CPI forecast. We consider that together they provide a reasonable coverage for the first four years and they will incorporate, to some extent, the other published forecasts. However the Treasury forecast, published twice a year, and the RBNZ forecast, published quarterly, will be considered if they provide more up to date information. In this situation the consensus forecasts may be adjusted accordingly.

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

- convert the relevant forecasts to a common year definition
- start with NZIER and Aon consensus forecasts for the first four years
- consider whether the Treasury and RBNZ forecasts provide any more up to date information and adjust accordingly, and
- use the long-term CPI rate from year five and onwards, determined as part of the long-term assumptions in this methodology, unless there is any compelling reason not to.

Long-term risk-free discount rates (Steps 5 and 6)

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

2.2.10 The real risk-free discount rate is the most critical long-term assumption for accounting valuations using present value techniques. This assumption is the primary driver of the actual value of cash flows that are inflated.

2.2.11 Judgment is required in selecting the rate that proxies a long-term real risk-free rate. Recent historical real risk-free returns, returns on long-term New Zealand index-linked bonds (if any), returns on relevant offshore index-linked bonds and economic theory are all relevant to selecting the long-term risk-free discount rate.

2.2.12 We have concluded that a reasonable long-term real return assumption for accounting valuations is **3.5%** pa**.**

2.2.13 While models use nominal risk-free rates and CPI assumptions, these assumptions are products of this real risk-free rate. Therefore, the difference in quantum between them (ie, the real-return assumption) is critical to the final valuation.

2.2.14 Having said that, these components are important individually in that they inform our views of an appropriate real risk-free return assumption and because the accounting standards place the most emphasis on the nominal risk-free rate. Minimal guidance is given on real rates of return and inflation assumptions in the standards.

2.2.15 The long-term nominal risk-free rate is determined from available data and historical market yields on long-term New Zealand government stock. The methodology concludes that a reasonable long-term risk-free discount rate is **6.0%** pa.

Long-term CPI inflation (Step 7)

2.2.16 Consistent with the long-term nominal risk-free rate the methodology sets a single CPI rate for the long term. This rate is calculated as the long-term nominal rate less the long-term real rate.

2.2.17 In the current, comparatively stable economic environment, this rate has been validated by reference to historic levels of CPI inflation and the historic relationship between CPI inflation and the RBNZ inflation target bands.

2.2.18 For some valuations, a single inflation rate may need to be used across all time periods. In this case the starting point should be the long-term inflation assumption.

2.2.19 While the mid-point of the RBNZ inflation target is currently 2%, the actual inflation has more often been above the mid-point than below, being below only five times in the last 20 years. Therefore, we have concluded therefore is that **2.5%** pa, calculated by taking the difference between the nominal and real risk-free rates, is reasonable.

Bridging the short and long-term (Step 8)

2.2.20 The government stock yield curve currently finishes at 15 May 2021 (currently 11 years). In future the longest duration for government stock is likely to range from 10 and 12 years. This raises the question on how the government stock yield curve should be blended with the long-term assumptions

2.2.21 The methodology assumes the difference between short-term and long-term risk-free discount rates should be smoothed.

2.2.22 Smoothing should commence at the maturity date of the last government stock. The selection of the end date would be guided by:

- the difference between the long-term rate and the rate at the end of the yield curve, and
- forward rates on bank SWAPS at that duration.

2.2.23 The interpolation should attempt to be consistent with bank SWAP rates where they are available.

2.3 Proposed Parameters

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

Item	Value	Comment
Adjustment to NZ Govt Stock	0	No adjustment required
Long-term real return	3.5%	
Long-term nominal discount rate	6.0%	
Long-term CPI	2.5%	
End of market observations	15 May 2021	Currently 11 years, expected to range from 10 to 12 years as new stock is issued
Start of long-term assumptions	End of yield curve plus 5 years (15 May 2026)	
Bridging assumption		Linear between the end of market and the start of long term

2.3.2 A sample table of annual rates from year one to year 20+, determined using this methodology, as at 31 May 2010 is shown in Appendix 3.

2.3.3 These rates are expressed as forward rates, ie, a different rate for each year of the projection. It is recommended that duration dependent rates are used.

2.3.4 The forward rates require that the valuation programme can cope with different interest rates each year.

2.3.5 There may be cases where the valuation programme can only handle a single rate. Spot rates have also been provided which are the single-equivalent interest rates for each duration in the table. In the case where a single discount rate is required then the appropriate spot rate can be selected to match the duration of the liabilities.

2.3.6 The appropriate inflation index or rate for assets and liabilities must be used for each individual case. Guidance on this has been explicitly excluded from the scope of this report.

2.3.7 It is however expected that inflation assumptions will be consistent with the specified CPI. All adjustments to the CPI should be supported by evidence, data or a reasonable argument.

2.4 Disclosures in Financial Statements

2.4.1 The Treasury applied judgments in setting discount rates that reflect the time value of money for accounting valuations. The appropriate discount rate is an area of international debate among accounting standard setters, regulators and the finance industry. There is also wide ranging academic and technical literature on setting discount rates.

2.4.2 Given the complexities of valuations using present value techniques and the wide ranging views about appropriate economic assumptions, such as discount rates, the Treasury recommends entities consider including additional disclosures in their individual financial statements such as:

- a table or graph of the undiscounted cash flows over time, and
- sensitivity analysis of the key economic assumptions.

2.4.3 These additional disclosures would provide readers with the ability to assess how sensitive a valuation is to a change in the discount rate and CPI assumptions.

2.4.4 These disclosures are not mandated in all accounting standards, but we would strongly encourage entities to include them if it would be useful to readers of their financial statements.

2.5 Ongoing Reviews Required

2.5.1 The inputs and parameters will be reviewed regularly, some more frequently than others. Minimum review periods are shown below. Significant changes in economic conditions or additional market instruments becoming available may result in an earlier review if appropriate.

Updated 30 June, 31 October, 31 December and 28 February

1 Treasury Bills and OCR.

2 New Zealand government stock yield curves, including any new stock.

Updated six monthly (30 June and 31 December)

1 Short-term inflation forecasts.

2 Impact of any new market instruments eg, long duration nominal or indexed stocks.

Updated annually (for 30 June year end valuations)

1 Any adjustments required to the New Zealand government stock yield curve, eg, by referencing bank SWAP rates.

2 Any new information regarding the long-term CPI and discount rate assumptions.

3 Any new information regarding the bridging assumption.

Updated Two Yearly

1 Any new information on the long-term real-return assumption.

2.6 Auditor Confirmation

2.6.1 The Office of the Auditor-General considers that the methodology for determining the risk-free discount rates and CPI assumptions is appropriate for the New Zealand Government to:

- value insurance claims liabilities under NZ IFRS 4 Insurance Contracts
- value employee benefits such as pension obligations, long service leave, and retiring leave under NZ IAS 19 Employee Benefits, and
- build a risk-adjusted discount rate used to value student loans.

3 Short-Term Risk-Free Rates

3.1 Introduction

3.1.1 This section describes the methodology and judgments that the Treasury made in determining the short-term risk-free discount rates for accounting valuations. In this context short-term means the period in which market yields are available in New Zealand to proxy risk-free rates (usually between 10 and 15 years).

3.2 Summary

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

3.2.2 The Treasury's overall conclusion is that government stock with no adjustment is currently a suitable proxy for risk-free rates.

3.2.3 The methodology for establishing a short-term risk-free yield curve is:

1 determine risk-free discount rates for the first year from the OCR and Treasury Bills and any stock maturing in this period

2 determine a smoothed market forward rate curve from New Zealand government stock yields, and

3 determine any adjustments required to the New Zealand government stock yields

3.2.4 At present, Treasury Bills are liquid and so Treasury Bill data, in our opinion, should contribute to the determination of risk-free discount rates for the first year without any adjustment. We do not expect that this will change and therefore, we have not considered in this paper any impacts of possible (but unlikely) future illiquidity issues on Treasury Bills.

3.2.5 Treasury Bills of up to six months can be used if forward rates for periods of up to six months are required. The overall shape of the yield curve when expressed in years is not particularly sensitive to the yields less than six months. The six month data point is particularly useful, as otherwise there is a potential large gap between the OCR and the first government stock maturity, which is currently 18 months duration.

3.2.6 When selecting to reference the market forward rate curve to New Zealand government stock we have been guided by the accounting standards and by generally accepted actuarial practice in New Zealand that government bonds are the most suitable risk-free proxy. The current market evidence also supports our view that the most suitable proxy to a New Zealand risk-free rate is yields on government stock.

3.2.7 However, we are aware from a review of international technical papers by the actuarial profession, that there are a number of sources of risk-free rates that an entity could use. These papers have also highlighted that there is considerable debate internationally on what the "best" basic risk-free rate source is and this can vary across jurisdictions. We are also aware that this debate has moved in response to bond market observations, particularly through the global financial crisis and during the recent sovereign bond crisis in some European countries.

3.2.8 After reviewing the international papers, as well as examining the current market in New Zealand, we have formed a view that the alternatives proposed, such as bank SWAPs or corporate bond rates minus risk adjustments, do not provide a more reliable and relevant proxy to risk-free rates in New Zealand.

3.2.9 The supply of government stock is forecast to increase significantly, and in our view this is a more appropriate starting point than bank SWAP rates. We recognise that in Europe the bank SWAP rate is regarded as a more appropriate starting point. However, they have the complication of multiple sovereigns issuing debt in a common currency which is not relevant in New Zealand. Therefore, this current European view is not automatically applicable to the New Zealand context.

3.2.10 We believe that in the current market, short-term risk-free discount rates can be reliably estimated through to the end of the government stock yield curve using the government stock and Treasury Bill data with no adjustment.

3.2.11 However, in the past, adjustments have been required to the New Zealand government stock yields to give short- term risk-free discount rates. We think that these adjustments have been, and continue to be appropriate in certain circumstances. This is particularly appropriate when a new bond issuance is very illiquid at valuation date. Therefore, our methodology requires an assessment for adjustments to the New Zealand government stock yields:

1 assessing whether any adjustment is required by investigating other sources of information

2 quantifying the scarcity discount or any other adjustment to government stock by investigating other sources of information

3 quantifying the risk premium or any other adjustment to bank SWAP rates by investigating other sources of information, and

4 attempting to reconcile the two adjustments (that is, government stock scarcity and bank SWAP risk premium) and making a judgment on the best approach considering the adequacy of the information available.

3.2.12 Our current view is that given the NZ DMO's current bond programme over the next 5 to 10 years (announced in the May 2010 Budget Update), it is unlikely that any adjustments will be required to government bond issuances as was the case in the past. However, we will remain vigilant for changes in activity in government bond trading which may indicate there is an anomaly in the market rate that requires an adjustment to determine a basic risk-free rate. In particular we will be vigilant of new government tranches that may be issued just before or on valuation dates that may show signs of illiquidity or prices out of line with the rest of the market. Our proposed smoothing process will allow for this by weighting the various stocks by the amount on issue. Consequently a new, small volume stock will receive a lower weighting in the fitting of the yield curve. This was the case with the 2021 government bond tranche issued in May 2009.

3.2.13 We believe that short-term risk-free rates should be expressed as forward rates and the yield curve smoothed because this is automatically hypothecates a portfolio of risk-free assets that matches the duration and timing of the liability cash-flows. The details of the curve fitting and smoothing are described in Appendix 2.

3.3 Analysis

3.3.1 The following analysis is divided into four topics:

- The risk-free rates for terms of less than one year.
- Market data for terms of more than one year (including a discussion on the various market data options over one year including our conclusion on the most appropriate risk-free option in New Zealand).
- Bank SWAPS compared to government stock.
- Market adjustments (including an assessment of adjustments to government stock rates).
- Illustrative examples using current market data.
- The outlook for the New Zealand government stock market.

3.4 Risk-Free Rates for Terms of Less than One Year

3.4.1 Risk-free rates for terms of less than one year are available from the OCR and Treasury Bills. Reuters and Bloomberg quote rates for Treasury Bills of the following durations:

- One month
- Two month
- Three month
- Six month

3.4.2 At present, Treasury Bills are liquid and so Treasury Bill data can be used to determine risk-free discount rates for the first year without any adjustment. At present there is no expectation that this will change.

3.5 Market Data for Terms of More than One Year

3.5.1 In an ideal world, market data on risk-free rates should be available directly from market observations. In practice we have limited observations from markets that may have shortcomings. We therefore need to consider how to best determine risk-free rates from available market data.

3.5.2 From our review of the international literature and discussions with New Zealand actuaries, we are aware that there are a number of different sources for risk-free rates, including:

- government stock rates
- government stock rates plus an adjustment for scarcity
- SWAP rates minus an adjustment for risk
- SWAP rates, and
- corporate bond rates minus an adjustment.

3.5.3 The two most liquid markets for New Zealand fixed interest are the bank SWAP market and the New Zealand government stock markets. The spread between the yields shown by these two markets can be caused by a number of factors, including:

- an extra risk addition to the yield for SWAPS;
- a liquidity addition to the yield for SWAPS, and
- a market scarcity deduction from the yield for government stock.

3.5.4 The corporate bond market in New Zealand is nowhere near as extensive as other countries and the available stock covers a wide range of credit ratings. It is generally accepted that New Zealand does not have a high quality corporate bond market. For this reason we have eliminated corporate bonds as a viable option as a reference to risk-free rates in New Zealand.

3.5.5 Furthermore, even if we did believe the corporate bond market was a viable starting point, the adjustment required for removing risk is not straight forward to determine and requires reference to other “risk-free” assets. For these reasons, we have not investigated this option further. The decision between the first four options then comes down to decomposing why the government stock rates are different from the bank SWAP rates and arriving at the most appropriate point between the two.

3.5.6 Government stock rates and bank SWAP rates without considering any adjustments described in the options above are not, in our opinion, viable options in New Zealand. These instruments have been prone to yield anomalies in the past when stresses are put on the market. Whilst currently such market stresses are not a significant issue, it may be in the future.

3.5.7 The issue of markets under stress is not unique to New Zealand and has been the subject of considerable international debate, particular during the recent global financial crisis. While adjustments may not be necessary at every valuation date, to future proof our methodology we have anticipated that any starting position whether it is government bonds or bank SWAPS, should be reviewed for adjustment for scarcity and risk respectively.

3.5.8 Therefore, in our view there are only two viable approaches in New Zealand, Firstly government stock plus a scarcity adjustment, or secondly bank swaps less a risk adjustment. There is potentially considerable uncertainty around determining the quantum of both of these adjustments. The next part of this section discusses these two main options and the reliability of both scarcity and risk adjustments depending on the starting point.

3.6 Bank SWAPS compared to Government Stock

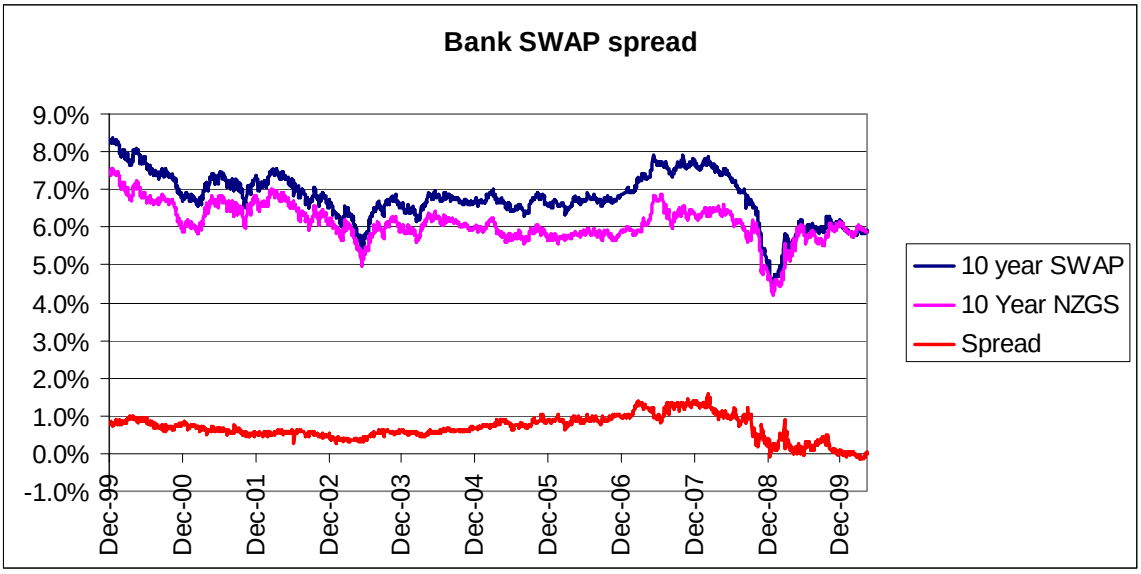
3.6.1 Bank SWAP rates are the commonly used description of the quoted market rates used to price a variety of interest rate swap instruments between two parties. In this paper we only consider the quoted market in NZ dollars and refer to the rates as bank SWAP rates.

3.6.2 The purpose of this section is to determine if Bank SWAP rates adjusted for risk are a viable alternative source to government stock adjusted for scarcity, for determining a basic risk-free rate. This comparison also gives us useful information on the size of adjustments required.

3.6.3 Currently, while this choice is simplified because the bank SWAP spread is close to zero and no adjustment is required to either, we recognise that this may not always be the case. Therefore, our decision needs to be based on principles that can endure beyond the current bank SWAP spread observations.

3.6.4 The difference between bank SWAP rates and government stock is known as the bank SWAP spread. It is extremely difficult to accurately decompose the spread into its components. However, the following observations can be made about the historic size of the spread shown in the graph below:

- From 2005 until the Global Financial Crisis (GFC), the spread increased. This was largely due to the fact that there was a large demand for government stock and limited availability as a lot of stock was tightly held and the New Zealand Government were paying off debt, driving the yields down.
- After the GFC, bank SWAPs were effectively government guaranteed for a period and the New Zealand government stock market also become significantly more liquid. The spread reduced to close to zero.



3.6.5 The graph above shows that the bank SWAP spread is currently close to zero and has been for over a year. The SWAP spread is a good measure of the sum of the upwards adjustment to government stock (the scarcity adjustment) and the downwards adjustment to bank SWAP rates (the risk adjustment). Because the sum is zero, we can conclude that both the scarcity and the risk adjustments are also zero.

3.6.6 This initial analysis shows the current equivalence of the two methods, but does not provide any clear answers on a robust methodology in the longer term. It is useful to further explore the adjustments that may be required in the future.

3.7 Market Adjustments

3.7.1 The reason for making market adjustments is based on the theory that the true risk-free rate lies somewhere between the market for government stock and bank SWAPs.

3.7.2 Based on this theory the two relevant adjustments are:

- a scarcity discount adjustment to apply to government stock rates (will increase the yield), and
- a credit risk adjustment to apply to bank SWAP rates (will reduce the yield).

3.7.3 A third possible adjustment is a liquidity adjustment to reflect the liquidity nature of insurance liabilities for accounting purposes. We believe this adjustment is not relevant for the purposes of the Financial Statements of the Government. The theory behind this adjustment is discussed at the end of this section.

3.7.4 As discussed above, the most useful market information on the two most relevant adjustments is the SWAP spread, which will give guidance on the total of these two adjustments but not the split between the two.

3.7.5 In New Zealand, the true risk-free rate will normally lie somewhere between the government stock rates and the bank SWAP rates. The true risk-free rate will normally be at or above the government stock rate, as government stocks are tightly held, leading to a scarcity premium. The bank SWAP market is more liquid than the government stock market, but arguably attracts a credit risk premium. An adjustment will move the government stock rates up towards the bank SWAP rates, or alternatively the bank SWAP rates down towards the government stock rates.

Process for adjusting market data

3.7.6 The following is an appropriate process to be adopted when assessing any required adjustments to market data:

1 **Assess whether any adjustment is required** by investigating other sources of information.

2 Quantify the **scarcity discount** or any other adjustment to government stock by investigating other sources of information.

3 Quantify the **risk premium** or any other adjustment to bank SWAP rates by investigating other sources of information.

4 Attempt to **reconcile the two adjustments** (scarcity discount and risk premium) and make a judgment on the best approach considering the adequacy of the information available.

5 Consider the **liquidity adjustment** and whether this can be justified from the nature of the liabilities.

Assess whether any adjustment is required

3.7.7 The first step is to investigate if there is any reason for government stock to be adjusted. The clearest signal will be obtained from the bank SWAP spread. If there is no or minimal spread (ie, 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 stock 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 stock curve is reasonable and needs no adjustment.

3.7.8 Currently the SWAP spread is minimal or even negative so no adjustment is required. This is supported by the increased liquidity and supply of government stock, implying that it is unlikely that a premium is being paid for government stock.

Scarcity discount

3.7.9 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 government stock, 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 stock and these could not be explained adequately by risk and liquidity.

3.7.10 It not straightforward to evaluate the size of the market adjustment required. 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 stock yield curve gives an indication of the extent of any adjustment required. This method was used for the ACC outstanding claims liability valuation in June 2008, when the bank SWAP spread was greater than 1.0%.

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

Risk premium

3.7.12 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.

Reconcile the two adjustments

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

3.7.14 If both methods are judged to be equally robust, then government stock is the preferred starting point. This is on the basis that some of the accounting standards refer to government stock explicitly, whereas none refer to bank SWAPS.

3.7.15 Currently the outlook for the government stock market is for significantly more supply. There seems to be no reason why the scarcity adjustment should change in the short term. Consequently, until there is evidence otherwise, the Treasury concludes that government stock is the appropriate starting point.

Liquidity adjustments

3.7.16 Another possible adjustment currently being debated is a liquidity adjustment to reflect the liquidity nature of insurance liabilities. The insurance accounting standard states that the nature of the liability should be considered, and the argument is that liquidity is part of the nature. The argument is that if insurance liabilities are illiquid, then the entity responsible for settling the liability can invest in illiquid risk-free assets that will return a slightly higher yield. The criteria for considering this adjustment is that the liabilities must be certain and not able to be redeemed immediately at no cost. In Europe the proposal is for there to be different degrees of liability liquidity.

3.7.17 It has been noted that the Australian Prudential Regulation Authority (APRA) has considered this same question for the purposes of capital reporting and their interpretation is that, for regulatory purposes, only lifetime annuities qualify for a liquidity adjustment.

3.7.18 In the Treasury's view the settlement of our insurance liabilities are too uncertain to be regarded as illiquid. Therefore, for the purposes of the Government's financial reporting under NZ IFRS, we do not think it is appropriate to make a liquidity adjustment to any starting point at this stage. This is currently a relatively new area of debate and may need to be reassessed as the international position is updated.

3.8 Illustrative Examples with Current Market Data

3.8.1 To put the preceding discussion in context it is useful to describe the current market and show illustrative market rates.

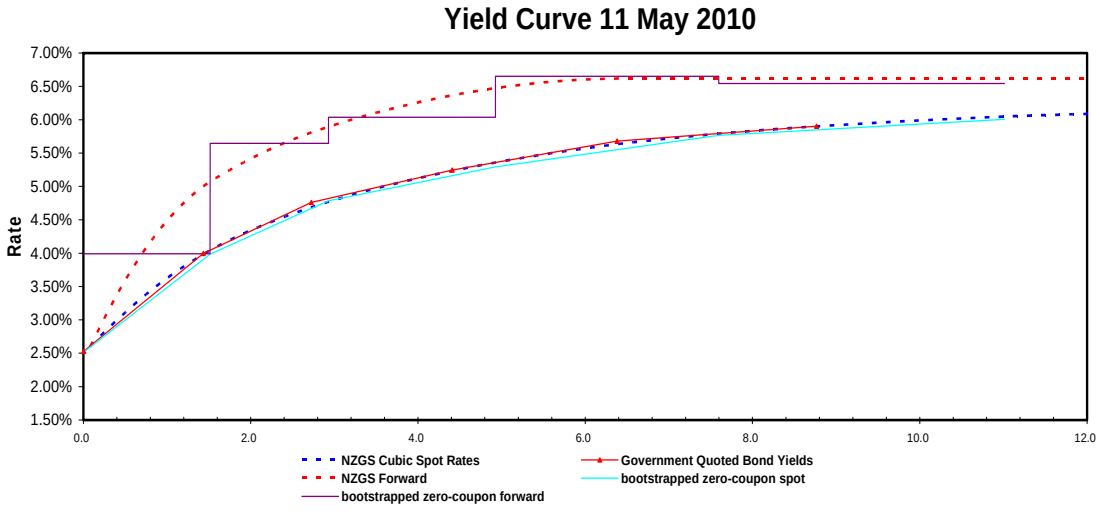
Government Stock

3.8.2 The current New Zealand government stock on issue is as follows.

Current New Zealand Government Stock maturities on issue (at 31 March 2010)

Maturity	Coupon	Total Issue $m	Available (net of RBNZ and EQC) $m
15-Nov-2011	6.00%	8,137	6,442
15-Apr-2013	6.50%	7,870	6,392
15-Apr-2015	6.00%	6,275	5,094
15-Dec-2017	6.00%	7,436	5,962
15-May-2021	6.00%	4,080	3,494
15-Feb-2016 CPI indexed	4.50%	1,521	1,171
Total		35,319	28,555

3.8.3 The yield curve of government stock, as at 11 May 2010, is shown below.



3.8.4 In the graph above, the top two lines are forward rates, raw and smoothed. The lower lines are the spot rates for actual stock, including coupons, plotted against average duration (note the coupons reduce the average duration of the stock), and the derived zero coupon curve plotted against raw duration. In this example Treasury Bills have not been included in the data.

3.8.5 When there is a negative yield curve, the forward rates will be below the spot rates, as if the whole graph had been flipped upside down.

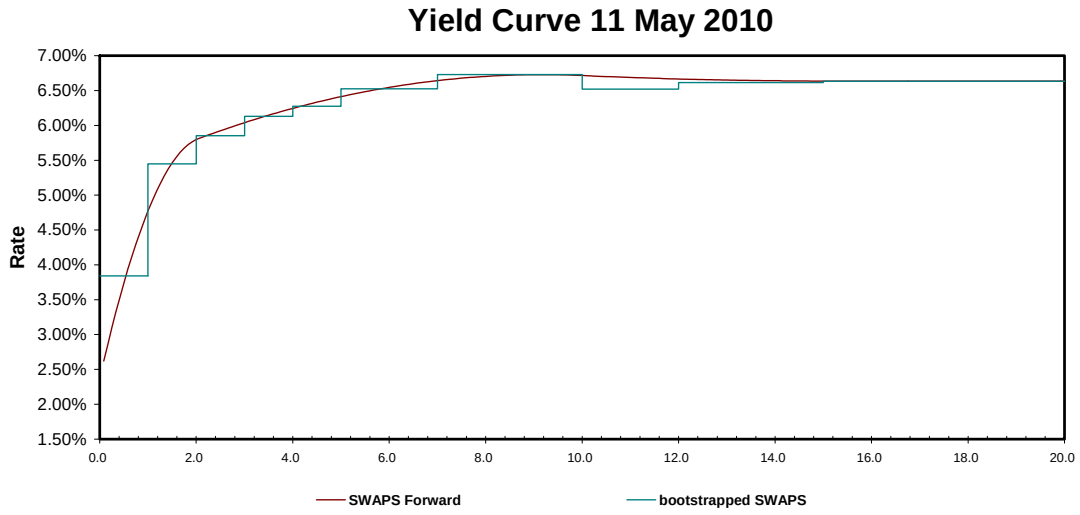
3.8.6 Note that in the graph above there is some evidence of forward rates peaking and then reducing for longer terms.

3.8.7 We have cross-checked the yield curves with those derived by NZ DMO and they are consistent. The yield curves have not yet incorporated the Treasury Bills, and for this reason they are slightly different to the NZ DMO's curves in the short term.

3.8.8 Information on the curve fitting methodology used is set out in Appendix 2.

Bank SWAPs

3.8.9 The bank SWAP yield curve for the same date is shown below.



3.8.10 The bank SWAP forward rate curve has longer term observations than government stock, namely at 12, 15 and 20 years. There is limited trading on the 20 year SWAP and the 15 year SWAP is probably the longest reliable duration.

3.9 Outlook for the New Zealand Government Stock Market

3.9.1 The New Zealand Government has significant and growing debt forecasts in the medium term and consequently a significant amount of government stock is expected to be issued in the medium term.

3.9.2 Presently, the NZ DMO is intending to maintain a reference 10 year government stock over the near future. It is expected that this will be achieved by issuing a 12 year stock every 2 years. In addition, other government stocks may be issued to maintain a yield curve that ideally has a maturity at least every two years.

3.9.3 The latest information from the NZ DMO reflects Budget 2010 (released 20 May 2010) and includes forecast bond programmes of $10.5 billion in 2011/12, $10 billion in 2012/13 and $6 billion in 2013/14.

3.9.4 Key features of this include the fact that the NZ DMO is actively considering reintroducing inflation-indexed bonds during 2010/11, as well as issuing a 2019 nominal bond which will fill the gap between the current 2017 and 2021 bonds.[1]

3.9.5 The implications of these plans are that:

- the liquidity of government stock markets is likely to improve and yield adjustments are unlikely to be needed in the near future
- new issues with a term of less than 12 years will not change any methodology but will add an extra data point, and
- new issues of longer dated indexed stock, particularly longer than ten years, will provide additional information on longer term real yields. This should not affect the methodology but may mean that the parameters for long-term real rates will need to be reviewed.

1 http://www.nzdmo.govt.nz/publications/mediastatements/debtprogramme/2010-05-20

4 Short-Term Inflation

4.1 Introduction

4.1.1 This section describes our methodology for setting the short-term CPI assumption. In this context short-term is up to five years.

4.1.2 The value of outstanding insurance claims liabilities, pension obligations and some provisions in the Government's accounts is determined from the present value of the expected future payments. Expected future payments means nominal amounts in the future and therefore, reflect future price increases.

4.1.3 Determining inflation assumptions that are specific to the obligation is a critical part of accounting valuations. For example, to determine the present value of ACC claims incurred to date, where the settlement is expected sometime in the future, ACC assess the impact of the Consumer Price Index (CPI), wage inflation generally, as well as sector specific inflation for carers and health workers. Rehabilitation, medical, and surgical treatments are subject to specific medical cost inflation on current levels of claims expenditure.

4.1.4 Another example is the Government Superannuation Fund (GSF) pension benefits, which are indexed to CPI. Future nominal pension payments reflect the CPI adjusted amounts before they are discounted. Also, there are members of GSF that are currently employed, but have accrued pension benefits based on their current level of service. An estimate of the final salaries of these employees reflects assumed future salary increases, including impacts of promotion.

4.1.5 In the case of asset valuations, predicted future cash receipts may also need to take account of inflationary impacts. For example, student loan repayments are based on the future income levels of borrowers and these grow as a result of salary increases and job promotions.

4.1.6 Although a variety of inflation assumptions are required by our entities, we have limited this document to determining the CPI assumption for three reasons:

- Firstly, it is vital that there is a consistency between the CPI and discount rate assumptions because under economic theory inflation rates are an integral component of interest rates.
- Secondly, forecasting CPI is a common assumption across accounting valuations and as such it is reasonable for Treasury to provide a central view.
- Thirdly, our reporting entities are in a much better position than the Treasury to determine specific inflation assumptions for the obligations or assets that they manage.

4.1.7 There needs to be a justifiable link between whatever discount rate is adopted and the recommended CPI assumption in order to maintain consistency between the various valuations.

4.1.8 CPI inflation assumptions are predictions of the average price of consumer goods and services purchased by households in the future. Statistics New Zealand determine and report actual CPI.

4.1.9 In New Zealand there are limited sources to assess the market's view of CPI in the future. Therefore, we will rely on a mixture of New Zealand consensus surveys, the RBNZ forecasts and Treasury's forecasts of CPI in the short term. In the longer term, we use a mixture of economic theory and historical analysis to cross-check the CPI assumption implied from our view of the long-term real return and nominal bond yields. Long-term CPI assumptions are discussed in section 7 of this paper.

4.2 Summary

4.2.1 To determine the short-term CPI assumption the proposed process is to:

- convert the relevant CPI forecasts to a common year definition
- start with the NZIER and the Aon consensus forecasts for the first 4 years
- consider whether the Treasury or RBNZ forecasts provide any more up to date information and adjust accordingly, and
- use the long-term CPI rate for years 5 and onwards, determined as part of the long-term assumptions under this methodology, unless there is any compelling reason not to.

4.2.2 The Treasury and its advisors will make final decisions and apply judgement in relation to any inconsistencies in short-term CPI forecasts.

4.2.3 In applying this methodology we think it's important to consider the purpose of the rates, which is to value cash flows that are long term in nature and are usually spread over many years, not just for short-term forecasting. Both the ACC and GSF obligations have future cash outflows that extend to 50 years and beyond. Consequently, for these valuations the timing of inflationary pressure or otherwise becomes less important. For example, 3.0% in year one and 2.0% in year two will have a similar outcome to 2.5% for two years. The timing of CPI changes is less important for valuation purposes than for short-term forecasting purposes.

4.2.4 In determining this process we have decided not to rely entirely on the Treasury's short-term forecast of CPI. NZIER and Aon consensus forecasts incorporate a wider range of forecasts of CPI in New Zealand and to ignore the available views of other credible sources may introduce some bias in our assumptions. Assumptions should be objective, impartial and verifiable under accounting and actuarial standards.

4.2.5 However, a balance must be struck between using numerous sources of objective and unbiased CPI assumptions while recognising that the accounting valuations are for the purposes of Treasury's financial reporting. As such we expect that the Treasury short-term CPI forecast would have significant weighting, particularly if it is more recent than any of the consensus forecasts and is updated for latest economic conditions.

4.2.6 We are aware that in different countries there are some CPI futures markets operating. For example, in Australia some of the investment banks offer CPI derivatives. However, we are not aware of any derivatives activity for the New Zealand CPI. If such markets were to develop in New Zealand they would be assessed as part of future reviews of this methodology.

4.2.7 There is an index-linked government stock maturing in 2016 that is discussed later in this report. Transpower has recently issued some 10 year CPI indexed stock; however, it is too early to assess how well this is trading. It is likely that adjustments for risk and liquidity would be required. The Transpower's recent issue of stock is unlikely to be directly applicable unless there are similar nominal stocks to compare it to directly.

4.3 Analysis

4.3.1 The following table summarises the main published forecasts of CPI inflation at the time of writing this paper. The forecasts are published at different times, and consequently may be based on different information. In each case below the forecasts are for March years.

Item	Published	2010 %pa	2011 %pa	2012 %pa	2013 %pa	2014 %pa	2015 %pa	2016 %pa	2017 %pa
Treasury (BEFU, May 2010)	Dec, May	2.2	5.9	2.4	2.4	2.4	-	-	-
NZIER Quarterly Predictions (March 2010)	Mar, May, Aug, Nov	2.2	2.9	1.3	1.5	1.9	-		-
NZIER Consensus Forecasts (March 2010)	Mar, June, Sep, Dec	2.2	2.4	2.4	-	-	-		-
Reserve Bank of New Zealand (March 2010)		2.0	2.3	2.8	2.7	-	-		-
Aon Economists Survey (April 2010)	Feb, May, Aug, Nov	-	3.4	-		2.5	-		2.4

4.3.2 The Budget Economic and Fiscal Update 2010 (BEFU 2010) forecast published by Treasury includes the effect of GST rising from 12.5% to 15% and it is likely that the Aon consensus survey includes some expectation of a GST increase as it was signalled by the Government prior to Budget 2010. Note also that the 2010 forecasts above are historic and the first forecast year is actually 2011.

4.4 Consensus Forecasts

4.4.1 Consensus forecasts are produced quarterly by Aon and NZIER. These forecast reflect a survey of a range of economists on the following specific measures:

Aon consensus:

- CPI in 1, 4 and 7 years
- AWE in 1, 4 and 7 years
- Rate of GDP growth in 1, 4 and 7 years
- Real interest rates in 1, 4 and 7 years.

NZIER consensus:

- CPI in 1, 2 and 3 years
- AWE in 1, 2 and 3 years
- Rate of GDP growth in 1, 2 and 3 years.

4.4.2 Note that the NZIER consensus forecasts are March years with the first one being 31 March 2010. The March consensus consequently has only 2 years of useful forecasts. A summary of the current forecasts is displayed below.

Item	1 year	2 year	4 year	7 year
CPI Aon (April)	3.4%		2.5%	2.4%
CPI NZIER (March)	2.4%	2.4%		
AWE Aon (April)	2.2%		3.4%	3.2%
AWE NZIER (March)	1.9%	2.6%		
GDP Aon (April)	3.1%		2.5%	2.7%
GDP NZIER (March)	3.1%	3.2%		
Real Interest Rates	3.2%		2.5%	2.7%

4.4.3 The two consensus forecasts together provide a reasonable coverage for the first four years. The Aon seven year forecast can be a useful additional piece of information for determining the long-term CPI assumption.

4.4.4 The NZIER is a non-profit incorporated society based in Wellington and is independent of government. NZIER's team of economists is one of the largest in New Zealand outside of government. NZIER provide regular economic forecasts to their members and conduct long-standing surveys of business and economic opinion. Consensus forecasts from NZIER include a range of banks plus NZIER, Treasury and RBNZ.

4.4.5 Aon New Zealand is a part of the international Aon Corporation. Examples of entities that contribute to the Aon Economist survey are ANZ Bank (NZ) Limited, NZIER, Bank of New Zealand Tower Asset Management, BERL UBS NZ Limited, Deutsche Bank (NZ) Limited, Westpac New Zealand and the Business Roundtable. Note the Aon surveys do not include Treasury or RBNZ.

4.4.6 We think it makes sense to start from the consensus forecasts for accounting valuations, as these will incorporate, to some extent, the other published forecasts, are produced regularly and are publicly available. These forecasts are published at different times so inevitably the different consensus views will not exactly align. Also, the figures quoted are an average of the views of different selections of participants and so some differences in the averages are to be expected. As these forecasts are ultimately various commentators' views, there will always be some differences. Therefore, we will need to apply judgment in resolving any inconsistencies between the consensus forecasts.

4.5 The Treasury Forecasts

4.5.1 The Treasury has specific short-term CPI assumptions that are used for the 5 year forecasts. These are updated every six months for the budget (generally published in May) and the half year budget update (generally published in December).

4.6 The Reserve Bank of New Zealand

4.6.1 As the central bank of New Zealand, the RBNZ is responsible for the New Zealand currency and for operating the monetary policy to maintain price stability. The mechanism of this is the Official Cash Rate which affects short-term interest rates. The current Policy Targets Agreement of the RBNZ defines price stability as annual increases in the CPI of between 1 and 3 per cent on average over the medium term.

4.6.2 RBNZ forecasts are another important source. The RBNZ and Treasury forecasts are both included in the NZIER consensus forecasts, so to some extent the process of amalgamating the various sources has already been done for us.

4.7 Adjustments to CPI Forecasts

4.7.1 From time to time there will be one-off effects in the CPI forecasts which will need to be considered, for example the increase in GST announced in May 2010. For the purpose of forecasting the CPI index the GST will need to be included, and the effect due to GST needs to be quantified. This will allow entities to determine the appropriate CPI assumption if the effects of GST on their future cash payments or receipts does not need to be incorporated in the valuation.

4.7.2 For the purposes of applying the inflation assumption the nature of the cash flows needs to be considered on a case by case basis, for example:

- payments indexed to the CPI but not subject to GST, include the GST effect
- payments with GST that are deductible, exclude the GST effect, and
- payments linked to wages or salaries are unlikely to be affected by the GST rise, exclude the GST effect before applying linkage to CPI.

4.8 Results using an Example

4.8.1 As discussed above, determining the CPI is a matter of applying judgment based on the views of New Zealand economic forecasters and commentators. Therefore, we believe the best way to describe our methodology for setting short-term CPI is to illustrate the process by applying the steps of the process at the current date below:

1 All the forecasts are for March years, so no adjustment is required.

2 The NZIER consensus forecast is 2.4% for 2011 and 2012; the Aon 2011 survey is likely to include some allowance for anticipated GST changes. The Aon forecast for 2014 is 2.5%. Start with the series 2.4%, 2.4%, 2.4%, and 2.5% for 2011 to 2014.

3 The Treasury forecast is more recent than the rest and includes the effect of the actual GST changes and other effects of the budget. This forecast indicated the 2011 figure should be changed to 5.9%.

4 The Aon survey has 2.4% after 7 years and the long-term rate is 2.5% so use 2.5% for year 5 onwards.

5 The result is the series 5.9%, 2.4%, 2.4%, 2.5%, 2.5% for 2011 to 2015+.

4.8.2 GST is allowed for in the forecasts on the basis that 90% of the CPI basket is subject to GST, so the effect on inflation is 0.9*(1.15/1.125 -1) = 2.0%.

4.8.3 In this example the inflation for the first year for cash-flows related to prices that are exclusive of GST would be 3.9%, and for payments that are linked to CPI or are inclusive of GST the first year inflation would be 5.9%.

4.8.4 These results have been included in the sample table of assumptions as at 31 May 2010 in Appendix 3. The Treasury intends to set the short-term CPI assumptions in time for valuations as at 30 June and 31 December each year. This fits with the timing of Treasury forecasts which are usually released in May and December each year. However we intend to perform a high level view of any new CPI forecasts available at the other key valuation dates eg, the GSF valuations of 28 February and 31 October. This will allow Treasury to assess at these dates if the latest short-term CPI assumption is still appropriate.

5 Long-Term Real Risk-Free Discount Rates

5.1 Introduction

5.1.1 This section sets out the Treasury's view of the ultimate long-term real risk-free rate. Section 6 looks at the ultimate long-term nominal risk-free rate and Section 7 looks at the long-term CPI assumption.

5.1.2 These three long term assumptions are closely connected. The order in which we have discussed them is deliberate.

5.1.3 The long-term real risk-free rate is considered first because this is the primary driver of the value of cash flows that are inflated. In addition it is reasonable to expect the real return to be largely unaffected to changes in long-term inflation outlook.

5.1.4 The nominal risk-free rate is considered second because it is the focus of accounting standards and can be cross checked to historical market rates. Finally, the long-term CPI assumption is derived from the first two assumptions.

5.1.5 The real rate of interest is the amount by which the nominal interest rate is higher than the inflation rate. The real risk-free interest 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 rate represents the real return an investor would expect from an absolutely risk-free investment over a given period of time.

5.1.6 The long-term real risk-free rate is a critical assumption in the valuation of the ACC claims liability and GSF pension obligation. Both of these obligations are linked to inflation. The value of these obligations is dependent on the real return (ie, the difference between the discount rate and inflation rate). An increase or decrease in both inflation and discount rates together will not change the value of the liabilities.

5.1.7 There is an absence of any direct and observable long-term yields to proxy a real risk-free rate in New Zealand. Therefore, we will determine a hypothetical real yield curve to match the duration of the Government's obligations and assets. We believe that determining an ultimate single long-term real yield is a rational and pragmatic approach to create the long end of the yield curve. This approach is supported by international commentators in the actuarial profession as discussed in section 9 of this paper.

5.1.8 We have concluded in earlier discussions of short-term assumptions that the most appropriate proxy for risk-free rates in New Zealand is the yield on government stock. Therefore, in the long term context, it is consistent that the resulting risk-free rate we assume is cross-checked against available data of real yields on government bonds in New Zealand.

5.2 Summary

5.2.1 The methodology is that a single long-term real risk-free rate can be set for accounting valuations and this rate should be stable for a reasonable time period.

5.2.2 In the absence of any long-term market data in New Zealand we have applied judgment in selecting the rate. Recent historical real risk-free returns, returns on long-term New Zealand index-linked bonds (if any), returns on relevant offshore index linked bonds and economic theory are all relevant to selecting the long-term real risk-free discount rate.

5.2.3 Recent historical rates, market observations and economic theory all point to a long-term real return currently of between 3.0% pa and 4.0% pa in New Zealand. In our view there is no compelling argument to go to either end of the range to set the rate. Consequently we have set the long-term real return assumption at 3.5% pa, being the mid-point of the range. We recognize that this is a judgment but have been guided by our analysis that 3.5% pa falls within the range of most of the indicators discussed below. In summary the 3.5% is supported by historical analysis, limited index bond data and economic theory.

5.3 Analysis

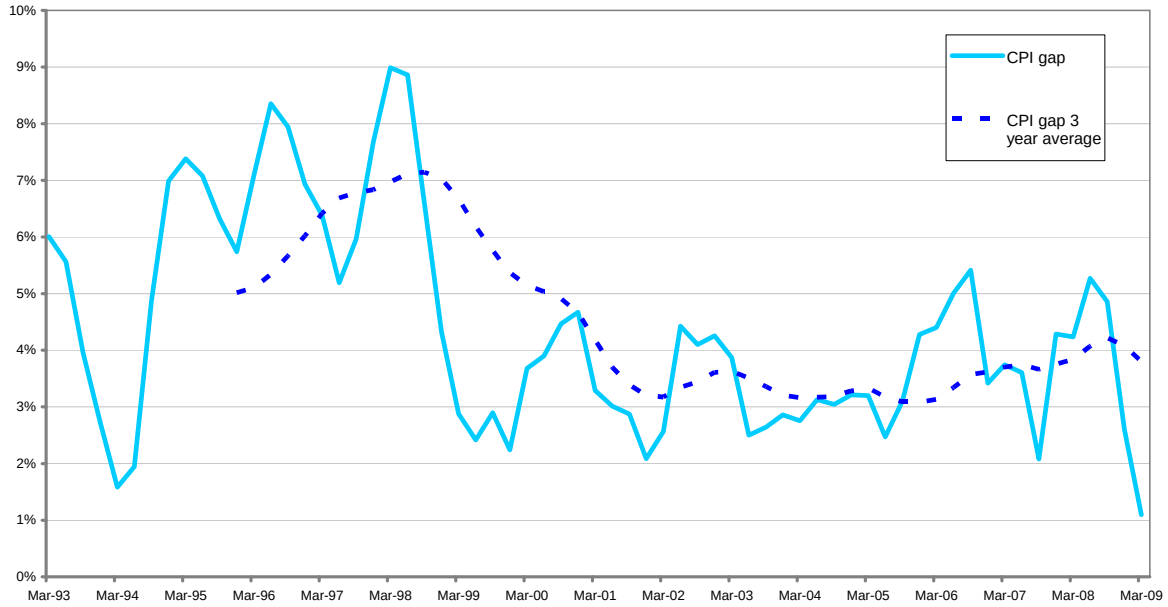
5.3.1 The analysis of the long-term real rate of return is summarised beneath the following three headings; historical rates, indexed linked stock and economic theory.

5.4 Historical Rates

5.4.1 In reviewing the historical real risk-free rate we have looked at the difference between interest rates and inflation rates in the past. There are a number of ways of considering this. The first is to look at 1 year interest rates compared to inflation expectations for the following year. Data on inflation expectations is not readily available, so instead we have performed this analysis retrospectively using actual inflation data compared to 1 year interest rates as at the start of that year. Because of this lag the graph only goes to March 2009. We recommend that in future this analysis be done using inflation forecast data if possible.

5.4.2 The following chart shows the historical difference between 1 year forward rates for New Zealand government stock and actual inflation for that year, as measured by CPI.

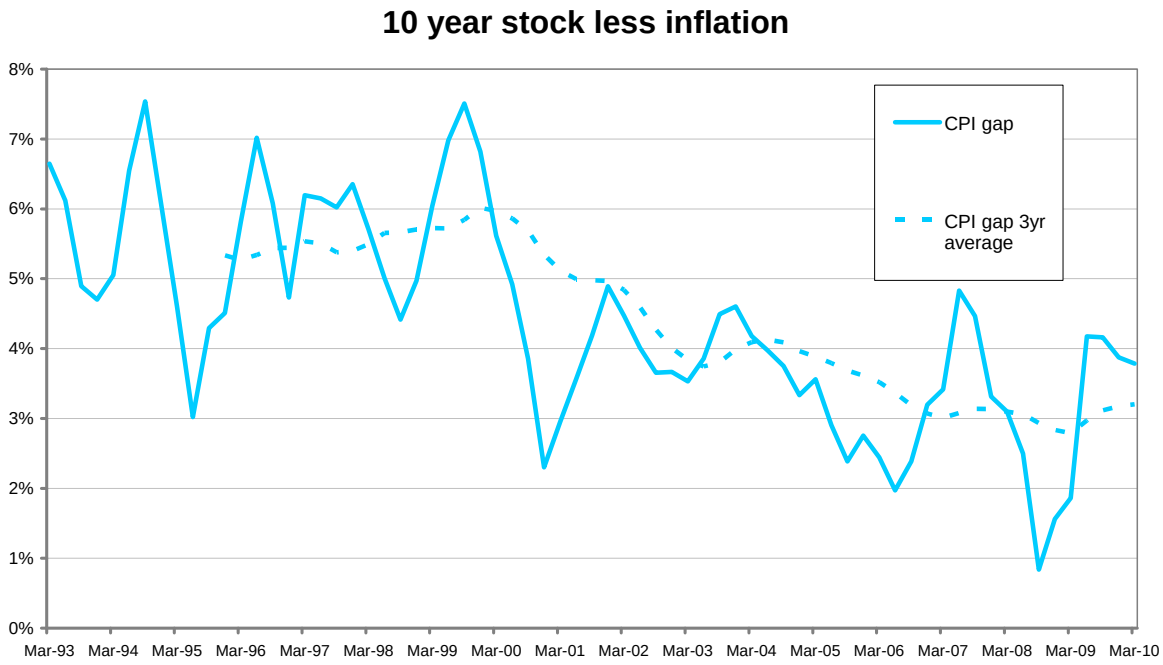
1 year stock (forward rate) less inflation (next year)



5.4.3 The graph shows that interest rates on 1 year government stock have been between 3% pa and 4% pa higher than CPI inflation for the last 8 years. In the last year, however, the observed gap has narrowed significantly, due to the dramatic drop in short-term interest rates.

5.4.4 This comparison of 1 year rates is affected significantly by monetary policy either tightening or loosening and does not allow for the difference between 1 year yields and long-term yields.

5.4.5 It is more relevant to look at the difference between long-term rates and inflation. The following graph shows the difference between 10 year forward rates on New Zealand government stock at the start of the year and inflation experienced over the year.



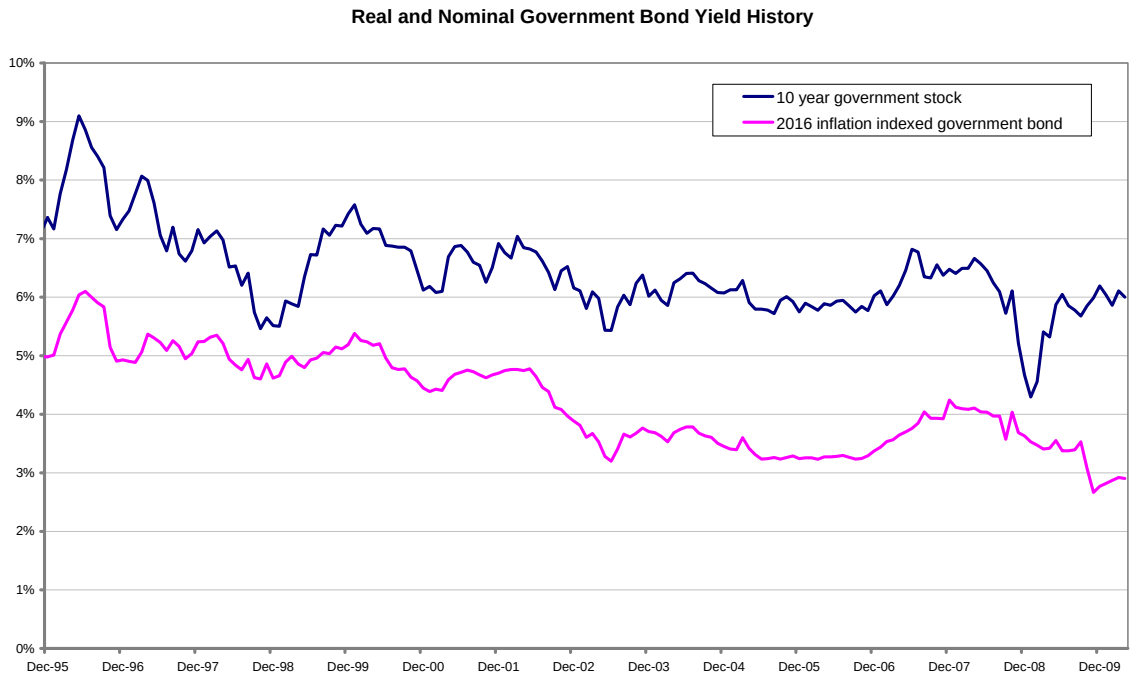
5.4.6 The 3 year average has been between 3% pa and 4% pa for the last 7 years, indicating that the difference between 10 year stock and CPI has consistently been in the range of 3% to 4% for the last 10 years.

5.4.7 Further analysis could be done to the longest duration of inflation forecasts and a matching interest rate, for example average 5 year inflation forecasts and 5 year government stock. This comparison would not be as affected by short term monetary policy. We have not done this analysis in detail, but 5 year inflation forecasts have been around 2.5% for a number of years and 5 year government stock has been around 6% over the last 8 to 10 years. This results in a similar conclusion.

5.5 Index Linked Stock

New Zealand index linked stock

5.5.1 Inflation linked bonds can be useful evidence of the markets view of real rates of return. In New Zealand there is only one index linked stock on issue, maturing in 2016. The history of this is shown in the graph below. Note that duration of this stock has become progressively shorter, from 20 years in 1995 to 6 years now.



5.5.2 For the last eight years this stock has been trading to yield between 3% pa and 4% pa. In the last year, the drop in yield has been driven mainly by the drop in short-term interest rates now that the duration of this stock is getting much shorter. In future this stock will not give much guidance to real yields in the longer term. In addition, any extrapolation of CPI inflation expectation from this stock is made complex by the mix of taxed and non-taxed investors who trade in it. Both the tax effect and an excess of demand over supply put downward pressure on the yields of this stock.

5.5.3 New issues of longer dated indexed stock, particularly longer than ten years, will provide additional information on longer term real yields. If such issues were to become available then how this information is incorporated will largely be a matter of judgement. Factors to be considered will be the duration of the stock, supply and demand pressures as well as market factors for nominal stock.

US index linked stock

5.5.4 The US Treasury quotes a 30 year index linked bond price. The return on this bond is 1.85% pa currently, and since 2004 has ranged between 1.8% pa and 2.5% pa.

5.5.5 This can be put into a New Zealand context by adding a risk premium to reflect the extra risk of investing in New Zealand. The Treasury's assessment of this country risk premium, as discussed below, is 1% pa.

5.5.6 This suggests a real return on a hypothetical 30 year inflation linked New Zealand government stock of approximately 3% pa currently or a range between 2.8% pa and 3.5% pa, since 2004.

5.6 Economic Theory

Link to GDP growth

5.6.1 The Treasury paper *Discount Rates for the Calculation of the Retirement Plan Liability of the Crown for the Government Superannuation Fund,* dated 28 August 2009 summarises the theoretical link between real interest rates and GDP growth. The paper was written specifically to support the discount rate assumptions for the GSF pension valuations for the Government's 2009 financial statements.

5.6.2 The Treasury considered the elements that comprise interest rates and relevant historical experience in the 2009 paper. Interest rates can be broken down into different components. The exact allocation between these components is not precise and may vary over time.

- The real component represents the real return on capital which should equate to long-term real economic growth rates. As this is from a global perspective, it is world growth that is relevant. Economic forecasters in Treasury have assumed this to be 3% per annum. New Zealand's real growth has averaged just above 3% over the past 10 years.
- The second component of an interest rate is compensation for inflation; Treasury economic forecasters currently assume that New Zealand's inflation will average 2% per annum in the long-term, the mid-point of the RBNZ's target band.
- The third component of interest rates in a world of global capital markets is a country risk premium. This reflects the premium demanded by foreigners to invest in New Zealand. The reasons commonly given for it are the large current account deficit (8.5% of GDP in the year to March 2009) and associated net debt position (98% of GDP at 31 March 2009), the small size of the economy (leading to a liquidity premium for NZ bonds), its dependence on primary product exports (which are subject to large swings in demand and can be affected by factors such as climate), the relatively short history of inflation targeting (although this history is now becoming longer) and levels of government debt (low over the past decade).

5.6.3 The economic theory is that in the long-term, interest rates are composed of three components:

- inflation
- real return on capital which should equate to long term real economic growth rates, and
- a country risk premium.

5.6.4 The rates adopted by the Treasury in the 2009 paper in support of a long-term bond rate are summarised below:

Components of long-term interest rates	Percent
Real return (real growth rate of economy)	3.0%
Compensation for inflation (mid-point of target band)	2.0%
Country risk premium for New Zealand	1.0%
Total	**6.0%**

5.6.5 Another source of real rates of return is the Aon Economists survey. The latest expresses real interest rate as the difference between 10 year government stock and inflation. The April 2010 survey projected that this will be 4.3% pa in 7 years time. During 2009, this forecast varied in the range of 3.6% pa to 4.2% pa.

Alternate theories

5.6.6 The Treasury is aware that the economic argument that links GDP growth and real returns above is not universally accepted. There is significant data available to suggest that real returns have historically been less than GDP growth.

5.6.7 There are also arguments suggesting that the 1.0% country risk premium is slightly too high and that the 3.0% long term growth may also be slightly too high. Conversely we have not come across any argument suggesting that the 4% real return is too low.

5.6.8 In the Treasury's view, given the significant levels of judgment required in setting these assumptions, it is important to focus on the purpose of the valuation. In particular Treasury is guided by the qualitative characteristics of financial statements under the accounting framework as described in section 9 of this paper.

5.6.9 Qualitative characteristics are the attributes that make the information provided in financial statements useful to readers. The four principal qualitative characteristics are understandability, relevance, reliability and comparability. In our view, the setting of a single long-term real return, that remains stable, is:

- compliant with specific accounting and actuarial standards
- consistent with the qualitative characteristics of financial statements, and
- useful to readers of the financial statements because it is a durable basis for valuing long duration obligations and assets.

6 Long-Term Nominal Risk-Free Discount Rates

6.1 Introduction

6.1.1 This section sets out the Treasury's view of the ultimate long-term nominal risk-free rate. In this context long-term rates are rates for durations longer than the market yield curves available.

6.1.2 Our methodology is to determine a single long-term nominal risk-free rate from historical government bond yields and other available data.

6.1.3 As mentioned previously it is important that the nominal risk-free rate is a robust stand-alone assumption. This is important because the accounting standards place the most emphasis on the nominal risk-free rate. The standards require that the nominal risk-free rate is extrapolated from available market data. Minimal guidance is given on real rates of return and inflation assumptions in the standards.

6.1.4 Extrapolation is the process of constructing new market data points of longer duration than the current yield curve. This process enables us to form a hypothetical yield curve that matches the Government's long duration assets and liabilities for accounting valuations.

6.1.5 Forming a full hypothetical yield curve is achieved in two stages. Firstly, using historical data of New Zealand government bonds we determine a single long-term risk-free rate. Secondly we consider the implications of extrapolating the short-term yield curve to the ultimate single long-term rate. This is a macroeconomic approach.

6.1.6 Interpolation describes the construct of the yield curve between known points. In this case, the known points are: (a) the final market rate on the current yield curve and (b) the ultimate long-term single assumption determined under this methodology. Our interpolation assumption (also referred to as "bridging") is discussed in Section 8 of this paper.

6.1.7 We already established in Section 3 that government bond yields are the appropriate market reference to proxy risk-free rates in New Zealand for accounting valuations. Therefore, this section only considers extrapolation of the long-term government bond rates in New Zealand. However, the methodology would still apply if at some point in the future the base were to change to bank SWAP rates.

6.2 Summary

6.2.1 In the Treasury's view it is reasonable to extrapolate a single long-term forward interest rate beyond the available yields of government stock. The conclusion is that a reasonable long-term nominal interest rate is 6.0% pa.

6.2.2 The long-term nominal rate of 6.0% pa is consistent with the historical rates of government stock in New Zealand.

6.2.3 The three long term assumptions of nominal rate, real rate and CPI should all be consistent. The fact that the three assumptions are consistent within the methodology supports the choice of 6.0%.

6.2.4 In our view, the approach described below is also in compliance with accounting standards and meets best actuarial practice.

6.2.5 While we believe this long-term assumption is reasonable for the foreseeable future, we intend to periodically review it. Any change in this long-term assumption will need to be supported by evidence that the long-term CPI and real rates have fundamentally and permanently changed in New Zealand. This change must also be reflected in current market yields.

6.3 Options for setting long-term rates

6.3.1 There are a number of possible options available to project a long-term government bond rate. These include:

- extrapolating the market yield curve using a constant spot rate
- extrapolating the yield curve using a constant forward rate
- extrapolating using the shape of the forward curve, and
- using other information to inform the extrapolation.

6.3.2 The principles of extrapolation for the purposes of liability valuations should always be considered. In assessing the options above, we have also taken into account the latest international literature and guidance from the actuarial profession. In particular we have been following the recent proposals from the the Committee of European Insurance and Occupational Pensions Supervisors (CEIOPS).

6.3.3 The November 2009 paper from CEIOPS[2] stated that extrapolation should take account of:

- realism, ie, it should be possible to earn this return in a risk-free manner, and
- volatility in long-term discount rates that can lead to substantial changes in values of liabilities and consequent pro-cyclical effects. The choice of extrapolation should take account of the effect on financial stability.

6.3.4 The updated March 2010 paper from CEIOPS expanded the discussion on extrapolation by proposing 11 principles for extrapolating the basis risk-free interest rate term structure. Of particular interest for our methodology are the principles numbered 3, 5, 6, 7 and 8 on page 25 of the CEIOPS's document. All 11 principles are listed in paragraph 9.5.21 of section 9 of this paper.

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[2] http://www.ceiops.eu/media/files/publications/submissionstotheec/20100303-CEIOPS-Task-Force-Report-on-the-liquidity-premium.pdf

6.3.5 We have applied the extrapolation principles in the CEIOPS paper and in particular, focused on the principles that extrapolation should be:

- theoretically and economically sound, and
- based on forward rates converging from one, or a set of, last observed liquid market data points to an unconditional ultimate long-term forward rate, to be determined for each currency by macroeconomic methods.

Option 1 - Extrapolate the market yield curve using a constant spot rate

6.3.6 Extrapolating the curve using a constant spot rate is the simplest method and is effectively what is done when, for example, the 10 year government stock rate from the RBNZ is used unadjusted.

6.3.7 This is the approach adopted in *The Commerce Commission's Approach to Estimating the Cost of Capital* paper dated June 2009[3]. Their base risk-free rate is determined from the five year government stock rate. However, their methodology uses a single risk-free rate rather than a term structure. The Commerce Commission concluded that for their purposes a term structure is not required.

6.3.8 While this has the benefits of being simple, it ignores some information about the term structure of the rates; consequently it is not theoretically correct and would not result in smooth forward rates. However, this method would result in a similar outcome to smoothing down to a long-term rate, in that the forward rate beyond the end of the yield curve would be lower than the last observed forward rate.

Option 2 - Extrapolate the yield curve using a constant forward rate

6.3.9 Extrapolating the yield curve using a constant forward rate, based on the last market point, is technically more correct than using a constant spot rate. However, this fundamentally assumes that the longest observation is valid forever with no real justification.

6.3.10 In New Zealand the government bond market yields are only available for 10-12 years in duration and the yield curve has a history of volatility. Where a constant discount rate, based on the last market point in the curve, is used to discount cash out flow durations exceeding 50 years, the value of the obligation is very sensitive to any small change in rate. A significant change in the value of an asset or liability, caused by a small amount of market volatility in the yield curve, may be misleading when there has been no change in the underlying cash flows expectations. .

6.3.11 In our view, using the constant forward rate, based on the last market point is contrary to the principles of the CEIOPS recent papers. For example the CEIOPS proposal states the choice of extrapolation should take account of the effect on financial stability of the obligation being valued. Extrapolation should also be theoretically and economically sound. In our view, the markets view of the forward yield in 10 or 12 years does not necessarily provide a sound theoretical or economic basis to apply to longer durations of cash flows for accounting valuations.

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3 http://www.comcom.govt.nz/cost-of-capital/

6.3.12 For the reasons stated above option 2 is considered not appropriate for the Treasury's methodology.

Option 3 - Extrapolate using the shape of the forward curve

6.3.13 This option supposes that there is sufficient information within the forward rate yield curve to determine what the shape of the yield curve is beyond the last market point. A number of theories have been proposed to perform this extrapolation. The idea is that this will give guidance on whether the curve should keep going up, stay constant or come down. Considering the prior shape of the yield curve requires considerable judgement and to the best of our knowledge has not been used successfully. We also doubt that the New Zealand yield curve has enough data points to enable any meaningful analysis of shape.

Option 4 - Use other information to inform the extrapolation

6.3.14 In our view, considering the historical government bond yields, along with any other relevant information available is the most appropriate way to determine an extrapolated long-term yield. That is, applying a macroeconomic approach to extrapolation, in our view, is the most rational option. Therefore, the final paragraphs in this section are focused on doing this.

6.4 Historical Market Yields on Long-Term New Zealand Government Stock

6.4.1 The following graph shows the historical market yields on 10 year New Zealand government stock. The graph shows the monthly average of 10 year notional stock from the RBNZ website, with the yields annualised. The graph also shows (dotted line) the implied forward rate between the 5 and 10 year stocks. This line departs from the market rate as the yield curve becomes steeper, either positively or negatively.

6.4.2 There are a couple of significant dates in the period covered by the graph. In 1989/90 the RBNZ explicitly changed its focus to targeting inflation, gradually bringing it under control. Their actions led to interest rates falling and becoming less volatile. The Official Cash Rate (OCR) was introduced in 1999 and is the RBNZ's primary tool in controlling inflation.

6.4.3 The table below shows the average 10 year stock yields as well as comparative CPI, real and GDP figures for various periods through to April 2010.

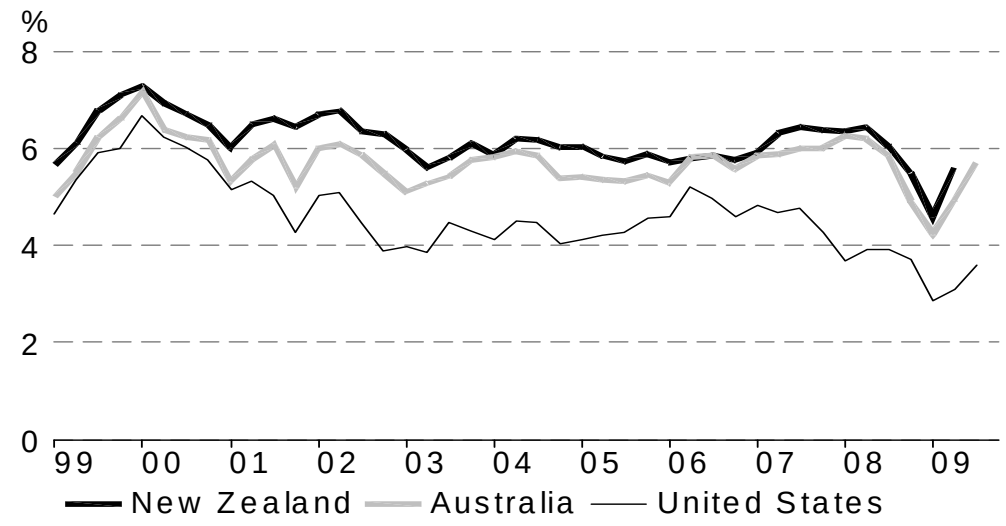
Averages	5 year	10 year	15 year	20 year
10 yr stock	6.0%	6.2%	6.5%	7.1%
5 to 10 year forward	6.0%	6.3%	6.6%	7.2%
CPI	2.9%	2.7%	2.2%	2.2%
Implied real return	3.1%	3.5%	4.3%	4.9%
GDP growth	0.3%	1.2%	2.0%	2.5%

6.4.4 The last ten years is the most consistent in terms of monetary policy, and over this period the 10 year stock rate has averaged 6.2%, 3.5% greater than inflation over the same period. The 5 to 10 year forward rates have averaged very similar figure. The historical analysis above supports the Treasury's assumption of a 6% long-term government bond yield.

6.5 International Observations

6.5.1 Although we are extrapolating the New Zealand bond data we believe it is appropriate to look at Australia and US bond rates to test the reasonableness of our 6% assumption. The following graphs compare New Zealand, Australia and US Bond rates.

NZ, AU and US 10 yr bond rates



Source: Reserve Bank of New Zealand, Datastream

6.5.2 The long-term US Rates at the time of writing this report are:

10 year	3.57%
20 year	4.23%
30 year	4.41%
30 year indexed	1.85%

6.5.3 In order to compare international rates, and test the reasonableness of our assumption, there needs to be some consistency between the inflation environments. The US rates quoted above imply an inflation outlook of 2.6% pa, which is consistent with the inflation assumption discussed earlier of 2.5% pa.

6.5.4 The implied forward rates on the US bonds from 10 to 30 years are approximately 4.8% pa. As discussed in paragraph 5.6.4 of section 5 of this paper, addition of a country risk premium of 1.0% pa for New Zealand would indicate notional forward rates for New Zealand of 5.8% pa for between 10 and 30 years.

7 Long-Term Inflation

7.1 Introduction

7.1.1 Long-term inflation is the third step in three connected components. The long-term inflation is determined as the long-term risk-free rate less the real risk-free rate. Consequently a single long-term inflation assumption is derived for accounting valuations.

7.1.2 It is also important to validate the long-term CPI assumption by considering economic theory and historical analysis in the context of New Zealand's economic environment.

7.1.3 As already noted in this paper many of the Government'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 claims liabilities and GSF pension obligations. These liabilities 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 assumption for accounting valuations.

7.2 Summary

7.2.1 In the current, comparatively stable economic environment, we believe that the long-term CPI rate can be set by reference to the long-term nominal risk-free rate less the long-term real risk-free rate.

7.2.2 This assumption is validated by the historic levels of CPI inflation and the historic relationship between CPI inflation and the RBNZ inflation targets.

7.2.3 The current Policy Targets Agreement of the RBNZ defines price stability as annual increases in the CPI of between 1% and 3% on average over the medium term. This inflation target band has changed over time since it was first introduced by the RBNZ in 1989/90. Some commentators suggest that any long-term assumption for accounting valuations should be the rate that is exactly half way between the current target band. For example, this would be 2% based on the current target of between 1% and 3%. However, our historical analysis below indicates that inflation tends to run consistently higher than the mid-point of the Bank's target band.

7.2.4 The historical analysis indicates that over the last 20 years CPI inflation has been comparatively stable and averaged 2.2% pa. It also shows that CPI inflation has exhibited a long term pattern of exceeding the mid-point of the RBNZ's target range by 0.7% pa. These indicate a reasonable range for future CPI is 2.2% pa to 2.7% pa (2.7% pa being 0.7% pa above the mid-point of the RBNZ's current target range).

7.2.5 Overall, a 2.5% pa assumption for accounting valuation purposes seems reasonable ie, 0.5% pa above the mid-point of the RBNZ range. For forecasting the New Zealand economy and the Government's projected debt track Treasury currently uses a mid-point CPI assumption of 2%. The next two paragraphs address the reasons for the two rates being slightly different.

7.2.6 The long-term inflation assumption of 2.5% p.a. is based on historical averages. Since the change to the Policy Target Agreement in September 2002, which set the RBNZ's targeted inflation band as between 1% and 3%, the average annual CPI-measured inflation has been 2.65%. Consequently, in setting a long-term assumption for an accountancy standard, it is not unreasonable, in the absence of any known policy change that could be assumed to alter the future path of inflation, to base the forward projection on historical data.

7.2.7 The assumptions in the Treasury's medium-term and long-term fiscal projections are based on more than just historical averages, as they reflect current policy. As the RBNZ is currently required to target achieving inflation between 1% and 3%, the assumption that involves the simplest interpretation of this policy, and no inherent call about a bias in either direction, is 2% p.a. ie, the middle of this band. Furthermore, the inflation assumption is only one of a number required for Treasury's projections, such as labour productivity growth, the unemployment rate and the Government bond rate. All of these assumptions are reviewed at each official forecast round by the Treasury. Consequently, while 2% p.a. is the current long-term assumption for inflation in the Treasury's fiscal projections, this could change in the future.

7.2.8 Whilst the rate in this methodology is not exactly the same as the 2% Treasury uses for long-term projections, the difference is understandable. The accounting and actuarial standards put more weight on the observable and verifiable data at valuation date for determining assumptions and less on policy intentions of governments.

7.3 Analysis

Inflation over the Last 20 Years

7.3.1 CPI inflation in New Zealand has been relatively stable since the following events:

- the introduction of the Reserve Bank Act with inflation targets (1989/90)
- the introduction of GST in 1986 and subsequent increase from 10% to 12.5% (1989).

7.3.2 The RBNZ inflation targets have been:

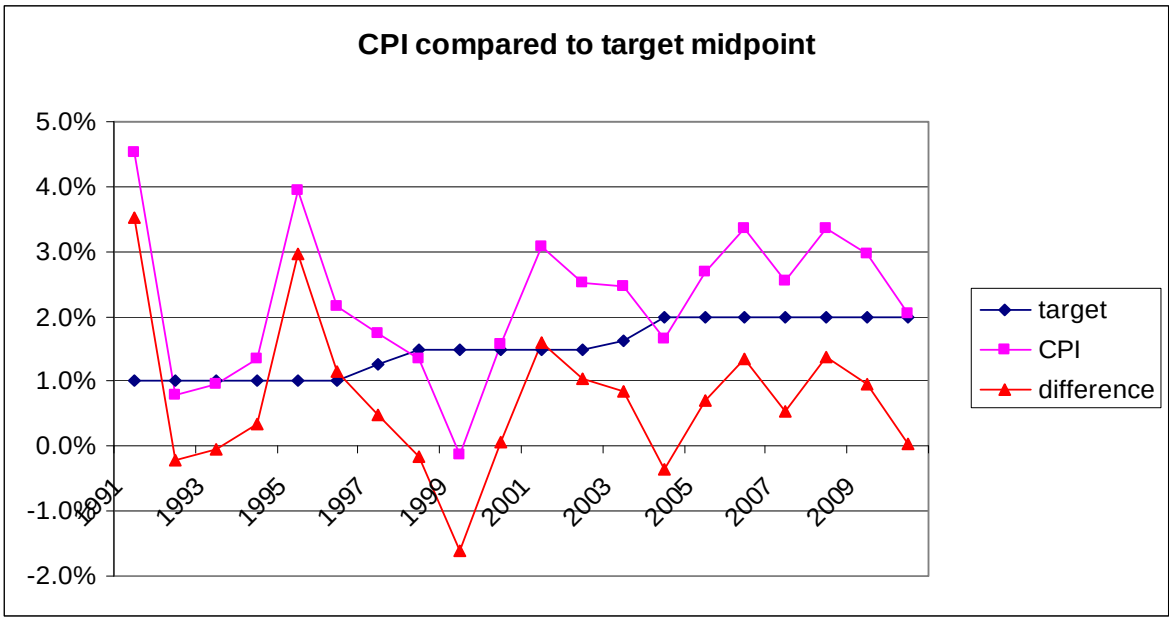
- from March 1990 0% to 2% mid-point 1.0%
- from Sept 1996 0% to 3% mid-point 1.5%
- from Dec 2002 1% to 3% mid-point 2.0%

7.3.3 The actual average CPI in periods to March 2010, compared to the mid-point of the RBNZ range, have been:

	5 year	10 year	15 year	20 year
CPI	2.9%	2.7%	2.2%	2.2%
RBNZ mid	2.0%	1.9%	1.7%	1.5%
Difference	0.9%	0.8%	0.5%	0.7%

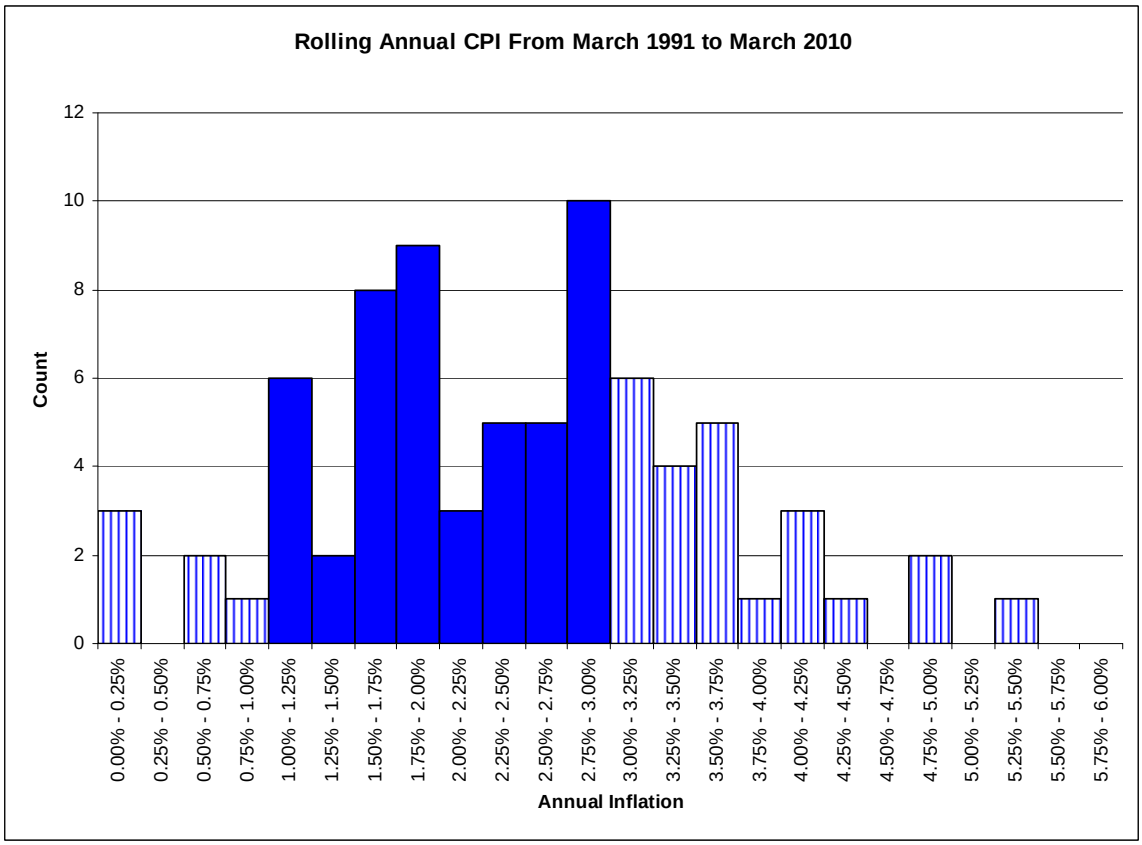
7.3.4 The table above shows that the average inflation has been within the RBNZ target range for each period but has consistently exceeded the mid-point.

7.3.5 The graph below shows the year-by-year progression of annual CPI plotted next to the target mid-point.



7.3.6 The actual inflation has more often been above the mid-point than below, being below only five times in the last 20 years.

7.3.7 The following histogram shows the historical inflation rates, as measured by CPI, since March 1991. The inflation rates are annual rates for each quarter during this period. The solid bars represent the number of times the inflation rate was between RBNZ's current target band of 1% and 3%.



7.3.8 The graph shows the distribution is skewed to the right of the target band block (the target band block of 1%-3% is shown as the solid bars). If the comparison was made to the target band at the time, the "skewness" would be more pronounced.

7.3.9 When doing this analysis the effect of a GST change should be backed out of the analysis, and this should be considered when the analysis is updated. It is generally accepted that GST is a step change and is unlikely to impact on longer term inflation expectations.

7.3.10 We have only reviewed the last 20 years for New Zealand historical CPI rates because this represents the time since the introduction of the Reserve Bank Act with inflation targets (1989/90). Prior to this, especially pre the 1984 economic reforms, the New Zealand's economy was based on significant interventions compared to the open and market based economy of the last 20 years. New Zealand also experienced very high levels of inflation, particularly in the 1970s. Therefore, in our view, the historical analysis pre 1990 is not applicable for determining the long-term CPI assumptions in the current economic environment.

The Treasury Long-Term Forecasts

7.3.11 The Treasury CPI forecasts are essentially done in three steps:

- the short-term 5 year budget forecasts, which are updated every six months
- the medium-term forecasts, which project a further 10 years to get 15 year forecasts
- the long-term model (LTFM) which extends forecasts to 50 years.

7.3.12 The inflation assumption currently used by the Treasury after five years is the mid-point of the RBNZ target range of 1.0% pa to 3.0% pa, being 2.0% pa.

7.3.13 As previously discussed the accounting and actuarial standards require that assumptions are objective, unbiased and verifiable when valuing liabilities and assets for accounting purposes. Therefore we believe that it is important to consider the asymmetrical nature of the inflation distribution evident in the historical analysis. There has been a consistent pattern of exceeding the target range, so in the long-term, average inflation is likely to be above the mid-point of the RBNZ range.

8 Bridging the short and long-term rates

8.1 Introduction

8.1.1 This section sets out the Treasury's view of how to bridge the short-term market rates to the long-term assumed rate. This includes a decision of the appropriate period over which to smooth the "bridge".

8.1.2 We recognise that this "bridge" is one of the most subjective areas of the methodology. The accounting standards do not contemplate this requirement; however, subsequent research and discussion papers outline the broad principles of extrapolation.

8.1.3 We have mainly relied on the principles in a number of actuarial technical papers identified in section 9 of this paper. These papers propose appropriate technical methods to join the short and long-term rates for valuation purposes.

8.2 Summary

8.2.1 The government stock yield curve currently finishes at 15 May 2021. This is currently 11 years. In future the longest duration for government stock is likely to range between 10 and 12 years.

8.2.2 The long-term nominal risk-free rate has been set at 6% under this methodology for accounting valuations.

8.2.3 In our view the most robust place to start the smoothing is the calendar date of the last stock. The selection of the end date (ie, where the 6% long-term rate starts on the hypothetical yield curve) would be guided by:

- the difference between the long-term rate and the rate at the end of the yield curve (ie, if this difference is greater the smoothing period may need to be longer), and
- forward rates on bank SWAPS at that duration to the extent that they are reliable.

8.2.4 The difference between short and long-term risk-free discount rates should be smoothed. This is consistent with principle in the March 2010 CEIOPS paper that proposes that extrapolated rates should follow a smooth path from the entry point to the unconditional ultimate long-term forward rate.

8.2.5 At present, the difference between the long-term rate and the rate at the end of the yield curve is quite small and the current swap forward rates reduce at long durations. Therefore, we conclude that at present 5 years is an appropriate period to smooth over.

8.2.6 It is appropriate, in our view, to lock this 5 year period in for a reasonable time and not change it in response to minor market fluctuations. For future proofing we prefer to express this as a period which results in a fixed date (15 May 2026), dependent on the maturity date of the longest bond. This corresponds to option 4 described below.

8.3 Analysis

8.3.1 In reviewing the literature we have identified a range of views over when the long-term rate should start:

- at the end of the yield curve
- from 20 years onwards (example in the paper from CEIOPS)
- somewhere in between.

8.3.2 However, to narrow the choices we have focused on how the interpolation should be done between the short and long-term rates under five viable options.

8.4 Interpolation between Market and Long-Term Rates

8.4.1 There are a number of ways to interpolate between the short and long-term rates, including:

- no interpolation, a step in the rates at the end of the yield curve
- starting the interpolation before the end of the yield curve
- interpolation from the end of the yield to a fixed duration (eg, 16 years)
- interpolation from the end of the yield for a fixed period (eg, end of yield curve plus 5 years), and
- interpolation from the end of the yield at a fixed slope (eg, -0.1% p.a).

8.4.2 All of these approaches will have advantages and disadvantages and the final selection is a matter of judgement. A combination of the last two is another option, with the fixed period being modified if the slope becomes excessive.

8.4.3 Linear interpolation should be adequate for all the options above, as it is unlikely that there will be advantage in using a more complex interpolation method.

8.4.4 The interpolation should attempt to be consistent with bank SWAP rates where they are available. However, long duration bank SWAPS are subject to scarcity premiums due to excess demand over supply so the yields may consequently be artificially low at the end of the curve.

8.4.5 If these bank SWAP rates, or any other observable rates, are significantly out of line with the resulting curve, then consideration should be given to any adjustment required. The rates should be adjusted for any scarcity or risk premium or any other adjustments that may required. The weight given to other observable rates needs to account for the uncertainty in the rates. Investigation would also be required to determine the pricing basis and level of trading underlying these rates. For example, in some instances the longer duration bank SWAP curve is not a genuine market observation, but is generated by extrapolating the forward rate from shorter durations. Currently the 15 year SWAP rate is consistent with the smoothed yield curve, but we would give a relatively low weighting to this information.

8.4.6 Under option 1, a step in the rates has the advantage that it results in the long-term real return immediately after the end of the yield curve. This will produce smooth spot rates and is simple. However, it potentially ignores additional market information from SWAP rates. The Treasury has decided not to use this as it ignores information from bank SWAP rates and will produce "odd looking" forward rates, although the spot rates will be smooth.

8.4.7 Under option 2, starting the interpolation before the end of the yield curve arguably ignores some market data to the end of the curve. For that reason it is not our preferred option.

8.4.8 Under option 3, interpolation for a fixed duration looks reasonable at face value, however the interpolation period will change as the duration of the longest stock changes with time. As we are looking to provide some future proofing we have ruled out this option.

8.4.9 Under option 4, interpolation to a fixed date keeps the interpolation period the same. However it still requires the selection of an arbitrary period to smooth over.

8.4.10 Under option 5, interpolation at a fixed slope is also attractive however it also requires the selection of an arbitrary slope.

8.4.11 Of all the options, the last two are the most reasonable for our methodology. We recognize that both options require an arbitrary assumption about either a time period or slope. Even so, we have elected to use option 4 as it provides the most reasonable and pragmatic framework in our "bridging" methodology.

8.4.12 The choice of the period to be smoothed over is slightly arbitrary. There are arguments that the long-term rate should be smoothed to at 20 year duration, which would currently give a smoothing period of 9 years. This may be the case if only nominal yields were relevant; however because of the importance we have placed on real risk-free rates, we believe that a shorter smoothing period is more appropriate.

9 Review of Accounting and Actuarial Standards and Other Literature

9.1 Introduction

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

9.1.2 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). For NZ GAAP purposes, the Government reporting entity is designated as a public benefit entity (PBEs). The financial statements comply with New Zealand equivalents to International Financial Reporting Standards (NZ IFRS) as appropriate for PBEs. Therefore, the accounting valuations reported in the Government's accounts must comply with specific accounting standards under NZ IFRS.

9.1.3 There are about 40 accounting standards under NZ IFRS which specify the financial reporting of certain transactions and balance sheet items.

9.1.4 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 NZ IFRS 4 *Insurance Contracts,* NZ IAS 19 *Employee Benefits* and NZ IAS 39 *Financial Instruments: Recognition and Measurement* respectively. A review of NZ IAS 37 *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.

9.1.5 There are a number of IFRSs requiring or permitting measurements using present value techniques. Each standard does not have identical wording in their respective discounting sections. However, we have concluded that the methodology described in this paper complies with all the relevant NZ IFRSs requiring the use of risk-free discount rates for the purposes of the Government's financial reporting.

9.1.6 In the case of Student Loans under NZ IAS 39 a risk-adjusted rate is required. Given the absence of any market for NZ student loan assets and no suitable observable proxy, we believe it is appropriate to use the risk-free rate as a starting point on which a risk premium is added. Therefore, this analysis has relevance not only for Student Loans, but other accounting valuations where a net present value is determined by using a risk-free rate plus a risk adjustment.

9.1.7 International 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.

9.1.8 As international actuarial standards have been developed to apply under IFRS, 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 rate. If any conflict or inconsistency between the accounting and actuarial standards were to arise, the accounting standards would need to receive more weighting because the valuations must comply with NZ IFRS.

9.1.9 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 recent global financial crisis has further heightened this sensitivity because all bond markets have been extremely volatile and accepted historical norms about the risk-free nature of debt issuances by sovereigns have now been questioned, particularly in Europe.

9.2 Literature Hierarchy

9.2.1 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
- international accounting standards
- New Zealand actuarial standards
- international actuarial standards, and
- papers from international bodies. Many of these have no official status and are research and discussion papers and are not definitive.

9.2.2 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.

9.3 Accounting Standards

9.3.1 The specific accounting standards under NZ IFRS require a significant amount of judgment to be applied in determining discount rates for measuring valuations using discounted cash flow models.

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

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

9.3.3 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.

9.3.4 In the Treasury's view, it may be appropriate to adjust an observable yield curve to be compliant with the principle of determining a risk-free rate. An example may be adjustments to government stock by giving less weight to the market rates of very illiquid tranches.

9.3.5 Below is the Treasury's analysis and interpretation of the applicable accounting standards that the Government's reported valuations must comply with.

NZ IFRS 4 Insurance Contracts

9.3.6 The discounting requirements in NZ IFRS 4 Appendix D for general insurance contracts are specified below.

> ***IFRS 4 Appendix D - Discount Rates***
>
> *6.1 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.*
>
> *6.1.1 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.*
>
> *6.1.2 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.*

9.3.7 The Treasury believes that the principle is clear. NZ IFRS 4 requires discounting to reflect the time value of money using current objective rates but not reflecting risks inherent in the obligations cash flow. The standard setters provide some guidance in that government bonds are typically an appropriate starting point for current observable risk-free rates.

9.3.8 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 much longer than the current observable market data, as in New Zealand.

NZ IAS 19 Employee Benefits

9.3.9 The discounting requirements in NZ IAS 19 for long-term employee benefits are specified below. NZ IAS 19 provides a mixture of rules and principles, which in the Treasury's opinion makes it a more cumbersome standard to interpret.

> ***NZ IAS 19 - Actuarial assumptions: discount rate***
>
> *78 The rate used to discount post-employment benefit obligations (both funded and unfunded) shall be determined by reference to market yields at the end of the reporting period on high quality corporate bonds. In countries where there is no deep market in such bonds, the market yields (at the end of the reporting period) on government bonds shall be used. The currency and term of the corporate bonds or government bonds shall be consistent with the currency and estimated term of the post-employment benefit obligations.*
>
> *79 One actuarial assumption which 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.*
>
> *80 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.*
>
> *81 In some cases, there may be no deep market in bonds with a sufficiently long maturity to match the estimated maturity of all the benefit payments. In such cases, 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 corporate or government bonds.*

9.3.10 In its supporting comments in the basis for conclusions, the International Accounting Standards Board (IASB) discusses and rejects using a risk-adjusted discount rate. It states "Therefore, the Board decided that the discount rate should reflect the time value of money but should not attempt to capture those risks….The rate that best achieves these objectives is the yield on high quality corporate bonds. In countries where there is no deep market in such bonds, the yield on government bonds should be used" (paragraph BC31). "The reference to market yields at the balance date does not mean that short-term discount rates should be used to discount long term obligations." (Paragraph BC34)

9.3.11 Treasury's conclusion is that the principle in NZ IAS 19 is to discount employee benefit obligations reflecting the time value of money using current objective rates but not reflecting risks inherent in an obligation's cash flows. This is the same principle as in IFRS 4 Insurance Contracts. Reading paragraph 78 of NZ IAS 19 in isolation is unhelpful, in Treasury's view, in determining the principle because it is a rule. However, by reading paragraphs 79 to 81 together with the IASB's basis of conclusion, Treasury believes the principle is clearer.

9.3.12 Some commentators, reading paragraph 78 in isolation, believe that discounting of employee benefits does require a risk-adjusted rate because all corporate bonds, regardless of the quality, include some risk. Treasury disagrees with this interpretation of the principle of NZ IAS 19. Treasury believes that the IASB was attempting to provide some guidance as to how to achieve a risk-free rate by referencing to high-quality corporate bonds or, failing that, to reference to government bonds. The Treasury believes that NZ IAS 19 has been poorly drafted in this instance and has made a submission to the IASB on this subject before.

9.3.13 Having said that, the approach adopted in this paper is to determine the discount rate by reference to government bonds (there is no deep market in high quality corporate bonds in New Zealand currency) consistent with the term of the obligation's cash flows. Despite the issue with the drafting of paragraph 78, the Treasury considers that our methodology is compliant with the letter of the standard.

9.3.14 Some of the key IASB comments in the basis of conclusion that Treasury has relied on in coming to a view on the principle of NZ IAS 19 are:

- discount rates should reflect the time value of money but should not attempt to capture risks associated with a plan's defined benefit obligation (paragraph BC 31)
- discount rates should be determined by reference to market yields at the balance sheet date (paragraph BC 33)
- the reference to market yields at the balance date does not mean that short-term discount rates should be used to discount long term obligations (paragraph BC 34), and
- the discount rate should reflect market yields (at the balance sheet date) on bonds with an expected term consistent with the expected term of the obligations (paragraph BC 34).

9.3.15 While the New Zealand Government is not required to comply with International Public Sector Accounting Standards (IPSASs), certain IPSASs do provide authoritative support for some items in the Government's financial statements. The IPSAS Board interpreted the discount rate to use when they recently issued IPSAS 25, their equivalent of NZ IAS 19. IPSAS 25 is based on the requirements of NZ IAS 19, modified where appropriate for the public sector. The IPSAS Board modified NZ IAS 19 by removing the reference to the corporate and government bond "rule" in paragraph 78 and replacing it with the principle that entities must apply a rate that reflects the time value of money. The IPSAS Board considered that entities should be left to determine the rate that best achieves that objective. This is consistent with the Treasury's view of the principle in NZ IAS 19.

9.3.16 The Australian Accounting Standards Board's equivalent of NZ IAS 19, AASB 119, includes a modification that requires not-for-profit public sector entities to discount post-employment benefit obligations using market yields on government stock.

9.3.17 Some commentators believe that, in the absence of a high quality corporate bond market it is not appropriate to look to the country's government bonds but to construct an artificial corporate bond yield curve by referencing a bond market in another country or currency and using a currency swap market. Treasury disagrees with this interpretation of NZ IAS 19 because the standard specifies a hierarchy to be applied in the domestic market. This alternative view is not compliant with the requirement that the currency of the bond must be consistent with the currency of the obligation.

9.3.18 NZ IAS 19 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 NZ IAS 19 does provide some principles below.

> ***NZ IAS 19 Actuarial Assumptions***
>
> *72 Actuarial assumptions shall be unbiased and mutually compatible.*
>
> *75 Actuarial assumptions are mutually compatible if they reflect the economic relationships between factors such as inflation, rates of salary increase, the return on plan assets and discount rates. For example, all assumptions which 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.*

9.3.19 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 assumption addressed by the methodology.

NZ IAS 39 Financial Instruments: Recognition and Measurement

9.3.20 The discounting requirements in NZ IAS 39 are specified below.

> ***NZ IAS 39 Application Guidance***
>
> ***No active market: valuation technique***
>
> *AG 79 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. Short-term receivables and payables with no stated interest rate may be measured at the original invoice amount if the effect of discounting is immaterial.*
>
> ***Inputs to valuation techniques***
>
> *AG 82 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 rate, such as LIBOR or a swap rate, as the benchmark rate. (Because a rate such as LIBOR 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.

9.3.21 Student loans, which are largely interest-free, are reported in the Government's accounts in accordance with NZ IAS 39. 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.

9.3.22 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 rate and adding an adjustment for credit risk.

9.3.23 NZ IAS 39, paragraph AG 82, provides some guidance and discussion on how a risk-free discount rate or "basic" rate might be derived. NZ IAS 39 states that the basic interest rates can usually be derived from observable government bond prices but offers some alternative yield curves for practical reasons. Treasury has concluded that New Zealand government bonds are the most representative risk-free rate in New Zealand. Therefore, the methodology outlined in this paper is applicable for determining the risk-free component of the Student Loan Scheme discount rate.

NZ IAS 37 Provisions, Contingent Liabilities and Contingent Assets

9.3.24 The discounting requirements in NZ IAS 37 are specified below.

NZ IAS 37 - Present value

45 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.

46 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.

47 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.

9.3.25 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 NZ IAS 37 are considered for completeness.

9.3.26 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 rate. This is normally easier than adjusting the discount rate for risk, which is complex and often requires significant amounts of judgment.

9.3.27 Therefore, Treasury believes that the methodology outlined in this paper is appropriate in determining a risk-free rate where it is required for valuing provisions under NZ IAS 37.

Qualitative Characteristics

9.3.28 As described above, the Treasury considers that the methodology outlined in this document provides an approach that complies with NZ IFRS 4, NZ IAS 19, NZ IAS 37 and NZ IAS 39. In addition, taking a single approach to this issue is the best application of the principle qualitative characteristics and therefore will result in the most fair presentation of financial information.

> *Extract of the New Zealand Framework for Financial Reporting*
>
> Paragraph 24
>
> Qualitative characteristics are the attributes that make the information provided in financial statements useful to users. The four principal qualitative characteristics are understandability, relevance, reliability and comparability.

9.3.29 Our methodology ensures that:

- there are not separate definitions and rates that are "risk-free". This increases the understandability and comparability of the information
- the use of market information, where it is available, ensures the relevance and reliability of the information, and
- relevance and reliability are not compromised because more than one rate purports to represent the same economic phenomenon.

9.4 Actuarial Standards

9.4.1 Actuaries apply financial and statistical techniques to value certain assets or liabilities for various purposes, including financial reporting under IFRS. 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.

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

General Insurance Business

9.4.3 NZSA Professional Standard No. 4 applies to General Insurance Business. The standard applies to every actuary preparing a report on the technical liabilities required for, or on the financial soundness of, a general insurance undertaking (eg, ACC). An extract of PS No.4 that is relevant to the methodology outlined in this paper is shown below.

> ***NZSA PS4 – General Insurance Business***
>
> *4.14 The risk-free rate of return, which is the rate of return on a portfolio of assets matched to the liabilities, must be the starting point for determining the appropriate discount rates. The Actuary should explain the reasons for adopting rates that differ from the risk-free rate.*

9.4.4 PS4 is entirely consistent with the NZ IFRS accounting standards, in that the starting position is the risk-free rate of return on a portfolio of assets matched to the liabilities. However, NZSA PS4 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).

9.4.5 The International Association of Actuaries (IAA) has also issued Professional Standard 300 *Actuarial Reports and Advice on General Insurance Technical Liabilities* (PS300). The relevant paragraphs are extracted below:

> **IAA PS300 – General Insurance Business**
>
> *8.2.2 Legislative and/or regulatory requirements may prescribe whether Claim Payments are to be discounted. The Member must consider the purpose of the valuation and document whether the future Claim Payments are to be discounted. Discount rates used must be based on the redemption yields of a Replicating Portfolio as at the valuation date, or the most recent date before the valuation date for which such rates are available.*
>
> *8.2.3 If the projected payment profile of the future Claim Payments cannot be replicated (for example, for Classes of Business with extended runoff periods), then discount rates consistent with the intention of Paragraph 8.2.2 must be used.*

9.4.6 'Replicating Portfolio' means a notional portfolio of current, observable, market-based, fixed-interest investments of highest rating, which has the same payment profile (including currency and term) as the relevant claim liability being valued.

9.4.7 To be consistent with paragraph 8.2.2 of IAA PS300, actuaries must consider if the purpose of the valuation is an accounting valuation for financial reporting and if so look to comply with accounting standards. As discussed above, the accounting standards require that the discount rate is the risk-free one.

Superannuation Schemes

9.4.8 NZSA Professional Standard No.2 applies to actuarial reporting of superannuation schemes but has no specific guidance on discount rates.

9.5 Technical Papers from International Bodies

International Association of Actuaries Technical Papers

9.5.1 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.

9.5.2 One such paper is the IAA's *Measurement of Liabilities for Insurance Contracts: Current Estimates and Risk Margins*. This paper is fairly extensive and discusses some topics that are relevant to the methodology outlined in this paper. We have used this paper 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.

9.5.3 The IAA's insurance contract paper discusses the components of a risk-free rate. It states that the risk-free rate is made up of:

- real interest rate
- plus inflation
- plus sovereign provision (country credit risk)
- minus other elements, including extreme market risk aversion and cost of safe keeping.

9.5.4 The IAA's paper states that there are a number of different sources for risk-free rates, including:

- government stock rates
- government stock rates plus an adjustment
- corporate bond rates minus an adjustment
- SWAP rates minus an adjustment, and
- SWAP rates.

9.5.5 In developing the methodology, we have discussed some of the IAA's options, while simultaneously ensuring that the methodology is compliant with the accounting standards. While NZ IFRS 4 states an example of one source (eg, typically government bonds are an appropriate starting point in determining a risk-free rate), this IAA paper introduces other sources for determining risk-free rates. In our view the IAA is recognising that different jurisdictions will have different sources of risk-free rates and the reliability of these rates may vary across those jurisdictions.

9.5.6 The IAA paper then goes on to detail the various adjustments that can be made in each of these cases. The most relevant in relation to the Treasury's methodology are the adjustments to government stock rates required due to:

- short supply at the long end of the yield curve, and
- the ability of government stock to be used as general collateral or repurchase (repo) transactions, which allows the holder to earn an extra premium and will lower market yields.

9.5.7 Although the accounting standards do not deal with market shortcomings, the IAA paper is authoritative technical support for adjusting New Zealand's observed government stock rates in certain cases. In the development of the methodology we have included indications of what cases may warrant such an adjustment.

9.5.8 The IAA's paper states that the simplest approach to extending the yield curve is by using the last available rate. This paper has largely been superseded by the Committee of European Insurance and Occupational Pensions Supervisors (CEIOPS) papers which have a more developed discussion of the issues.

The Committee of European Insurance and Occupational Pensions Supervisors

9.5.9 CEIOPS 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 CEIOPS views carry considerable weight and can be regarded as authoritative.

9.5.10 CEIOPS published in November 2009 *Advice for Level 2 Implementing Measures on Solvency II: Technical Provisions – Article 86 b – Risk-free interest rate term structure* that is of interest to the Treasury in developing our methodology. While we are interested in the principles of this technical paper, we are conscious that it is focused only on the European Union. The conclusions of this paper may not always be automatically transferable to different jurisdictions like Australia and New Zealand. Papers such as CEIOPS have no formal status for New Zealand actuaries. However, for any issue that is not covered by New Zealand actuarial standards it is generally good practice to get support for any principles, methodology or assumptions used from overseas guidance or research so long as it is appropriate to New Zealand.

9.5.11 The CEIOPS paper discusses many of the same issues as the IAA's paper. However, it introduces some other concepts that have been used as technical support for the methodology. These concepts include: criteria for a robust risk-free rate, the three-stage process and long maturities. These three topics are summarised below.

Criteria for a robust risk-free rate

9.5.12 The CEIOPS paper, in paragraph 3.3, states that the criteria for a robust risk-free rate include:

a) no credit risk

b) realism – it should be possible to actually earn these rates

c) reliability of method to determine term structure

d) high liquidity of reference stock

e) no technical biases

f) availability for all relevant currencies, and

g) proportionality – there exists a process to centrally determine rates for entities too small to do it themselves.

9.5.13 The criteria a) to e) are all relevant to New Zealand and helpful in guiding our methodology. Criteria f) is not important to us and criterion g) may or may not be relevant but will be satisfied nonetheless by the publication of this paper and regular publication of rates.

The three stage process

9.5.14 The CEIOPS paper also introduces a three stage process to determining risk-free discount rates as follows:

1 If government stocks are available that meet the criteria then use them.

2 If government stock are available but do not meet the criteria, then they should be adjusted for their deficiencies.

3 Failing 1 and 2, other instruments should be used but adjusted for credit risk.

9.5.15 This three stage approach is consistent with the methodology adopted, in that government stock rates broadly meet the criteria but there are times when it is appropriate to adjust government bond rates to cope with market shortcomings such as illiquid tranches of government stock.

Long maturities

9.5.16 The CEIOPS paper is one of the few to develop principles for determining appropriate extrapolation techniques for the interest rate curve of long maturities. It states extrapolation should take account of:

- realism, ie, it should be possible to earn this return in a risk-free manner, and
- volatility in long term discount rates can lead to substantial changes in values of liabilities and consequent pro-cyclical effects. The choice of extrapolation method should take account of the effect on financial stability.

9.5.17 Treasury agrees with these principles and they have been reflected in our methodology. Extrapolation is of crucial importance for our long-term insurance and pension obligations (ACC and GSF) where slight differences in the extrapolated part of the yield curve may lead to significant differences in the valuation. We have applied the principle that the ultimate extrapolated long-term forward rate should be stable over time and only change due to fundamental changes in long term expectations.

9.5.18 The CEIOPS taskforce in March 2010 issued another paper the main purpose of which was to update the previous November 2009 paper by specifically discussing the liquidity premium for both assets and liabilities. However other purposes included an update on extrapolation methods and the choice of basic risk-free interest rate curve.

9.5.19 On the matter of the basic risk-free rate structure the CEOIPS March 2010 *Task Force Report on the Liquidity Premium* reached the opposite conclusion to the previous paper for the starting point for risk-free rates. They have now advised the risk-free rate should be bank SWAP rates adjusted downwards for credit risk.

9.5.20 The Treasury believes that the CEIOPS latest view on the starting point for risk-free rates is conceptually inferior for valuing ACC's insurance and GSF pension obligations and would not be practical to implement for the Government's financial reporting. In New Zealand markets it would be very difficult to reliably quantify the credit risk for the purpose of adjusting the basic SWAP rates by. The proposal also introduces a complexity for readers of the Government's accounts when it is widely accepted that New Zealand government bonds are a more reliable proxy of risk-free rates in New Zealand than bank SWAP rates.

9.5.21 The updated March 2010 CEIOPS paper also provided 11 principles for extrapolating the basic risk-free interest rate term structure building on the high level principles indentified in the March 2009 paper. Of particular interest for our methodology are the principles stated in No 3, 5, 6, 7 and 8 on page 25 of the Task Force's document (refer below). These support, in particular, the use of a fixed long-term rate.

> *Extract of CEIOPS Task Force Report on the Liquidity Premium*
> *http://www.ceiops.eu/content/view/724/1/*
>
> *Principles for extrapolating the basic risk-free interest rate term structure – Page 25*
>
> *#1. All relevant observed market data points should be used.*
>
> *#2. Extrapolated market data should be arbitrage-free.*
>
> *#3. Extrapolation should be theoretically and economically sound.*
>
> *#4. The extrapolated part of the basis risk free interest rate curve should be calculated and published by a central EU institution, based on transparent procedures and methodologies, with the same frequency and according to the same procedures as the non extrapolated part.*
>
> *#5. Extrapolation should be based on forward rates converging from one or a set of last observed liquid market data points to an unconditional ultimate long-term forward rate to be determined for each currency by macroeconomic methods.*
>
> *#6. The ultimate forward rate should be compatible with the criteria of realism as stated in CEIOPS advice on the risk free interest rate term structure and the principles used to determine the macro-economic long term forward rate should be explicitly communicated.*
>
> *#7. Criteria should be developed to determine the last observed liquid market data points which serve as entry point into the extrapolated part of the interest curve and for the pace of convergence of extrapolation with the unconditional ultimate long-term forward rate.*
>
> *#8. Extrapolated rates should follow a smooth path from the entry point to the unconditional ultimate long-term forward rate.*
>
> *#9. Techniques should be developed regarding the consideration to be given to observed market data points situated in the extrapolated part of the interest curve.*
>
> *#10. The calibration of the shock to the risk free interest rate term structure used for the calculation of the SCR should be reviewed in order to be compatible with the relative invariance of the unconditional ultimate long term forward rate.*
>
> *#11. Extrapolation should be arbitrage-free across different currencies, taking into account forward and spot foreign exchange rates observable in the financial markets.*

9.5.22 Principle 10 is not relevant because the CEIOPS paper's purpose is primarily relating to solvency calculations which include the impact of interest rate shocks.

9.5.23 Our methodology for extrapolating to the long-term has been developed on similar principles to those outlined by the CEIOPS Task Force in the March 2010 paper.

9.5.24 The main purpose of the Task Force's March 2010 paper was to consider the implication of including a liquidity premium in the risk-free rate for technical insurance valuations. The Task Force concluded that "the illiquidity of an insurance liability measures the extent up to which its cash flow are certain in amount and in timing, due consideration being given the resilience to forced sales". The Task Force believe most life insurance liabilities can be considered to be at least partially illiquid.

9.5.25 In the Treasury's opinion the settlement of our insurance liabilities is too uncertain to be regarded as illiquid. Therefore, for the purposes of the Government's financial reporting under NZ IFRS, we do not think it is appropriate to make a liquidity adjustment. This is currently a relatively new area of debate and may need to be reassessed as the international position is updated.

Australian Prudential Regulation Authority (APRA)

9.5.26 APRA has been following the European debates on discounting insurance obligations and the discussions of CEIOPS in developing insurance regulation in Australia. APRA has recently issued Discussion Paper - *Review of capital standards for general insurers and life insurers* on 13 May 2010. This recent paper has useful sections on both risk-free discount rates and liquidity premiums that reflect recent developments.

APRA – Review of capital standards for general insurance and life insurers

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."

Liquidity Premium

"The existence of a 'liquidity premium' in the valuation of assets is generally accepted by market participants. A liquid asset is believed to have a higher market value than an equivalent but illiquid asset with the same expected cash flows and credit risk.

In relation to liabilities, the argument has been made by some market participants and observers that if future cash flows from insurance obligations are illiquid, it may be appropriate to add to the risk-free rates an allowance for a liquidity premium. The argument is that if the future cash flows of an insurance liability are certain, then in theory an insurer could purchase a portfolio of relatively illiquid securities to exactly match the quantum and duration of the liabilities and wait until maturity to realise the value of those assets. As long as this portfolio of assets was free from credit risk and there was no chance that the assets would need to be realised early to meet the liability cash flows, then this portfolio might be considered risk-free.

APRA is following the international debate on liquidity premiums and the risk-free discount rate. APRA may consider allowing a liquidity premium adjustment to the risk-free rate for discounting lifetime annuities with no provision for voluntary termination, provided that APRA can arrive at a robust method for quantification of the liquidity premium. APRA considers that any general insurance or life insurance liabilities (other than annuities with no provision for voluntary termination) are unlikely to meet the certainty criterion required for allowance of a liquidity premium adjustment."

9.5.27 APRA's conclusion that, for the purposes of capital reporting, the risk-free rate should be a term structure derived from Government securities, and that a liquidity premium is unlikely to be justified. While APRA's conclusion is for regulatory purposes only, it is consistent with the Treasury's view on the subject of a suitable proxy and liquidity premium for reporting under NZ IFRS.

Other International Papers

9.5.28 Annex E of the first CEIOPS paper is a discussion of macroeconomic extrapolation methods that we believe is applicable in developing our methodology.

9.5.29 The Swedish and Norwegian markets are similar to New Zealand markets in that there are no government stocks beyond 10 years and no reliable information on SWAP rates beyond 15 years. 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*.

9.5.30 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, and
- which method should be used to interpolate between the last observable liquid rate and the fixed forward rate.

9.5.31 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.

9.5.32 The Treasury believes this is a useful reference and clearly articulates principles, adjustments required and the projection of yield curves. CEIOPS's 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, and
- 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.

9.5.33 The Dutch Actuarial Association and Actuarial Institute has issued Report in Principles for the Term Structure of Interest Rates (undated but approx 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.

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

- government stock 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 stocks may be higher than nominal stocks due to limited supply
- it may be appropriate to adjust for the liquidity of liabilities, and
- forward rates should be used, if spot rates are used this should be justified.

9.5.35 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.

9.5.36 The Institute of Actuaries (UK) has recently commissioned some research into discount rates and this work should be completed soon. However this work will be unable to be considered in time for determining the Treasury's methodology.

9.6 Other New Zealand Technical Papers

The Treasury

9.6.1 In August 2009 the Treasury prepared a paper *Discount Rates for the Calculation of the Retirement Plan Liability of the Crown for the Government Superannuation Fund.* This was the start of a process to bring the ACC and GSF risk-free rate assumptions onto a consistent basis. That paper was designed specifically to meet the 2009 financial reporting requirements under NZ IFRS. The Treasury's intention at that time was to undertake a project to develop principles and a methodology to determine consistent risk-free rates to be used in the Government's financial statements in 2010 and beyond. This paper and methodology is the outcome of the Treasury's project identified last year.

The Commerce Commission's Approach to Estimating the Cost of Capital, June 2009

9.6.2 This paper uses a risk-free rate as the basis for building up a cost of capital and concludes that government stock is the appropriate starting point. It provides some useful discussion on proxies for the risk-free rate.

> *"112. In practice, the risk-free rate cannot be observed; it is usually proxied by the return on a very safe asset. When selecting the risk-free rate, the first step is to identify a suitable proxy. A related second issue involves choosing how to deal with the statistical properties — mean reversion and interest rate volatility — of certain proxies. Depending on the proxy chosen, the third step is to decide whether spot rates or yields to maturity should be used. The final step is to determine the appropriate maturity of the rate."*

Appendix 1 Reliance and Limitations

This report has been prepared by the Treasury with the assistance of their professional advisors PricewaterhouseCoopers (in accordance with the terms of a contract dated 18 May 2010) for the purposes of specifying a methodology for determining risk-free discount rates and CPI assumptions for valuations for the purposes of financial reporting in the Government's Financial Statements.

PricewaterhouseCoopers' responsibilities and liabilities are limited to the Treasury and exist only in the context of their use of this report for the purposes set out above.

No liability or responsibility will be accepted by the Treasury or PricewaterhouseCoopers in relation to the use of this report for any other purpose. We will not accept any liability or responsibility to any third party recipients.

The sources of information we have relied on are set out in our report. Accordingly, we express no opinion on the total reliability, accuracy or completeness of the information provided to us and upon which we have relied. We have no reason to believe that the information provided to us is inaccurate or misleading.

This report must be read in its entirety. Individual sections of this report could be misleading if considered in isolation from each other.

Appendix 2 Forward Rate Yield Curve Fitting Methodology

The purpose of this appendix is to describe the process of converting quoted government stock yields to a smoothed forward rate yield curve to be used as a basis for the short-term risk-free rates.

Short-Term Interest Rates

The available sources of information are the Overnight Cash Rate (OCR) and Treasury Bills.

Construction of zero Coupon Portfolio

Government stocks are decomposed into maturity and individual coupon payments to produce a set of equivalent zero coupon stocks maturing on the 15th of the month.

Bootstrapping

Starting at the short end of the yield curve a forward rate is determined for the shortest stock, equal to the spot rate for the whole period up until the first stock matures. For the period between the first stock and the second stock a forward rate is determined so that the second stock market value is equaled using the previous forward rate as well. The forward rates are applied to the deconstructed cash flows already determined. This process is repeated solving for each successive forward rate until all stocks have been valued.

Curve Fitting and Interpolation

The fitting process will ideally be able to allow for anomalous prices for a particular stock. This is most likely to occur for a stock with less available on the market.

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

This process is equivalent to weighting the yields by 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). This means that implied forward rates automatically give less weight to those stocks that is less market information.

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 anywhere there are gaps between maturities.

Appendix 3 Sample Table of Rates

Below is a sample of assumptions as at 31 May based on the Treasury methodology described in this paper.

Table based on market rates at 31 May 2010

This table is duration based and is to be used for valuations as at 31 May 2010.

Year	CPI 31 March year	Forward Rate	Spot Rate
1	5.9% *	3.44%	3.44%
2	2.4%	4.69%	4.06%
3	2.4%	5.35%	4.49%
4	2.5%	5.82%	4.82%
5	2.5%	6.14%	5.08%
6	2.5%	6.33%	5.29%
7	2.5%	6.38%	5.44%
8	2.5%	6.38%	5.56%
9	2.5%	6.38%	5.65%
10	2.5%	6.38%	5.72%
11	2.5%	6.38%	5.78%
12	2.5%	6.34%	5.83%
13	2.5%	6.26%	5.86%
14	2.5%	6.19%	5.89%
15	2.5%	6.11%	5.90%
16	2.5%	6.03%	5.91%
17	2.5%	6.00%	5.91%
18	2.5%	6.00%	5.92%
19	2.5%	6.00%	5.92%
20	2.5%	6.00%	5.93%
20 plus	2.5%	6.00%	

* Note CPI includes 2.0% due to GST increase from 12.5% to 15%.

Table of forecast June 2010 rates based on market rates at 31 May 2010

This table is to be used for forecast valuations as at 30 June 2010 that used 30 June year cash flows.

June Valuation Year (year ending 30 June)	CPI 31 March year	Forward rate	Spot Rate
2011	5.9% *	3.58%	3.58%
2012	2.4%	4.76%	4.17%
2013	2.4%	5.39%	4.57%
2014	2.5%	5.85%	4.89%
2015	2.5%	6.16%	5.14%
2016	2.5%	6.34%	5.34%
2017	2.5%	6.38%	5.49%
2018	2.5%	6.38%	5.60%
2019	2.5%	6.38%	5.69%
2020	2.5%	6.38%	5.76%
2021	2.5%	6.38%	5.81%
2022	2.5%	6.33%	5.86%
2023	2.5%	6.26%	5.89%
2024	2.5%	6.18%	5.91%
2025	2.5%	6.10%	5.92%
2026	2.5%	6.03%	5.93%
2027	2.5%	6.00%	5.93%
2028	2.5%	6.00%	5.94%
2029	2.5%	6.00%	5.94%
2030	2.5%	6.00%	5.94%
2030 plus	2.5%	6.00%	

Note this table is intended to represent the market's current view of interest rates for June years, consequently the rates shift by one month, ie, the first year above is derived from rates for months 2 to 13, the second year from months 14 to 25, etc.

* Note CPI includes 2.0% due to GST increase from 12.5% to 15%.

The resulting fitted rates are plotted below. Note that while the forward rates look somewhat artificial the spot rates that they generate look reasonable and are smooth.