RESERVE BANK
OF NEW ZEALAND
TE PŪTEA MATUA

CAPITAL REVIEW

Regulatory Impact Assessment and Cost-Benefit Analysis 2019

Contents

Adequacy Assessment

This Regulatory Impact Assessment (RIA) provides an analysis of the options considered during the Capital Review. This RIA consists of two parts:

- Part One covers the problem definition, options, and impact analysis, as well as covering implementation, monitoring, evaluation, and review.
- Part Two is a detailed assessment of the quantified and unquantified costs and benefits of the final set of decisions contained Part One.

The RIA has been prepared by the Reserve Bank in accordance with the requirements of section 162AB of the Reserve Bank of New Zealand Act 1989 (the Act).

This Assessment provides a qualitative assessment of all decisions, and a quantitative assessment where this is possible. This type of analysis has a number of limitations, including a range of assumptions that need to be made. The RIA provides an assessment of the key sensitivities and the impact that varying the assumptions would have on the overall conclusions about costs and benefits of the decisions.

Transition period

The decisions described in this Assessment will be phased in over a seven year period.

Consultation

Public consultations have taken place throughout the Capital Review. In particular, the Reserve Bank has issued four papers for public consultation, with papers 2, 3 and 4 resulting in in-principle decisions for the Review:

- *Issues Paper: Review of the capital adequacy framework for domestically incorporated banks.* Published on 1 May 2017.
- *Review Paper 2: What should qualify as bank capital? Issues and options.* Published on 14 July 2017.
- *Review Paper 3: The calculation of risk-weighted assets.* Published on 19 December 2017.
- *Review Paper 4: How much capital is enough?* Published on 14 December 2018.

For each paper the Reserve Bank sought submissions and published a response to these submissions. The summary of submissions for *Review Paper* 4 has been published on the Reserve Bank's website, and the response will be published at a later date. The responses have included an assessment of the points raised in the submissions, as well as any consequent revisions to decisions in the Review.[1]

Quality Assurance processes

This paper has been subject to a high level of scrutiny.

The analytical framework used throughout the RIA, including the CBA in Part Two, is the same one that was described in *Review Paper 4,* published in December 2018, and described in more detail in the April 2019 Background Paper published by the Reserve Bank called *An Outline of the Analysis Supporting the Risk Appetite Framework.* Adjustments

[1] A complete list of all the consultation papers as well as responses to submissions and other material released during the Capital Review is available here: https://www.rbnz.govt.nz/regulation-and-supervision/banks/consultations-and-policy-initiatives/active-policy-development/review-of-the-capital-adequacy-framework-registered-banks

have been made to the framework to incorporate feedback since those documents were published.

The inputs into the cost-benefit analysis included in the RIA have been reviewed by three External Experts in their review of the Reserve Banks's analysis underpinning the Capital Review in August 2019.[2]

In addition, Dr John Yeabsley, Senior Fellow at the New Zealand Institute of Economic Research, acted as an external source to test ideas and concepts in the final stages of developing the RIA. Dr Yeabsley's role was to test and assess the approach taken to the RIA to ensure that it provided a balanced and comprehensive assessment of the costs and benefits of the Capital Review. Dr Yeabsley provided the following text for inclusion in this section of the RIA:

> "I have completed my brief for the Capital Review. My assessment is that the RIA has been carried out in a comprehensive and transparent way, covered the key information required to inform decisions, as well as covering the risks and sensitivities in depth. The final documents are consistent with best practice for completing regulatory analysis."

[2] Copies of the Final Reports of the three External Experts are available here: https://www.rbnz.govt.nz/regulation-and-supervision/banks/consultations-and-policy-initiatives/active-policy-development/review-of-the-capital-adequacy-framework-registered-banks

Capital Review Decisions

Capital Ratio

- Tier 1 capital requirement (including Prudential Capital Buffer):
  - 16% of RWA for systemically important banks (D-SIBs)
  - 14% of RWA for non-systemically important banks (Non-D-SIBs)
  - Of which 2.5% can be made up of Additional Tier 1 capital (AT1)
- Prudential Capital Buffer (PCB) composition:
  - Total Prudential Capital Buffer of 9% of RWA (CET1 buffer)
  - Of which, 2% will consist of D-SIB buffer (applied to banks deemed to be systemically important)
  - Of which, 1.5% will be an early-set countercyclical capital buffer (CCyB)
  - Of which, 5.5% will consist of a conservation buffer
- Keep Tier 2 capital, which can comprise 2% of the minimum total capital ratio
- Adopt a minimum total capital ratio requirement of 9%
- Total capital requirement (including PCB):
  - 18% of RWA for systemically important banks (D-SIBs)
  - 16% of RWA for non-systemically important banks (Non-D-SIBs)
- Allow for a seven year transition period
- Omit a leverage ratio

Denominator

- Increase RWA outcomes for IRB banks to approximately 90% of what would be calculated under the standardised approach:
  - Apply an 85% output floor for credit risk RWA of IRB banks
  - Increase scalar applied to credit risk RWA of IRB banks from 1.06 to 1.2
- Dual reporting requirement for IRB banks
- Apply standardised approach for sovereign and bank exposures of IRB banks
- Only allow Standardised Measurement Approach for operational risk modelling (consult in due course)
- Retain the current market risk capital framework and current standardised approach

Numerator

- Remove contractual contingency from the definition of capital
- Accept redeemable perpetual preference shares as AT1 capital (with suitable protections in the contract terms)
- Accept long-term subordinated debt as Tier 2 capital

Executive Summary

The outcome of the Capital Review is that banks will need to get more of their funding from shareholders …

The Reserve Bank is required, under the Reserve Bank of New Zealand Act, to promote the maintenance of a sound and efficient financial system, and to avoid the significant damage to the financial system that could result from the failure of a bank. The focus of the Capital Review is to ensure that bank capital requirements support a sound and efficient financial system.

Banks get their funding from two places – their owners (often referred to as 'shareholders') and people they borrow from, including depositors (often referred to as 'creditors'). The funding that banks get from shareholders is referred to as 'capital'. Banks in New Zealand, like banks around the world, are required to have minimum levels of capital. This means that a minimum percentage of all a bank's funding must come from shareholders.

When a bank loses money, it is the shareholder's investment in the business (the bank's capital) that is lost first, not the money the bank borrowed.

… to address the problems created by the risk of bank failure

The central problem addressed in the Capital Review is the risk that bank failure poses to New Zealand. The viability of a bank in the face of significant losses is ultimately driven by its solvency; how much shareholder funds (capital) exist to absorb losses. If a bank suffers significant losses and its viability is put into question, it can lose market confidence, be unable to access capital markets, and struggle to meet its debt obligations. Ultimately, the bank would be unable to perform basic banking operations for customers (such as writing loans, extending credit lines, and providing liquidity for demand deposits). In such circumstances, the bank is unable to do business and is deemed to have failed. Capital serves as a buffer against a bank's unexpected losses, thereby reducing the likelihood of the bank becoming insolvent and its chances of failing.

Bank failures have negative impacts on society and the wider economy that far exceed the direct effects of the initial losses of the failed bank. The failure of a major bank would have the immediate effect of reducing the availability of credit in the economy, limiting customers' access to liquidity (and thereby potentially causing businesses to collapse and jobs to be lost), and potentially putting other banks into difficulty, leading to a system-wide crisis.

Such crises have wide-ranging and long-lasting effects on the real economy. As access to bank credit becomes restricted, businesses would be less able to invest and consumption by households would be affected, with unemployment likely to rise. This would be expected to lead to significant, long-lasting impacts on overall output and therefore incomes, that last for years following a crisis. In addition to the cost of lost output and lower incomes, wider social effects can include adverse impacts on health, mental wellbeing, and social cohesion.

Higher capital requirements do come at a cost

Higher capital requirements result in shareholders contributing more towards bank funding. Shareholders generally expect a higher return than depositors. This is because if a bank suffers unexpected losses it is the shareholders that lose their money first, not the people who have lent money to banks (depositors). This means risk is higher for shareholders than depositors so shareholders expect to be compensated with a higher rate of return.

At a very simple level, as shareholder funding (equity) has a higher required return, it 'costs' more for banks, compared with, say, debt funding. So higher requirements can result in higher lending rates, and possibly lower deposit rates, adversely impacting economic output. These costs from higher capital requirements need to be weighed against the benefits of higher solvency in the banking system.

However, these trade-offs are not that simple. There are factors pushing against banks passing on cost increases. Banks are less able to pass on costs when there is active competition (and/or new entrants are emerging). Also, when a bank is better capitalised the lower volatility of shareholder returns has an offsetting effect on the rate of return required by shareholders, and by creditors.

The Capital Review has set the risk tolerance at a level equivalent to approximately a 1-in-200 year chance of a financial crisis – this will increase the soundness of the financial system

If banks in New Zealand fail, some of us might lose money and some of us might lose jobs. There would also be indirect costs on all of society that may be harder to see: the impact on the well-being of New Zealanders. In the end, we would all bear the cost of bank failures, in one way or another. This is why we want to make the chances of this happening very small.

The changes will require banks to have a total capital ratio of 16 percent to 18 percent, supported by changes to the definition of capital and the way risk-weighted assets are calculated

The changes materially increase the required amount of high quality capital that banks will need to have. In practice, actual changes to the amount that they have will be less than implied by regulatory requirements (as banks hold more than current minimum requirements already) and will vary, however the overall increase in bank capital levels will be material.

Institution-specific increases will depend on their current levels of capital, how much extra they choose to have above the required minimum, and whether they are a large or small bank.

The benefits of the changes exceed the costs …

Not all the benefits and costs are easily measurable. But where it is possible, this Regulatory Impact Assessment provides estimates of the costs and benefits that can be quantified. In the 'base case' these benefits are estimated to exceed the costs, providing a net benefit equivalent to a little over 0.4 percent of annual GDP.

In addition, the Reserve Bank considers that the unquantified benefits (including from the impacts of a more stable economic environment on the wellbeing of New Zealanders) are very likely to exceed the unquantified costs (such as less access to credit for riskier customers). As such, the Reserve Bank considers that the unquantified impacts add to the case for the proposals.

Executive Summary Table 1: Quantified costs and benefits

High-level issue/inputs	Impact	Cost / Benefit	Channel	Estimated impact (as % of potential GDP)
Expected GDP	Lower probability of banking failure increases expected GDP	Benefit	Higher capital lowers a banks probability of failure, reducing the likelihood of a crisis	+0.83
	Lower expected GDP due to higher interest rates	Cost	Higher interest rates lowers investment in capital and ultimately lowers long-term GDP.	-0.205
	Net impact: expected GDP			**+0.63**
Transfer of Wealth	Transfer of wealth from New Zealand bank customers to foreign bank owners	Cost	Bank owners will want a higher nominal profit to compensate for the larger equity base. This will result in higher interest rates on customers, paid to foreign bank owners	-0.27
	Higher tax intake from wealth flows that would otherwise have gone to foreign bank owners	Benefit Indirect	As bank owners will want higher profits, they will face higher taxes, partially offsetting the transfer of wealth from NZ bank customers to foreign bank owners.	+0.08
	Net impact: transfer of wealth			**-0.20**
Net impact (impact on expected GDP + impact on transfer of wealth)				**+0.43**

Note: numbers may not add due to rounding.

There is a significant degree of uncertainty around the estimates of cost and benefits in this RIA. The most important of these are:

- The size of the impact that a banking crisis would have on the economy.
- The reduction in the likelihood of a banking crisis that arises from higher capital.
- The impact of higher capital requirements on interest rates, and the ultimate flow-on effect of these higher interest rates to economic output.

The RIA has involved a careful weighing of all of these factors. It is possible to generate scenarios that would see more costs than benefits. However, the Reserve Bank considers the ‘base case’ to represent the most credible and likely set of assumptions and inputs for key components of the estimates of costs and benefits. In particular, while larger interest

rate increases are possible, such increases would not be consistent with the fundamental economic drivers of interest rates.

The benefits are estimated to exceed the costs in the vast bulk of the possible combinations of the key inputs

To test the sensitivity of the estimated net benefits to alternative inputs for the key assumptions, the RIA models the estimated costs and benefits under a range of different inputs. This analysis shows that in around 85 percent of these combinations the benefits exceed the costs.

The quantified net benefits are also higher for a capital ratio of 16 percent (1-in-200 years) than for a 13 percent ratio, which corresponds to approximately a 1-in-100 year risk of a crisis.

Executive Summary Table 2: Impacts of alternative ratios

	Tier 1 capital ratio of 13%	Tier 1 capital ratio of 16%
Impacts on expected GDP		
Quantified benefits	+0.50%	+0.83%
Quantified costs	-0.10%	-0.205%
Net impact: expected GDP	0.40%	+0.63%
Impacts on wealth transfers		
Quantified benefits	+0.04%	+0.08%
Quantified costs	-0.15%	-0.27%
Net impact: wealth transfer	-0.11%	-0.19%
Overall annual net benefit (as % of GDP)	+0.29%	+0.43%

Changes will be subject to careful monitoring and review over time

Each year the Reserve Bank will publish an assessment entitled “Capital Requirements: Annual Implementation Update”. This assessment will be published by the end of November each year. An annual review will be provided to the Minister of Finance, and the Reserve Bank Board, and published on the Reserve Bank’s website.

The first of these annual reviews is scheduled for November 2021. The final review will be published once the transition period for all the changes has ended.

Part One: Problems, options, and impacts

Section 1: Background

Minimum capital requirements help promote the maintenance of a sound and efficient financial system

The Reserve Bank is responsible for the prudential regulation of banks in New Zealand. Setting minimum capital requirements is a key element of this prudential framework. The framework for the supervision of registered banks in New Zealand is governed by Part 5 of the Reserve Bank of New Zealand Act 1989. Section 68 of the Act requires the Reserve Bank to exercise the powers conferred on it for the purposes of:

- Promoting the maintenance of a sound and efficient financial system; or
- Avoiding significant damage to the financial system that could arise from the failure of a registered bank.

In achieving these purposes the Reserve Bank sets a number of prudential requirements. New Zealand registered banks are required to maintain minimum levels of capital in relation to the risks of their businesses.

Capital requirements promote the maintenance of a sound financial system and, by reducing the probability or extent of bank failures, also protect the wider economy from the costs that can arise from the failure of financial institutions. Capital requirements also help ensure that the banking system can continue to supply credit to the economy in times of economic stress, thereby reducing the negative feedback loops that can occur between financial losses to banks and the real economy.

The Reserve Bank started a review of bank capital in 2017

In May 2017, the Reserve Bank published an *Issues Paper* setting out the areas of the capital adequacy framework that the Reserve Bank intended to address in the Capital Review. This included a set of principles for the Capital Review (outlined in Section 4), and that the Review would focus on the following components of the current framework:

- The definition of eligible capital instruments.
- The measurement of risk.
- The minimum capital ratios and buffers.

The *Issues Paper* invited stakeholders to provide initial feedback on the intended scope of the Review, and issues that might warrant particular attention. Throughout 2017 and 2018 the following subsequent consultation papers were issued:

- *Review Paper 2: What should qualify as bank capital? Issues and options.*
- *Review Paper 3: The calculation of risk-weighted assets.*
- *Review Paper 4: How much capital is enough?*

Review Papers 2, 3 and 4 included in-principle decisions and sought feedback from stakeholders about the topics covered in the papers. Feedback from consultations on specific parts of the Reserve Bank's proposals are discussed in more detail in the following sections of Part One of this RIA.

Section 2: *Status Quo*

Regulatory capital requirements set levels of capital to absorb losses that could arise in a plausible range of unexpected events

The capital adequacy framework for locally incorporated registered banks is set out mainly in documents BS2A and BS2B of the Reserve Bank's Banking Supervision Handbook. The framework is based on an international set of standards produced by the Basel Committee on Banking Supervision. Regulations in New Zealand have been modified from the Basel Committee standards in places for New Zealand-specific circumstances.

New Zealand's regulatory framework imposes capital ratio requirements on banks as a Condition of Registration. These are ratios of eligible capital to loans and other exposures. Exposures are adjusted (risk-weighted) so that more capital is required to meet the minimum requirement if the bank has riskier exposures.

$$Capital\ Ratio = \frac{Capital\ Amount}{Risk\ weighted\ assets}$$

Capital can take a number of different forms in New Zealand's current regulatory framework. Table 1 outlines these forms of capital.

Tier 1 capital is sometimes called 'going-concern' capital. If a bank makes a loss, depositors and other senior creditors can continue to be paid if the bank has sufficient going-concern capital (and liquidity) available to it. When the loss occurs, the value of the bank's going-concern capital absorbs the loss and falls in value. When a bank makes a profit, any remaining value after dividends increases the value of the bank's going-concern capital.

Tier 2 capital consists primarily of long-term subordinated debt and is sometimes called 'gone-concern' capital. Unlike going-concern capital, gone-concern capital will typically only absorb losses once the bank is close to insolvency (i.e., there is no value in Tier 1 capital left to absorb losses) and is being resolved.

Table 1: Types of Capital in the current framework

Type of capital	Features
Tier 1 Capital = CET1 + AT1	
Common Equity Tier 1 capital (CET1)	
Ordinary undated shares	• Remain on issue until the company is wound up or the shares cancelled. • There is no 'expiry' date and holders can only exit their investment by finding someone to sell the share to. • Value determined by face value plus any excess paid of the shares on issue. • Loss absorbing on a going-concern basis – holders only receive what is left after other expenses and creditors have been paid. • Considered to be the highest quality capital.
Retained earnings and certain reserves	• Non-distributed profits are known as 'retained earnings' and accumulated retained earnings are known as 'reserves'. • May be earmarked for future purposes or simply serve as an extra buffer.

	• Less stable than ordinary shares as it can reflect scale and timing of past and future payments and receipts. • Loss absorbing on a going-concern basis.
Additional Tier 1 capital (AT1)	
Some perpetual preference shares	• No maturity date. • Discretionary dividends and optional redemption. • Callable date of no less than five years. • In the current regime these must convert to ordinary shares when contingency is triggered. • Provides investors with a contractual stream of income with priority over other shareholders. • Have priority in insolvency over ordinary shareholders. • Loss absorbing on a going-concern basis.
Subordinated perpetual debt	• No maturity date. • In the current regime the debt ceases to be owed by the bank when a 'trigger point' of either common equity falling to 5.125 percent of risk-weighted exposures, or the bank being deemed non-viable. • Removal of debt automatically triggered by a defined event. • Investors can be compensated for debt write-off by receiving newly issued shares ('conversion') at the trigger point. • Loss absorbing on a going-concern basis.
Tier 2 capital	
Long-dated, fixed term debt	• Subordinated debt that has a set maturity (cannot be less than 5 years). • In the current regime the debt writes off when the bank is considered non-viable (may convert to ordinary shares). • Can only absorb losses once a bank has entered financial difficulty. • Considered lower quality than Tier 1.

The denominator in the specification of the capital ratio is calculated either through a standardised methodology or through the banks' own internal modelling (for approved banks only)

Banks must have capital to manage three specific types of risk:

- Credit risk: the risk of losses that result from a borrower not making their loan repayments.
- Operational risk: the risk of loss resulting from failure of internal processes, people or systems within a bank.
- Market risk: the risk of losses in on-and off-balance sheet positions that arise from adverse movements in market prices.

Banks can use 'standardised' methods to calculate risk-weighted exposures ('the Standardised approach'). These are risk weights specified by the Reserve Bank in the

capital standards.[3] This is the default setting, and risk-weighted assets (RWA) are calculated according to a set list of broad categories of loans and risk weightings that are applied mechanically.

Banks may, however, use their own internal models to calculate RWA for credit and operational risk (the 'IRB approach' and 'Advanced Measurement Approach' respectively).[4] The internal models approaches are only available to those banks who have been accredited by the Reserve Bank, and these banks must follow the framework set by the Reserve Bank.[5] In addition, to retain their accreditation status they must comply with a number of on-going accreditation requirements (for instance the banks are required to regularly validate existing models and seek Reserve Bank approval for changes to their models or estimates).

At present four banks (ANZ, ASB, BNZ, and Westpac) are accredited to use internal models. All other banks use the Standardised approach. Because the four largest banks have large market shares, credit risk weights calculated using the internal models approach account for approximately 90 percent of banking sector exposures in New Zealand.

The internal models approaches allow banks to align their capital requirement more closely with their individual risk profile. For credit risk, this means that the capital requirement for each category of asset is calculated with reference to the bank's own internal modelling and determination of factors that drive the risk profile of that asset (to a standard acceptable to the Reserve Bank).

The capital adequacy framework imposes ratio requirements for the entire banking group

The current capital adequacy framework imposes minimum capital ratio requirements, as well as an additional 'conservation' Common Equity Tier 1 ('CET1') ratio requirement. Table 2 outlines these 'ratio' requirements.

Table 2: Current capital ratios requirements (as percent of RWAs)

Ratio	Total capital requirements	Amount that must be met with Common Equity	Amount that can be met with Additional Tier 1 capital	Tier 1 capital requirements	Amount that can be met with Tier 2 capital
Minimum ratio	8.0	4.5	1.5	4.5+1.5 = 6.0	2.0
Conservation buffer	2.5	2.5	0	2.5+0.0 = 2.5	0.0
Total requirement	***10.5***	***7.0***	***1.5***	***7.0+1.5 = 8.5***	***2.0***

[3] Reserve Bank of New Zealand Capital Adequacy Framework (Standardised Approach) BS2A.
[4] The internal models approach was established by the Basel Committee on Banking Supervision in 2006 as part of international changes introduced in the Basel II reforms. The approach was expected to create incentives for banks to improve the sophistication and quality of their risk management systems and processes. The enhanced risk sensitivity could also lead to a more efficient alignment of banks' regulatory capital requirements with their underlying risk portfolios.
[5] Reserve Bank of New Zealand Capital Adequacy Framework (Internal Models based Approach) BS2B.

While the conservation buffer is intended to provide a mechanism that can be drawn down in times of stress, if a bank's capital ratio falls into the conservation buffer it is subject to restrictions on its distributions to shareholders as dividends and share buy-backs as shown in Table 3.

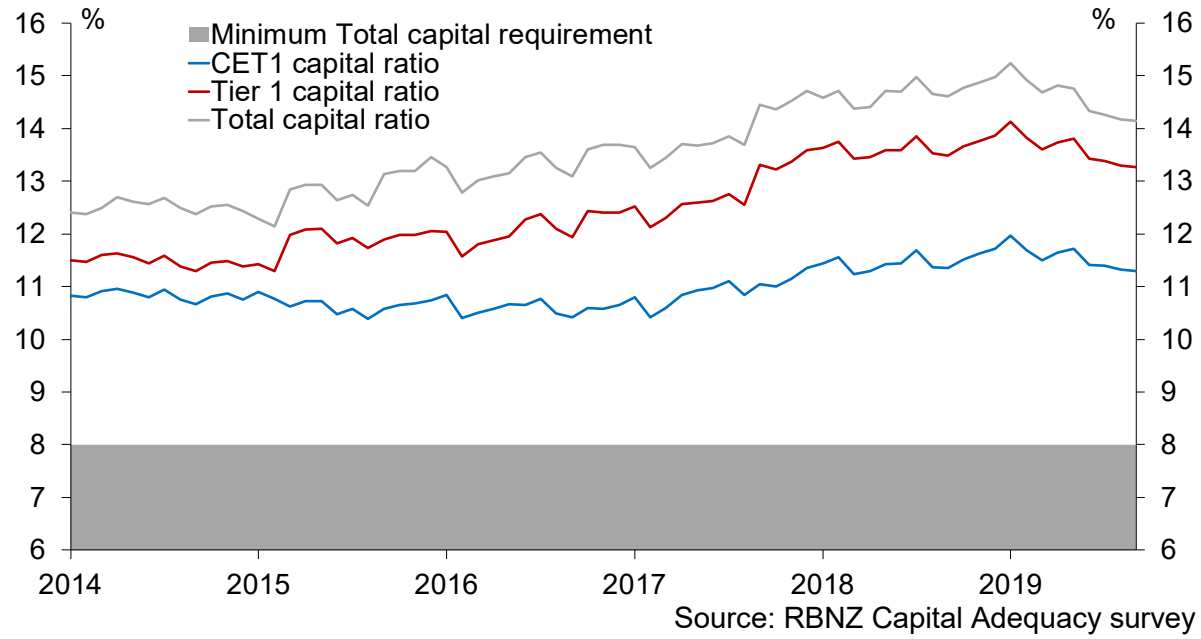
Table 3: Current buffer ratio restrictions

Buffer ratio	Percentage limit to distribution of bank's earnings
0% - 0.625%	0%
>0.625% - 1.25%	20%
>1.25% - 1.875%	40%
>1.875% - 2.5%	60%

Current capital levels are above what is required

Banks currently have capital levels above the regulatory requirements set by the Reserve Bank. This provides banks a buffer to help minimise the risk of unexpected events pushing them into the conservation buffer. It also helps banks meet expectations of credit rating agencies, reducing their cost of debt funding

Figure 1: Aggregate capital ratios of all locally incorporated banks



Section 3: Problem Definition

The central focus of the Capital Review is to ensure that bank capital requirements support a sound and efficient financial system

The Reserve Bank is required, under the Reserve Bank of New Zealand Act, to promote the maintenance of a sound and efficient financial system, and to avoid the significant damage to the financial system that could result from the failure of a bank (as outlined in Section 1). The Capital Review focuses on setting bank capital requirements to support this aim, seeking to reduce the chances of banks not being resilient to a systemic banking crisis. Such a crisis may emerge through two channels:[6,7]

- Threats to insolvency arising from losses on a bank's loan portfolio, from operational losses (for example, high remediation costs arising from a cyber-attack on the bank), or losses arising from market risk.[8]
- A disruption to financial intermediation resulting from depositors and other creditors seeking to withdraw their funds.

Bank insolvency – the first channel – is the central problem that the Capital Review addresses.[9] A bank becomes insolvent if it suffers significant losses and has more debt than it can match with assets. As a bank approaches this point, its viability is put into question. This can lead to a loss of market confidence in the bank, and the bank may lose access to capital markets and struggle to meet its debt obligations. Ultimately, this may leave the bank unable to perform basic banking operations for customers. From a regulatory perspective, a bank can be deemed to have failed at, or when it is approaching, this point.

Capital serves as a buffer against the losses that a bank cannot fully anticipate, its 'unexpected losses', thereby reducing banks' chances of approaching insolvency and failing.

Capital requirements are not just important for individual banks, but also for the sector as a whole and the wider economy. This is because problems in one institution can spill-over into other parts of the financial system as well as the wider economy potentially causing a system-wide collapse, and impose costs on society that are not borne by bank owners. This is particularly true in a concentrated banking system.

That is, the negative impacts on society and the wider economy can far exceed the direct effects of the initial losses of the failed bank. The failure of a major bank would have the immediate effect of reducing the availability of credit in the economy and limiting customers' access to liquidity (and thereby potentially causing businesses to collapse and jobs to be lost), and potentially putting other banks into difficulty, leading to a system-wide crisis.

The effects on the economy from systemic banking crises can be wide-ranging and long-lasting. As access to bank credit becomes restricted, businesses become less able to invest, and household consumption decreases. This could lead to significant economic losses that have long-lasting impacts on output and therefore incomes, as the reduction in investment reduces the economy's potential to generate output and income in the future. In addition to the cost of lost output and lower incomes, wider social effects can include adverse impacts

[6] Hunt (2009) provides a detailed review of crises and the New Zealand experience.
[7] Another potential avenue, losses on trading activities, is not as relevant in New Zealand because banks tend to have relatively few assets that are used for trading purposes.
[8] Market risk (losses on trading activities) is not as relevant in New Zealand because banks tend to have relatively few assets that are used for trading purposes.
[9] The second relates to the liquidity of the banking system, and is not the focus of the Capital Review – nevertheless, creditors' solvency concerns can lead to liquidity problems, and vice versa.

on health, mental wellbeing and social cohesion. These effects are difficult to measure, but an increasing number of researchers consider the costs are real, and potentially substantial.

These wider costs from the failure of one or more large banks, are not accounted for by individual banks when making their own decisions about levels of capital.

The Capital Review considers the level of capital needed to guard against the risks a bank failure poses to New Zealand

The Capital Review considers the level of capital needed to guard against the risks that a bank failure poses to New Zealand, and asks whether current policy settings (the '*Status Quo*') are well-placed to maintain a sound and efficient financial system.

Having higher levels of capital in the banking system increases solvency, but also comes with costs, as raising capital requirements results in shareholders contributing more towards bank funding. Shareholders generally expect a higher return than depositors. This is because if a bank suffers unexpected losses it is the shareholders that lose their money first, not the people who have lent money to banks (e.g. depositors). This means risk is higher for shareholders than depositors, so shareholders expect to be compensated with higher rate of return.

As shareholder funds (equity) has a higher required return, it 'costs' more for banks. So higher capital requirements can ultimately result in higher lending rates, and possibly lower deposit rates, adversely impacting economic output. These costs from higher capital requirements need to be weighed against the benefits of higher solvency in the banking system.

Throughout this RIA, outcomes under the current arrangements and requirements (referred to as the *Status Quo*) are compared with outcomes under policy options. These policy options reduce the chances of a failure of one or more large banks, but at the same time could reduce the level of economic activity, through the impact of higher interest rates on business investment. Part Two of this RIA discusses the quantified and unquantified costs and benefits of the preferred set of options against the *status quo*.

The Capital Review has identified a range of problems across all elements of the framework, including how capital is defined

Capital regulations need to address not only the amount of capital banks should be required to have, but also the type of instruments that qualify as capital (the 'numerator' of the capital ratio calculation).

The Reserve Bank's central focus has been to ensure that only instruments that are truly loss absorbing are included as part of regulatory capital.

New Zealand's framework currently recognises a range of different forms of capital. These are outlined in Table 1 in Section 2. Common Equity Tier 1 capital ('CET1'), which is composed of ordinary shares and retained earnings, is generally considered the highest 'quality' form of capital because it is perpetual and absorbs losses with great certainty. The framework also recognises instruments other than CET1 as part of regulatory capital. It is in this area where the Reserve Bank identified a range of potential issues in the definition of capital, outlined in Table 4.

Table 4: Issues identified in the definition of capital

Dimension 1: Features that lead AT1 to depart from common equity
• Preference shares and subordinated debt are alternatives to common equity and both are currently accepted as AT1. • Both types of instruments are able to be redeemed by the bank after 5 years, which may weaken their capital qualities. • In both cases distributions are set relative to a benchmark interest rate. Investors may be surprised if the bank opts not to pay a distribution or redeem. In this case AT1 can signal bad news and exacerbate pressures on the bank. • The fixed income nature of distributions may lead some retail investors to underestimate risk. This might increase fiscal risks of a government bail-out.
Dimension 2: 'Going concern' triggers (currently included in AT1 capital)
• The potential for contingent debt to absorb losses on a going-concern basis is limited. • International experience in the case of Spanish bank Banco Popular showed that none of the contingent instruments became loss absorbing prior to the bank being deemed non-viable. • Due to the discrepancy in timing between receiving information and losses actually occurring, by the time the triggers are invoked the actual capital position of the bank may be significantly weaker, and the bank much closer to non-viability. In such circumstances the instrument will not be loss-absorbing on a going-concern basis.
Dimension 3: Non-viability triggers (currently included in AT1 and Tier 2 capital)
• AT1 and Tier 2 capital currently include non-viability triggers. The definition of a 'non-viability' event involves action by a bank regulator. When this is triggered, the debt is converted into ordinary shares or written off. However, due to the complexity of the instruments, and the interaction of the contractual terms with legislation, there is a degree of legal risk that the instrument may not convert or be written off as intended (Compulsory write-offs that occur before equity is fully written down would result in debt holders losing their investment before shareholders). • Non-viability triggers for subordinated debt instrument seems unnecessary given the ability to include such instruments in bank resolution under New Zealand legislation. • The current acceptance of non-viability triggers means investors in contingent debt can incur losses ahead of shareholders under certain circumstances.
Dimension 4: Conversion
• The threat of conversion into ordinary shares serves a purpose, but triggers have generally been set at a low level, such that conversion can only be expected once the bank has become non-viable. • The inclusion of conversion incentives could encourage management to adopt a lower risk appetite, however, this advantage diminishes to the extent if the debt will only become loss-absorbing when a bank has already become non-viable. Nor can conversion be expected to act as a discipline on banks when the instrument is issued to the parent. • Conversion of instruments sold by NZ subsidiaries may recapitalise the parent bank, but this may not lead to recapitalisation of the NZ subsidiary.
Dimension 5: Interaction with the tax system
• Some debt capital instruments impose a tax liability on banks. Tax liabilities may arise when contingent debt becomes loss absorbing. The Reserve Bank has no view on tax policy, but is concerned that banks have been incentivised by tax considerations to create complex instruments. This complexity brings risks of ineffective capital and uneven access to capital across the sector.
Dimension 6: Defining the banking group
• Identifying the scope of activities and entities that must be reflected in the capital requirement on banks is important. This group definition matters for the calculation and measurement of capital, and also the definition of risk-adjusted exposures. • The definition matters because instruments can only be loss absorbing if they are issued to parties that are economically independent from the bank.

Convertible instruments have been a particular focus in the Capital Review. These convertible instruments are eligible Additional Tier 1 (AT1) and Tier 2 capital, and are considered lower quality than CET1, but might be attractive to banks because of the lower returns required by holders, tax advantages or because, in normal times, they do not interfere with the control of banks by ordinary shareholders. These instruments are intended to absorb losses but there is uncertainty about how effective they would be in practice in the New Zealand context.[10]

There is also a concern that governments could feel obligated to compensate holders for losses. Moreover, not all banks are able to issue contingent instruments and/or recognise the full value of contingent instruments as capital – despite there being no difference in the loss absorbing potential of the instruments issued by banks. Hence, there can be unintended impacts on banks when contingent instruments are accepted as capital.

The Reserve Bank has also identified a number of problems in the way that risk-weighted assets (RWA) are calculated in the capital framework

A key issue that the Reserve Bank has focused on has been the extent to which the IRB approach to setting RWA should be available to banks, as well as whether the inputs or outputs of IRB models should be constrained. Table 5 summarises the issues identified during the Capital Review.

Table 5: Issues identified in the calculation of risk-weighted assets

Issue 1: Complexity
• The internal models approach has posed challenges around the world due to its complexity and the burden it puts on supervisory resources. For the Reserve Bank it has posed a particular challenge to the supervisory model, which is based on the role of self and market discipline, with relatively less emphasis on supervisory discipline.
Issue 2: Inconsistent outcomes
• There is evidence that internal model results are inconsistent, as different banks come up with similar rankings of risk, but absolute levels of risk are substantially different, even for the same set of obligors.
Issue 3: Gaps between standardised and internal models outcomes
• Outcomes for internal models have drifted below standardised approaches, and it is not clear whether this is justified by differences in underlying risk or by the different approaches (IRB and standardised) in measuring risk.
Issue 4: Transparency
• For banks operating the IRB approach, the determination of many of the key inputs for the models, including the probability of default, loss given default and exposure of default, happens within the models and are not publically disclosed.

[10] In the New Zealand experience, issuance of convertible instruments has been predominant. Instruments issued to parent banks may, if effective, recapitalise the parent. However it is less clear that this would result in the New Zealand subsidiary being recapitalised. Moreover, while there is limited international experience, contingent instruments have been legally challenged in some instances. Legal challenges can impede the ability of the instruments to perform as intended and/or prevent the instrument from performing in a timely manner.

Section 4: Objectives

One aim of the Capital Review is to identify the most appropriate framework for setting capital requirements for New Zealand banks

The Reserve Bank exercises its powers to impose capital requirements in order to maintain a sound and efficient financial system, and to avoid significant damage to the financial system that could arise from a large bank failure. Throughout the Capital Review, the Reserve Bank has been conscious of the potential trade-offs between the costs and benefits of higher capital requirements.

To achieve the objectives of the Review the Reserve Bank has set the following six high-level principles:

1. Capital must readily absorb losses before losses are imposed on creditors and depositors.

2. Capital requirements should be set in relation to the risk of bank exposures.

3. Where there are multiple methods for determining capital requirements, outcomes should not vary unduly between methods.

4. Capital requirements of New Zealand banks should be conservative relative to those of international peers, reflecting the risks inherent in the New Zealand financial system and the Reserve Bank's regulatory approach.

5. The capital framework should be practical to administer, minimise unnecessary complexity and compliance costs, and take into consideration relationships with foreign-owned banks' home country regulators.

6. The capital framework should be transparent to enable effective market discipline.

These six principles help ensure that the benefits of capital are realised in practice, and that capital requirements are appropriately calibrated and relatively simple.

In assessing the options in the Capital Review, the Reserve Bank has used information from a range of sources, including international and domestic literature, insights from economic and financial modelling, and the results from stress testing exercises carries out with banks. The Reserve Bank has also carried out cost-benefit analysis of options and alternative scenarios.

This RIA provides a qualitative assessment of the costs and benefits of all decisions, and a quantitative assessment where this is possible. This type of analysis has a number of limitations, including a range of assumptions that need to be made. The RIA provides an assessment of the key sensitivities and the impact that varying the assumptions would have on the overall conclusions about costs and benefits of the decisions.

Section 5: Definition of Capital – Options and Impact Analysis

Sections 5, 6 and 7 of this RIA consider options for each of the components of the system separately – the numerator, denominator and capital ratio. For each component this RIA summarises the options that were considered during the Capital Review and assesses these options against the objectives for the Review, as described in Section 4 of the RIA.

The complete costs and benefits of the options are considered for the decisions as a whole in Part Two of this RIA. The interactions between all the various parts of the framework mean that the costs and benefits of all the decisions in the Capital Review need to be considered together, rather than trying to quantify the costs and benefits of each individual decision in Sections 5, 6 and 7.

The Reserve Bank considered a number of options to address problems identified in the definition of capital

The Problem Definition summarised six specific areas where the Reserve Bank has identified problems in the definition of capital. The options for change seek to address all of these issues raised.

The options described below are similar to the options identified in *Review Paper 2*, which was published in 2017. One key addition to that previous set of options is the addition of a redeemable preference share as a candidate for assessing as part of the definition of capital – this has been added in option 5 in Table 6. The Reserve Bank added this instrument after taking into account the significant increase in the level of Tier 1 capital that was being proposed (this increase meant any remaining risks with redeemable preference shares were tolerable) and in response to feedback provided during the Capital Review public consultations.

Table 6: Options considered for the definition of capital

Options: Capital Instruments
Option 1: '*Status quo*'
• The definition of capital would remain the same as the existing framework, set out in Section 2 of this RIA.
Option 2: '*Status quo* plus'
• Preference shares remain part of the definition of AT1, but would not be redeemable, and would not be required to write-off or convert to shares.[11] • Contingent debt with going concern triggers remains part of AT1. • Conversion from debt to ordinary shares retained. • Require a comprehensive tax ruling for any instrument that is eligible as capital, and is either contingent debt or part of a wider arrangement that includes contingent debt. • Group definition amended so that a Special Purpose Vehicle used to raise capital would be included in the banking group for regulatory purposes.
Option 3: 'Limited trigger regime'
• Only common equity and non-redeemable preference shares are accepted as Tier 1 capital. Preference shares would not be redeemable, and would not be required to write-off or convert to shares. • Contingent debt with going concern triggers would not be part of AT1.

[11] Redeemable means that the shares are able to be redeemed by the bank for cash at pre-set dates announced within the contract on maturity or on a specified call date.

• Contingent debt with a non-viability trigger leading to write-off (not conversion) is accepted as Tier 2 capital. • Reforms to tax recognition and group definition as per option 2.
Option 4: 'No trigger regime'
• All features as per option 3, except that contingent debt with a non-viability trigger leading to write off (not conversion) is not accepted as Tier 2 capital.
Option 5: 'No trigger regime with redeemable preference shares'
• All features as per option 4 with the addition that redeemable preference shares would also be accepted as part of AT1, so long as they did not write-off or convert to shares and can only be redeemed at least five years after issuance.
Option 6: 'Equity only regime'
• Limits regulatory capital to ordinary shares, retained earnings and preference shares. • In this option banks structured as mutual societies would be constrained to grow at the rate of their retained earnings as they would struggle to raise ordinary shares. • No Tier 2 in this option.

The preferred option (option 5) removes contingent debt from the definition of capital and introduces a new redeemable preference share that will qualify as AT1

During the Capital Review, the Reserve Bank identified the following key features of capital that it considers important for determining the types of instruments that should qualify as capital:

- Greater certainty regarding the loss-absorbing quality of regulatory capital – it is critical that capital can be relied upon to be 'loss absorbing' and reduce the risk of bank failure.
- Reduced complexity for the capital regime – the Reserve Bank's preference is for a capital framework that is simple to administer and comply with.
- Minimise opportunities for regulatory arbitrage – complexity in the capital framework can create incentives for institutions to design instruments to exploit differences in prudential and tax treatments.

The most significant change in the Reserve Bank's final decision compared with the in-principle decisions previously announced in December 2017, is the addition of redeemable preference shares to the definition of AT1 capital. Box 1 (on page 25) provides a detailed description of redeemable preference shares and the Reserve Bank's rationale for recognising these as going concern capital as part of the package of final decisions.

In addition, option 5 is preferred as it most closely delivers the objectives of loss-absorbency, simplicity, and helps level the playing field while also minimising the costs

Option 5 is The Reserve Bank's preferred option. Table 7 compares the options against the six principles for the Capital Review.

Table 7: Comparison of numerator (Tier 1) options with the six principles underpinning the Review

Principles	Option 1	Option 2	Option 3	Option 4	Option 5	Option 6
1. Capital must readily absorb losses before losses are imposed on creditors and depositors	—	↑	↑	↑↑	↑↑	↑↑↑
2. Capital requirements should be set in relation to the risk of bank exposures.	*Not applicable*					
3. Where there are multiple methods for determining capital requirements, outcomes should not vary unduly between methods.	*Not applicable*					
4. Capital requirements of New Zealand banks should be conservative relative to those of international peers, reflecting the risks inherent in the New Zealand financial system and the Reserve Bank's regulatory approach.	—	↑	↑↑	↑↑	↑↑	↑↑↑
5. The capital framework should be practical to administer, minimise unnecessary complexity and compliance costs, and take into consideration relationships with foreign-owned banks' home country regulators.[12]	—	↑	↑	↑↑	↑↑	↑
6. The capital framework should be transparent to enable effective market discipline	—	↑	↑	↑↑	↑↑	↑↑

↑ *means better than the* status quo, — *means no different,* ↓ *means worse than the* status quo

Table 7 shows that options 4, 5 and 6 are rated as broadly the same against the six objectives. Each of options 4, 5 and 6 have the following features:

- The loss absorbing effectiveness of capital is more certain than the *status quo*. This is the most important benefit provided by these options.
- By placing a high priority on the loss-absorbing effectiveness of eligible instruments, the options are more conservative than the *status quo*. Option 6 is the most conservative.
- The removal of convertible instruments means the framework is less complex than the *status quo*.

In addition, unintended, uneven competitive impacts are reduced in options 4, 5 and 6 compared to the *status quo*.

[12] There are competing factors for principle 5. Options 4, 5 and 6 are the least complex, while 2 and 3 would be closer to other relevant regulators.

Option 5 has been preferred to options 4 and 6 for the following reasons:

- Option 6 is the least complex approach, but limiting the framework to only ordinary shares drives a larger difference between New Zealand and the foreign-owned banks' home regulators, hence the lower rating for option 6 against principle 5.
- Option 4 is similar to option 5, with the exception of including redeemable preference shares in the definition of AT1 capital in option 5.
- Given the significant increase in Tier 1, any remaining residual risks associated with redeemable preference shares were considered tolerable (these risks are outlined in Box 1). Redeemable preference shares were considered superior to redeemable subordinated debt because they are Basel compliant without having to include contingent conversion, and are considered to more reliably absorb losses (for example, the risk of mis-selling is perceived to be lower).
- There was widespread support during public consultation for including a wider measure of AT1 than contained in option 4. Option 5 responds to this support by broadening the measure, without having a significant effect on the loss absorbency of capital.
- Option 6 would be the most expensive, as it is made up only of equity.

Public consultation identified a number of common themes

Review Paper 2 (published in July 2017) sought feedback on the proposed changes to the definition of capital ('the numerator'). This covered options 1-4 above, as well as option 6. Option 5 was added later, after the Reserve Bank had considered the submissions on *Review Paper 2*. Seventeen submissions were received, and an additional 22 submissions were received to an earlier consultation paper (the 'Issues Paper') that included detailed responses about the definition of regulatory capital.

Some of the common themes from the submitters were:

- In general, submitters were opposed to no longer recognising contingent debt as capital.
- Some of the smaller banks indicated they would prefer new instruments to be included in the capital framework, rather than the proposal to remove contingent instruments.
- Banks structured as mutual societies requested that a bespoke mutual society Tier 1 capital instrument be included in the framework.
- There was opposition to the proposal that perpetual preference shares must be non-redeemable in order to qualify as Tier 1 capital. Submitters were concerned that there was no investor appetite for such instruments.
- Submitters also felt that the consultation papers had placed too much emphasis on tax in the consideration of contingent debt.

A number of these points were reiterated in submissions on *Review Paper 4* (published in December 2018), which covered the level of capital. Some submitters on *Paper 4* said that given the size of the proposed increase in capital requirements, the Reserve Bank should revisit its previous in-principle decisions, particularly regarding what can qualify as AT1 capital. In particular, some submitters stated that the current hybrid capital instruments are effective at absorbing losses and should therefore continue to qualify as AT1 capital. Some submitters also said that the Reserve Bank's concerns around the economic and legal effectiveness of hybrid capital instruments are either unwarranted or can be addressed via mitigating actions. For example, some suggested increasing the CET1 ratio trigger point so that AT1 instruments would convert to equity at CET1 ratios above the current 5.125

percent. Some also say that although the legal effectiveness of contractual conversion and write-off provisions has not been tested in New Zealand, legislative reform can be undertaken to ensure effectiveness of conversion.

The Reserve Bank is not convinced by arguments supporting the retention of contingent convertible debt. Contingent convertible instruments are not suitable in all situations. Several aspects of the New Zealand context reduce the certainty associated with contingent instruments. The dominant role played by unlisted subsidiaries of Australian banks is an important example.

Instruments issued by New Zealand subsidiaries under Basel III, for example, may be effective when triggered at recapitalising the parent bank but there is uncertainty as to whether this will result in recapitalisation of the subsidiary. Instruments that have been issued by New Zealand subsidiary banks also include triggers that mean the subsidiary imposes losses on holders when the parent is in stress (i.e. the instruments can be a contractual source of 'contagion').

There are other reasons the Reserve Bank prefers non-contingent instruments. Features of the New Zealand tax system have created incentives for banks to issue complex instruments that have less certain capital qualities, for example, and not all banks are able to report the same capital value for common instruments because of tax rules. These issues do not arise with non-contingent instruments.

The final decisions covered in this RIA have retained the proposals that contingent instruments should not be part of the capital framework.

After considering the submissions the Reserve Bank has taken steps to reduce, where possible, obstacles presented to banks structured as mutual societies by the current definition of ordinary shares. In addition, the Reserve Bank's preferred option now includes redeemable perpetual preference shares.

Box 1: A focus on redeemable preference shares

Redeemable perpetual preference shares (RPPS) are a form of equity funding. The funding is available to the issuer indefinitely, unless voluntarily repaid (i.e. unless 'redeemed' on one of several specified 'optional call' dates set in advance in the contract terms).

RPPS differ from ordinary shares in that the dividend reflects a benchmark interest rate, rather than annual earnings, preference shares rank ahead of ordinary shares in liquidation and typically have no voting rights.

RPPS have the potential to absorb losses on a going concern basis because the dividends payable are fully discretionary to the issuer. No obligation accrues if dividends are unpaid. Similarly the issuer is under no obligation to redeem the instrument.

With the dividend payments and any redeeming of the instrument being solely at the discretion of the issuer and no expiry date in the contract, a preference share can be considered to be permanent capital. If the bank needs to retain the funding provided by the preference share, everything in the contract permits it to do so.

From an investor's perspective RPPS bear a strong resemblance to debt. Not only are dividends based on a benchmark interest rate, but if redeemed, the shares are repaid at face value rather than market value at the time the share is redeemed.

Despite having the loss absorbing properties of equity, investors in RPPS require returns that are similar to fixed term debt. This is because the optional call dates act as an anchor for calculating the return required.

Because there are features that make RPPS look like debt to investors, issuers can be under pressure to behave as if these shares are debt, endeavouring to pay dividends in all circumstances (rather than exercising the right not to pay), for example, or redeeming on a scheduled call date rather than extending.

RPPS are thus not risk-free from a financial stability perspective:

- Funding that has the potential to absorb losses may be paid out inappropriately by banks (e.g., in hindsight the redemption may leave the bank with insufficient capital) ('inappropriate repayment' risk).
- By exercising its discretion to not redeem, a bank experiencing stress may signal bad news, prompting a widespread loss of confidence in the bank, thus making bad news worse ('signalling risk').

Tier 2 is the final component of the definition of capital to consider

The preceding parts of Section 5 focused on Tier 1 capital. As noted, this is sometimes called going-concern capital, because it absorbs losses while the bank is operating. Higher levels of Tier 1 capital reduce the possibility of bank insolvency and hence the risks of an ensuing financial crisis.

Tier 2 capital is different. It is gone-concern capital, which helps absorb losses in the event that a bank becomes non-viable *and* enters a formal resolution process such as liquidation. In this scenario, once Tier 1 capital has been depleted, Tier 2 capital can absorb losses before losses are imposed on depositors and other unsecured creditors.

Contingent debt instruments will no longer be considered part of AT1 capital. The issues around this were discussed in depth above. The same rationale applies to Tier 2 capital – as a result contingent convertible measures would not be considered part of Tier 2. This leaves only long-term subordinated debt as Tier 2 capital.

Two options were considered for Tier 2 during the Capital Review:

- Option 1: Continue to allow 2 percent of the minimum total capital requirements to be met with Tier 2 capital. Tier 2 capital will solely consist of long-term subordinated debt as reflected by the 2017 in-principle decision.
- Option 2: To no longer allow Tier 2 instruments in the framework, but also lower the total capital requirements by 2 percent.

The key benefits of retaining Tier 2 in the framework are that:

- It provides gone-concern capital and therefore aids resolution as it provides loss absorbency at the point of failure and gives depositors' confidence.
- Tier 2 capital owners could provide additional monitoring discipline.
- Some submitters also noted that Tier 2, as simple subordinated debt, provides an additional investment option for retail investors, and that this could help market development.

Removing Tier 2 has the benefits of:

- Making the capital framework simpler.

- Reducing the total capital ratio requirement (from 18 percent to 16 percent for D-SIBs)
- Reducing the cost of capital requirements, although this impact is very low.

With a higher Tier 1 capital ratio, the likelihood of a bank failure is significantly lower, so it could be argued that there is less need for gone-concern capital (and the total capital ratio requirement can be reduced). Table 8 compares the two Tier 2 options against the principles for the Capital Review.

The table shows that there is no clear cut stand-out option. Retaining Tier 2 capital (option 1) provides additional loss absorption, while removing Tier 2 from the minimum requirements (option 2) provides more simplicity. In addition, the costs of Tier 2 are relatively small – estimated to add around half a basis point to interest rates, relative to a framework that does not include Tier 2.

On balance, the Reserve Bank has decided in favour of option 1. This is because Tier 2 has some value when a bank enters formal resolution processes, it has the potential to provide discipline on banks and it is relatively low cost.

Table 8: Comparisons of options for Tier 2 with the six principles underpinning the Review

Principles	Option 1	Option 2
1. Capital must readily absorb losses before losses are imposed on creditors and depositors	—	↓
2. Capital requirements should be set in relation to the risk of bank exposures.	*Not applicable*	
3. Where there are multiple methods for determining capital requirements, outcomes should not vary unduly between methods.	*Not applicable*	
4. Capital requirements of New Zealand banks should be conservative relative to those of international peers, reflecting the risks inherent in the New Zealand financial system, and the Reserve Bank's regulatory approach.	—	↓
5. The capital framework should be practical to administer, minimise unnecessary complexity and compliance costs, and take into consideration relationships with foreign-owned banks' home country regulators.	↑	↑
6. The capital framework should be transparent to enable effective market discipline	↑	—

↑ *means better than the* status quo, — *means no different,* ↓ *means worse than the* status quo

Section 6: Calculation of Risk-Weighted Assets – Options and Impact Analysis

The Reserve Bank considered a number of options to address problems identified in the calculation of risk-weighted assets

The capital ratio requirements are specified as a percentage of capital to risk-weighted assets (RWA). The approach used to calculate RWA is therefore a crucial part of the prudential framework.

The options identified during the Capital Review have related to the different methods that banks can use – standardised or internal models – and to constraints on the inputs to or outputs from the calculation. These were presented in *Review Paper 3* (published in December 2017), with some changes to particular components that occurred following consultation.[13]

Public consultation was carried out in 2018

In December 2017, the Reserve Bank published a consultation paper covering issues and options around calculating risk-weighted assets. The Reserve Bank received nine submissions in response to the paper.[14] A further 22 submissions that covered matters relating to calculating RWA were also received in response to an earlier consultation paper (the 'Issues Paper'). In July 2018 the Reserve Bank published a response to the submissions. The feedback in the submission covered:

- Global standards – most submitters were in favour of harmonising New Zealand's capital framework with either the newly revised Basel III standards or APRA's framework, due to administrative efficiencies for banks and regulators, and the potential for a greater understanding of the New Zealand framework among external observers.
- The role of IRB models – views among submitters varied widely as to the benefits of allowing risk modelling in the capital regime. Some submitters pointed to the advantages of allowing banks to distinguish between low risk and high risk credit exposures within an asset class. Some submitters said being allowed to model RWA gave the large four banks an unjustified competitive advantage.
- Dual reporting – some support for the policy came from the standardised banks that submitted. Those who opposed the proposal claimed it would be confusing for third parties to interpret two reported capital ratios, that it would be onerous to explain the difference between the two calculations, and costly to produce this additional information.
- The output floor – the issues that arose in submissions from IRB banks related to global harmonisation (some banks supporting following Basel and thus applying the floor only at the total portfolio level); system costs (one bank expressing the view that implementing a floor at the exposure level would be onerous); and the appropriate level of the floor.
- Standardising externally-rated exposures – some submitters supported modelling being removed from the regime entirely, and thus did not explicitly support this partial approach. The IRB banks, as a general assessment, prefer more limited constraints

[13] The particular changes to the components across the options were: to only apply the standardised approach to bank and sovereign asset classes rather than all externally-rated exposures, and to only apply restrictions on the output (risk-weights) of IRB modelling and not the inputs (PD, LGD, and EAD factors).

[14] A full summary is available here: https://www.rbnz.govt.nz/regulation-and-supervision/banks/consultations-and-policy-initiatives/active-policy-development/review-of-the-capital-adequacy-framework-registered-banks

on their models versus the complete replacement of modelled outputs with standardised risk weights (pointing to the benefits of risk discrimination outlined earlier).

- Operational risk – the majority of submitters supported adopting the Basel standardised approach, but some banks questioned Basel's adjustment for the historical loss experience, saying that it may say little about the future losses.
- Market risk – most submitters appeared to be supportive of retaining the current framework. A relatively common view among submitters was that, because New Zealand banks have relatively 'vanilla' business models, the level of market risk in New Zealand is relatively low, and therefore anything more than the current approach may not be justified.
- Retaining the *status quo* standardised approach – views among submitters were mixed. Some small banks favoured the new Basel framework, saying that it provided "a better empirical base" for their RWA calculation than the present regime. Two banks sought changes to the treatment of unrated corporate exposures, saying the current blanket 100 percent risk weight penalises relatively less risky exposures. Another bank said the current approach to residential mortgages should be amended to incorporate other known drivers of risk.

Each of these different components, and the options considered, are discussed in subsequent sections.

6.1 Specifying and analysing the options – IRB: credit risk

Options for changing the approach to calculating credit focus on limits to the IRB approach

Table 9: Options for credit risk in the IRB approach

Options: Credit risk – IRB approach
Option 1
• *Status quo*
Option 2
• Adopt a similar approach to Basel Committee setting restrictions on IRB modelling through an output floor. • Preserve existing New Zealand variations such as prescribed losses given default for mortgages and farm lending.
Option 3
• Adopt a similar approach to Basel Committee by setting restrictions on IRB modelling through an output floor. • Adopt the Basel Committee's original proposal to require the standardised approach for bank exposures and also require the standardised approach for sovereign exposures. • As in Option 2, preserve New Zealand variations.
Option 4
• As for Option 3, but require the standardised approach for all exposures except unrated corporate exposures.
Option 5
• Entirely replace the IRB approach with the standardised approach.

Other features of the options

- For Options 2-4, the risk weight floor could be aggregate or fine-grained (e.g., one floor per asset class).
- For all of Options 1-5, capital requirements could be made more transparent by requiring IRB-accredited banks to report capital ratios using both IRB approach and standardised approach ('dual reporting'), more reporting of risk weights by indices of risk (e.g., security coverage), or disclosure of internal model documentation.

Option 2 would be more limited than the* status quo*, while option 3 includes more aspects of the recent Basel Committee decisions

In option 2 the IRB approach would be more limited than the *status quo*, by adopting a risk-weight floor and increasing IRB risk-weights (through a scalar multiplier) in order to restrict IRB modelling. Option 2 also retains existing differences between New Zealand implementation and the Basel approach, such as higher correlations for residential mortgages and minimum losses given default for mortgages and rural lending.

Option 3 would also apply the standardised approach for bank and sovereign exposures.

The Reserve Bank's assessment is that risk categories for bank and sovereign exposures are relatively fine-grained under the standardised approach as these counterparties are by and large externally-rated. As such, it is questionable whether banks' internal models can provide more reliable information than external ratings produced by rating agencies. However, this does mean that errors by rating agencies could have wider consequences.

Option 4 replaces the IRB approach entirely with the standardised approach for most exposures while option 5 replaces IRB with the standardised approach for all exposures

Option 4 goes further than option 3 by replacing the IRB approach with the standardised approach for all exposures except unrated corporate exposures. This would mean that the standardised approach would also apply to residential mortgages and exposures to other non-corporates. This option was considered as these portfolios are relatively homogenous across banks and differences across methodologies (IRB and standardised approaches) may not be justified. The IRB approach would only be available for unrated corporate exposures. Option 5 goes even further, and the IRB approach would no longer be available to any banks – the standardised approach would be used for all exposures.

***Options 2, 3 and 4 all incorporate an output floor and a higher scalar than the* status quo**

The calibration of the output floor on RWA and the IRB scalar in options 2, 3 and 4 was also considered during the Capital Review. This included discussion of the specific design of the output floor; whether it should be applied at an asset-class level or aggregate portfolio level, as well as the size of the floor and scalar. To mitigate the risks of the IRB approach, the Reserve Bank has decided to maintain its position to introduce the output floor and increase the IRB scalar.

The output floor could be implemented in a number of ways:

- Exposure-by-exposure: IRB banks would calculate an IRB and Standardised capital requirement for each individual credit exposure. IRB Banks use the maximum of the IRB outcome and a set percent of the Standardised outcome, and aggregate across

all individual exposures to determine the total credit risk RWA used in the capital ratio calculations.

- By exposure category (asset class): For each asset class (e.g., retail SME lending), IRB Banks would calculate RWA as the maximum of the IRB outcome and a set percent of the Standardised outcome for each asset class.
- Total exposure: IRB Banks would perform two standalone calculations across the aggregate of their credit risk exposures: RWA using IRB as at present, and RWA as if they were using the Standardised approach. The RWA for all modelled exposures (i.e. exposures for which banks apply the IRB approach to determine capital requirements) would be the maximum of the IRB-modelled RWA and a set percent of the standardised calculated RWA.

The Reserve Bank considers a 'total exposure' basis for the output floor is preferable to an exposure category basis. While a 'total exposure' floor would still potentially reduce the overall risk sensitivity of the IRB approach, this would be to a lesser extent than setting a range of floors for each exposure category. A 'total exposure' approach would allow higher risk exposure categories, as assessed by banks' IRB models, to offset lower risk exposure categories, while still in aggregate limiting the extent to which the IRB approach can produce unduly lower total RWA outcomes than the Standardised approach. A 'total exposure' approach would also be the simplest of the three options to implement.

The 'IRB scalar' also helps manage the risks. The 'IRB scalar' is a fixed multiplier that already applies to all IRB banks' credit risk RWA, to increase the average RWA outcome of all IRB banks closer to what would be calculated using only the standardised approach.

Table 10: Setting the output floor and IRB scalar

Calibration of output floor		Calibration of IRB scalar	
Status quo	New	*Status quo*	New
None	85%	1.06	1.2

A range of alternative calibrations of the output floor and the scalar were considered in the Capital Review. The levels above were set to balance the following concerns:

- Reduce the gaps between IRB and standardised approach.
- Reduce the gaps across IRB banks.
- Preserve a risk sensitive capital framework.

The overall impact of the output floor and the scalar is to increase the calibration of IRB models to approximately 90 percent of the standardised outcome.

***Options 2, 3 and 4 all incorporate greater transparency than the* status quo**

Alongside the detailed options above for the IRB approach, the Reserve Bank also identified a range of options to deal with concerns about transparency:

- *Status quo*.
- Dual reporting of standardised risk weight outcomes alongside IRB risk weight outcomes – in this option, IRB banks would be required to calculate and publish capital under bot the internal model and standardised approaches.

Other options include more reporting of risk weight outcomes by measures of risk, such as security coverage or debt servicing capability, or to require banks to publish model documentation.

Table 11: Comparison of options for the IRB approach to credit risk with the six principles of the Review

Principles	Option 1	Option 2	Option 3	Option 4	Option 5
1. Capital must readily absorb losses before losses are imposed on creditors and depositors	*Not applicable*				
2. Capital requirements should be set in relation to the risk of bank exposures.	—	—	↑↑	↓	↓↓
3. Where there are multiple methods for determining capital requirements, outcomes should not vary unduly between methods.	—	↑	↑↑	↑↑	↑↑
4. Capital requirements of New Zealand banks should be conservative relative to those of international peers, reflecting the risks inherent in the New Zealand financial system and the Reserve Bank's regulatory approach.	—	↑	↑	↑↑	↑↑
5. The capital framework should be practical to administer, minimise unnecessary complexity and compliance costs, and take into consideration relationships with foreign-owned banks' home country regulators.	—	↑	↑	↑	↑↑
6. The capital framework should be transparent to enable effective market discipline	—	↑	↑↑	↑↑	↑↑

↑ *means better than the* status quo, — *means no different,* ↓ *means worse than the* status quo

Option 3 is the Reserve Bank's preferred option to change the way risk-weighted assets are calculated for the IRB approach to credit risk

Options 3, 4 and 5 have similar overall assessments against the principles of the Review. When compared with the *status quo* all three options provide improvements against most of the six principles. Options 1 (the *status quo*) and 2 were rejected as they were out-performed by options 3, 4 and 5 on almost all of the six principles considered in Table 11.

Options 3 and 4 retain the IRB approach, but both options limit the potential for gaming (i.e. minimising) capital requirements through the use of 'mitigants' (e.g., dual reporting, output floor, and higher scalar). Conservatism and transparency would increase in options 3 and 4, without a significant reduction in risk sensitivity.

Option 5, which removes the IRB approach entirely, would be the most transparent, and probably the most conservative approach. However, maintaining some use of IRB models allows for greater risk sensitivity of capital requirements in some areas, leading to improved efficiency, and also permits greater consistency with the Australian regulatory approach. Hence, option 5 has not been preferred.

The Reserve Bank prefers option 3 over option 4. While option 3 is less conservative than option 4 it has the benefit of providing more risk differentiation, as option 4 replaces the IRB

approach with the standardised approach for all exposures except unrated corporate exposures. Overall, option 3 reduces the ability of IRB banks to use risk weights to their competitive advantage, but still allows them to benefit from more risk differentiation and better capital allocation between sectors (which it was intended for).

6.2 Specifying and analysing the options – Standardised approach: credit risk

Options for changes to the standardised approach to credit risk focus on considering New Zealand-specific amendments to the Basel rules

Table 12: Options for credit risk in the standardised approach

Credit risk – standardised approach
Option 1
• *Status quo.*
Option 2
• Adopt the new Basel Committee standardised approach with risk weights that are more finely grained than the current international approach.
Option 3
• As Option 2 but with risk weights recalibrated for New Zealand circumstances.

Option 2 would adopt the Basel Committee's new approach, which introduces new asset classes for specialised lending and real estate, and would create a more risk-sensitive approach than the previous Basel framework. However, this is only marginally more risk-sensitive than New Zealand's existing approach as New Zealand already has a more fine-grained classification of residential mortgage exposures. New Zealand's current approach also includes separate risk categories for reverse mortgages – there is no equivalent in the Basel Committee's proposal.

In addition, the Basel Committee's new approach permits lower risk weights for some real estate exposures with low loan-to-value ratios. Low-to-value ratios in New Zealand have fallen, so the new Basel framework could reduce average risk weights for some banks with significant real estate exposures. This could result in lower capital in the New Zealand system through a lower level of RWA.

Option 3 is similar to option 2, but would alter the calibration for New Zealand conditions. For example, the Basel Committee's changes would permit lower risk weights than the New Zealand approach for some real estate exposures with low loan-to-value- ratios. So the new Basel framework might reduce average risk weights for banks with significant real estate exposures. Option 3 would make adjustments for this.

Table 13 compares the credit risk options for the standardised approach with the six principles underpinning the Review

The **status quo** *for standardised credit risk is the Reserve Bank's preferred option*

The *status quo* is the Reserve Bank's preferred option for the time being, given planned work programme for the next steps of the Capital Review (e.g., consultation regarding the countercyclical capital buffer and Escalating Supervisory Response). The current standardised framework in New Zealand is also relatively risk sensitive. The *status quo* is

also more conservative (principle 4) than the other two options, meaning that capital would be higher and hence more likely to absorb losses (principle 1).

Table 13: Comparison of options for the standardised approach with the six principles of the Review

Principles	Option 1	Option 2	Option 3
1. Capital must readily absorb losses before losses are imposed on creditors and depositors	*Not applicable*		
2. Capital requirements should be set in relation to the risk of bank exposures.	—	↑	↑
3. Where there are multiple methods for determining capital requirements, outcomes should not vary unduly between methods.	—	↑	↑↑
4. Capital requirements of New Zealand banks should be conservative relative to those of international peers, reflecting the risks inherent in the New Zealand financial system and the Reserve Bank's regulatory approach.	—	↑	↑↑
5. The capital framework should be practical to administer, minimise unnecessary complexity and compliance costs, and take into consideration relationships with foreign-owned banks' home country regulators.	—	↑↑	↑
6. The capital framework should be transparent to enable effective market discipline	—	—	—

↑ *means better than the* status quo, — *means no different,* ↓ *means worse than the* status quo

6.3 Specifying and analysing the options – operational risk

Operational risk options consider a range of changes to focus banks' attention on improving their systems for identifying and modelling operational risks

Table 14: Options for operational risk capital requirements

Operational risk
Option 1
• *Status quo*
Option 2
• Adopt the new Basel framework that replaces the existing standardised and internal models approaches with a new standardised approach.
Option 3
• As (2) but with the addition of explicit requirements for advanced risk management processes and systems.
Option 4
• As in (2), but remove the scope provided by the Basel Committee for banks to make adjustments for historical losses

In option 1, the current rules would remain as they are, allowing accredited banks to use the Advanced Measurement Approach (AMA) to measure operational risk. All other banks would use the current standardised approach. Under AMA, the banks are allowed to develop their

own models to quantify required capital for operational risk, subject to approval from the Reserve Bank.

Option 2 follows the recent changes introduced by the Basel Committee. These changes replace both the internal model and standardised approaches for determining operational risk with a new Standardised Measurement Approach (SMA). The new approach makes use of two measures:

- Business indicator – a combination of gross and net income across various areas of a bank's business.
- Adjustment for historical operational loss experience of the bank – this can only be used by large banks and makes the new approach marginally more fine-grained than the current approach.

As in option 2, option 3 also follows the Basel Committee approach, incorporates an explicit set of requirements for operational risk management processes and systems. This would help focus banks' attention on improving their systems for identifying and modelling operational risks.

Option 4 is the Reserve Bank's preferred option. As with options 2 and 3, option 4 would increase conservatism and transparency relative to the current (internal models) approach. Removing the capacity for banks to make an adjustment for their historical loss experience makes option 4 is less pro-cyclical than options 2 and 3. Option 4 is also more closely aligned with the approach taken by APRA.

Table 15 assess operational risk options using the principles for the Capital Review.

Table 15: Options for operational risk compared with the principles of the Review

Principles	Option 1	Option 2	Option 3	Option 4
1. Capital must readily absorb losses before losses are imposed on creditors and depositors	—	—	—	—
2. Capital requirements should be set in relation to the risk of bank exposures.	—	—	—	—
3. Where there are multiple methods for determining capital requirements, outcomes should not vary unduly between methods.	—	↑	↑	↑↑
4. Capital requirements of New Zealand banks should be conservative relative to those of international peers, reflecting the risks inherent in the New Zealand financial system and the Reserve Bank's regulatory approach.	—	↑	↑	↑↑
5. The capital framework should be practical to administer, minimise unnecessary complexity and compliance costs, and take into consideration relationships with foreign-owned banks' home country regulators.	—	↑	↑	↑
6. The capital framework should be transparent to enable effective market discipline	—	↑	↑	↑

↑ *means better than the* status quo, — *means no different,* ↓ *means worse than the* status quo

6.4 Specifying and analysing the options – market risk

For market risk the options cover the* status quo *compared with the standardised Basel approach

Table 16: Options for market risk capital requirements

Market risk
Option 1
• *Status quo*
Option 2
• Replace the current approach with the new Basel Standardised approach.

The Reserve Bank does not currently allow an internal models approach for market risk and does not intend to introduce this as part of the Capital Review.

Option 1 is the *status quo*. New Zealand's current approach to market risk is a standardised approach and is based on a Basel framework from the 1990s. New Zealand's approach corresponds roughly to the "general market risk" component of the Basel II standardised approach. An important difference is that in the case of interest rate risk the Basel II approach is applied only to assets and liabilities in the trading book, (i.e., assets that are held for trading or available for sale), while the New Zealand approach is applied to assets and liabilities in the 'banking book' (i.e., assets that are held to maturity) as well.[15]

New Zealand's current approach is rudimentary, so it reduces the amount of computation banks need to carry out for calculating market risk, but it has some shortcomings. It:

- Does not recognise characteristics of individual exposures.
- Assumes that positions can be rapidly liquidated for both the trading and the banking book.[16] This is unrealistic for the banking book.

Option 2 covers the new Basel standardised approach, approved by the Basel Committee in 2016. Key changes include:

- A capital requirement to reflect the risk of changes in the value of the instrument due to changes in risk factors.
- A requirement to reflect the risk of changes in implied volatility.
- A requirement that reflects the risk that there will be a default which affects the instrument or – in the case of a derivative – the underlying instrument.
- A 'residual risk add-on' which imposes an additional capital requirement for more complex instruments.

[15] The New Zealand framework does this implicitly as there is no distinction between 'banking book' and 'trading book' for capital requirements for market risk

[16] In this context, the trading book refers to assets held by a bank that are available for sale and hence regularly traded. The banking book is a term for assets on a bank's balance sheet that are expected to be held to maturity, usually consisting of customer loans to and deposits from retail and corporate customers.

The status quo *is the Reserve Bank's preferred option for approaches to RWA market risk calculations*

The benefits of greater risk sensitivity (principle 2) in option 2 do not offset the practical disadvantages (principle 5) of implementing option 2. As a result the *status quo* is the Reserve Bank's preferred option.

Compared to New Zealand's current approach, the new Basel standardised approach has more risk factors to take into account and their effects on the values of instruments are made more explicit. The treatment of default risk is more comprehensive, and there is a residual charge for risk factors which are not picked up elsewhere.

In principle, these points of difference should be improvements to the current market risk framework. However, the new standardised approach would be incompatible with parts of New Zealand's current capital framework, requiring changes to one or the other. In particular, in respect of interest rate risk, credit spread risk, and equity risk, the Basel market risk approach applies only to the trading book. New Zealand's current market risk framework, which explicitly picks up interest rate and equity risk, applies to the banking book as well. As such, incorporating the Basel standards for market risk would involve substantial changes to the current capital framework. Given that market risk accounts for less than 5 percent of New Zealand banks' capital requirements, we are of the view that there is currently no significant benefit to reviewing our market risk capital requirements.

Box 2: Impact of changes to RWA the IRB approach

The changes to the calculation of RWA for credit risk by IRA banks will have a number of impacts on the level of RWA used in the calculation of their capital ratios. The changes will mean that current nominal levels of assets will result in higher estimates of risk-weighted assets, and a lower capital ratio for a given quantum of capital.

The combined impact of all of the changes will result in RWA calculated using the IRB approach increasing to an average of 90 percent of RWA calculated using the Standardised approach. Under the proposed calibration, RWA calculated under IRB would be the binding constraint, meaning IRB would continue to be the determinant of capital allocation for all four banks (the 85 percent floor to Standardised would only act as a backstop).

To meet a 16 percent capital ratio banks will need to raise capital to cover the change in RWA calculations, as well as the higher ratio, and the changes to the definition of capital. Due to the interactions between all of these components, the costs and benefits of the proposals as a whole are considered in Part Two of this RIA, rather than trying to separate out the quantified costs and benefits of each component.

Section 7: Setting the Capital Ratio – Options and Impact Analysis

7.1 Framework

The Reserve Bank has used a risk appetite framework to design and assess options for change …

The Reserve Bank has used a 'risk appetite' model to consider the appropriate setting for the capital ratio. This approach builds on, and is consistent with the conventional treatment of bank capital in the international literature.[17]

To describe the way the framework was applied in the Capital Review, this section covers the following topics:

- Sets the framework within the context of the international literature to describe the relationship between capital and output.
- Describes the approach taken in the framework to set the risk appetite at 1-in-200 years, as well as the alternatives that were considered during the Capital Review.
- Estimates the level of capital associated with delivering 1-in-200 year soundness.
- Assesses the impacts on output, and whether there is scope to further increase capital without affecting efficiency.
- Considers a range of detailed design options.

The analysis in the RIA assumes that people are risk neutral. However, there is some literature that suggests people are risk averse, or that people would be willing to sacrifice some expected output in exchange for more certain economic growth.[18] This would suggest that the net benefits of higher GDP could be scaled up to reflect the welfare benefits to New Zealanders from more stability in the economy, due to higher levels of capital. Rather than taking this approach, the risk appetite is directly reflected in setting the desired level of risk.

The framework incorporates the key perspectives from the international literature

In the literature there are three key relationships that underpin capital policy setting. One of these is the relationship between bank capital and the likelihood of a banking crisis – the more capital there is in the system, the lower the likelihood of a banking crisis.

The other two relationships relate to output. One of these is the impact of a crisis on output. While the evidence suggests banking crises trigger or exacerbate severe recessions, the extent of the harm done is debated in the literature. By reducing the probability of a banking crisis, increasing capital generates an 'output benefit' which is the output losses that have been averted.

The remaining relationship relates to the impact of capital on output, mediated by lending rates. An increase in capital may prompt an increase in lending rates that reduces output by way of an impact on the volume of lending (this is the 'output cost' of capital).

The Reserve Bank's view is that the level of capital required of the banking sector should be sufficient to ensure banks can retain creditor confidence when subject to an extreme shock. Generally speaking this means banks can maintain access to capital markets and maintain fundamental banking operations even when faced with large unexpected losses.

The Reserve Bank wants enough capital in the system to cover losses that are so large they might only occur very infrequently. The Reserve Bank views this objective as consistent with

[17] For example, see Brooke et al (2015), Cline (2016), Firestone et al (2017) and Schanz et al (2011).
[18] For example, see O'Donoghue and Someville (2018).

the legislated responsibility to maintain financial system ‘soundness. This goal can be expressed in risk appetite terms, focusing on the expected frequency and impact of financial crises.

Setting a goal to deliver efficiency is not quite so straightforward. This is because, according to academics, regulators and banks themselves, the relationship between capital and economic activity is complex.

It is generally assumed that capital impacts on output in two competing directions. On the one hand, an increase in capital reduces the probability of a banking crisis and mitigates the extent of output losses that would occur in the event of a crisis. This is the output ‘benefit’ of capital. On the other hand, an increase in capital may prompt an increase in lending rates that reduces output by way of an impact on the volume of lending. This is the output ‘cost’ of capital.

The literature suggests that up to relatively high levels of capital the benefits of increasing capital are expected to outweigh the costs. From this perspective, it makes sense to target higher capital, because doing so increases the stability and expected output (as the likelihood of banking crises fall) more than it increases the costs from higher interest rates.

However, at some point (generally at very high levels of capital) the benefits of increasing capital by a marginal amount may be quite small and outweighed by the costs. In this case, provided there is sufficient capital to deliver on the soundness objective, it makes little sense to increase capital further.

The Reserve Bank interprets the efficiency criteria in the context of bank capital as taking up all available opportunities to increase stability where doing so involves no loss of expected output. That is, where possible the Reserve Bank wants to maximise the value of the benefits less the costs of higher capital (the ‘net benefits’).

Applying the risk appetite framework

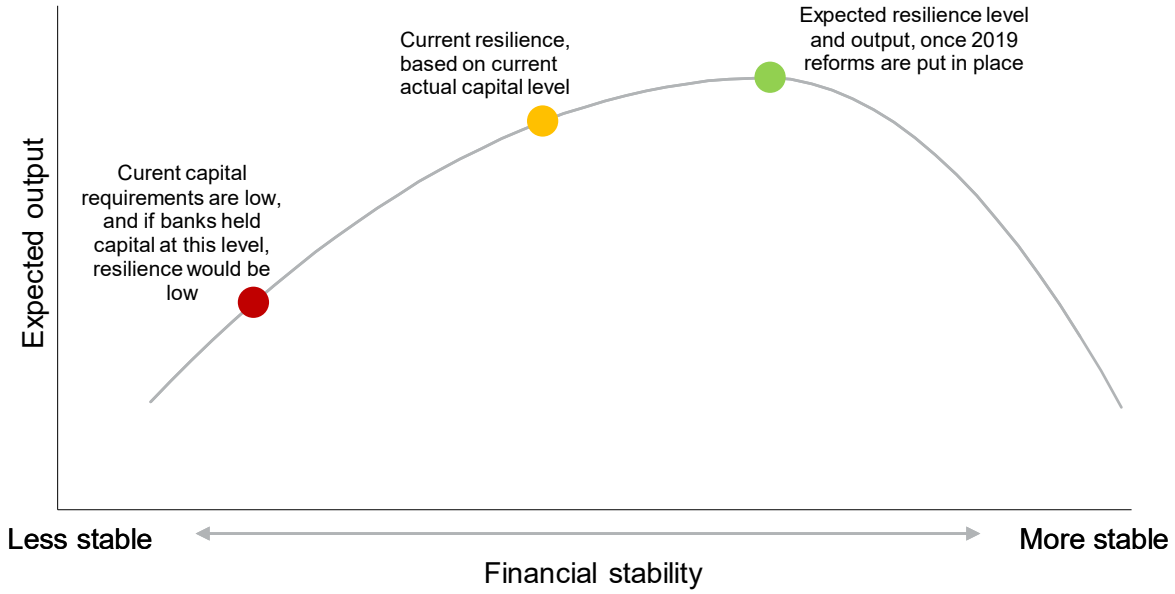
In order to apply the risk appetite approach it is necessary to form a view about the potential expected output-stability combinations that are available to New Zealand. Inevitably this involves uncertainty and the exercise of judgement. The expected output-stability combinations are illustrated in Figure 2. Each point on the output-stability curve represents a distinct level of Tier 1 capital in the banking system.

Some combinations have more stability and expected output that is not less than the *status quo*. These combinations are unambiguously preferable to the *status quo*. Some combinations have more stability but lower expected output. The value to society of these combinations is ambiguous – if a high value is placed on stability they will be seen as preferable to the *status quo*, but not otherwise.

The decision of what level of capital to require of the banking system amounts to selecting an output-stability combination that has a high probability of being preferable to the *status quo*.

A more detailed description of the specific modelling inputs used to derive a view about the expected output-stability combinations available to New Zealand is provided in Part Two of this RIA.

Figure 2: Stylised risk-appetite framework



In Figure 2, 'financial stability' is the probability that there will not be a banking crisis in any given year. 'Output' is expected output, which is the probability-weighted output of two states of the world: a 'low output' state associated with periods of financial crisis, and a normal state. Expected output in this context is not the same as actual, observed economic output, as there is an adjustment to allow for the possibility of a future financial crisis.

The measure of expected GDP used throughout this RIA incorporates the risk of a crisis as well as the likely impact of a crisis on potential GDP. Annex 1 has a detailed description of expected GDP (or expected output).

To estimate expected GDP in the counterfactual requires an assessment of two factors:

- The probability of a crisis.
- The cost of a crisis.

When considering the impact of a higher going concern capital ratio than the *status quo*, the expected GDP estimate also requires an estimate of the impact of higher capital on interest rates and steady state economic activity. Together, all of these factors provide an estimate of expected GDP – in Figure 2 increases in the going concern capital ratio increase stability and expected GDP up to the green dot. Increases to the capital ratio beyond the green dot lead to reduction in expected GDP, relative to the green dot, as the higher interest rates have a larger impact.

As with any model, judgements need to be made about design and calibration. One key area of judgement is around the society's risk appetite for a financial crisis and its effects on the real economy. This RIA shows how the Reserve Bank concluded that a 1-in-200 year risk tolerance was appropriate for New Zealand. Alternative risk appetite settings are considered in subsection 7.2.

Alongside the net benefit outcomes of different capital levels, qualitative aspects of the options is considered. This includes other important aspects of capital regulation that are outlined in Section 2, such as the performance of capital instruments in absorbing losses, as well as the sensitivity of outcomes to underlying assumptions. Although these aspects do not provide precise estimates for the net benefit calculation, they are important in providing

confidence in the ability of different options to deliver the soundness and efficiency goals set out by the Reserve Bank.

7.2 Determining the appropriate risk appetite

The risk appetite level is a key dimension of the proposal calibrations …

Banking crises can have large and long-lasting impacts on an economy, beyond the initial economic downturn that may have precipitated them. In addition to the cost of lost economic output, broader societal costs of crisis events include impacts on health, mental wellbeing and social cohesion.[19]

Estimates of the economic costs vary widely. One key judgement is determining the extent to which the output losses that are observed alongside a financial crisis are attributed to the financial crisis itself, or to the underlying real shock to the economy that might have precipitated the crisis. A second judgement relates to the permanence of the impact of financial crises. Economic output can take a long time to recover to its pre-crisis trend, and in many cases may never do so. The counterfactual path of output chosen to measure the cumulative loss of output arising from a financial crisis therefore depends on assumptions about whether that pre-crisis trend was sustainable or not. Part Two of this RIA provides a detailed review of this information as part of the full cost-benefit analysis of the decisions.

While there is a wide range of estimates available, the Reserve Bank concluded that the costs, both economic costs and other social costs, of financial crises are significant and can be long lasting. The Reserve Bank wants to avoid these costs by maintaining a sound financial system. On top of this, studies have consistently shown that individuals are generally loss averse, meaning that they hate losing money more than they love winning it.[20] For assessing the risk appetite, this suggests that society may be willing to forego a certain amount of output if it means that a severe downturn can be avoided.

The 1-in-200 years risk appetite provides the highest degree of assurance that a financial crisis will be avoided, in all but the most severe of possible scenarios, and reflects the concept of risk aversion. Critically, the 1-in-200 year setting also takes into account the costs that higher bank capital can impose on the economy. More detail about this assessment is provided in the ‘Costs and Benefits’ section of this RIA.

The Reserve Bank received a wide range of submissions about the risk appetite underpinning the Capital Review. The Reserve Bank also met with a range of stakeholders, including social service agencies, iwi and banks. In addition, The Reserve Bank ran a series of ‘deliberative workshops’, similar to in-depth focus groups, with members of the public.

The submissions and public engagements did not deliver a consensus about the risk appetite. For example, in the workshops older people tended to welcome extra stability, while people under the age of 25 were more likely to tolerate higher risk, especially if protecting against risk entails higher interest rates from extra capital. Some submitters also suggested alternative risk-appetites.

Table 17 compares the alternative risk appetite alongside the 1-in-200 year setting with the principles for the Capital Review. Both cases are more transparent than the *status quo*, which does not specify a risk tolerance. A 1-in-200 year appetite is more conservative than one-in-100 years as it implies a higher level of capital, and less risk of a crisis. From this perspective, the 1-in-200 year risk appetite was preferred over one-in-100 years for

[19] For example, see World Health Organisation (2011).
[20] Refer to Kahneman and Tversky (1979).

delivering a sound financial system. Going further than 1-in-200 years would increase resilience, but at growing costs (and these trade-offs are discussed throughout this document).

Part Two of this RIA also demonstrates that the net benefits of a 1-in-200 year risk appetite exceed the net benefits of a 1-in-100 year risk appetite, thereby achieving the 'efficiency' goal of the Reserve Bank Act. The results of this are described in more depth in Part Two of the RIA.[21]

Table 17: Comparing different risk-appetite settings with the principles of the Review

Principles	1-in-200 year risk-appetite	1 in 100 year risk-appetite
1. Capital must readily absorb losses before losses are imposed on creditors and depositors	↑↑	↑
2. Capital requirements should be set in relation to the risk of bank exposures.	*Not applicable*	
3. Where there are multiple methods for determining capital requirements, outcomes should not vary unduly between methods.	*Not applicable*	
4. Capital requirements of New Zealand banks should be conservative relative to those of international peers, reflecting the risks inherent in the New Zealand financial system and the Reserve Bank's regulatory approach.	↑↑	↑
5. The capital framework should be practical to administer, minimise unnecessary complexity and compliance costs, and take into consideration relationships with foreign-owned banks' home country regulators.	—	—
6. The capital framework should be transparent to enable effective market discipline	↑	↑

↑ *means better than the* status quo, — *means no different,* ↓ *means worse than the* status quo

7.3 Lenses to calibrate appropriate options for capital requirements

The Reserve Bank considered a wide range of options for setting the capital ratio

There is no one approach that delivers the 'answer' about what the appropriate capital ratio is for New Zealand. The Reserve Bank has considered a range of different sources of information when assessing different options for the capital ratio in New Zealand:

- International financial crisis literature and data.
- Risk modelling of New Zealand banks.
- Stress testing.
- Optimal capital modelling by the Reserve Bank and others.

It is based on these lenses that the final options for capital requirements were calibrated.

[21] Note that for the 1-in-100 year calculations, all of the inputs remain the same as in the 1-in-200 year calculations described in Part Two, except that the interest rate increase is only half as large (i.e., around 10 basis points rather than 20.5, and the probability of a crisis after capital levels increase is 1 percent rather than 0.5 percent.

As with any model, judgements need to be made about design and calibration. One key area of judgement is around society's risk appetite for a financial crisis and its effects on the real economy.

The next step is to calculate the amount of capital that would deliver the 1-in-200 year risk appetite, and convert this into a desired capital ratio

There is an extensive international literature that covers the connection between the level of capital and the probability of a crisis. For the Capital Review the key question is how much capital would deliver 1-in-200 year soundness – equivalent to a 0.5 percent probability of a crisis.

Various approaches have been adopted in the literature in order to estimate the relationship between capital and the probability of a crisis. These include:

- Collating evidence about the scale of losses experienced by banks historically, using historical losses as a guide to future losses.
- Estimating the relationship between capital and bank failure directly; using cross sectional regression analysis is one alternative.
- Using a stylised model of the banking system to generate hypothetical loss distributions for bank credit portfolios.
- In addition, stress tests can also provide a window into potential future credit losses during stress events.

To complete this RIA, the Reserve Bank considered what overseas regulators and other researchers have found to be the relationship between the level of capital and the probability of a banking crisis. Their estimates are based on regression analysis, or other estimation methods. This approach reflects a wide range of experiences, drawing on a variety of countries and types of crisis. However, the downside of this approach is that the New Zealand-specific context cannot be captured in the estimates of the capital needed to ensure a sound banking system.

To complement this approach, the Reserve Bank also used risk modelling tools to explore the possible scale and frequency of large losses in New Zealand. This requires us to consider the types of loans that are made by New Zealand banks, the historical record of bank losses in New Zealand, the drivers of banks' loan losses, and the operational and/or trading-related risks to which New Zealand banks are exposed.

Table 18 below summarises research findings that relate to the relationship between capital and the probability of a crisis – and specifically, the capital required to limit the probability of a crisis to 1/200.[22] Note, however, that there are cross-jurisdictional differences in risk-weight framework and calibration, and as such, the 'optimal' capital ratios below may need to be adjusted for New Zealand banks.

[22] *Review Paper 4* published by the Reserve Bank in December 2018 and the Background Note published in April 2019 (Guthrie (2019)) provide more detail about this international literature.

Table 18: Capital needed to cap the probability of a crisis at 0.5 percent

Study	Ratio measurement	Required amount
BCBS (2010)	CET1(equity)/RWA	10% to 13%
Brooke et al (2015)	Tier 1 leverage ratio (Tier 1 / Exposure Measure)	3% to 5%
Firestone et al (2017)	Tier 1 Capital/RWA	17%+
Dagher et al (2016)	Equity/RWA	15% to 23% required to avoid 85% of the crises during the GFC

Portfolio loss modelling was one input to inform the estimate of the level of capital required to deliver 1-in-200 year soundness …

The small size and concentrated nature of the New Zealand banking sector, and the absence of any banking crisis here in the post-war era, poses some pragmatic constraints on the range of analytical tools that are available. In particular, the value of regression-based analysis applied to historical and cross-sectional loss data, is limited in the New Zealand context.

A portfolio risk model was used to incorporate the New Zealand context in the analysis, as a complement to the review of overseas findings summarised above. The model was used to explore what level of Tier 1 capital might be sufficient to ensure the sector retained the confidence of the market after a large shock.

The central modelling tool used throughout the Capital Review was an asymptotic single risk factor (ASRF) model. This is one example of a Value-at-Risk portfolio loss model (VaR).[23] A similar approach was taken in the 2012 RIA undertaken when implementing Basel III.[24]

To use the ASRF approach the New Zealand banking system was modelled as a single bank, with a crisis defined as the bank losing the confidence of the market, meaning that there is significant uncertainty as to whether the banking system is solvent.

The ASRF model generates a convex relationship between capital and the probability of insolvency. This means that the more capital there is in the system already, the smaller the impact on a probability of a crisis due to a marginal increase in that level of capital.

The VaR tool was used to consider the potential losses arising from aggregate lending. VaR models require assumptions about the average annual probability of default of the portfolio (PD) and the loss given default (LGD). These parameters feed into an estimated loss distribution, which is key to the analysis as it allows users to infer the probability that a given loss or something larger will eventuate, which is the key issue of interest.

A range of values for these variables were considered, based on assumptions about a variety of data. Part Two of this RIA, and Annexes 1 to 7, provide an analysis of the key variables underpinning the modelling, as well as the alternative ranges considered by the Reserve Bank during the Capital Review.

[23] This is the approach described in the Reserve Bank's April 2019 Background Paper, see Guthrie (2019).
[24] Reserve Bank of New Zealand (2012), https://www.rbnz.govt.nz/-/media/ReserveBank/Files/regulation-and-supervision/banks/policy/4932427.pdf

… with the Reserve Bank concluding that a 16 percent Tier 1 capital ratio would meet the risk appetite of 1-in-200 years

Rather than derive a single 'best estimate' of the relationship between capital and the probability of a crisis – and, in particular, the capital needed to cap the probability of a crisis at 1/200 – but to identify a range of reasonable estimates. Monte Carlo simulations were used to generate multiple arrays of data relating capital to the probability of crisis.

The question the Monte Carlo analysis sought to answer was: which capital ratios emerge most often as being sufficient to cap the probability of a crisis at 1/200? Monte Carlo analysis using the input ranges for the key input variables, and a risk tolerance of 1/200 produces a frequency distribution of unweighted capital ratios. Based on this analysis the resulting capital ratio is estimated to be 16 percent.[25]

Stress test results were also considered

By assessing the impact of a hypothetical stress event on balance sheets and profitability, stress tests generate an estimate of the ability of banks to remain solvent during a severe crisis given their current portfolios.

Recent stress tests have found that the banking system can maintain significant capital buffers above current minimum requirements during a severe downturn. During the 2017 stress test, the capital ratios of major banks fell to around 125 basis points above minimum requirements, while earlier tests had a trough buffer ratio of around 200 basis points. However, stress test results are sensitive to assumptions on the scale and timing of credit losses, and on the ability of banks to generate underlying profit under stress.

While stress tests are one useful lens on the calibration of capital requirements, there are several reasons why there is no automatic link between the two. First, a given stress scenario will not capture all possible risks facing the banking system, particularly the type of extreme scenario that is being contemplated in the capital ratio calibration of a 1-in-200 year event. The Reserve Bank's stress tests typically assess a severe but plausible macroeconomic downturn event, the type of which may happen once over a period of several decades. Second, it is difficult to capture the real-world complexities of a financial crisis. Moreover, stress tests only consider the banking system as it is currently. As a result, stress tests did not play a strong role in determining 16 percent as the capital ratio required to deliver a 1-in-200 year risk appetite.

As a final step to implement the risk appetite model, the level of expected output was tested at higher levels of capital.

Step 2 of the risk appetite framework involves considering the impacts of increasing capital even further.

Higher levels of capital increase the soundness of the financial system, but as the level of capital increases, the marginal increase in soundness begins to decline. In addition, the costs, via higher interest rates continue to increase. The judgement reached during the Capital Review was that the gains from extra soundness at higher levels of capital were not sufficient to offset the costs of higher interest rates. Section 7.5 considers this in more depth.

[25] *Review Paper 4*, published in December 2018, contains a detailed description of this Monte Carlo modelling exercise.

Box 4: Illustrating a 1-in-200 year event

This box considers the scale of the loss event that would lead to a systemically important bank reaching the point of failure, at a 16 percent Tier 1 capital ratio.

The Reserve Bank used a small-scale reverse stress test model to assess the scale of losses a D-SIB would need to incur to either breach its minimum capital requirements, or exhaust all of its Tier 1 capital, over a five year horizon.

The model simulates the income statement and capital position of a representative D-SIB, taking into account changes in net interest margins (NIM), operating expenses, RWAs and impairment losses we expect to occur in an extreme scenario. The model does not specify the macroeconomic scenario needed to generate this scale of losses (e.g., the combination of unemployment and house price declines), rather it simply calculates the quantum of losses needed to result in a breach or failure.

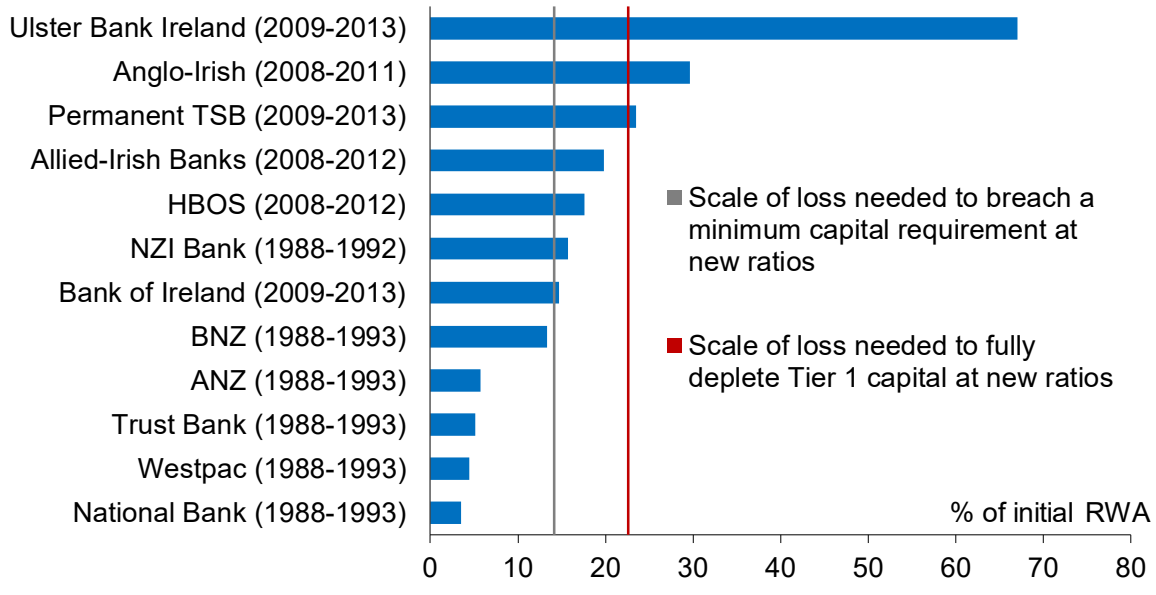
The test stresses the pre-provision net revenue (PPNR) of a bank, by assuming a 100 basis points decline in NIM phased in over the first two years of the scenario. This is a highly adverse assumption, although not implausible for a systemic shock given low and declining interest rates, nor for a 'name' crisis where stresses are focussed on one bank.

Under this scenario of significantly lower PPNR, the reverse stress test model suggests a D-SIB would be able to absorb impairment losses of around 14 percent of RWA before breaching a minimum requirement, or 23 percent of RWA before exhausting all Tier 1 capital, if the bank started the scenario with the capital ratios the Reserve Bank has calibrated to (i.e., a 16 percent Tier 1 capital ratio).

Figure 3 compares this result with international (UK and Ireland) and New Zealand experiences of impairment losses. Figure 3 shows the proposed capital levels would have been insufficient to prevent failure in the face of Anglo-Irish and Ulster Bank Ireland's loss experiences over the past decade.

A further comparison can be made with the New Zealand banks' credit losses in the late 1980s and early 1990s. While most New Zealand banks' solvency was not threatened during this period, BNZ and NZI Bank incurred significant losses, primarily on corporate lending. In both cases these banks required capital injections from their respective shareholders, and saw significant losses of market share as they repaired their balance sheets (and eventually exited the market in the case of NZI Bank). The reverse stress test model suggests that the new levels of Tier 1 capital would be just enough for a D-SIB today to be able to absorb a BNZ-scale credit loss event, on top of significant stress to its PPNR, and continue to meet their minimum capital requirements.

Figure 3: Examples of previous large loss events, compared to future capital levels



Source: Companies' financial statements, RBNZ estimates.

7.4 Detailed considerations

Having identified the preferred headline requirements, the Reserve Bank has considered a range of options for what the 16 percent ratio should be made up of

Key detailed design considerations in the Capital Review cover:

- The extent to which Tier 1 capital requirements can be met by Additional Tier 1 capital instruments.
- Whether to include a Countercyclical Capital Buffer (CCyB) in the framework.
- Whether to include a buffer for domestically systemically important banks (DSIBs)

1.5 percentage points of the Tier 1 capital ratio requirement has been allocated to an 'early set' counter-cyclical buffer …

A Countercyclical Capital Buffer ('CCyB') is a buffer that the prudential regulator can turn on or turn off during the financial cycle. A CCyB has the objectives of building financial system resilience and dampening the financial cycle. Resilience is generally viewed as the primary benefit of the CCyB, while the scope for the CCyB to mitigate the upswing of a financial cycle is generally seen as a secondary benefit.[26]

During a significant downturn or where there is a materialisation of systemic risk, banks are likely to suffer losses that can reduce their capital levels or growth in risk-weighted assets (RWA). If bank capital ratios reduce to levels closer to their minimum regulatory capital requirements, banks may restrict the flow of credit during the downturn to reduce their leverage. Such a reaction can further depress economic activity in a pro-cyclical manner. The release of the CCyB, which takes immediate effect, looks to limit the potential that the interaction between higher losses and minimum regulatory capital requirements hinder the supply of credit to the economy.

Three broad options were considered for the CCyB.

- Implement the proposed 1.5 percent early-set CCyB, as described in the December 2018 proposals. This would require further consultation regarding implementation and indicators for releasing the CCyB during times of stress and rebuilding the CCyB following an event.
- Set the CCyB at 0 percent (late-set), and leave the overall prudential capital buffer unchanged (e.g., maintain the 16% Tier 1 Capital ratio).
- Remove the CCyB from the framework (and maintain the proposed 16 percent Tier 1 ratio). This reflected points raised by some submitters and two of the External Experts, who questioned whether it is possible to accurately estimate where in 'the cycle' the economy is.

The options above consider two forms of the CCyB strategy. The late-set CCyB strategy raises the CCyB when risks are elevated in the financial system, and in most capital frameworks the increase in the CCyB has to be announced one year before it comes into effect (so that banks can raise capital). The early-set strategy begins building the CCyB towards a prescribed neutral level, even if risks are not elevated, forming part of a through-the-cycle capital calibration that can be removed during a severe downturn.

[26] O'Brien, O'Brien, and Velasco (2018) provides an overview of how the CCyB has been developed, and the BCBS (2017) provides an overview of how the CCyB has been implemented as part of Basel III.

The Reserve Bank determined that a 1.5 percent early-set CCyB provides the most benefits for New Zealand, given that it provides optionality and flexibility to lower capital requirements following a downturn or crisis. In particular, the early-set CCyB is built up sufficiently early in the cycle to maximise the likelihood that a buffer is available if and when required, accounting for the time lag in implementing a CCyB and given there is some uncertainty involved in assessing the level and potential materialisation of cyclical systemic risks. There may also be more targeted tools to mitigate the 'upswing' in the financial cycle by stemming the impact of credit growth rather than raising a system-wide tool such as the CCyB (for example, Loan-to-Value Ratio restrictions or sectoral capital requirements).

However, there are operational issues to consider relating to the release of the CCyB. If the CCyB is released too early, there is potential for it to accentuate the expansion of the financial cycle and worsen the crisis that may follow. If it is released too late, it may entail a significant cost to the real economy in the form of reduced credit availability.

The Reserve Bank will be carrying out a detailed consultation about specific aspects of the CCyB in due course, including how to mitigate the risks described, and establishing an operational framework for the CCyB.

… and small banks will not be subject to the 2 percent buffer for domestically systemically important banks (D-SIBs)

In general, the aim of a D-SIB in the New Zealand context is to reflect the larger cost of failure of a systemic bank relative to that of a non-systemic one. For the purposes of calibrating the D-SIB buffer the Reserve Bank has used international benchmarks and a risk-appetite framework

To reflect the additional risk posed by the failure of a systemic bank, a lower risk appetite can be set relative to non-systemic banks. This is an approach used by the Basel Committee in their analysis on G-SIB calibrations (and similarly was used in an IMF report into the Australian D-SIB calibration). In the New Zealand context, as the Capital Review calibrated the 1-in-200 year probability to a single representative (and systemically important) bank, the question is then what risk-appetite reflects the relatively lower risks posed by non-systemically important banks. This ultimately collapses to a judgement based on a range of considerations, including the degree to which the D-SIBs are systemically important and potential mitigating factors.

The Reserve Bank has determined that a higher D-SIB buffer (2 percent rather than 1 percent) than proposed in December 2018, and therefore a lower capital requirement for the small banks, is appropriate for New Zealand. A key determining factor is that the failure of a small bank on the financial system is significantly smaller than the impact of a D-SIB failure.

Although there is a risk that imposing a lower capital requirement lowers the resilience of small banks to survive large shocks, the riskiness should be commensurate with the risk the banks pose to the system. A 2 percent D-SIB buffer would reflect a failure probability of approximately 1-in-115 years for small banks.

Compared to setting a 16 percent Tier 1 ratio for all banks, the 2 percent buffer would reduce system Tier 1 capital by approximately $400 million, relative to a 1 percent DSIB buffer. This impact is very small within the overall context of the size of system capital, and the increase of around $20 billion from the 2019 reforms.

Public submissions on the level of the Capital Ratio canvassed a range of views

Overall submitters support the objective of ensuring a sound and efficient financial system in New Zealand. In general, submitters note several benefits to reduced risk in the financial system from having well capitalised banks with some pointing to avoiding the economic costs of crises and others being concerned with the social costs, particularly on the most disadvantaged members of society. Others say that the fiscal risk associated with potential bank bailouts is reduced with higher capital, and note that higher capital levels would provide greater protection to depositors.

However, a range of submitters questioned whether the Reserve Bank has sufficiently established a strong case for increasing capital requirements to the extent proposed. Some, but not all, say that the Reserve Bank has not demonstrated that there is a problem with the existing level of capital in the banking system, and therefore the current level of capital is sufficient. A number of submitters suggested that the costs of higher capital requirements would be substantially higher than in the Reserve Bank's documents, meaning that the costs of higher capital would outweigh the benefits.

A detailed summary of themes from public consultation is available on the Reserve Bank website: https://www.rbnz.govt.nz/regulation-and-supervision/banks/consultations-and-policy-initiatives/active-policy-development/review-of-the-capital-adequacy-framework-registered-banks

7.5 Ratio options considered

A key consideration for options was the degree of confidence in delivering soundness with different levels of capital and types of capital …

The Reserve Bank determined that the appropriate level of capital to achieve a 1-in-200 year risk- appetite was around 16 percent Tier 1 capital relative to risk-weighted assets. Given the different components of capital ratio requirements, as described in Section 7.3, the Reserve Bank identified four potential options that would deliver this approximate level of soundness. While the Reserve Bank believes that these four options could viably achieve a 1-in-200 year risk-appetite, they do so with varying degrees of confidence and different outcomes against the key principles Capital Review. As such, the net benefits of the four options were quantified alongside these key principles.

The options considered had different mixes of capital components. While there are numerous alternative combinations of capital instruments that could be derived, the four options considered by the Reserve Bank were chosen as they represent similar, but different, outcomes in net benefits and confidence in achieving the Reserve Bank goals of efficiency and soundness. For example, the Reserve Bank was comfortable with considering option 3 with 2.5 percent AT1 capital (instead of 1.5 percent), but was not comfortable with more than this amount as the performance of the AT1 instruments is much less certain at lower levels of CET1.

These four options also accommodate comments from submitters who argued for alternative capital compositions to that which was proposed in the *Review Paper 4* (December 2018) consultation. The four viable options that the Reserve Bank identified are outlined in Table 19.

Table 19: Ratio options

Options: Capital ratio
Option 1
• A 16 percent Tier 1 Ratio requirement, of which 1.5 percent could met with redeemable-preference share (RPPS) AT1 instruments, and an 18 percent Total Capital Ratio requirement. 2 percent of the Tier 1 Ratio requirement would be a D-SIB buffer, and 1.5 percent an early-set CCyB.
Option 2
• Option 2: A 16 percent Tier 1 Ratio requirement, of which 1.5 percent could met with redeemable-preference share (RPPS) AT1 instruments. The Total Capital Ratio requirement would also be set at 16 percent. 2 percent of the Tier 1 Ratio requirement would be a D-SIB buffer, and 1.5 percent an early-set CCyB.
Option 3
• Option 3: A 16 percent Tier 1 Ratio requirement, of which 2.5 percent could met with redeemable-preference share (RPPS) AT1 instruments, and an 18 percent Total Capital Ratio requirement. 2 percent of the Tier 1 Ratio requirement would be a D-SIB buffer, and 1.5 percent an early-set CCyB.
Option 4
• Option 4: A 15 percent Tier 1 Ratio requirement, of which 1.5 percent could met with redeemable-preference share (RPPS) AT1 instruments, and a 17 percent Total Capital Ratio requirement. 1 percent of the Tier 1 Ratio requirement would be a D-SIB buffer, and 1.5 percent an early-set CCyB.

… with Option 3 identified as the preferred option

Each of the four options above were assessed against the principles for the Capital Review, as shown in Table 20. The table also includes the quantified net benefits of each option, using the approach described in Part Two of this RIA. Option 3 was identified as the preferred option. By expanding the role of AT1 and reducing the size of the CET1 buffer, this is likely to result in lower interest rates without materially reducing the resilience of the system.

Table 20: Comparing options for ratio calibrations with the principles of the Review

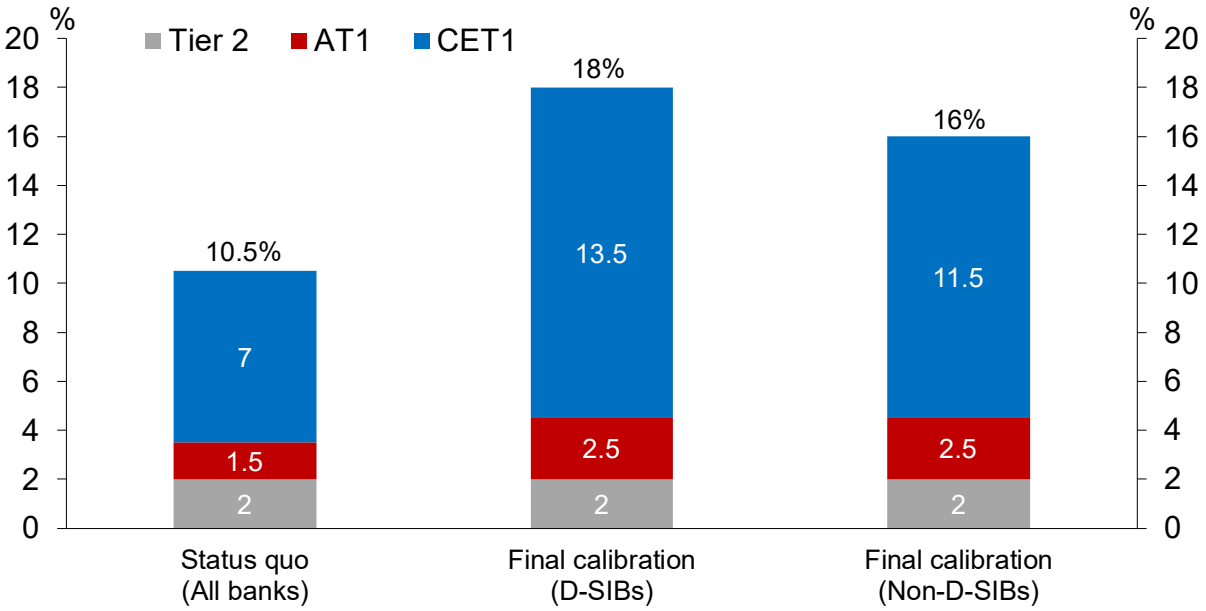
Principles	Option 1	Option 2	Option 3	Option 4
1. Capital must readily absorb losses before losses are imposed on creditors and depositors	↑↑	↑	↑↑	↑
2. Capital requirements should be set in relation to the risk of bank exposures	↑↑	↑↑	↑↑	↑
3. Where there are multiple methods for determining capital requirements, outcomes should not vary unduly between methods	*Not applicable*			

4.	Capital requirements of New Zealand banks should be conservative relative to those of international peers, reflecting the risks inherent in the New Zealand financial system and the Reserve Bank's regulatory approach	↑↑	↑↑	↑↑	↑
5.	The capital framework should be practical to administer, minimise unnecessary complexity and compliance costs, and take into consideration relationships with foreign owned banks' home country regulators	*No difference*			
6.	The capital framework should be transparent to enable effective market discipline.	↑↑	↑	↑↑	↑↑
7.	Net benefits for GDP (per annum)	0.38%	0.39%	0.43%	0.40%

↑ *means better than the* status quo, ▬ *means no different,* ↓ *means worse than the* status quo

Figure 4 compares the *status quo* against the Reserve Bank's final decision on capital calibration – option 3 above. The CET1 ratio in the chart includes both the minimum CET1 capital requirement of 4.5 percent, and buffer ratio requirement of 9 percent for D-SIBs and 7 percent for non-D-SIBs respectively.

Figure 4: *Status quo* vs final calibration (December 2019)



The preferred option incorporates a range of differences relative to the* status quo*, including an increase in the minimum capital requirement

Changes relative to the *status quo* cover the introduction of a D-SIB buffer, an early-set countercyclical capital buffer (CCyB), an increase in the conservation buffer and an increase in the minimum total capital requirement.

To accommodate the higher AT1 capital as a proportion of the total Tier 1 capital ratio, the minimum Tier 1 capital ratio was increased from 6 percent to 7 percent (of which at least 4.5 percent must be met with CET1, and the remaining 2.5 percent can consist of AT1), and the

minimum Total capital ratio was increased from 8 percent to 9 percent. The Reserve Bank's view that increasing the minimum Tier 1 capital ratio and the minimum Total capital ratio has zero or marginal impacts on the net benefits of the proposal. In some jurisdictions, the minimum Total capital ratio is viewed as a point of 'non-viability'. In other words, in some jurisdictions, a bank's breach of minimum total capital requirements is credible grounds for resolution (i.e., the bank is no longer viable once it breached its minimum capital ratio).

The Reserve Bank is of the view that a breach of minimum Total capital requirements is not likely to be automatic grounds for resolution. It is more likely that the Reserve Bank will assess on a case-by-case basis whether a bank that is in breach of its minimum capital requirements is likely to be insolvent, or whether it is a temporary issue. As such, we have not incorporated the change in the minimum Total capital ratio requirements in our cost-benefit analysis.

7.6 Overview of costs and benefits of the package of final decisions

Part Two of this RIA demonstrates that the benefits of lifting Tier 1 capital requirements to 16 percent of RWA exceed the costs…

A final, critical step of the process for setting the capital ratio at the proposed levels was to estimate the costs and benefits, including considering alternative assumptions and underlying settings. Part Two of this document – the CBA – focuses on assessing the costs and benefits of the final set of decisions discussed in Part One.

Not all the benefits and costs of the changes to the capital regulations are able to be quantified. But where it is possible, the CBA provides estimates of the quantified costs and benefits. In the 'base case' the quantified benefits are estimated to exceed the quantified costs, providing a net benefit equal to around 0.4% of GDP each year. Table 21 summarises the quantified results.

Table 21: Summary of quantified costs and benefits

High-level issue/inputs	Impact	Cost / Benefit	Channel	Estimated impact (as % of potential GDP)
Expected GDP	Lower probability of banking failure increases expected GDP	Benefit	Higher capital lowers a banks probability of failure, reducing the likelihood of a crisis	+0.83
	Lower expected GDP due to higher interest rates	Cost	Higher interest rates lowers investment in capital and ultimately lowers long-term GDP.	-0.205
	Net impact: expected GDP			**+0.63**
Transfer of Wealth	Transfer of wealth from New Zealand bank customers to foreign bank owners	Cost	Bank owners will want a higher nominal profit to counteract the larger equity base. This will result in higher interest rates on customers, paid to foreign bank owners	-0.27
	Higher tax intake from wealth flows that would otherwise have gone to foreign bank owners	Benefit Indirect	As bank owners will want higher profits, they will face higher taxes, partially offsetting the transfer of wealth from NZ bank customers to foreign bank owners.	+0.08
	Net impact: transfer of wealth			**-0.19**
Net impact (impact on expected GDP + impact on transfer of wealth)				**+0.43**

Note: Numbers may not add due to rounding

Section 8: Implementation

There are a number of changes to the Reserve Bank's capital framework for banks that arise from the decisions covered in this RIA.

It is likely that any decisions to change the capital framework will take time for banks to implement, both to meet the higher capital requirements, and to address IT (and other) system build requirements. This section discusses the different dimensions to the implementation of the proposed requirements, and the general approach used to determine the appropriate transitional arrangements.

As there is an existing process for the restructure of the Banking Supervision Handbook, the implementation of the Capital Review changes will occur in conjunction with the Exposure Draft consultations for the Handbook restructure. This will reduce the regulatory impost for banks and other stakeholders. To accommodate this, implementation of initial Capital Review changes will not commence until 1 July 2020. As such, the introduction of the Capital Review changes has been delayed by four quarters since the dates originally proposed in *Review Paper 4* (the December 2018 consultation paper).

8.1 Impact of transitional arrangements

A shorter transition period could increase the likelihood of bank credit rationing …

As part of the Capital Review, the Reserve Bank proposed to implement changes to capital requirements over a five year period. Submitters generally opposed the five year transition period, with many arguing for longer transition and noting that the consultation did not take into consideration the transitional costs of the proposals.

In general, banks can choose to maintain their current credit growth and accept temporarily lower dividend payouts in order to meet higher capital requirements, or they can restrict credit growth in order to maintain higher dividend payouts. A third alternative is to raise equity directly (e.g. through share issuance) to meet the new requirements. For this CBA and assessment of transition options, the Reserve Bank made the conservative assumption that banks would only raise equity by retaining their earnings. If enough of the banking sector restricts credit growth, it can lead to system-wide rationing of credit that can ultimately limit business and household borrowing, negatively impacting the economy. These dynamics and potential transitional costs are discussed in more detail in Part Two of this RIA.

The transitional arrangements should mitigate the potential transitional costs while not compromising the underlying principles of the Capital Review …

This focuses on the approach used to set the transitional arrangements to implement the Capital Review proposals. Determining the appropriate timeframe for implementing the Capital Review changes involves balancing the need to mitigate potential impacts from short transition paths and the underlying objectives driving the reforms.

For the implementation of the changes in the numerator (Section 5) and denominator (Section 6), the timing does not affect the nominal increase in capital levels for banks over the transition period. This makes it difficult to quantify the benefits and costs of particular transitional arrangements for these changes. As such, this RIA does not attempt to do so and instead explains the Reserve Bank's approach for setting transitional arrangements for denominator and numerator changes.

8.2 Transitional arrangements for changes in the way risk is measured

We first assessed the implementation of the denominator changes, in particular for credit risk (described in Section 6). The overarching principle these changes are addressing is Principle 3: Where there are multiple methods for determining capital requirements, outcomes should not vary unduly between methods. The December 2018 consultation (*Review Paper* 4) proposed implementing the IRB scalar changes in October 2019, and Dual Reporting and the output floor in April 2020.

These changes only have an impact on the IRB banks (ANZ, ASB, BNZ, and Westpac NZ). Some of these banks have suggested that a delayed scalar implementation would be beneficial for them as it avoids a sudden reduction in their capital ratios early in the overall transition. However, implementing these changes later than proposed would maintain the difference in the two approaches to calculating capital outcomes, which the Reserve Bank does not see is justifiable, for a longer period. This could also disadvantage non-IRB banks by limiting their ability to compete in certain sectors as they would have higher risk weights relative to IRB banks.

While it is acknowledged that there could be a large one-off impact for IRB banks, given the initial transition period has already been delayed by four quarters and the preferred capital composition is a softer position than the initial December 2018 proposal, the Reserve Bank's preferred transition path for credit risk changes is to implement them as soon as is reasonable. This would mean implementing the increase in the IRB scalar on 1 October 2020, and the output floor and dual reporting on 1 January 2021.

For the changes in how operational risk is measured, the Reserve Bank will need to undertake further consultation before it is in a position to finalise the transition of these changes. Consultation is expected to begin in 2020, with implementation possibly a few quarters afterwards. The impact of this would depend on individual banks, however we do not anticipate that it would be significant.

8.3 Transitional arrangements for changes in the definition of capital

For the changes in the definition of capital (described in Section 5), the underlying principle of the Capital Review for these changes is Principle 1: Capital must readily absorb losses before losses are imposed on creditors and depositors. The Reserve Bank proposed to phase-out non-compliant contingent instruments over the transition period using a straight-line approach. As the initial transition period proposed was five years, this would mean an additional 20 percent of the instruments' regulatory value would be 'de-recognised' each year.

Some banks argued that the contingent instruments that are currently recognised as capital should be fully recognised until their next call date. However, this would only ease the transition for a few banks. Furthermore, a longer transition period overall could provide a relief through a longer de-recognition process for non-compliant contingent instruments.

As the final reforms for the Capital Review includes extending the transition period to seven years for ratio requirements (discussed in the next subsection), the Reserve Bank's preferred transition is to maintain a smooth de-recognition, but over a seven year period.

8.4 Transition for ratio requirements

Estimates for credit rationing are possible for the different ratio transition periods …

For the transition of the changes in the ratio requirements described in Section 7, the key consideration is the extent to which the potential transitional impacts should be mitigated through longer timeframes to implement the proposals. Unlike the changes to the denominator and the numerator, the determining the transitional impact from ratio requirements changes is quantifiable to the extent that estimates can be taken for bank credit growth using scenario analysis. This is explained in more detail in Part Two of the RIA.

The Reserve Bank has therefore determined that a seven year transition period, alongside other changes in the ratio requirements (such as permitting redeemable preference shares as AT1), would be sufficient to mitigate the potential transitional costs from the reforms.

D-SIBs pose more of a risk from failure to the system …

The D-SIB buffer applies to banks that pose more of a risk from failure. As such, the Reserve Bank believes it is appropriate that the first two years of increases in the ratio requirements is comprises the D-SIB buffer. This would mean the risked posed by the 'systemic-ness' of some banks is addressed first in the prudential buffer increases.

The second increase in ratio requirements is to increase the amount that can be attributed to AT1 capital. This will allow banks to recognise more of the new redeemable preference shares as AT1 earlier in the transition path.

The CCyB will be implemented as the last portion of the ratio increases.

8.5 Further consultation work

The Reserve Bank also intends to complete a number of further consultation processes:

- The Escalating Supervisory Response (including dividend restrictions) – this will consider how supervisory actions would intensify if a bank begun to move further and further into its capital buffer.
- Operationalising the CCyB.
- Adopting the Standardised Measurement Approach for operational risk for all banks.
- Model change approval process for IRB banks.

Section 9: Monitoring, evaluation, and review

Each year the Reserve Bank will publish information on the implementation of the 2019 reforms. This information will be published by the end of November each year. The annual review will be provided to the Minister of Finance, the Reserve Bank Board, and will also be published on the Reserve Bank's website.

The first of these annual reviews will be published in November 2021. The last report will be published once all the transition period for all the changes has completed. The annual review is expected to cover the following:

- An update on implementation, including any issues that have been identified during the previous year.
- A summary of issuance of all types of new capital, dividends paid and retained earnings.
- An overview of estimated impacts on:
    - Lending rates and margins.
    - Credit growth and the availability of credit.
    - Bank profits and returns on equity.
- Changes in the structure of the financial system, including new entrants and financial disintermediation, and developments in key variables, such as extent of foreign funding of bank borrowing etc.
- An update of any relevant regulatory changes in New Zealand and other jurisdictions.
- An overview of any relevant recent economic research and analysis.

At the conclusion of the transition period, the final annual review will include an assessment of the extent to which the policy is achieving its intended objectives.

In addition, the following topics will be picked up through business-as-usual work programmes at the Reserve Bank:

- Monitor the performance of the Basel III loss-absorption features in other countries. The monitoring will take account of the experience of the contractual loss-absorption features in countries with a significant presence of foreign-owned and unlisted banks.
- Use the dual reporting process to investigate the extent to which the RWA amounts calculated using internal models provide a more accurate prediction of unexpected credit losses for IRB banks than those calculated using the standardised model.

Part Two: Cost-Benefit Analysis

Section 1: Framework

Cost-Benefit Analysis (CBA) is a central part of the Reserve Bank's approach to Regulatory Impact Assessment

This Cost-Benefit Analysis (CBA) follows the approach to Regulatory Impact Analysis set out in the Reserve Bank's Statement of Policy Making Approach.

The problem definition, *status quo,* and the options considered in the Capital Review were described in Part One of this RIA. Part Two of the RIA completes the remaining stages of the process:

- The CBA has a detailed description of the counterfactual. This is a description of what the future would look like without the 2019 reforms. The description of the counterfactual includes an assessment of the key assumptions and judgements needed to form the counterfactual.
- The CBA then focuses on the changes introduced with the 2019 reforms and the expected costs and benefits of the changes. Not all of the costs and benefits are quantifiable but all can be articulated. The assessment of the quantified costs and benefits focuses first on the expected long-term impacts, once all of the changes have been implemented and the economy has adjusted.
- The CBA then considers the transitional impacts during the period in which the proposals are being implemented.
- To test the robustness of the results, the CBA also considers a number of alternative scenarios, by altering some of the key assumptions in the CBA.

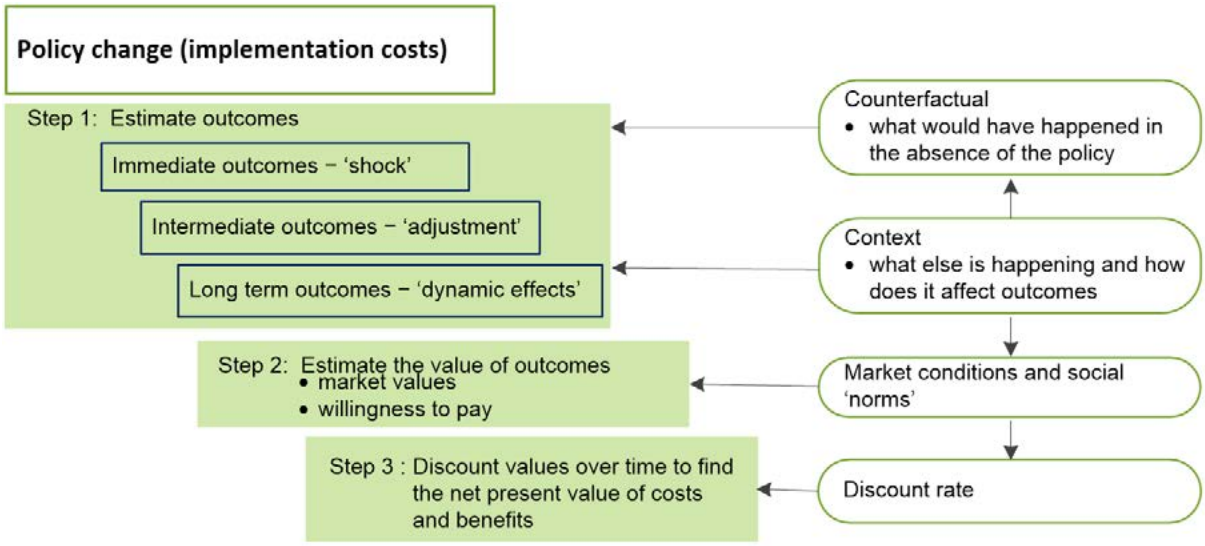
The CBA considers the impacts of the change, the pattern of adjustment and the longer term dynamic outcomes

The New Zealand Treasury has published guidance for the carrying out of cost-benefit analyses. The guide states that "the purpose of CBA is not to calculate 'the' benefits and 'the' costs, but to reduce the degree of uncertainty that would otherwise exist around [net] benefit estimates."[27] The guide also advocates identifying potentials costs and benefits "as comprehensively as possible", including not only measurable consequences "on people, rather than on organisations or decision-makers" but "avoided costs and benefits" as well, and considering the behavioural changes that may ensue from the policy. This RIA approaches these challenges by considering alternative scenarios, and articulating (if not always quantifying) a wide range of potential impacts including, but not limited to, dynamic responses to the change in incentives produced by the policy.

Other agencies have provided guidance for CBAs, and one framework that has been adopted for this report was developed by the Australian Productivity Commission (the 'framework'):[28]

[27] The New Zealand Treasury (2015) Guide to Social Cost Benefit Analysis.
[28] Australian Productivity Commission (2015).

Figure 5: Australian Productivity Commission framework



Source: Australian Productivity Commission (2015).

The framework is useful for considering bank capital requirements as the initial change (or 'shock') is expected to increase bank funding costs and interest rates, while also delivering a sounder financial system. The 'shock' is expected to generate a transition path for the economy (the 'adjustment') as well as a change in long term outcomes (the 'dynamic effects').

Costs and benefits are assessed by comparing the expected outcomes of the 2019 reforms with the counterfactual that would exist without the changes

Developing a credible and likely counterfactual of what the future would look like without the reforms is a key component of the framework used in this CBA.

The counterfactual is driven by the '*status quo*' policy settings. The CBA develops a counterfactual under the *status quo*. It is important to note that the counterfactual for what the economy would look like in the future is not just the economic environment that we have at the moment. The counterfactual must also capture the risk that there could be a crisis at some point in the future where one or more banks become insolvent, and the economic impacts of banks significantly reducing credit availability during a crisis, even if banks do not become insolvent.

The net impacts of the capital reforms are assessed by comparing estimated outcomes after intervention with estimated outcomes in the counterfactual. The critical variable for this is described as 'expected output' (or expected GDP) in this CBA. Expected output is potential ouput (or GDP) adjusted for the possibility of a crisis.

There are wide ranges of uncertainty around both the description of the counterfactual – the outcomes that would exist without intervention, including the possibility of a crisis – and the estimation of outcomes after intervention, including the (reduced) possibility of a crisis.

To incorporate this uncertainty the CBA considers a range of alternative scenarios to illustrate the areas of greatest uncertainty.

The CBA focuses on impacts on New Zealand

The guide emphasises that the CBA should only measure costs and benefits to people in New Zealand – "… benefits or costs that accrue to people outside of New Zealand are generally ignored, on the grounds that the government only has responsibility for the well-being of those who are in New Zealand."[29]

The CBA covers a wide range of economic and social costs and benefits

The guide requires CBAs to identify costs and benefits as comprehensively as possible. To do this the CBA considers all possible costs and benefits, including those identified during the consultation period. The costs and benefits cover the economic and social costs of the reforms, plus behaviour changes and potential dynamic effects.

The assessment of costs and benefits has been careful to avoid double counting – that is, all costs and benefits should only be counted once. The costs and benefits that cannot reasonably be quantified are discussed in detail in Section 5 of Part Two.

Submissions on the Capital Review have included comments on a range of topics relating to the costs and benefits of bank capital

The Reserve Bank received over 200 submissions during the course of the Capital Review as a whole. The Reserve Bank also met with a range of stakeholders, including social sector service providers, representatives of Māori communities, financial services firms, business representatives, rural sector community leaders and banks. Not all of these groups provided a formal submission.

The Reserve Bank also engaged a third party service provider to carry out three deliberative workshops with members of the public, spread across three regions.

[29] The New Zealand Treasury (2015) Guide to Social Cost Benefit Analysis, p. 10

Section 2: Defining the Counterfactual for the CBA

"The counterfactual is the situation that would exist if the decision is not made, if the policy does not go ahead. It is sometimes described as the 'do nothing' or as the 'do minimum' scenario."[30]

The counterfactual is one of the key building blocks of the CBA. The outcomes in this "do nothing" alternative are used to compare with the outcomes if the policy is implemented.

The concept of 'expected GDP' is central to the counterfactual in this CBA

The *status quo* provides the policy settings for the counterfactual. Existing financial and economic aggregates provide a range of metrics for the *status quo*.

The first candidate considered for the counterfactual is to use observed economic data. For example, actual GDP provides a measure of the level of GDP now under current policy settings. However, this would provide a flawed counterfactual as it is simply a measure of currently observed GDP and makes no account of the possibility that there could be a crisis in the future, under current policy settings, which leads to a fall in GDP.

To get around this problem, the counterfactual uses the concept of 'expected GDP'. This measure incorporates the risk of a crisis as well as the likely impact of a crisis. Annex 1 explains the expected GDP concept in more detail and shows how it is applied for the counterfactual and for the policy change. The key point is that expected GDP is central to each of the following:

- The counterfactual – to establish the level of expected GDP if the proposals are not implemented.
- The impacts of the 2019 reforms – to assess the change in expected GDP once the reforms are fully implemented (in the 'steady-state').

As shown in Annex 1, expected GDP is measured relative to potential output. This means that if expected GDP was estimated as 100 percent it would be equal to potential GDP. However, because expected GDP includes an allowance for the probability of a crisis, and no matter what level of capital is required there will always be some probability of crisis, expected GDP will always be less than 100 percent.

Estimates of expected GDP for the counterfactual require an assessment of the probability of a crisis and the impact of a crisis

Expected GDP has four elements:

- The probability of a crisis – relevant for the counterfactual and policy change estimates of expected GDP.
- The cost of a crisis – relevant for the counterfactual and policy change estimates of expected GDP.
- An estimate of the impact of higher capital on interest rates – relevant for only estimates of expected GDP after policy changes.
- An estimate of the impact of higher interest rates on steady-state economic activity – relevant for only estimates of expected GDP after policy changes.

Incorporating these critical factors into the estimates of expected GDP, in both the counterfactual and after the reforms, introduces a significant degree of uncertainty. There

[30] The New Zealand Treasury (2015) Guide to Social Cost Benefit Analysis

are a wide range of possibilities to consider about each input – the approach taken in the CBA is to identify a likely and credible set of assumptions and judgements to underpin the counterfactual.

To complete this process, each element of the counterfactual is considered separately, to assess the range of possible inputs, and then a likely and credible 'base case' is selected. This process is supported by detailed analysis in the Annexes to the CBA, which show the rationale behind each of the factors considered during the construction of the counterfactual.

2.1 Probability of a Crisis

***There are high degrees of uncertainty around 'expected GDP' estimates, as we do not know the true probability of a crisis** …*

If future unexpected losses are large enough to overwhelm the banking system's capital, the banking system will lose the confidence of the market and a banking crisis may occur.[31] However, the nature and timing of future shocks and the scale and impact of future bank losses, are unknown, so the relationship between the existing level of capital and the probability of a crisis cannot be known with certainty.

… however, we do know the amount of capital in the system, which provides the starting point for assessing the probability of a crisis in the counterfactual

The CBA estimate of the probability of a crisis in the counterfactual is based on the amount of capital in the system at the moment. This level of capital provides protection against losses, and therefore helps prevent a crisis. The Reserve Bank has concerns about the loss-absorbency properties of contingent convertible capital in a crisis, and under the proposals such instruments would no longer be accepted as AT1. Therefore, this form of capital has been excluded from the measure of capital in the system for the purposes of estimating the probability of a crisis.

Table 22: Measure of capital in the system

Type of Capital	As at 30 September 2019
Actual shareholder equity	$43.4bn
Non-compliant AT1	$6.3bn
Actual CET1 – used for estimate of probability of a crisis in the counterfactual	$36.1bn
Adjusted Tier 1 as a % of risk-weighted assets (adjusted for proposed changes in RWA rules and excluding non-compliant AT1)[32]	10.3%
Source: RBNZ estimates	

A range of different inputs have been used to help inform estimates of the probability of a crisis, including international literature and portfolio risk modelling

Because the probability of a crisis is an important component of the CBA, and because of the inherent difficulty in estimating the probability, the CBA has used a range of different

[31] In this context, 'unexpected losses' means losses not covered by provisioning by the bank. Unexpected losses would be absorbed by equity. 'Expected losses' are covered by provisioning.
[32] This is effectively equal to CET1 capital as a percent of adjusted risk-weighted assets.

approaches to inform the overall assessment. Modelling and international literature have been two of the central approaches. The final estimate reflects the Reserve Bank's analysis and judgement of all the available information to arrive at a credible and likely estimate for the probability of a crisis.

The full list of the approaches considered for the CBA are provided below:

- Regressions of the relationship between capital and bank failure using New Zealand data – a lack of New Zealand experience of severe banking stress limits the usefulness of this approach.
- Using historical loss distributions as the basis for estimates of future bank losses in New Zealand. Measuring actual historical losses is complex due to measurement difficulties, given losses can be removed from balance sheets during resolution, be realised only a long time after the event, or avoided by bailout (losses that would have arisen didn't as the crisis was averted). However loss-related historical data was factored into views about possible future losses (for example, average historical impairment rates were used as basis for the range for the probability of default in the risk modelling that was done).
- Stress tests could be used as an indicator of future losses – stress tests are highly sensitive to assumptions about the scale and timing of losses and on the ability of banks to generate underlying profits when subject to shocks. However the loss given default input range used in the risk modelling was informed by stress test results.
- Inferring default rates from credit ratings. Credit ratings relate to the probability a creditor will face a loss, which is not the same thing as a bank losing market confidence.
- Surveying market participants (e.g., creditors of banks).
- International research and analysis.

The approach in the CBA relies on two main inputs, listed below:

- International literature about the relationship between the level of capital and the probability of a crisis, supplemented by qualitative analysis prompted by advice from the External Experts who assessed the Capital Review analysis and advice (e.g., considering any incentive-related implications of capital back for the probability of default).
- Portfolio risk modelling using an asymptotic single risk factor (ASRF) model. Inputs to the modelling have been informed by a number of the approaches described above, including using stress test results to set ranges for losses given default (LGD) and reviewing historical loss data.

All of these inputs have played a role in the analysis of the probability of a crisis. It is worth noting that no single approach, or model specification, drove the analysis. Instead, the approach taken in the CBA is to use a portfolio risk model, test this for a range of inputs, and then cross check this against insights from the international literature.

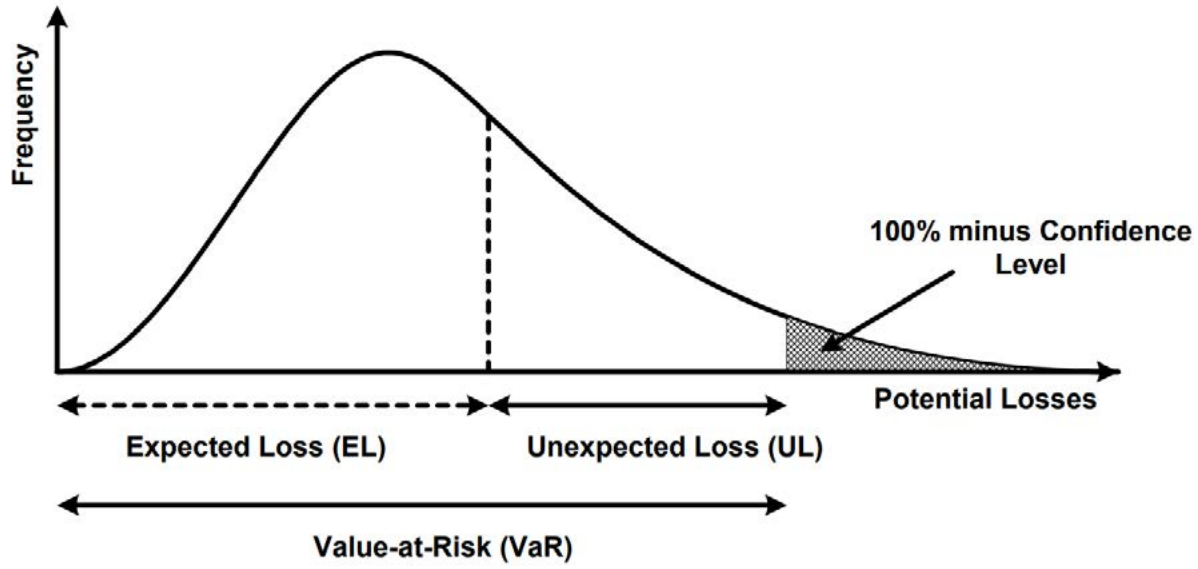
A portfolio loss modelling approach was used to help inform estimates of the probability of a crisis

The central modelling tool used in the CBA is an asymptotic single risk factor (ASRF) model. This is one example of a Value-at-Risk portfolio loss model (VaR).[33] A similar approach was taken in the 2012 RIA undertaken when implementing Basel III.[34]

To use the ASRF approach the New Zealand banking system was modelled as a single bank, with a crisis defined as the bank losing the confidence of the market, meaning, at a minimum, that the bank is viewed by market participants as being insolvent.

The ASRF model generates a convex relationship between capital and the probability of insolvency. Marginal increases in the level of capital have a smaller impact on the probability of crises as the overall capital in the system increases. Graphically, the modelling approach can be considered in the figure below.

Figure 6: Value-at-Risk, unexpected losses and the probability of a crisis[35]



Source: BCBS (2005).

The shaded region in this figure shows the probability that capital will be exceeded by losses in a shock. This is effectively the measure of the probability of a crisis that is used in the counterfactual. Expected Losses (EL) would be covered by provisioning by the bank, unexpected losses would be absorbed by equity. Once there is no more equity to absorb losses, the bank would be insolvent.

These sorts of models are highly stylised and are dependent on a relatively small number of inputs.[36] Nevertheless, they are widely used in a range of applications. It is also the approach specified in Basel III for use by banks accredited to use internal models. Estimating these models requires assumptions about the following variables:

[33] This is the approach described in the Reserve Bank's April 2019 Background Paper, see Guthrie (2019).
[34] Reserve Bank of New Zealand (2012) https://www.rbnz.govt.nz/-/media/ReserveBank/Files/regulation-and-supervision/banks/policy/4932427.pdf
[35] BCBS (2005).
[36] Tarashev et al (2008) and Danielsson (2002) provide a critique of these models.

- Probability of Default (PD) – the probability that a borrower will default on their obligation over a one year time horizon, averaged across all states of the economy, including crisis conditions. See Annex 2.
- Loss Given Default (LGD) – the economic loss the bank would face if the borrower defaults, as a percentage of the credit exposure, calibrated to economic downturn conditions. See Annex 3.[37]
- Correlation 'R' – measures the extent to which defaults are influenced by a common factor rather than idiosyncratic shocks. The correlation factor shows how the asset value of one borrower depends on the asset value of another borrower, or on the general state of the economy. See Annex 4.
- A failure threshold for banks – i.e. the point at which a bank would be nonviable. See Annex 5.
- Other technical aspects, such as bank provisioning. See Annex 5.

These input variables are not known with certainty. For the purposes of considering the probability of a crisis in the counterfactual, a central or 'base case' is identified in Table 20 below. Based on the evidence available and findings in the literature, the base case is deemed by the Reserve Bank to provide a reasonable 'central' estimate of unknown future values.

Table 23: Key variables to determine the probability of a crisis in the counterfactual

Probability of Default (PD)	Loss Given Default (LGD)	Correlation "R"	Failure threshold
2.25%	40%	0.3	Strict insolvency – capital ratio of 0%
Estimated implied probability of crisis in the counterfactual: approximately 1.8%			

The Annexes provide more details about how the 'base case' versions of these variables were determined, including how stress test results were considered. All of these estimates incorporate a significant degree of uncertainty, introducing uncertainty into the definition of the counterfactual.

In all cases there is no New Zealand data that can provide a clear cut estimate of the input variables. Instead the CBA looks at a range of proxies to inform the judgements about the variables. Because of the inherent uncertainty in the process the base case variables were also varied within plausible ranges to assess the sensitivities to alternative inputs. Therefore the base case variables in Table 23 should not be interpreted as a literal assessment of their values in the counterfactual – rather they provide a credible and likely basis for considering the probability of a crisis.

The CBA incorporates an estimated probability of a crisis in the counterfactual of around 1.8 percent…

The inputs above are used in an ASRF model to estimate the implied probability of a crisis. Annex 6 shows that this calculation suggests an implied probability of a crisis of around 1.8 percent. This is equivalent to a probability of a crisis of around one in 55 years.

During the submissions process for the Capital Review some submitters suggested that the estimates for PD, LGD and R were too conservative and therefore biased the estimate in

[37] PD multiplied by LGD gives an estimate of expected losses, which are assumed to be matched by provisions.

favour of higher capital, and a higher implied probability of a crisis. The Reserve Bank does not agree with this conclusion. Some inputs for the base case are higher than often used in New Zealand large bank IRB models, and in IRB models overseas. However, the solvency threshold of 0 percent is not conservative. In practical terms a bank is likely to be considered non-viable well before it hits 0 percent capital. When a non-zero failure point is assumed, the amount of capital needed to avert bank failure increases commensurately.

The CBA requires a central case. However as in the analysis outlined in the consultation papers and related documents, the Reserve Bank's risk modelling approach used several combinations of plausible inputs, rather than rely on a central estimate. The CBA does not aim to identify a 'base case' and stop there. The CBA also explores the implications of deviating from base case assumptions, to check that the conclusions remain reasonable when input values are varied. This 'sensitivity analysis' was done for each of the key inputs (PD, LGD and R).

To cross-check the estimated probability of a crisis at current capital levels, alternative inputs were used to estimate the probability. This is shown in Table 21. This incorporates lower measures of PD, LGD and R, which are less conservative than the 'base case', and also incorporates a higher failure threshold, compared with the zero percent threshold in the base case.

Table 24: Alternative variables to estimate the probability of a crisis

Probability of Default (PD)	Loss Given Default (LGD)	Correlation "R"	Failure threshold
1.5%	30%	0.25	Capital ratio of 4%
Estimated implied probability of crisis with the alternative parameters: approximately 1.8%[38]			

… and this looks plausible compared with estimates in the international literature

International research was also considered in the assessment of the probability of a crisis. There are a range of international estimates available, constructed using different methods and covering different countries.

The current system CET1 capital ratio of New Zealand banks, after adjusting for proposed RWA changes is around 10 percent, as banks currently have capital ratio above the regulatory requirements.

Table 25 summarises the findings from the literature covered in the December 2018 consultation paper about the probability of a crisis associated with a capital ratio of around 10-11 percent. The table shows that the estimate of a probability of a crisis in the counterfactual of 1.8 percent is comfortably within the range suggested by international literature.

[38] The revised probability of crisis using alternative inputs was also derived using an expected loss adjustment of 0.38 percent of Exposure at Default, and assumed operational risk and market risk capital requirements equivalent to 1.2 percent of Exposure at Default. These figures are based on the Reserve Bank's analysis of IRB banks' *Capital Satellite Survey* returns. In the Table 23 estimates, expected losses were assumed to be equal to provisions, which is a conservative assumption.

Table 25: Relationship between banking crisis and capital

Study	Capital ratio	Probability of systemic banking crisis	Comment
1. Basel Committee LEI study (2010)	11% of tangible common equity	1.0%	Based on regressions and portfolio modelling.
2. Brooke et al (2015)	6% Tier 1 leverage ratio	0.3%	Estimates from Brooke et al.
3. Firestone et al (2017) 'Bottom-up' measure of capital shortfalls.	11% of Tier 1 capital	1.9%	Falls to 1.8% after adjustments for liquidity regulations, and falls to 1.3% after adjustments for liquidity and increased resolvability.
4. Firestone et al (2017) 'Top-down' measure from regressions	11% of Tier 1 capital	2.3%-5.2%	Estimated probability depends on model specification.

As a further consideration, Laeven and Valencia (2018) show that from 1970 to 2017, the probability of crisis for advanced economies is 2.0 percent.[39] This is a little higher than the base case of 1.8 percent used in this RIA.

The estimated probability of a crisis of 1.8 percent incorporates a number of layers of uncertainty, stemming from uncertainty around the key inputs, and the simplifications used in the modelling process. Despite these caveats, the conclusion of this CBA is that this is a credible and likely probability for the purposes of describing the counterfactual. Section 6 on scenarios considers alternative specifications of the probability of a crisis, and the impacts on expected GDP and the costs and benefits of the proposals.

2.2 Cost of a Crisis

There are high degrees of uncertainty around expected GDP estimates, as we do not know the likely cost of a crisis

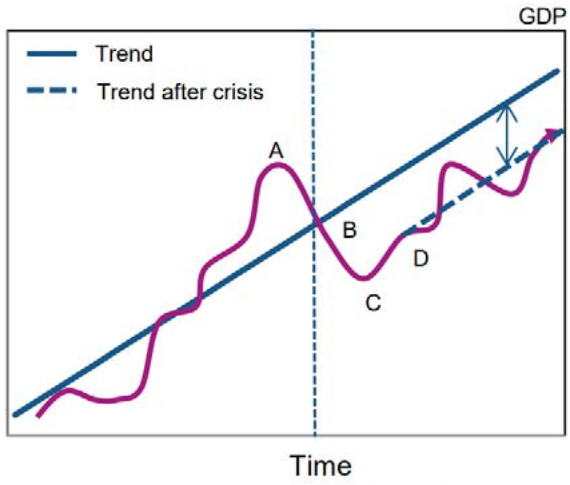
Just as there is uncertainty about the probability of a crisis, an actual crisis could take a range of different forms. A crisis could result in a temporary drop in level of GDP, followed by a quick rebound, in which case the cost of a crisis would be relatively small. Or a crisis could lead to a long-lasting or even permanent drop in the level of potential GDP. This would mean that the future path of the economy would build off a lower base, and in this situation the cost of a crisis would be large.

Defining the counterfactual, as well as the impact of policy changes, requires an assessment of the economic cost of a crisis to feed into the calculations of expected GDP. Research

[39] The 2.0 percent estimate includes the following sample: Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Hong Kong, Iceland, Ireland, Italy, Japan, Luxembourg, the Netherlands, New Zealand, Norway, Portugal, Singapore, Spain, Sweden, Switzerland, Turkey, the United Kingdom and the United States.

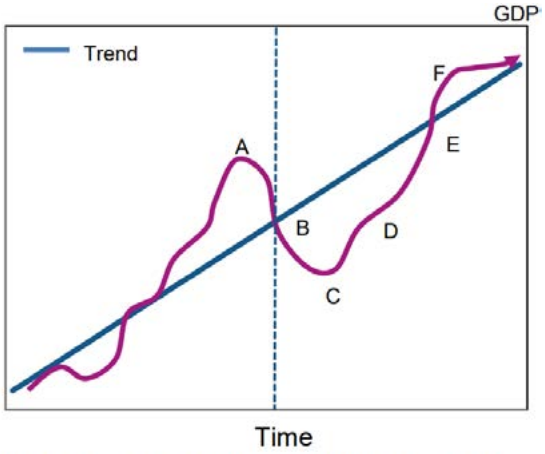
from the Bank of England illustrates how these judgements affect the expected size of a crisis, and are shown in Figures 7 and 8.

Figure 7: An example of a crisis with permanent effects



Point A = pre-crisis peak; B = onset of crisis; C = post-crisis trough; D = GDP growth equals pre-crisis trend for the first time after the crisis.

Figure 8: An example of a crisis with temporary effects



Point A = pre-crisis peak; B = onset of crisis; C = post-crisis trough; D = GDP growth equals pre-crisis trend for the first time after the crisis; E = return to pre-crisis GDP peak; F = return to the path of pre-crisis GDP levels.

Source: Brooke et al (2015).

When the impact is permanent the level of GDP falls permanently. The economy eventually returns to its pre-crisis rate of trend growth (point D in Figure 7), but the economy is permanently on a lower path. In this case, the cost of the crisis includes the present value of all of the future lost GDP in each year.

When the impact is temporary, in that it only lasts for a fixed number of years, the growth path falls to point C in Figure 8. This is followed by a sharp acceleration in growth through points D, E and F, which sees the economy return to its previous growth path. Given that the impact is time-limited, and the economy returns to its previous growth path, the impact measured by lost GDP in the temporary case is much smaller than in the permanent case.

There are wide ranges of estimates in the international literature about the likely economic cost of a crisis

New Zealand has little experience of severe banking crises in the post-WWII era. This is a challenge for estimating the likely output costs of a crisis, as the CBA cannot rely on previous New Zealand evidence to form a view. The estimate for the cost of a crisis that have been used in the CBA is judgement based, guided by international empirical results.

Table 26: Estimated cumulative present value of output lost due to a crisis

Study	Duration of impact on the economy	Discount rate	Net present value
Firestone et al (2017)	Long-lasting and varying	2.7%	41% to 99%
BCBS LEI (2010)	No permanent effect	5.0%	19%
BCBS LEI (2010)	Moderate permanent effect	5.0%	63%

BCBS LEI (2010)	Large permanent effect	5.0%	158%
Brooke et al (2015)	Permanent effect	3.5%	43%
BCBS (2019a)	"[Previous] LEI estimates stand up reasonably well to later studies."		

A key judgement applied in this CBA is that the output effects of a crisis are long lasting

The central case used for the cost of a crisis in counterfactual and for proposals is 63 percent. This reflects a judgement that the impacts are long lasting, consistent with the "moderate permanent effect" from the BCBS LEI study in 2010. More recent analysis from the BCBS (2019a) has supported their earlier estimates.[40] This CBA also identifies an upper and lower bound and considers the sensitivity of the CBA results to different assumptions about the costs of a crisis. These are covered in the Scenarios section.

Table 27: Range for cost of crisis estimates

	Lower bound	Upper bound	'Base case'
Cost of a crisis	19%	153%	63%

Potential changes to New Zealand's crisis management regime under Phase 2 of The Reserve Bank Act Review are not expected to materially reduce the economic and social impacts of a banking crisis…

Phase 2 of The Reserve Bank Act Review includes a review of New Zealand's crisis management regime.[41] Once this review is complete, it is expected that the Reserve Bank's role as the resolution authority, along with its objectives as the resolution authority, will be clarified. The Reserve Bank may also be provided with additional statutory powers to effect a resolution, which could include the legislative authority to establish a 'bail-in' framework that would allow it to write down, or convert to equity, certain unsecured liabilities of the distressed bank in order to recapitalise the bank and protect taxpayers from loss.[42] However, at this time, the Reserve Bank has not yet determined whether it would establish a bail-in framework in New Zealand, even if provided with the legislative authority to do so.

During the course of the Capital Review, several submitters and commentators have expressed interest in potential intersections between Phase 2 of The Reserve Bank Act Review and the Capital Review. Some submitters and commentators have also suggested that potential changes coming out of the Phase 2 Review – and specifically those that may come out of the review of the crisis management regime – should be factored into the Reserve Bank's calibration of capital requirements.

[40] Cerra and Saxena (2008) reach a similar conclusion.
[41] On 24 June 2019 a consultation document (*Consultation Document 2B)* was released that included a chapter entitled 'What features should New Zealand's bank crisis management regime have?' (Chapter 5), which closed for comment on 16 August 2019. Consultation Document 2B can be found here: https://treasury.govt.nz/news-and-events/reviews-consultation/reviewing-reserve-bank-act/public-consultation
[42] More information on how a 'bail-in' framework could be structured can be found by using the Financial Stability Board (2015) *Total Loss-Absorbing Capacity Principles and Term Sheet* as a reference.

… In any event, any changes to the crisis management regime would not be implemented for several years and would also be untested

At this stage, it is not clear what the ultimate outcome of the Phase 2 Review of the crisis management regime will be, nor is it clear that any of these potential changes would have an impact on the economic and social costs of banking crises in New Zealand.

From a practical perspective, it should be noted that:

- The Capital Review has been in progress for more than two years and it is important to provide banks with certainty by finalising the capital framework within a reasonable time frame.
- Any legislative changes to New Zealand's crisis management regime are not likely to come into effect for several years.
- The Reserve Bank has not yet determined whether establishing a bail-in framework would be desirable in the New Zealand context, even if provided with the legislative authority to do so.
- Were the Reserve Bank to establish a bail-in framework, it would likely not become effective for several years after the legislative authority is provided.
- Were a bail-in framework to exist, it should not be assumed that it would be appropriate to use it in all resolution scenarios.
- Were a bail-in framework to exist, its effectiveness could not be evaluated until after it is executed (bail-in frameworks remain untested internationally).

In light of all the uncertainties noted above, the Reserve Bank believes it would be premature to incorporate potential changes to New Zealand's crisis management regime into the capital framework for New Zealand's banks.

Box 5: illustrating the role of the discount rate in determining the cost of a crisis

Discounting allows costs and benefits with different time periods to be compared on a common present value basis. Table 28 showed the range of discount rates used in the overseas studies to discount the stream of annual output costs that are incurred in a crisis into a net present value. This CBA incorporates a 5 percent discount rate, and a cost of crisis with a net present value of 63 percent of GDP. This is equivalent to a permanent annual fall in GDP of 3.2 percent as the result of a crisis, if the GDP impact is assumed to be a constant rate each year. This assumption would not hold in an actual crisis as the initial impact would likely be larger than the ongoing permanent fall.

The discount rates in the Basel Committee on Banking Supervision (BCBS) studies, and the discount rate in this CBA, are lower than the 6 percent public sector discount rate recommended by the New Zealand Treasury for regulatory changes. Treasury recommends this be used "unless a project-specific discount rate can be determined on objective grounds". A 6 percent discount rate in stylised example described above would reduce the cost of a crisis to around 55 percent.

The Treasury's 6 percent rate, set out in their public sector discount rate guidance material, is largely based on the social opportunity cost of capital (SOC) approach to setting discount rates. This is effectively the pre-tax rate of return that can be expected from private sector investments. Treasury builds up its estimate from a version of the tax-adjusted capital asset pricing model with the inputs below.

Table 28: New Zealand Treasury assumptions for discount rate

Statutory tax rate	Effective marginal tax	Equity risk premium	Risk free rate	Inflation rate	Gearing (default rate)
28%	24%	7%	2.8% (as at 21 May 2018)	2%	33%

The SOC measure provides a solid basis for considering the impact of government spending and the returns to investment. However, for the type of policy being considered in the Capital Review, with benefits and costs that arise over a long time period, the conclusion of this CBA is that the Social Rate of Time Preference (SRTP) approach to setting a discount rate is appropriate.

The policy problem in the Capital Review is not about a spending decision to divert public funds, for which the SOC measure is most useful. Instead, the Capital Review is a long run social decision about the appropriate regulatory settings. This is the way the SRTP measure is used. Creedy and Passi (2017) describe the SRTP rate as "the rate of return required by a socially minded decision-maker in order to defer a unit of consumption from the present to the future".

This CBA uses a 5 percent discount rate in the calculation of the cost of a crisis. This in in line with BCBS measures. It is close to the 6% rate suggested by Treasury, while also incorporating an allowance for the long period over which costs and benefits arise.

On the other hand, in his External Experts Report for the Capital Review, Professor Miles (2019) noted that a 5 percent discount rate would likely underestimate the cost of crisis. He noted that the yield on long-term New Zealand government bonds ranged from 1 to 1.5 percent. Given an average inflation rate of 2 percent, this implies that real yields were mildly negative, and that viewed from this perspective, the 5 percent discount rate appears to be too high.

In other countries, alternative measures of discount rates are used based on an opportunity cost of consumption, equivalent to a SRTP. The UK Treasury describe this approach in detail in their *Green Book*, where they estimate a time preference and a wealth effect to build their estimated discount rate. They note that there are a range of plausible estimates but recommend a rate of 3.5 percent for the first 30 years of costs and benefits, then declining in a series of steps after that time. Internationally, the Australian Productivity Commission (2010) and Creedy and Passi (2017) show international discount rates based on the SRTP measure that range from 1.4 percent to 5.5 percent . This suggests that the 5 percent rate used in the CBA is not out-of-line internationally.

2.3 Estimate of expected GDP in the counterfactual

Bringing all of the elements together provides an estimate of expected GDP in the Counterfactual

The estimates described above for the probability of a crisis and the cost of a crisis are used to create an estimate of expected GDP for the counterfactual, using the approach described in Annex 1. This calculation is shown Table 29.

Table 29: Expected GDP in the counterfactual

Probability of a crisis in the counterfactual (p_{cf})	Cost of a crisis (L_c= present value as a % of GDP)	Expected GDP (equals $1 - p_{cf} \times L_c$) (As % of potential GDP)
1.82%	63%	98.85%

Table 29 shows that the measure of expected GDP in the counterfactual is 98.85 percent of potential GDP. This is a crucial estimate for the rest of the CBA. If the estimate of expected GDP rises after the policy change is introduced this means that there is a net benefit on expected GDP from the proposed changes. If expected GDP falls after the policy change is introduced, this means that there is a net cost to expected GDP from the proposed changes.

Section 3: Identifying the costs and benefits

Table 30: Costs considered in the CBA

Cost	Affected party	Description of transmission channel
1. Higher interest rates , leading to reduction in expected GDP	NZ society	A higher capital ratio means more bank funding must come from equity and less from debt. Equity tends to be more expensive than debt, so more equity may increase the average funding cost. If banks react to higher funding costs by passing these to borrowers, then borrowers will pay more in interest. This could reduce the level of consumption, investment and steady state GDP, reducing expected GDP.
2. Transferring of wealth out of NZ from higher interest rates	Borrowers	Higher interest rates mean borrowers pay more to banks. NZ banks are largely foreign-owned, so this means a larger transfer of wealth out of NZ.
3. Social costs	NZ society	If there are lower levels of economic activity and more unemployment this could lead to social costs, such as impacts on health and wellbeing.
4. Reduced availability of credit	NZ society	Banks may achieve a higher capital ratio by decreasing their assets (i.e. lending less). This could make it harder for some people to buy a house, start a business etc.
5. Financial disintermediation or other changes in financial system structure	NZ society	The new regulations will not apply to non-bank deposit takers (NBDTs). This may provide a competitive advantage to this sector, shifting activity away from banks. This could impose a cost if it shifts risks into unregulated sectors, or a benefit if non-banks offer innovative financing solutions.
6. Indirect costs on productivity	NZ society	Some submitters have suggested that the proposals could have a dampening effect on productivity or investment.
7. Reduced capital market efficiency	NZ society	New Zealand has shallow capital markets. Some submitters have suggested the proposals will add to this, diminishing the efficiency of capital markets to allocate resources to areas of highest returns.

Table 31: Benefits considered in the CBA

Possible benefit	Affected party	Description of transmission channel
1. Reduced probability of a crisis, lifting expected GDP	NZ society	Higher capital levels lower the probability and impact of bank failure, providing a benefit in terms of a reduction in the likelihood of facing the output losses associated with financial crises
2. Transfer of wealth into New Zealand from higher taxes	Crown	More equity financing and less debt financing will reduce the interest expenses of banks and lift taxable profit.
3. Less risk of fiscal cost of bailout in the future/reduction of implicit subsidy	Crown	Less risk of bank failure means less risk that the government would support a failing bank. There is also less risk associated with the government bailing out retail investors in contingent convertible instruments.
4. Social benefits	NZ society	Less risk of bank failure means less risk of incurring costs associated with poor mental and physical health and societal disconnection.
5. More competition	NZ society	Changes to the way that RWA is calculated will level the playing field for banks. This will reduce the advantages currently available to the IRB banks. Changes to the definition of capital will remove the tax advantages available to the big banks from issuing contingent debt to their parent banks.
6. More investment due to stability	NZ society	Reduced uncertainty is positive for firms' decisions to invest and innovate as the future path of GDP is less volatile. Innovation in the financial system is also possible.
7. Lower risks, plus transfer of risk	NZ society	A lower risk financial system will be welfare enhancing for people who are risk averse. In addition, the risks shift towards foreign owners, and possibly away from domestic depositors and creditors. This potential benefit is explicitly captured in the risk appetite framework, in that the level of risk is represented directly as a decision-relevant variable.

Section 4: Quantifying the costs and benefits

The discussion in this section focuses on the steady-state or long-run 'dynamic impacts' described in Section 1. The costs and benefits during the transition period are covered separately in Section 10. Table 32 below summarises the quantified costs and benefits of the 2019 reforms.

Table 32: Summary of quantified costs and benefits

High-level issue/inputs	Impact	Cost / Benefit	Channel	Estimated impact (as % of potential GDP)
Expected GDP	Lower probability of banking failure increases expected GDP	Benefit	Higher capital lowers a banks probability of failure, reducing the likelihood of a crisis	+0.83
	Lower expected GDP due to higher interest rates	Cost	Higher interest rates lowers investment in capital and ultimately lowers long-term GDP.	-0.205
	Net impact: expected GDP			**+0.63**
Transfer of Wealth	Transfer of wealth from New Zealand bank customers to foreign bank owners	Cost	Bank owners will want a higher nominal profit to compensate for the larger equity base. This will result in higher interest rates on customers, paid to foreign bank owners	-0.27
	Higher tax intake from wealth flows that would otherwise have gone to foreign bank owners	Benefit Indirect	As bank owners will want higher profits, they will face higher taxes, partially offsetting the transfer of wealth from NZ bank customers to foreign bank owners.	+0.08
	Net impact: transfer of wealth			**-0.20**
Net impact (impact on expected GDP + impact on transfer of wealth)				**+0.43**

Note: Numbers may not add due to rounding.

The CBA does not model the direct benefit of risk transfer (item 7 in Table 31) because it is considered explicitly in the risk appetite framework. Nor does it quantify the range of social benefits and costs discussed in Tables 30 and 31. The primary reason for this is a lack of data and established precedents for making these estimates. Nevertheless, the Reserve

Bank's assessment is that net impact of the unquantified costs and benefits factors would be to lift the overall net benefit of the reforms.

4.1 Impacts on expected GDP

This CBA considers costs and benefits by theme, starting with the impacts on expected GDP

Impacts on expected GDP are a feature of both the costs and the benefits identified in Section 6. Throughout the Capital Review the costs and benefits have been compared simultaneously throughout the consultation documents. Therefore, this CBA considers the impacts all in one place, comparing the benefits of a lower possibility of a crisis with the costs of higher interest rates.

The counterfactual in Section 4 provides the starting point for assessing costs and benefits of the 2019 reforms. As shown in Section 2 of Part Two of this RIA, the counterfactual estimates the level of expected GDP in the absence of the reforms, by adjusting potential GDP for the possibility of a financial crisis in the future. The test now is to estimate the level of expected GDP when the level of capital increases, and compare this with expected GDP in the counterfactual.

This requires the inputs discussed in Section 2, as well as estimates of the impact of higher capital on interest rates and the impact of interest rates on investment and potential GDP. In this analysis, the cost of a crisis is assumed to be the same regardless of the starting level of capital. This means the estimates for expected GDP in the counterfactual and after the policy change both include an estimated cost of crisis of 63 percent. The rationale for this is that the analysis assumes that more capital reduces the risk of a crisis, but does not affect the impact of a crisis once one occurs.

The probability of a crisis is estimated to fall from 1.8 percent to 0.5 percent following the 2019 reforms

The Reserve Bank's view throughout the Capital Review has been that the level of capital required of the banking sector should be sufficient to ensure banks can retain market confidence when subject to an extreme shock. Generally speaking this means creditors and market participants believe banks can pay their debts – remain solvent in other words – when faced with large unexpected losses.

The Reserve Bank has decided that having enough capital in the system as a whole to cover losses that are so large they might only occur very infrequently (once every 200 years) is reasonable and consistent with the Reserve Bank's legislated responsibility to maintain financial system 'soundness'.

To reflect this, the level of capital for the Capital Review reforms has been calibrated to a 1-in-200 year risk appetite. This means that the probability of a crisis in any given year is 1:200, or 0.5 percent. This does not include any voluntary buffers that banks might choose to hold.[43]

This is smaller than the probability of a crisis in the counterfactual, which has been set at 1.8 percent. This increase in soundness is the largest quantified benefit from the proposals, which is estimated to be 0.83 percent of potential GDP.

[43] Adding such a buffer would increase the estimated benefits.

However, higher bank funding costs are expected to increase interest rates…

Investors in a bank's capital, such as its shareholders, typically require a higher return on their investment than debt investors, such as depositors. This is because investors in a bank's capital bear more of a bank's risk.

More capital may imply that a bank's average funding costs (the 'weighted average cost of capital') will increase to reflect a greater reliance on this costlier funding source. Hence, increasing the capital required of a bank has the potential to increase the bank's average cost of funding, and this can be expected to flow through (to some degree) to the interest rate charged to borrowers.

… with the base case estimate pointing to an average increase in interest rates of 20.5 basis points

During the Capital Review the Reserve Bank considered a range of different approaches to estimating the expected impact on interest rates of higher capital. Analysis published in the April 2019 *Background Paper* identified a range of 20 to 40 basis points as the average increase in interest rates across all borrowers.

For the CBA, the range has been narrowed down to a more precise estimate. Dr James Cummings and Professor David Miles, External Experts who reviewed the Reserve Bank's analysis and advice during the Capital Review, suggested that the estimates used during the Capital Review were too high as they overestimated the cost of capital for banks.

The CBA incorporates updated estimates about the expected increase in interest rates induced by a 16 percent Tier 1 capital ratio. To refine the estimate, and to allow for exploration of the effects of different mixes of capital types in the capital stack, the CBA models an interest rate estimate using a more graduated funding structure, based on the various combinations and required returns on:

- Common Equity Tier 1 capital.
- Additional Tier 1 capital.
- Tier 2 capital.
- Marginal, or return-sensitive, debt funding, i.e. wholesale and term deposit funding.
- All other debt funding, e.g. transaction and savings deposits, derivative liabilities.

The net interest rate impact of the 2019 reforms has been modelled using a 'base rate plus margin' approach, whereby the return that investors require for each tier of funding is expressed relative to a common benchmark interest rate, which can be thought of as either a swap rate or risk-free rate. Summing up the product of the quantities of funding at each tier, and the computed required returns, allows us to compare the blended cost of funds for different capital stack compositions, resulting in an estimate of a 20.5 basis point increase. Annex 7 includes a more detailed description of the approach and the modelling results.[44]

The key margin inputs to the pricing calculation are shown in Table 33, including an estimation of how the margins are assumed to adjust after the transition to higher interest rates.

[44] Compared with the previous approaches, which simply used historic balance sheet returns, rather than base rates plus market-determined margins, the difference in interest rate impact for the final Capital Review reforms is immaterially different. This is explained in Annex 7.

Table 33: Investors' required returns by funding source

Funding source	Current	Post-Capital Review	Explanation
Equity (market value)	8.5% (after corporate tax)	8.25% (after corporate tax)	• Current required return implies a 7% equity risk premium (7% + 1.5% base rate), consistent with current Treasury guidance (for firms with beta of 1), and comments from ANZBGL CEO who stated ANZBGL's cost of equity was now assessed at between 8% and 8.5%.[45] • RBNZ replication of Cummings and Nguyen (2019) implied a 25bps decline in the equity risk premium given the proposed change in the equity to debt mix.
Additional Tier 1	5.5%	5.5% (after corporate tax)	• Current AT1 issuances are assumed to include a margin of 400bps. • Increases in CET1 capital reduce the expected loss of AT1 instruments. • The trigger for primary loss absorption on RPPS will effectively be 0% CET1 under our proposals, instead of the minimum of 5.125% under current rules, reducing expected loss. • On the other hand, there is likely a reduced pool of investors for the new instrument. There is likely no appetite from parent banks to purchase, given potential APS111 changes.[46] There is unknown appetite from the current pool of external investors, for example given the novelty of the instrument, lack of Basel III compliance and how this affects investment mandates, and loss of tax deductibility relative to current AT1 debt instruments. • On balance, no change in the required investor return (after corporate tax) is assumed in the CBA.
Tier 2	3.5%	3%	• Current Tier 2 issuances include a margin of approximately 200-250bps.[47] • An increase in Tier 1 capital reduces the expected loss of Tier 2 instruments, justifying a decrease in margin (this CBA assumes -50bps).
Marginal debt	2.66%	2.61%	• An increase in Total capital reduces the expected loss of senior debt (this CBA assumes -5bps).
Other debt	0.87%	0.87%	• No change in required return as this type of debt is assumed to be relatively inelastic.

[45] A transcript of an interview with ANZ CEO following FY19 results announcement, October 2019, is available at https://www.anz.com/shareholder/centre/reporting/results-announcement/

[46] APRA has published a discussion paper covering its Capital Adequacy Prudential Standards: https://www.apra.gov.au/discussion-paper-revisions-to-aps-111-capital-adequacy-measurement-of-capital

[47] For example, ANZBGL issued $1750m of domestic Tier 2 (10 year, non-call 5 year) at BBSW+200 basis points in July 2019.

Higher interest rates are estimated to reduce the level of steady state expected GDP by around 0.21 percent

Households will react to higher interest rates by spending less. Firms are likely to invest less. In the steady state this is expected to result in a small reduction in economic activity. To convert the increase in interest rates to an impact on steady state output, the CBA needs an 'output multiple'. The assumption for the CBA is that the output multiple is equal to 1. This assessment is based on the international evidence summarised in the table below:

Table 34: Estimated output multiple

	Effect on lending rates from 100 bps increase in Tier 1 capital	Effect on long run GDP (basis points)	Implied 'output multiple'
Firestone, Lorenc and Ranish (2017)	3.4 to 6.9	-3.7 to -7.4	0.57 to 2.33 (with 1.07 as the 'base case')
Fed Reserve of Minneapolis (2017)	5.7	-5.7	1
Fender and Lewrick (2016)	13	-12	0.92
Brooke et al (2015)	5 to 10	-1 to -5	0.2 to 0.5
Miles, Yang, and Marcheggiano (2013)	2.5	-2	0.8
BCBS (2010)	13	-9	0.7

A recent paper from the BCBS (2019a) that collates international literature regarding optimal capital, points towards a range for the output multiple of 0.1 to 7. This output multiple of 1 used in the CBA is roughly equal to the median output multiple across the eight studies referenced in BCBS (2019a).[48]

[48] The studies referenced in BCBS (2019a) are: BCBS LEI (2010), Miles et al (2013), Brooke et al (2015), Fender and Lewrick (2016), Firestone et al (2017), Barth and Miller (2018), Federal Reserve Bank Minneapolis (2017), and Almenberg et al (2017). All but one of these studies had output multiples that are less than 2.33.

The net impact of all of these different effects on expected GDP is an increase of 0.63 percent compared with the counterfactual

Table 35: Estimating the benefit to expected GDP from a 16 percent capital ratio (14 percent for D-SIBs)

	Probability of crisis	Output lost from higher interest rates	Output lost from a crisis	Expected output as percent of potential GDP
Variables after proposed changes	0.50%	0.21%	63%	99.48%
Counterfactual (no policy change)	1.82%	N/A	63%	98.85%
Change in expected output				**0.63%**

4.2 Impacts on wealth transfers

The CBA quantifies two types of wealth transfers:

- There is a direct cost to borrowers from higher interest rates, which will transfer wealth out of New Zealand.
- There is also an expected increase in taxes paid by the foreign-owned banks, which will transfer wealth to New Zealand.

A 20.5 basis point increase in interest rates would increase the interest payments made to banks by nearly $1 billion …

Loans from the banking industry to New Zealand households, firms and farms totals around $450 billion. If the interest rates on all of this lending increased by an average of 20.5 basis points, this would be equivalent to an additional $925 million in interest payments. The table below shows this calculation. Higher interest payments are a transfer from New Zealand to the foreign owners, effectively this is a payment for a more sound system. For New Zealand as a whole the total impact is somewhat smaller, at 0.27 percent of GDP.[49]

Table 36: Estimate of the direct impact of higher interest rates on borrowers

	$ million
Increase in interest paid (total borrowing approximately $450 billion)	925
Adjusting for New Zealand ownership (88% assumed to be foreign-owned)	814
As percentage of nominal GDP	0.27%

Source: RBNZ (sector lending, C5)

[49] To ensure that all costs and benefits are measured on a consistent basis with expected output the estimate is used as a proxy for the cost as a percent of potential GDP.

… directly taking income out of New Zealand equivalent to 0.27 percent of GDP

Borrowers would pay a higher share of their income to (largely foreign-owned) banks. Even if there was no impact on expected GDP from higher interest rates there would still be a larger outflow of income from New Zealand.

There has been a detailed discussion of this direct impact of higher interest rates in a number of Capital Review submissions. A key conclusion in this CBA is that this cost should be added to the total costs, independent of any change in GDP, as it is effectively a transfer of income out of New Zealand. This is estimated to be equivalent to 0.27 percent of GDP, as calculated above.

There are a number of simplifications that have been made for the purposes of this calculation. For example, to the extent that some of the bank shareholders are New Zealanders the wealth transfer estimate may be overstated. There is little definitive evidence available about the proportion of bank shareholders that are New Zealanders. The Reserve Bank's assessment is that any shareholding is unlikely to be material, so no adjustment has been made to reflect New Zealand shareholders. It is also possible that there could be a small fall in desired borrowing in response to higher interest rates, which would lead to a slightly lower wealth transfer cost.[50] It would also be possible to make the calculation on total interest bearing assets held by banks, instead of total borrowing. The Reserve Bank considered a number of these alternative approaches to making this calculation, and none result in a materially different number from that included in the CBA.

Increased taxes paid by foreign shareholders to New Zealand are expected to provide a small offsetting benefit

The additional interest income will lead to higher bank profits and higher corporate taxes. Banks will also pay less interest themselves as more of their funding will be made up of equity, rather than debt.

To simplify the estimate for the CBA, the additional interest received is assumed to flow through to higher taxes, with no adjustment for higher interest costs. At a 28 percent tax rate this suggests an opposite wealth transfer (to New Zealanders) of 0.08 percent relative to GDP.

It is important to note that the key consideration with regards to tax payments here is not the overall tax income of the government, but the flows of income from New Zealand. Although New Zealand business may pay less tax if interest rates are higher, this would not impact the overall ownership of wealth in New Zealand as lost income streams from the New Zealand government are 'transferred' to New Zealanders (who pay lower nominal taxes). However in this instance, when the tax intake increases from foreign-bank income streams, this does shift the ownership of wealth from foreign shareholders to the New Zealand government, thus transferring some of the wealth back to New Zealanders.

[50] There is a precedent for excluding wealth transfers where the transfer is directly linked to another offsetting benefit, even if this is unquantified. For example, the Court of Appeal considered this in Godfrey Hirst NZ v Commerce Commission, January 2017.

Section 5: Unquantified costs and benefits

There are a range of unquantified costs and benefits that are an important component of the CBA

The CBA does not attempt to quantify all the possible costs and benefits associated with the 2019 reforms. Instead, there are a range of qualitative impacts discussed below. The Reserve Bank's assessment is that the non-quantified net benefits are likely to add to the overall quantified benefits shown in the CBA.

It is generally desirable to quantify all of these unquantified costs and benefits in the CBA. However, with respect to the unquantified costs and benefits identified, this approach has not been taken as it would be speculative and provide a false degree of accuracy, as there is a lack of robust methods and data to carry out such an exercise.

More capital reduces the fiscal risk of a bank bailout

When a bank fails there is a possibility that the government may bail out creditors. In this case a bank bailout transfers costs from one group (creditors) to another (taxpayers), and leads to additional costs in the form of interest costs to cover extra government borrowing and/or economic costs from higher taxes. In effect this can be seen as similar to an implicit subsidy to banks. If the bank doesn't fail, there are no bailout costs.

Quantifying this would require the following inputs:

- Size of bank assets
- Size of any deadweight costs in crisis (e.g. fire sales and administrative costs).
- Probability of a crisis.
- Probability of a government bailout.
- Assumption about the proportion of creditors that would be 'made good'.

Financial crises are associated with social costs as well as economic costs

The social impacts of crises are a relevant consideration for society and society's attitudes towards the risk of harm from crises that is represented in capital policy settings. The discussion in this CBA largely covers the quantified economic impacts. Nevertheless, there are significant social benefits that will arise from higher capital. These are discussed in more depth in Box 7.

Box 7: Unquantified benefits and unquantified costs

Social benefits and costs

There is a large literature about the economic and social impacts of deep and prolonged recessions (such as are likely to arise in the event of a banking crises). A common theme in the literature is the harm to mental and physical health, family cohesion and community connectedness caused by the economic stress induced by a severe downturn – through unemployment, falling incomes, reduced savings and/or declining asset values. There is evidence of these impacts in both developed and developing countries although local circumstances can act to mitigate the effects.

These social impacts are not quantified in the CBA, but are another factor to consider when assessing the overall benefits of the proposals.

A number of Capital Review submissions raised the point that there could be social costs associated with the higher interest rates. This is possible through two possible channels:

- Higher rates may make existing loans unaffordable for some individuals or firms.
- If higher interest rates lead to lower expected GDP then there could be social costs associated with unemployment, bankruptcies and associated health effects.

While these are genuine social costs, the Reserve Bank's assessment is that the social benefits of the 2019 reforms are likely to be higher than the social costs.

A number of other unquantified benefits will result from the 2019 reforms

Table 31 included a range of other unquantified benefits:

- More competition in the financial sector.
- More investment due to a less variability in the future path of GDP.
- Less regulatory arbitrage.

None of these factors were central considerations during the Capital Review. However, in each instance there is likely to be a small unquantified benefit to New Zealand.

7.4 Unquantified costs

Access to credit could fall, constraining opportunities for some people …

The economic impact of higher interest rates has been quantified in the RIS. The possibility of social costs associated with higher interest rates is summarised in Box 7 above.

… or there could be financial disintermediation where activity moves into unregulated sectors

Many submissions on *Review Paper 4* claimed that higher capital requirements for banks would result in disintermediation in the financial sector – a shift in credit provision from the regulated banking sector to the non-regulated sector or lightly-regulated sector, such as finance companies, credit unions, and offshore lenders. Some submitters noted that these non-bank lenders would be more likely to restrict or withdraw credit to the economy during periods of financial stress. Some submitters also note that branches are not required to meet New Zealand capital adequacy rules, and may therefore create a competitive advantage for branches.

In order for significant disintermediation to occur, it must be accepted that higher capital requirements for banks would result in a significant reduction in the credit provided by banks. Given the relative size of the banking system compared to the size of other financial institutions in New Zealand, it is unlikely that significant disintermediation will occur in the near to medium term. This is backed up by the analysis in Section 7 in this part of the RIA.

It should also be noted that New Zealand's financial sector is currently heavily dominated by banks, so a potential shift in credit provision from the banking sector should not necessarily be viewed as a negative development, given that it would reduce the concentration of credit provision in the financial sector. In any event, the Reserve Bank will monitor developments in the financial sector (both regulated and non-or-lightly-regulated sectors) during the Capital Review transition period and will take actions, or suggest actions be taken, to maintain a sound and efficient financial system.

Box 8: The Capital Review and the role of incentives

In his External Expert Report, Professor Ross Levine recommended that the Capital Review give greater attention to the incentive effect of capital regulation on bank decision makers. According to Professor Levine, banking crises can not only arise from large shocks to banks' assets, but also from excessive risk-taking incentives for banks. These arise from moral hazard problems that are based on externalities from banks not having to fully bear the costs of risk-taking. Professor Levine describes that the incentives on executive risk-taking behaviour stemming from capital requirements are moderated by ownership and governance factors. The positive incentive effect stemming from capital requirements will be strengthened if:

- Decision makers (influential owners and executives) have more personal wealth invested in their bank.
- The additional equity comes from influential owners.
- Executive remuneration schemes penalise excessive risk-taking and variable remuneration is not based on the bank's return on equity.

Professor Levine also states that executives' behaviour influences the stability and efficiency of the financial system. For example, if executives decrease risks in credit allocation, the expected losses from borrowers defaulting would decrease as well as the likelihood of a financial crises in New Zealand. A more stable financial system can in turn increase investment and GDP levels. In contrast, if executives have incentives to increase risk- taking in credit allocation, the resulting decrease in financial stability could incur output losses and social costs.

The Reserve Bank's assessment is that the cost- and benefit-side of incentives effects are balanced.

<u>Possible cost-side incentive effects encompass the following:</u>

- Executives of New Zealand banks could be under pressure from shareholders, and/or motivated through their remuneration schemes, to maintain their bank's return on equity at increased levels of regulatory capital and, therefore, be willing to take greater risks in credit allocation.
- Bank decision makers could be incentivized to cut costs and/or to pass on costs to customers.
- Bankers may be motivated to reduce the quantity of credit allocation as a means to attain a higher capital ratio. A reduction of lending activity could curtail investment and consumption and, thus, impact NZ's GDP negatively.
- Due to higher capital levels, bank creditors may be disincentivised to monitor the bank as closely, since they view the bank as only having 1-in-200 chance of failing.

<u>Possible benefit-side incentive effects include the following:</u>

- New Zealand's bank decision makers could be incentivized to reduce RWAs by decreasing risks in credit allocation.
- Bankers may be motivated to reduce debt financing and, as banks in New Zealand are largely foreign-owned, the resulting decrease in debt-related interest payments would mean a wealth transfer into New Zealand.

As the higher capital requirements reinforces New Zealand's 'non-zero failure' regime and emphasis on market-discipline, it could incentivise shareholders to more closely monitor bank management and, if necessary, demand reduced risk-taking.

Other indirect impacts are also possible …

The Reserve Bank's analysis to determine capital requirements was primarily focused on the resilience of the banking system in the face of a diversity of shocks and the economic costs arising from higher capital. However, consideration was also given to the indirect effects of capital reforms on banks, the financial system as a whole, and the wider economy. The Reserve Bank considered, for example, whether it is possible to reduce the uneven competitive impact on banks of the current capital regime, the impacts of higher capital on the behaviour of bank managers and creditors, the wider economic implications of different capital instruments and the importance of deep and liquid financial markets for the economy.

Analysis of this nature is inherently uncertain. There are many drivers of behaviour and disentangling the implications of bank capital from other factors is problematic. The relevant factors are highly context-specific and there may be few parallels globally with the New Zealand situation, meaning there is a limited pool of 'peer' countries to learn from. More generally, the findings in the international literature can be ambiguous.

On balance, the Reserve Bank is of the view that the broader, indirect economic effects of the 2019 reforms are likely to be positive but ongoing monitoring of the broader impacts is warranted. The Reserve Bank will monitor and report annually on key developments in areas that are likely to be impacted by the 2019 reforms.

… but the impact on competition is unclear

One issue that received particular attention in submissions is the impact of higher capital on competition. The impact of the 2019 reforms, in terms of increased competition on domestic banks from foreign banks and foreign institutions, is not clear. Higher capital requirements may potentially exacerbate any barriers to entry facing foreign banks who wish to compete as banks in the New Zealand retail deposit and retail lending market. On the other hand, foreign institutions can engage in lending and banking services (but not deposit-taking) in New Zealand via branches that are not subject to Reserve Bank capital requirements. These branches are subject only to the home regulator's capital rules and may thus have a regulation-induced competitive advantage over New Zealand banks.

There are factors that can be expected to moderate these competitive impacts. For example, the systemic banks may not opt to increase their margins substantially, preferring instead to maintain their market share.[51]

The Reserve Bank's view is that the 2019 reforms are likely to helpfully support competition and that developments that support and foster competition in the financial system are, on balance, to be welcomed. However new risks can accompany innovation and rapid change in the financial system and thus a close watch on developments as the reforms are implemented is warranted.

[51] There is an extensive literature on the question of whether increased competition is desirable. For example, see Beck, Demirgüc-Kunt, and Levine (2006). The authors conclude that "regulatory policies and institutions that thwart competition are associated with greater banking system fragility"

Section 6: Scenarios and Sensitivities

The section considers a range of scenarios to illustrate the sensitivities of the costs and benefits discussed in the CBA.

The key areas of uncertainty identified in this CBA are:

- Estimates of the reduction in the probability of a crisis.
- Assessment of the costs of a crisis.
- Estimates of the expected change in interest rates, and the extent to which this flows through to lower economic activity.

Alternative specifications of each of these key topics would have an impact on the quantified costs and benefits of the proposals.

The CBA considers how much higher capital would need to increase before the quantified costs would exceed the benefits

The preceding sections show that quantified benefits exceed the costs of the proposals, with the benefits of higher stability offsetting the costs of higher interest rates. One way to test the sensitivity of the results is to consider the point at which the costs of higher capital would exceed the benefits.

Table 37 shows the costs and benefits of a 22 percent capital ratio. At a 22 percent capital ratio the net benefits fall sharply. This is because the interest rate increase would be substantially higher, resulting in higher costs through lost GDP.

A 22 percent capital ratio was not considered for implementation during the Capital Review, but is included here to illustrate that capital levels would need to be increased to a significantly higher level than included in the final decisions before the net benefits would fall to a significantly lower level.

Table 37: Costs and benefits for selected levels of capital

Key inputs	*Status quo* (Capital ratio of 10%)[52]	Tier 1 capital ratio of 13%	Tier 1 capital ratio of 16%	Tier 1 capital ratio of 22%
Impact on Expected GDP				
Quantified benefits	N/A	+0.51%	+0.83%	+1.02%
Quantified costs	N/A	-0.11%	-0.205%	-0.41%
Net impact: expected GDP	N/A	+0.40%	+0.63%	+0.61%
Impact on Wealth transfers				
Quantified benefits	N/A	+0.04%	+0.08%	+0.15%
Quantified costs	N/A	-0.15%	-0.27%	-0.54%
Net impact: wealth transfer	N/A	-0.11%	-0.20%	-0.39%

[52] 10 percent is the approximate current Tier 1 capital ratio after excluding non-compliant AT1 instruments and adjusting for changes to RWA calculations.

Overall annual net benefit (as % of GDP)	**N/A**	**+0.29%**	**+0.43%**	**+0.22%**

Monte Carlo analysis shows the estimated net benefits when all of the inputs are varied at the same time …

The CBA uses Monte Carlo analysis to simultaneously vary all of the inputs to the cost-benefit assessment to illustrate the sensitivities of the estimated costs and benefits to alternative specifications. Monte Carlo analysis randomly chooses values of the key inputs, from within a selected range and uniform distribution, and shows how the output, the net benefits, varies. In the Monte Carlo analysis in this CBA the net benefit has been calculated 10,000 times, for 10,000 different combinations of the key inputs into the cost-benefit estimates.

Table 38: Inputs for Monte Carlo simulation

Input	Lower bound	Upper bound	Base case
Change in probability of a crisis	0.5%	1.9%	1.32%
Cost of crisis	19%	158%	63%
Change in interest rates	0.16%	0.26%	0.21%
Output multiple (pass through from interest rates to GDP)	0.7:1	1.3:1	1:1

The figure below shows the outcome of the Monte-Carlo estimation. The approach to estimating costs and benefits is the same as in the base case, and incorporates the impacts on expected GDP and the wealth transfer.

Figure 9: Monte Carlo estimates of the net benefit of higher capital

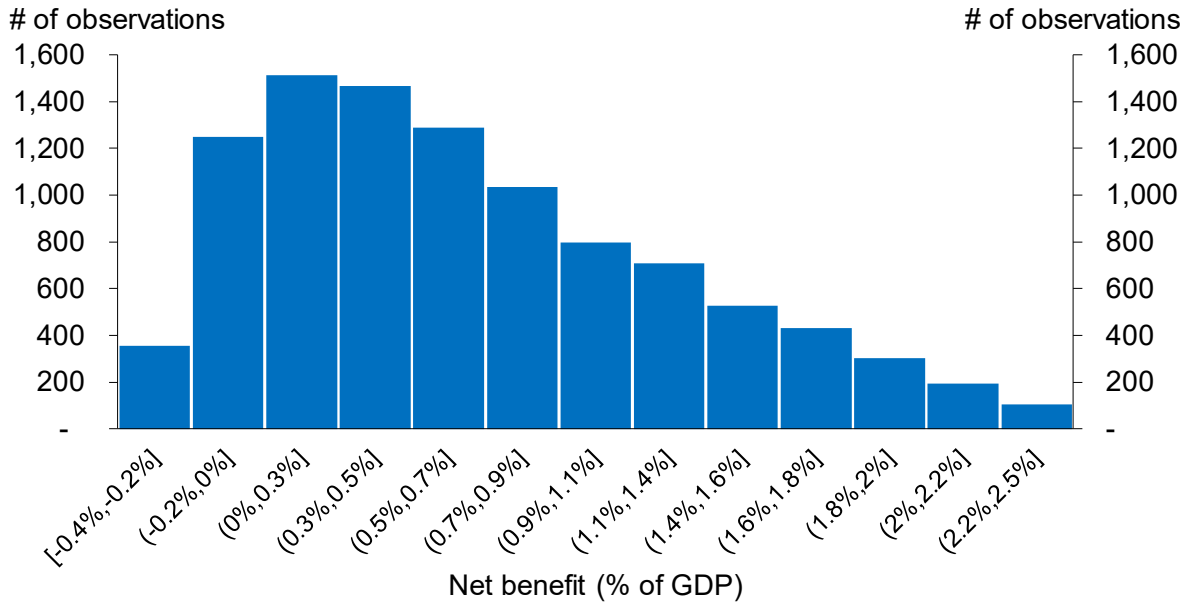


Table 39: Summary statistics from Monte Carlo simulation

Summary of key statistics			
Median net benefit	0.54% of GDP	Proportion of positive cases	86%
Average size of positive cases	0.79% of GDP	Average size of negative cases	-0.13% of GDP

… and the results show that benefits exceed costs in around 86 percent of the randomised combinations of the key inputs.

Benefits exceed costs in around 86 percent of the estimates carried out in the simulation. This does not mean that the base case is necessarily 'right', but it does show a wide zone of inputs where the net benefits are highly likely to be positive.

Substantially higher interest rate increases than in the base case are not considered likely or credible

By construction, the CBA is sensitive to the estimate of interest rate impacts. However, we are confident that the central interest rate assumption is robust for a number of reasons. It is consistent with the approach recommended by Dr. James Cummings, one of the Capital Review External Experts, in his review of the analysis and advice underpinning the Capital Review.[53]

One of the issues with interest rates being central to the framework is that interest rates move around constantly for a variety of reasons. One example is the recent repricing of risk in the rural sector, which is unrelated to capital requirements. It is important to only consider the impact from the higher capital requirements for the CBA as other fluctuations can occur independently of the reforms.

This approach has also been used to consider possible alternative increases in interest rates. If interest rates increased by two to three times more than estimated in the base case then the net quantified benefits would likely be close to zero.

However, we do not consider a two to three times larger increase in interest rates than the base case to be plausible, as it would require a combination of inputs that are not credible. Such an increase would require all of the following to hold:

- Investors' return expectations are invariant to risk (i.e. the 'Modigliani-Miller' offset is 0 percent).
- The cost of equity for banks is 11 percent (an after tax equity risk premium of 9.5 percent), based on market values, compared with percent in the CBA's estimated 8.5 percent cost of equity (7 percent equity risk premium).
- Banks hold a voluntary buffer of two percentage points, which is twice the voluntary buffer included in the base case.[54]

[53] The final reports of the External Experts are available here: https://www.rbnz.govt.nz/regulation-and-supervision/banks/consultations-and-policy-initiatives/active-policy-development/review-of-the-capital-adequacy-framework-registered-banks

[54] A voluntary buffer has been included in the estimate of interest rate impacts and the costs of higher capital, but has not been included in the calculation of the benefits of higher resilience.

Such an increase in interest rates would be well outside what we consider to be plausible, based on the economic factors that should underpin interest rates and the contribution of banks' funding structure to loan pricing.

The overall conclusion of this CBA is that the benefits exceed the costs

There is a significant degree of uncertainty around the cost and benefit estimates in this CBA. The CBA makes assumptions about the impact that a financial crisis would have on the economy. It also makes assumptions about the probability that a crisis would occur, both after implementing higher capital levels, as well as in the absence of higher capital.

The CBA has involved a careful weighing up of these factors. While it is possible to generate scenarios that would see more costs than benefits the Reserve Bank does not consider these to be likely or credible. In particular, competitive pressures in the banking sector will mean that significantly larger interest rate increases, that would increase the costs of the proposals, are not likely in New Zealand.

After considering all of the quantitative and qualitative factors, as well as a range of alternative scenarios, the conclusion reached in this CBA is that the benefits of the proposals exceed the costs.

Section 7: Impacts during transition period

The previous section of this CBA shows the estimated costs and benefits in the 'steady state' once the changes have been fully implemented and the economy has fully adjusted. This section assumes that the higher capital requirements are gradually phased in over a seven-year period and considers the costs and benefits during the transition period.

This section of the CBA considers the extent to which credit rationing could lead to large negative economic impacts during the transition period

The preceding sections of this RIA have centred on the costs and benefits in the steady-state, with interest rate increases being the driver of costs this steady-state. However, increasing capital requirements can create costs in the transition period that are independent of the steady-state costs. This is driven by banks restricting credit growth, rather than by restricting dividend payouts to investors, in order to meet capital requirements. This generally occurs through both increasing price as well non-price related factors (such as collateral and lending standards). Banks may be able to do this during the transition period because of market frictions that may not fully adjust in the short term.

Banks face a trade-off – they can either accept lower dividend payouts and maintain their credit growth, or lower their credit growth to maintain higher dividend payouts

To assess the potential for credit rationing over the transition period, the Reserve Bank analysed banks' credit growth as benchmarked against dividend payout ratios. A model incorporating bank balance sheet and income statement data was used to project the amount of capital required over the transition period relative to bank income.

To assess banks' behavioural responses, the analysis makes plausible assumptions based on information received in bank reports, bank submissions and overseas experience.[55] The model also allowed for some banks to increase their lending growth if it is consistent with past experience and future strategies.

The key consideration in this analysis is the timeframe and interest rate impact. In general, a longer timeframe, and lower CET1 requirements, allows banks to maintain higher dividend payouts with less impact on their credit growth. A higher interest rate in the steady-state also means that banks will have less pressure to ration credit as they transition to higher levels of nominal profit. In this sense, any transitional costs can run counter to steady-state interest rate impacts.

For a base case, the analysis makes a number of assumptions, which are in line with the CBA in the rest of this RIA.[56]

The historic credit growth over the past two years was used to establish a counterfactual in the absence of changes. With some small adjustments for unsustainable growth levels, this

[55] Recent BCBS evidence suggests that Group 1 and 2 banks have tended to maintain dividend payouts, even as their capital ratios have increased. See BCBS (2019b).

[56] The key assumptions are: (i) Banks maintain their current portfolio composition (housing/rural/corporate mix of loans), (ii) Operating expenses and other income increases proportionately to lending growth, (iii) Banks will target a Tier 1 ratio that is the regulatory requirement plus a 1 percent voluntary buffer, (iv) Interest rates are adjusted as per the base case of the CBA , (v) All banks would issue AT1 preference shares at a 8 percent% 'coupon' rate, (vi) Banks only raise CET1 capital through retained earnings, and (vii) there is no monetary response.

points to counterfactual credit growth in the system of 5.10 percent per annum over the transition period.[57]

The analysis then considers the impact of banks targeting dividend payout ratios, achieved by limiting their credit growth. This is estimated to have a significant impact on some banks that must restrict credit growth to maintain some dividend payouts. The result is that annual credit growth falls to 5.08 percent for a seven-year transition period.

The conclusion of this analysis is that with a transition period of seven years there is only a 2.2 basis point reduction in annual credit growth. This analysis does assume that some banks will be willing to accept lower dividend payout ratios (than they would otherwise), but at levels in line with the international experience of the implementation of the Basel standards.

Table 40: Estimates of credit growth during the transition period

	5 Years Transition Period		7 Years Transition Period	
	Annual credit growth	Relative level of credit by end of transition	Annual credit growth	Relative level of credit by end of transition
Counterfactual	5.10%	100%	5.10%	100%
Changes if banks target dividend ratio	4.44% (↓65.7bps)	95.66%	5.08% (↓2.2bps)	99.85%

The estimated reduction in credit growth over a seven year transition period is small and not expected to have a material impact on economic growth

In the seven-year scenario, credit growth is expected to be only 2.2 basis points lower than the counterfactual, significantly smaller than the impact of a five-year transition period. This is due to both the longer transition period, and banks being able to meet 2.5 percent of their Tier 1 requirements from AT1 instruments.

While this analysis depends on the scenarios inputs assumed, the Reserve Bank believes that overall these have been generally conservative for the following reasons:

- Banks could meet the requirements through portfolio reallocation, or issuance of new equity, which would mean any credit rationing may not be as large as implied in this scenario analysis.
- Banks could take other mitigating factors other than credit rationing, such as efforts to reduce operating expenditure.
- It is possible that other non-bank sourced funding could fill any credit demand gap.

[57] Unsustainable growth levels refer to individual banks' credit growth that cannot be sustained without materially depleting their capital ratios. As these banks cannot maintain these growth rates regardless of the Capital Review, they should not be considered at face value in the counterfactual.

Annex 1: Detailed description of Expected GDP (output)

Expected GDP (output)

Expected output is represented in the following equation

$$Q_e = \bar{Q}[(1-p) - p \times L_c - L_r]$$

Where:

Q_e= expected output, expressed as a percentage of potential output ($\bar{Q}$).

$\bar{Q}$ = potential output, the level of output if there were no crises. This is set to be consistent with current capital requirements (and lending rates) for comparative purposes. We set $\bar{Q} = 1$.

p = the probability of a crisis. $p = p(k)$, where k is the capital ratio, so the probability of a crisis is some function of the level of capital.

L_c = the present value of the cumulative output lost in a crisis, as a percentage of $\bar{Q}$. L_c is assumed to be a constant

L_r = the present value of cumulative output lost to changing lending rates, as a percentage of $\bar{Q}$. This is a function of capital: $L_r = L_r(k)$.

Counterfactual expected GDP (output)

In the counterfactual, regulatory capital remains the same as the *status quo*, so $L_r = 0$. This gives the following measure of Expected GDP in the counterfactual *as a percent of potential GDP*, where cf is used to denote the counterfactual state:

$$Q_{e,cf} = (1 - p_{cf}) + p_{cf} \times (1 - L_c)$$

Rearranging this equation gives:

$$Q_{e,cf} = 1 - p_{cf} \times L_c$$

Policy change expected GDP (output)

In the state where the policy change is implemented, denoted by cr, the amount of regulatory capital changes and expected output is:

$$Q_{e,cr} = (1 - p_{cr}) \times (1 - L_r) + p_{cr} \times (1 - L_r - L_c)$$

$$Q_{e,cr} = 1 - L_r - p_{cr} \times L_c$$

These two measures of expected output ($Q_{e,cf}$ and $Q_{e,cr}$) are used in this CBA to compare the expected output if the proposals are implemented with the expected output in the counterfactual if the proposals are not implemented.

Change in Expected GDP

Change in Expected GDP can be calculated as:

$$Q_{e,cr} - Q_{e,cf} = (1 - L_r - p_{cr} \times L_c) - (1 - p_{cf} \times L_c)$$

$$Q_{e,cr} - Q_{e,cf} = (p_{cf} - p_{cr}) \times L_c - L_r$$

Annex 2: Probability of Default

Lower bound	Upper bound	Base Case in Counterfactual
1.5%	3%	2.25%

Description	Data / model limitations
PD is the likelihood that a credit exposure will default averaged over a range of economic conditions. It is expressed as an annual rate. It is averaged across all states of the economy, so it should cover both normal times and a crisis. Therefore, when looking at historical information to inform the assessment of PD it is important that the PD data includes a downturn period.	There is limited downturn default data for New Zealand banks to provide empirical estimates. The GFC is not considered a sufficiently severe enough downturn to represent a long-term cycle. Furthermore, the 1989 recession is only partially reflected in some data sources.

Key information considered for the CBA

A wide range of factors were considered to address the absence of downturn loss date for the purposes of setting PD values and ranges for the CBA. IRB models used by banks include average PD values of around 1.1%. This was rejected as a base case as the current benign credit environment means the long-term average will be somewhat higher and IRB values do not necessarily reflect the Reserve Bank's interventions on IRB models.

Annualised default rates in stress tests are typically around 2.8%. This does not reflect the long-term average PD.

The CBA considered the ratio of non-performing loans to total loans (the NPL ratio). This is a snapshot of loans that shows the relative frequency of defaulted loans at a point in time. This means that the NPL measure is being used to guide the PD input value, to provide a proxy of the probability that a loan will default in a year. The NPL data provides a longer time period of observations that the PD data. However, the key limitation is that non-performing loans can remain on a bank balance sheet over several years, resulting in a 'double counting' as the observed loan is counted as non-performing each year it remains on the bank's book (whereas a loan should only 'default' once).

Conclusion

The simple average non-performing loans ratio (total impaired and past due assets / loans and advances) of New Zealand banks between 1989 and 2017 was 2.98%. To get around the double counting problem the CBA uses the average nonperforming loan ratio at the top of the range, and the 50% of the historical average at the lower bound (which assumes a two year workout period for nonperforming loans).

The base case is set as the mid-point between the upper and lower bounds.

There is no 'right' input value to use for PD. Any chosen value involves judgement and introduces uncertainty. The PD for the CBA largely is therefore judgement based, informed by the historical data discussed above. The CBA adjusts the observed average impairment rate of 3% down to 2.25%, to allow for the risk of double counting in the impairment data. The Scenarios section of the CBA considers alternative specifications.

Annex 3: Loss Given Default

Lower bound	Upper bound	Base Case in Counterfactual
35%	50%	40%

Description	Data / model limitations
LGD is the proportion of a loan exposure expected to be lost following default, calibrated to economic downturn conditions. LGD is dependent on the characteristics of the loan. Losses are influenced by the presence of collateral, and when no collateral exists, the cash flows that the borrower pays after default determine the LGD of the loan.	There is limited downturn loss data for New Zealand banks to provide empirical estimates. However, there are stress tests that provide useful insight into expected downturn losses.

Key information considered for the CBA

During 2014 and 2017 the Reserve Bank carried out stress testing of the big four banks. These exercises assess the extent to which bank balance sheets are resilient to a range of different shocks. Stress testing results for total losses are shown in the table below.[58]

Table A3.1: Stress testing results

	Exposure at Default ($b, 2017)	Cumulative default rate (%)		Cumulative loss rate (%)	
		2014 test	2017 test	2014 test	2017 test
Total	488.3	13.7	13.8	5	4.3
Implied LGD (%)					
2014			2017		
36.5			31.4		

The stress tests above were used as a guide to considering an appropriate LGD for the CBA. LGD is calculated in the table above by dividing the cumulative loss rate by the cumulative default rate.

Conclusion

For the base case in the CBA the LGD estimate was scaled up to 40%, to allow for a higher level of losses that could be associated with a crisis event. In a crisis event the losses could be higher and this consideration has led to the application of a higher LGD.

The LGD for the CBA largely is therefore judgement based, informed by the stress test data discussed above. The Scenarios section of the CBA considers alternative specifications.

[58] The Table is a modified version of Table 3 from Lilly (2018).

Annex 4: Correlation 'R'

Lower bound	Upper bound	Base Case
20%	40%	30%

Description	Data / model limitations
'R' is the degree to which the default of a credit exposure is related to systematic risk. It represents how strongly linked defaults in a credit portfolio are to general economic conditions, as opposed to idiosyncratic factors.	R is a difficult variable to measure. While some empirical estimates have been undertaken, these are heavily reliant on assumptions around the distribution and independence of individual obligors. While the Basel framework provides a basis for asset-class specific R-values, the Basel calibration is based on large internationally active banks. As such, it implicitly assumes a degree of and geographic diversification that is unlikely to be present in banks with narrower business model focusses, such as those operating in New Zealand.

Key information considered for the CBA

In a Bank of England Working paper Neumann describes R (the asset value correlation) in the following way:[59]

"In the Basel internal ratings-based (IRB) framework for assessing credit risk, banks estimate certain parameters such as probability of default (PD) and loss given default (LGD) using their own data. They then feed these parameters into the regulatory-defined IRB function, which in turn transforms them into a 'risk weight'. This risk weight determines the minimum amount of capital a bank has to fund the asset with."

The asset value correlation (AVC) parameter within the IRB function is a key driver of how high the risk weight is for any given combination of PD and LGD. The intuition of this parameter is as follows: consider 100 loans with an annual probability of default of 1%. If correlation is zero then we would see about one default a year. If correlation is one then either all loans default together or no loan defaults. So we would see no defaults at all for 99 years and then 100 defaults in a single year. Clearly this all-or-nothing risk has different risk management and capital requirement implications than a steady procession of on average one default a year. The higher the AVC parameter, the closer the portfolio risk is to the all-or-nothing situation."

There is limited New Zealand evidence available about how R should be set for the CBA. As in the discussions in Annexes 2 and 3, New Zealand does not have a recent crisis that we can use to track the correlation of loan defaults.

In the absence of strong New Zealand information the CBA looked to other information sources to act as indicators to help set to base case (and ranges) for R. Defaults in housing are likely to be driven by serviceability issues, which is likely correlated with unemployment rate. However, since we do not have data on household-level debt servicing, we assume that return on house values (e.g. changes in house prices) is a reasonable substitute for household income.

The table below shows statistical correlation estimates between real asset values and real GDP in New Zealand.

[59] Neumann (2018).

Table A4.1: Correlation and 'R' estimates for NZ and other countries

Country	Statistical correlation estimates				Approximate 'R' value (square root of correlation)
	1990 to 2007	1990 to 2017	Full sample available	Full sample result	
New Zealand	0.52	0.63	1990 to 2017	0.63	0.39
UK	0.37	0.62	1976 to 2018	0.47	0.22
Canada	0.24	0.26	1971 to 2018	0.31	0.10
Norway	0.40*	0.44*	1993 to 2018	0.44	0.19
Ireland	N/A	N/A	2006 to 2018	0.44	0.19

Conclusion

The base case R was set at 0.3. This is a judgement-based measure, influenced by considering the correlation of asset prices and GDP in New Zealand.

Annex 5: Other factors in the ASRF model

Failure threshold

Lower bound	Upper bound	Base Case
0%	4%	0%

Description	Data / model limitations
This is the level of Tier 1 capital ratio that a bank 'fails' at. This could represent an accounting concept of insolvency, or the point at which a bank can no longer conduct its operations or access capital markets.	While it is likely that banks would fail prior to reaching the accounting level of insolvency (0% failure threshold), it is difficult to determine the exact point at which banks fail.

Key information considered for the CBA

The point at which a bank fails is determined by both judgement and the definition of 'failure'. One clear option is to adopt the accounting concept of insolvency (0% equity remaining). In reality though, banks often 'fail' in the sense that they can no longer provide banking functions before this point. Determining at which Tier 1 ratio this occurs at does, however, depend on a degree of judgement and only limit historical experience (e.g., Royal Bank of Scotland effectively failed at around 1.5 - 2% Tier 1 capital and the BCBS use 4.5% in their G-SIB analysis).

Conclusion

For the base case in the CBA, the failure threshold used was 0%. This likely understates the actual level of capital required from the ASRF model. However, as Professor Miles noted that, while we are understating this factor, the Reserve Bank has been conservative elsewhere, such as the PD inputs used. As such, for the base case 0% was used noting it likely understates the capital requirements produced by the ASRF model, but that conservative judgements are made elsewhere.

Expected Loss

Description

The loan losses that are expected on an average year. The ASRF model assumes that banks hold provisions for this amount and that Expected Losses do not make-up the regulatory capital requirements for downturn events.

Key information considered for the CBA

The ASRF model assumes that the PD input multiplied by the LGD input is the average loan losses on a given year. However, in reality IRB banks use their own internal model outputs to calculate required provisions, and under the standardised approach provisions do make up part of the regulatory capital requirements.

Conclusion

The use of PD times LGD for Expected Loss generally understates the capital required through the ASRF model, as in practice, New Zealand IRB banks' provisions are lower than the expected loss estimates computed in the base case. However, as there have been conservative assumptions elsewhere in the modelling, for the base case the RIA maintains the PD times LGD approach.

Confidence interval

Description
The probability that, over a one-year horizon, unexpected losses on a portfolio of credit exposures will not exceed the amount of capital. For the Capital Review, this was set to 99.5%, which in notional terms represents a 1-in-200 year probability of insolvency or bank failure.
Key information considered for the CBA
The Basel equation made a number of simplifying assumptions (such as the normal distribution of economic variables) to make it tractable for banks and supervisors. As such, model uncertainty means that in practice the Basel equation is likely to deliver a lower level of solvency than implied by the notional 99.5% confidence level. This could be addressed through either a more conservative confidence level representing 1-in-200, or more conservative inputs elsewhere.
Conclusion
While the limitations of the normal distribution of the Basel equation could be addressed through a higher confidence interval (to proxy for a more accurate 1-in-200 year risk appetite), given conservative assumptions elsewhere and the sensitivity of the model, for the base case in the RIA a 99.5% confidence interval was used to represent 1-in-200.

Annex 6: Estimating the probability of a crisis

The probability of a crisis in the 'base case' of 1.8% is estimated by entering each of the base case input variables into the ASRF model.

The ASRF model we used is identical in almost all respects to the model specified in the Basel III standards for use by IRB banks when estimating portfolio risk weights. We omit the Basel factor for borrower size (used for corporate exposure) and we inputted assumed values for the correlation variable (R), rather than allowing it to be determined by the value assumed for PD (as the Basel standards allow for some types of loan portfolios). In the Basel equation, capital (k) is estimated in the way shown in equation A6.1. The equations below show that this can be rearranged to give the "confidence level" in the model (C.L. in the notation below) – this is effectively a measure of the probability of a crisis (Equation A5.2).

Equation A6.1

$$K = LGD \times \left(N\left(\frac{1}{\sqrt{1-R}} \times G(PD) + \sqrt{\frac{R}{1-R}} \times G(Confidence\ Level) \right) - PD \right)$$

$$\frac{K}{LGD} + PD = N\left(\frac{1}{\sqrt{1-R}} \times G(PD) + \sqrt{\frac{R}{1-R}} \times G(C.L.) \right)$$

$$G\left(\frac{K}{LGD} + PD\right) = \frac{1}{\sqrt{1-R}} \times G(PD) + \sqrt{\frac{R}{1-R}} \times G(C.L.)$$

$$\frac{G\left(\frac{K}{LGD} + PD\right) - \frac{1}{\sqrt{1-R}} \times G(PD)}{\sqrt{\frac{R}{1-R}}} = G(C.L.)$$

Equation A6.2

$$N\left(\frac{G\left(\frac{K}{LGD} + PD\right) - \frac{1}{\sqrt{1-R}} \times G(PD)}{\sqrt{\frac{R}{1-R}}} \right) = C.L.$$

In the equations above:

- N refers to the standard normal distribution applied to the single risk factor (the single risk factor has a mean value of 0 and a standard deviation of 1)
- G refers to the inverse of the standard normal distribution, applied to PD
- Provisions are assumed to equal expected losses. Capital is required to fill the gap between the total loss and provisions.

The 'confidence level' in this model (C.L. in the notation above) is effectively a measure of the probability of a crisis.

For the purposes of describing the counterfactual we know what the observed level of CET1 capital is. We also have input values for R, PD and LGD, as well as other considerations such as the failure threshold. The equation is then solved to calculate the implied confidence level' or probability of a crisis.

Annex 7: Overview of interest rate impact analysis

One key input to the CBA calculation is the impact of changes in bank capital ratios on lending rates. The Reserve Bank had previously communicated its expectation that the changes could lead to lending rates increasing by between 20 and 40 basis points (bps).

In the CBA the Reserve Bank estimated this impact using a 'base plus margin' approach to calculating banks' cost of funds. The chosen approach assesses the change in banks' funding expense by altering the relative quantities of the different types of funding banks employ, and the margins that each funding source needs to earn (expressed relative to a benchmark) to compensate those providing that funding. If increases in banks' capital ratios lead to a higher total funding expense, this is likely to be recovered by charging higher lending rates to borrowers. By expressing the cost of different types of funding relative to a common benchmark interest rate, this approach allows for the evaluation of the lending rate impact of different capital ratio and instrument combinations.

Five types of funding are considered in the CBA analysis:

- Equity, expressed as an estimated market value
- Additional Tier 1 capital (redeemable, perpetual, preference shares)
- Tier 2 capital (subordinated debt)
- Marginal senior debt funding (senior debt funding which is interest rate-sensitive, such as wholesale funding and term deposits)
- All other debt funding (debt funding which is less interest rate-sensitive, such as transactional and on call savings deposits, and derivative liabilities)

For each type of funding, investors require the bank to compensate them with a return that can be expressed relative to a common benchmark interest rate (the 'base rate'). In the CBA, the base rate is set at 1.5 percent, which is consistent with average wholesale swap rates over the past year. Relative to the base rate, the CBA assumes the five tiers of funding have different required margins, consistent with their position in the creditor hierarchy:

- An equity risk premium (after corporate tax) of 700bps above the base rate is assumed for the *status quo*. This is consistent with current Treasury guidance on the equity risk premium (for firms with an equity beta of 1), and comments from ANZ Banking Group CEO who stated ANZ's cost of equity was now assessed at between 8 percent and 8.5 percent.[60]
- Margins above the base rate for AT1 and Tier 2 instruments are assumed to be 400bps and 200bps in the *status quo* respectively, reflective of the margins required on recent issuances of these types of instruments in New Zealand and Australia.
- For remaining debt funding, the Reserve Bank computed annualised yields for these two categories of debt funding from reported in banks' *Income Statement Survey*. In September 2019, the annualised yield for marginal senior debt funding was 2.66 percent, and 0.87 percent for all other debt funding. Relative to the assumed base rate, this leads to margins for these two funding sources of 1.16 percent and -0.63 percent respectively.

To evaluate the impact of the Capital Review changes on banks' total funding expenses, we need to assess both how the quantities of the different tiers of funding would change, as well

[60] A transcript of an interview with ANZ CEO following FY19 results announcement, October 2019, is available at https://www.anz.com/shareholder/centre/reporting/results-announcement/

as any changes we might expect to investors' required margins on each type of funding given the shifts in the distribution of the banks' risk profile between funding types.

Balance sheet changes as a result of the Capital Review

The CBA first computes the changes in the proportion of total funding that comes from each of the five tiers.

The returns on equity in the calculation are expressed as an equity risk premium, which is conceptually related to the value that investors would assign to the equity in New Zealand banks (not the book value of equity). Since most New Zealand banks are not publicly listed, we cannot readily observe a market value for their equity. However, we can make some simplifying assumptions to estimate a market value. In the CBA, we assume that the equity of New Zealand banks would be valued at a multiple of 12.5 times their after tax earnings over the year to September 2019, which is consistent with the long run average price to earnings ratio of listed Australian banks. As at September 2019, this leads to an estimated market value for the ten largest New Zealand-incorporated banks' equity of $69,830m.

As a result of the Capital Review changes, we assume that in aggregate the New Zealand banks increase their capital levels to the prescribed ratios, plus operate with a 1 percent CET1 management buffer. For each dollar of increased total capital, it is assumed that banks reduce their marginal debt funding by a corresponding dollar (banks would prefer to repay their expensive debt funding ahead of their cheaper debt funding).

Table A7.1 illustrates the pre- and post-Capital Review balance sheet of the aggregate of the New Zealand banks.

Table A7.1: Stylised balance sheet of New Zealand incorporated banks, before and after Capital Review[61]

	Current (September 2019)	Change	Pro forma post-Capital Review
CET1 capital	35,345	+15,029	50,374
Net profit (year to 09/2019)	5,586		
Market value of equity	69,830	+15,029	84,859
AT1 capital	6,330	+2,356	8,685
Tier 1 capital	41,675	+17,385	59,060
Tier 2 capital	2,734	+4,214	6,948
Total capital	44,409	+21,599	66,008
Marginal debt	307,924	-21,599	286,326
Other debt	182,706	0	182,706
Risk-weighted assets	315,355		347,409
CET1 ratio	11.21%		14.5%
Tier 1 ratio	13.22%		17%
Total ratio	14.08%		19%

[61] Tables A7.1, A7.2 and A7.3 represent aggregated cost of funds data for ANZ, ASB, BNZ, Co-op, Heartland, Kiwibank, SBS, Rabobank NZ, TSB, and Westpac NZ.

Margins

Having determined the relative quantities of the different funding sources before and after the Capital Review, the next step in the analysis is to compute the total funding expense before and after the Capital Review.

Increases in capital should reduce the margins required on banks' funding. For debt investors, increased capital reduces the probability that an investor will receive back less than what is owed. For equity investors, increased capital reduces a bank's leverage, and therefore reduces the variance of its earnings. This means that the stream of income attributable to equity investors (the bank's profits) are less volatile relative to the amount of equity invested in the bank. A less volatile return on equity should lower the cost of equity.

Three assumptions are made with respect to the margins banks' investors require once transitioned to the new capital ratios:

- The equity risk premium falls from 700bps to 675bps. The Reserve Bank replicated a study of the impact of changes in capital ratios on Australian banks' cost of equity (Cummings and Nguyen, 2019), which suggested a 25bps decline in the equity risk premium was appropriate.
- The margin required on Tier 2 instruments was reduced by 50bps, to reflect the materially lower risk that such instruments would incur losses, given the increase in Tier 1 capital.
- The margin required on marginal senior debt funding was reduced by 5bps, which is approximately equivalent to the reduction in funding costs associated with a one notch credit rating upgrade.

Redeemable perpetual preference shares are not tax deductible, unlike AT1 instruments currently on issue. As a result, from banks' perspective, the funding cost associated with preference shares is assumed to be grossed up to reflect that the returns to investors need to be paid from after-tax earnings. This is a conservative assumption, as in practice banks may issue these instruments to domestic investors who can take advantage of the imputation credit system, lowering the effective cost of preference shares from banks' perspective.

Given the assumed quantities and relative margins for each source of funds, the CBA computes the change in the total blended cost of funds before and after the Capital Review changes. Tables A7.2 and A7.3 report the outcomes, including the grossing-up for corporate tax of equity funding.

Table A7.2: Total blended cost of funds, *status quo* (as at 30 Sept. 2019)

Funding source	Base rate		Required margin (for investor)	Grossed for tax		Cost of funds (for bank)	Quantity ($m)
Equity (market value)			7%	2.38%		10.88%	69,830
AT1			4%	0%		5.5%	6,330
Tier 2	1.5%	+	2%	0%	+	3.5%	2,734
Marginal debt			1.16%	0%		2.66%	307,924
Other debt			-0.63%	0%		0.87%	182,706

Total equity and liabilities ($m) (market value)	569,525
Blended cost of funds ($m)	17,818
Blended cost of funds (%)	3.129

Table A7.3: Total blended cost of funds, post-Capital Review (as at 30 Sept. 2019)

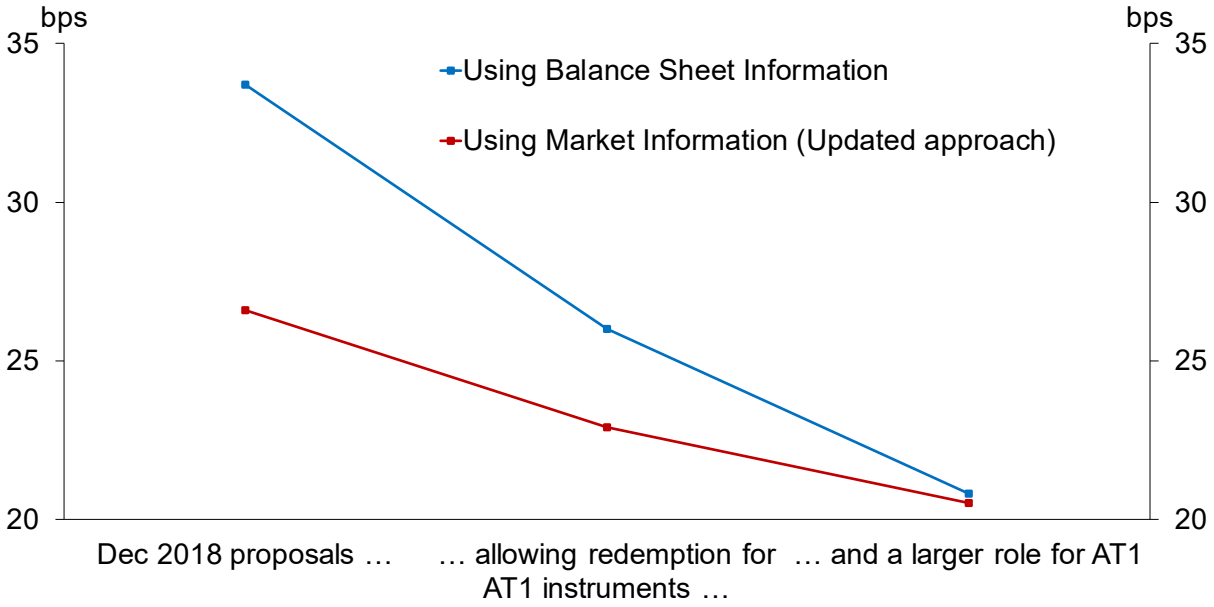
Funding source	Base rate		Required margin (for investor)	Grossed for tax		Cost of funds (for bank)	Quantity ($m)
Equity (market value)			6.75%	2.31%		10.56%	84,859
AT1			4%	1.54%		7.04%	8,685
Tier 2	1.5%	+	1.5%	0%	+	3%	6,948
Marginal debt			1.11%	0%		2.61%	286,326
Other debt			-0.63%	0%		0.87%	182,706

Total equity and liabilities ($m) (market value)	569,525
Blended cost of funds ($m)	18,840
Blended cost of funds (%)	3.308

This analysis suggests an increase in the blended cost of funds for banks of 17.9bps. Recovery of the increased funding expense over total interest-earning assets of $499,759m as at September 2019 implies an average increase in lending rates of 20.5bps.

For the purpose of comparability, the figure below shows the effect of the methodological changes on the interest rate impact. The blue line uses balance sheet information for equity, and is in line with the approach explained in the April 2019 Background Note. The only difference is that it incorporates different types of funding, rather than simple debt and equity mixes. The red line uses estimated market values and required returns for equity. This approach is the updated methodology explained in this section. This illustrates that, while the two approaches have different outcomes for the December 2018 proposals, the two measures converge with the changes in AT1 instruments (both definition and quantity). As such, the difference between the two methodologies for the final Capital Review reforms is expected to be immaterial.

Figure A7.1: Different approaches for lending rate impact calculation



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Appendix – Glossary

AT1 capital	Additional Tier 1 capital. AT1 capital, which includes perpetual preference shares, is the second highest quality of capital behind CET1.
Capital	Part of a bank's funding that allows it to absorb financial losses while remaining solvent. Includes the investment of the bank's shareholders (e.g., ordinary shares and retained earnings).
Capital ratio	A bank's capital divided by its RWA. A capital ratio is a key indicator of the financial strength of a bank, measuring the losses it can withstand relative to the risk of its business.
CET1 capital	Common Equity Tier 1 capital. CET1 is the highest quality of capital as it is permanently available to absorb a bank's financial losses. CET1 includes shareholders' investment (ordinary shares) and the bank's retained earnings.
Conservation buffer	A type of prudential capital buffer that applies to all banks. The conservation buffer promotes capital resilience by requiring banks to maintain capital levels above the minimum requirement.
Countercyclical capital buffer	A type of prudential capital buffer that the Reserve Bank may increase or decrease over the financial cycle. Increasing the countercyclical capital buffer aims to build banks' capital resilience and guard against financial stability risks. Lowering the countercyclical capital buffer enables banks to operate at lower capital levels during periods of financial system stress, to promote their ability to continue lending to support the economy.
D-SIB buffer	Domestic-Systemically Important Bank capital buffer. A type of prudential capital buffer that applies to banks that are deemed systemically important and whose failure would have a significant impact on the economy and the rest of the financial system. A D-SIB buffer promotes higher capital strength of banks and lowers their probability of failure.
IRB approach	Internal ratings-based approach to credit risk. One of the two methodologies available to calculate RWA for banks' credit risks, IRB involves the use of inputs from credit models developed internally by the bank to a formula specified by the Reserve Bank. The Reserve Bank must accredit a bank to use the IRB approach, and approve the models it uses in its RWA calculation.
IRB scalar	A parameter in the IRB approach to credit risk set by the Reserve Bank. The IRB scalar adjusts the level of conservatism in the IRB approach's calibration.
Leverage ratio	A measure of a bank's financial strength that does not attempt to adjust for risk. A leverage ratio measures a bank's capital levels relative to a non-risk based measure of its financial position, such as the accounting value of its assets. While both a leverage ratio and the risk-based capital ratio use the same definition of capital, they contrast in what they measure this capital against (e.g. assets (accounting definition) versus RWA respectively).

Minimum capital requirements	A minimum capital ratio requirement. If a bank has a capital ratio below the minimum requirement, it is likely to be in financial distress from a prudential perspective, and the Reserve Bank would likely seek to place it in a resolution.
Non-performing loans	Generally speaking, non-performing loans are loans that are at risk of not being fully repaid, or where interest on the loan may not be fully paid by the borrower.
Output floor	A limit on the IRB approach. An output floor means that, when determining its capital ratio, the RWA a bank calculates using the IRB approach cannot go below a certain proportion of the RWA that it would calculate under the Standardised approach.
Prudential capital buffer	An amount of capital above the minimum capital requirement. A bank that operates with a capital ratio within the prudential capital buffer applying to it would not be in breach of its Conditions of Registration, but it may have restrictions placed on it and be required to rebuild its capital levels over time.
Risk appetite framework	A risk appetite framework enables decisions about the right balance of risk and return. In the context of this Consultation Paper, the Reserve Bank has developed a risk appetite framework to determine settings for its capital framework that strike a balance in its outcomes on financial stability, economic activity and societal welfare.
Risk-weighted assets (RWA)	Risk-weighted assets (RWA) is an adjusted picture of a bank's financial position (e.g. its loan portfolios and other investments, and its operational and market trading activities) that takes into account the risk profile of that financial position.
Standardised approach	Standardised approach to credit risk. One of the two methodologies available to calculate RWA for banks' credit risks, the Standardised approach requires banks to use Reserve Bank-specified tables to determine the risk weights to apply to different types of loans and other assets.
Tier 1 capital	Tier 1 capital consists of CET1 capital and Additional Tier 1 (AT1) capital.
Tier 2 capital	Tier 2 capital, which includes some subordinated debt, is capital that can generally only absorb losses once a bank has already entered into financial difficulty. It is therefore considered of lower quality than Tier 1.