RESERVE BANK
OF NEW ZEALAND
TE PŪTEA MATUA

Consultation Paper:

Review of the Capital Adequacy Framework for locally incorporated banks: calculation of risk weighted assets

December 2017

Submission contact details

The Reserve Bank invites submissions on this Consultation Paper by 5pm on 5 March 2018. Please note the disclosure on the publication of submissions below.

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Publication of submissions

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The Reserve Bank may also publish an anonymised summary of the submissions received in respect of this Consultation Paper*.*

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Summary

The Reserve Bank is undertaking a Review of the Capital Adequacy Framework for locally incorporated banks. The aim of the review is to identify the most appropriate framework for setting capital requirements for New Zealand banks, taking into account how the current framework has operated and international developments in bank capital requirements.

The review is guided by six 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.

This is the third consultation document of the review. The first document provided an overview of the review. The second document considered the definition of capital, which is the numerator in the minimum regulatory capital ratio. This document is concerned with the denominator in the minimum capital ratio, which is effectively a measure of exposure to risk.

Issues considered in this document

In the first consultation document the Reserve Bank identified a number of potential problems with the denominator, including:

- concerns about banks' use of their own models for calculating credit and operational risk;
- the substantial gap between risk estimates using banks' models and risk estimates using standardised calculation approaches; and
- a lack of transparency about the way in which risk estimates are arrived at.

In this document further evidence for the concerns is provided and options are proposed for mitigating and responding to those concerns.

It was also noted that international (Basel) standards for calculating risk exposure have changed, or are about to change. This document spells out the changes in more detail and suggests options for incorporating them into New Zealand's current framework. The Basel standards were finalised a week or two prior to the publication of this consultation paper. The standards differed in some respects from what Basel had consulted on. This paper

outlines both the original Basel proposals and the finalised framework, as both have a bearing on our proposals.

Concerns about the use of 'internal' models[1]

There is international and New Zealand evidence that minimum capital requirements went down significantly after banks were permitted to use their internal models for parts of the capital calculation.

There is also international evidence that internal model outcomes are inconsistent. Different banks often come up with similar *rankings* of risk but the absolute levels of risk are substantially different even for the same obligors. The evidence is clearest in the case for exposures to governments, banks, and large corporations, but there is also some evidence of problems in other portfolios such as residential mortgages and SME lending.

The international evidence is not necessarily generalisable to New Zealand. However, international studies do demonstrate that is difficult for supervisors to verify that the results of banks' internal models accurately reflect risk, and the Reserve Bank considers that this is true here as well as overseas. Several different approaches have been tried (see *Appendix 2: methods for verifying internal model outcomes*) but all have their weaknesses and so conclusions are often tentative. Hypothetical portfolio exercises that require banks to generate risk weights for common obligors ensure the highest degree of comparability, but this approach is generally not suitable for the retail or SME portfolios that are dominant in New Zealand's banking system.

It is also difficult for external observers to judge the appropriateness of outcomes from banks' internal models. Banks in New Zealand are required to report risk weights by asset class, but are required neither to break these down by standardised risk measures (such as security coverage ratio) to enable readier comparisons between banks, nor to publicly disclose the inputs to or mechanics of their internal models.

There are incentives for banks to engineer their models to produce lower capital requirements and internationally there is some indirect evidence that banks have acted on these incentives.

Changes to international capital standards

The current New Zealand capital standards are quite closely related to international standards. The Basel Committee on Banking Supervision has been proposing changes to the international capital standards, and finalised the Basel framework in December.

[1] Banks use their own internal models for calculating capital for credit risk exposures and operational risk. The credit risk models are formally referred to as IRB (Internal Ratings Based) models and the operational risk modelling is referred to as AMA (Advanced Measurement Approach). BS2B refers collectively to the Internal Models Based Approach, or "internal models" for short. "Internal models" can denote banks' own models in either credit or operational risk, whereas IRB and AMA models denote internal models for credit risk and operational risk respectively.

The Basel Committee had proposed to replace the IRB approach with the standardised approach for bank and large corporate exposures, and with a standardised or semi-standardised approach for all specialised lending to corporates. The finalised framework did not go this far – it continues to allow a more limited form of IRB modelling, the Foundation IRB (F-IRB) approach, for bank and large corporate exposures. The new framework does, as originally proposed, constrain the outputs of internal models and impose an overall floor – based on the risk assessed under the standardised approach – on the average risk weight, to prevent it from straying too far from a common level.

The new Basel framework makes the standardised approach more sensitive to risk by introducing new asset classes for specialised lending, commercial and residential real estate, and land and property development. Though more sensitive than the current Basel standardised approach, the new framework doesn't significantly improve sensitivity compared with New Zealand's approach, because the Reserve Bank has already made our standardised requirements more risk sensitive than the current international standards by adding a finer-grained classification of residential mortgage exposures.

The changes made by the Basel Committee are intended to address the recognised shortcomings of banks' internal modelling, and to achieve greater alignment between the IRB and standardised approaches.

The Basel Committee has also made changes to the operational risk capital requirements. The existing internal model and standardised approaches are replaced by a new standardised approach, which uses the bank's revenue streams as a key indicator of operational risk but also allows some banks to take into account their past experience of losses due to operational risk. The internal models approach is being removed because a hoped-for (international) consensus about how to model operational risk never materialised.

Lastly, in 2016 the Basel Committee finalised changes to the market risk capital requirements. There are new internal models and standardised approaches that are aimed at addressing shortcomings that became evident in the global financial crisis. The Basel Committee has also proposed a simplified standardised approach for smaller institutions with vanilla banking operations. The Reserve Bank notes that while New Zealand's current rudimentary market risk approach needs to be updated, this is not a priority for the current capital review.

Options

In light of the concerns explored in this document and international changes to capital regulation, the Reserve Bank has identified several options for policy change (the options are also summarised in Table 2 on page 34 of this document).

For the IRB approach to credit risk, the options are:

- to maintain the *status quo*;
- to follow the Basel Committee changes (though retaining some existing New Zealand variations from the Basel standards);

- to follow and extend the Basel Committee's original proposals so that the IRB approach would not be available for exposures to sovereigns, banks, large corporates, specialised lending exposures, or any exposure with an external credit rating (the standardised approach would be used);
- to follow and extend the Basel Committee's original proposals so that the IRB approach would not be available for any exposure except exposures to unrated corporates (the standardised approach would be used); or
- to entirely replace the IRB approach with the standardised approach.

The Reserve Bank favours extending the Basel Committee's original proposals so that the IRB approach is no longer available for any exposure that is externally rated. Although the Basel Committee eventually altered its original proposals to allow the use of the F-IRB approach, the Reserve Bank considers that the arguments for standardising some portfolios remain compelling. Moreover, the Reserve Bank has already announced that it will remove the F-IRB approach from the New Zealand standards, and while it could change its position and retain the F-IRB approach this would be inconsistent with reducing unnecessary complexity in the standards.

The Reserve Bank expects that it would look to calibrate the proposed capital floor at a level that is appropriate for New Zealand. A subsequent consultation will take place on calibration.

The Reserve Bank also favours requiring reporting of standardised outcomes alongside IRB outcomes under all of the options, to make it easier for external observers to identify unusually high or low model outcomes. Such deviations may or may not be justified, and therefore may lead to further investigation, but they should at least be transparent.

The Reserve Bank considers that these options are consistent with the principles of the review.

- Limiting the use of IRB models is consistent with international evidence that, in practice, some models have not been shown to produce the accurate and consistent assessment of risk that the theory promised, either because they were inaccurate or because it was impractical to measure accuracy (not all of the international evidence is precisely applicable to New Zealand, but the Reserve Bank agrees, based on its own experience, that determining the accuracy and consistency of internal models across banks is often impractical).
- It is expected that conservatism and transparency would be increased if the use of IRB modelling was more limited, without a significant reduction in true risk sensitivity.
- 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.

For the standardised approach to credit risk the options are:

- to maintain the *status quo*;

- to follow the new Basel framework (though retaining some existing New Zealand variations from the Basel standards); or
- to use a recalibrated version of the new Basel approach.

The Reserve Bank favours the *status quo* for the time being. New Zealand's current approach is already relatively risk sensitive, so the new Basel approach would deliver a lesser benefit if it were introduced here. New Zealand's approach is also more conservative for certain exposures that are common in New Zealand.

For operational risk the options are:

- to maintain the *status quo*;
- to follow the new Basel framework; or
- to follow the new Basel framework but with additional requirements for banks relating to internal processes and systems for identifying and managing operational risk.

The Reserve Bank favours the Basel approach. This would be simpler to administer and would increase conservatism and transparency, relative to the current (internal models) approach, and – given the global lack of confidence in the outputs of operational risk models – is unlikely to significantly reduce true risk sensitivity. If a decision is taken to pursue this option, the Reserve Bank will give further consideration to the need for additional requirements relating to internal processes and systems.

For market risk the options are to follow the new Basel standardised approach (with or without the proposed simplification for smaller banks), or to retain the *status quo*.

The Reserve Bank's prefers to retain the *status quo* for the time being.

The Reserve Bank notes that the existing standard could be more comprehensive in some areas. But the Reserve Bank currently views replacing the market risk requirements as a lower priority than other work relating to capital requirements.

In addition, the Basel market risk approach on its own is not a complete replacement for the New Zealand market risk approach, which applies to both the trading and banking books. The Basel approach could be supplemented with a new optional international standard for interest rate risk in the banking book, but that new standard would require further development for use in New Zealand.

Introduction

1. The Reserve Bank is undertaking a comprehensive review of the capital adequacy framework applying to locally incorporated registered banks. The aim of the review is to identify the most appropriate framework for setting capital requirements for New Zealand banks, taking into account how the current framework has operated and international developments in bank capital requirements.

2. The review is guided by six principles:

   - Capital must readily absorb losses before losses are imposed on creditors and depositors.
   - Capital requirements should be set in relation to the risk of bank exposures.
   - Where there are multiple methods for determining capital requirements, outcomes should not vary unduly between methods.
   - 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.
   - 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.
   - The capital framework should be transparent to enable effective market discipline.

3. On 1 May 2017 the Bank published an issues paper, which provided an outline of the areas that would be covered as part of the review. It explained that the headline capital requirements are minimum capital ratios, being ratios of recognised regulatory capital (the numerator) to risk-weighted assets (the denominator).

4. This consultation document focusses on the denominator, presenting options for calculating and reporting risk-weighted assets.

5. To provide some context:

   - banks are required to have a minimum amount of capital that reflects the risk of losses due to credit, operational, and market risks;
   - capital requirements are expressed as a percentage of risk-weighted assets;
   - for credit risk, loans and other assets are weighted according to the risk of losses from creditor default;
   - for operational and market risk, a notional capital requirement is calculated directly but is then expressed as a quantity which is equivalent to risk-weighted assets (by dividing by 8%);

- standardised approaches are available to calculate risk-weighted assets for credit, operational and market risk[2];
- for credit and operational risk only, approved banks may use their own models in conjunction with the regulatory framework to calculate risk-weighted assets, instead of the standardised approaches[3];
- the internal models approach for credit risk is referred to as the internal ratings-based (IRB) approach and the internal models approach for operational risk is referred to as the advanced measurement approach (AMA).

6. The options presented in this document relate mainly to the choice of calculation approach – internal models or standardised, for example – and to constraints on inputs to or outputs from the calculation. There are other policy issues that relate to the denominator, such as ambiguities in definitions of asset classes under the IRB approach and unclear drafting of existing regulations. Those issues are not being addressed as part of the capital review but are intended to be looked at separately, either in parallel as part of restructuring of the Banking Supervision Handbook that has already commenced, or following the review.

[2] See *Capital Adequacy Framework (Standardised Approach)* in the Banking Supervision Handbook, often referred to as "BS2A".
[3] See *Capital Adequacy Framework (Internal Models Based Approach)* in the Banking Supervision Handbook, often referred to as "BS2B".

Issues identified

7. In our 1 May Issues Paper we identified several issues:

- it is unclear how accurately the internal models approaches are picking up risk;
- there is a gap between capital requirements under the internal models and standardised approaches, and it is not clear that the gap is justified by differences in underlying risk;
- there is a lack of transparency about the design and implementation of banks' internal models and this makes comparisons between banks or jurisdictions difficult;
- the global capital standards on which New Zealand's have so far been based have changed:
  - the Advanced Measurement Approach (AMA) for operational risk is being dropped;
  - there are more limitations on the use of the IRB approach;
  - there are more risk-sensitive standardised approaches for credit and operational risk; and
  - there are new standardised and internal models approaches to determine capital requirements for market risk.[4]

8. In the following paragraphs, we consider the issues in more detail.

The internal models approaches

9. The internal models approach was established by the Basel Committee on Banking Supervision in 2006.

Arguments for the use of internal model approaches

10. There are several arguments for the use of internal models approaches.

11. Under the "Basel I" regime, which preceded the introduction of the internal model approaches, risk-weighting was a blunt exercise. For example, all residential mortgages were given a 50% risk weight.[5] It is argued that the blunt approach gave banks incentives to seek out riskier lending opportunities. They could, for example, undertake high-margin, high-LVR mortgage lending without the requirement for any more capital than for low-margin, low-LVR mortgage lending.[6] By using their internal

[4] There are other changes to global standards that have been proposed or finalised (e.g. changes to the counterparty credit risk framework). Those changes are currently outside the scope of the capital review, but may be considered in parallel or at a later date.
[5] Reserve Bank of New Zealand (2007), Capital Adequacy Framework: Financial Stability Document BS2, March 2007.
[6] The implicit assumptions here are that a bank has a privately optimal level of capital that is less than the regulatory minimum and that bank capital is more costly (privately, not necessarily socially) than debt. If these assumptions are satisfied then the bank will have a financial incentive to increase the riskiness, which it will charge the borrower for, of its exposures.

models to assess riskiness, banks can more comprehensively take into account the detailed characteristics of each loan, so that higher-risk lending translates into a requirement for more regulatory capital.[7]

12. Another argument for the introduction of internal model approaches is that as a result of adopting such approaches banks will invest in better systems for monitoring and managing the risks they face.[8]

13. In 2014 the Institute of International Finance, a global association of financial institutions, published a document putting the case for the continued use of internal models approaches.[9] As well as arguing that standardised approaches skew bank portfolios towards riskier exposures, it also suggested that excessive standardisation could promote herd behaviour and create systemic risk:

> Model risk [i.e. the risk that the model gives incorrect results] could quickly become systemic risk if all industry participants embrace exactly the same [standardised] view on their risks, portfolios, and clients.
>
> When operating in a risk-conscious manner, informed by robust internal models, banks are empowered to make business decisions away from the 'herd'.

Use of internal model approaches

14. In New Zealand, ANZ, ASB, BNZ, and Westpac New Zealand are currently accredited to use the internal model approaches. Other locally incorporated banks are required to use the standardised approaches. Because the four banks that use the internal model approaches have large market shares, credit risk weights calculated using the internal models approach account for approximately 90 percent of banking sector exposures.[10]

15. In Australia, ANZ, CBA, NAB and Westpac are permitted to use the most advanced internal model approaches. In addition, Macquarie bank is permitted to use a less advanced set of the internal model approaches.[11] Some smaller banks are

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[7] For example, see Basel Committee on Banking Supervision (1999), A New Capital Adequacy Framework: Consultative paper issued by the Basel Committee on Banking Supervision, http://www.bis.org/publ/bcbs50.pdf, at paragraph 7 of the Executive Summary.
[8] Improved risk systems are a prerequisite for using the internal model approaches. The Basel Committee seems to have contemplated lower capital requirements to encourage the required investment by banks. See for example the references to calibration and incentives in Basel Committee on Banking Supervision (2004), Consensus achieved on Basel II proposals, https://www.bis.org/press/p040511.htm (retrieved on 12 November 2017).
[9] Institute of International Finance (2014), Risk-sensitivity: the important role of internal models, September 2014.
[10] This figure might be slightly over-stated because the internal models banks still use the standardised approach for a small proportion of their exposures.
[11] Macquarie Bank uses the Foundational IRB approach for credit risk rather than the Advanced IRB approach that the other accredited Australian and New Zealand banks use.

reportedly working towards accreditation but are not using the internal model approaches yet.[12]

16. In the European Union at least 114 banks are approved to use internal model approaches for at least part of their portfolio.[13] On average, the internal models banks supervised directly by the European Central Bank, which tend to be the larger European banks, use internal models approaches to determine approximately half of capital requirements, with standardised or other approaches used for the rest.[14]

17. In the United States, our understanding is that current regulations *require* the use of internal model approaches for the largest banks and for most internationally active banks, once they have met regulators' requirements and conducted a parallel run of the internal model and simpler approaches.[15] The use of the internal model approach is optional for other banks. Only a small number of banks have been approved to use the internal model approaches following completion of their parallel run.[16]

18. For the banks that are using the internal model approaches in the United States, our understanding is that a capital floor is currently imposed that is 100 percent of the capital requirement under the standardised approaches. The floor was introduced as part of the Dodd-Frank Act, following the global financial crises.[17] The floor is currently binding for about half the banks reporting under the internal models approach.[18]

Effect of internal models approaches on risk weights

19. Internationally there is some dispute about the effect of the internal model approaches on risk weights, and unfortunately independent analysis is made more

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[12] On 16 November 2016 the Australian Broadcasting Corporation reported that "Second tier lenders, such as Bank of Queensland, Bendigo and Adelaide Bank and Suncorp are also working towards achieving the expensive IRB certification, which would lower their risk weightings". See http://www.abc.net.au/news/2016-11-16/big-banks-get-19-billion-dollar-benefit-over-rivals/8030498 (retrieved 14 June 2017).
[13] European Banking Authority (2016), Results from the 2016 High Default Portfolios (HDP) Exercise, EBA BS 2017 027, https://www.eba.europa.eu/documents/10180/15947/EBA+Report+results+from+the+2016+high+default+portfolio+exercise+-+March+2017.pdf (retrieved 16 June 2017), page 7.
[14] European Central Bank, Aggregate Statistical Data for 2015, https://www.bankingsupervision.europa.eu/banking/supervisory/html/index.en.html (spreadsheet retrieved 16 June 2017), Parts 2-4.
[15] The United States House of Representatives recently passed the Financial CHOICE Act, which would allow banks to opt out of the internal model *and* standardised approaches if they had simple leverage ratios in excess of 10 percent. At the time of writing, the Act has yet to pass through the Senate (it is not yet law).
[16] As at 30 June 2017 only 10 of 44 of the bank holding companies with assets over US$50 billion were reporting using the internal models approach: JPMorgan, Bank of America, Wells Fargo, Citigroup, Goldman Sachs, Morgan Stanley, U.S. Bancorp, Bank of New York Mellon, State Street, and Northern Trust. See https://www.ffiec.gov/nicpubweb/nicweb/HCSGreaterThan10B.aspx.
[17] See US Code, Title 12, Chapter 53, Subchapter I, Part C, § 5371.
[18] As at 30 June 2017 the reported standardised capital ratio was lower than the internal model ratio (and therefore the standardised ratio was binding) for JPMorgan, Wells Fargo, Citigroup, U.S. Bancorp, State Street, and Northern Trust.

difficult by a dearth of publicly available aggregate data. In 2014, the Bank for International Settlements wrote: [19]

> In fact, the average risk weight in bank portfolios has been falling since 2007. Despite the Great Recession and the sluggish recovery, ratios of RWA [risk-weighted assets] to total assets were about 20% lower in 2013 than six years earlier. Market commentary indicates that more than a genuine reduction in assets' riskiness has been at play and suggests that banks redesigned risk models in order to lower capital requirements by underestimating risk and providing optimistic asset valuations.

20. The Institute of International Finance initially acknowledged the decline, saying that "average risk-weights certainly have trended down" (and said that this could be explained by a shift towards genuinely less risky portfolios).[20] But two years later the Institute used data for the largest European banks to conclude that risk weights had in fact plateaued when the internal model approaches were introduced, "[contradicting] the claims that internal models are merely used to reduce capital requirements".[21]

21. In New Zealand, there is some evidence that average risk weights fell in the switchover to the internal models approach. For a period of time beginning in 2008 banks were required to report both their internal models capital ratio and their old (Basel I) ratio. Capital ratios were generally higher on the internal models basis, which is consistent with lower risk weights (see Figure 1).[22]

22. Following an initial decline in the early years of internal model use, the average risk weight for internal models banks has stabilised around 42% (see Figure 2).[23] However, the Reserve Bank made changes to the IRB approaches for farm lending and residential mortgages from 2011 to 2015, with the aim of reversing declines.[24] In the absence of those changes, risk weights would have been lower than 42%.

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[19] Bank for International Settlements (2014), 84th Annual Report, page 107.
[20] Institute of International Finance (2014), Op. Cit.
[21] Institute of International Finance (2016), Basel's Evolution: A Retrospective, April 2016.
[22] The Reserve Bank notes that direct comparisons of risk weights under the internal models and older approach are complicated by wider changes in the capital calculation. Under the old (Basel I) standard risk weights implicitly incorporated operational risk, but under the internal models approach this was split out into a separate capital requirement. Using an indirect approach, comparing overall capital ratios, overcomes some of these complications.
[23] This statement is based on risk weights for exposures which are credit risk-weighted using the Internal Ratings-Based Approach, including specialised lending but excluding defaulted exposures.
[24] For a brief summary of changes see Reserve Bank (2017), Information relating to the capital adequacy framework in New Zealand, http://www.rbnz.govt.nz/regulation-and-supervision/banks/prudential-requirements/information-relating-to-the-capital-adequacy-framework-in-new-zealand (retrieved 21 June 2017).

Figure 1: Simple average of capital ratios of internal models banks

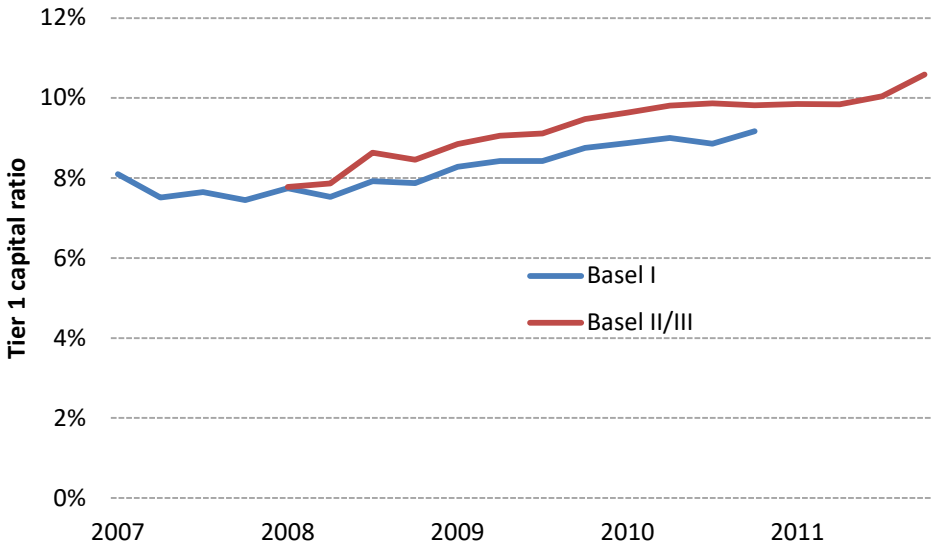
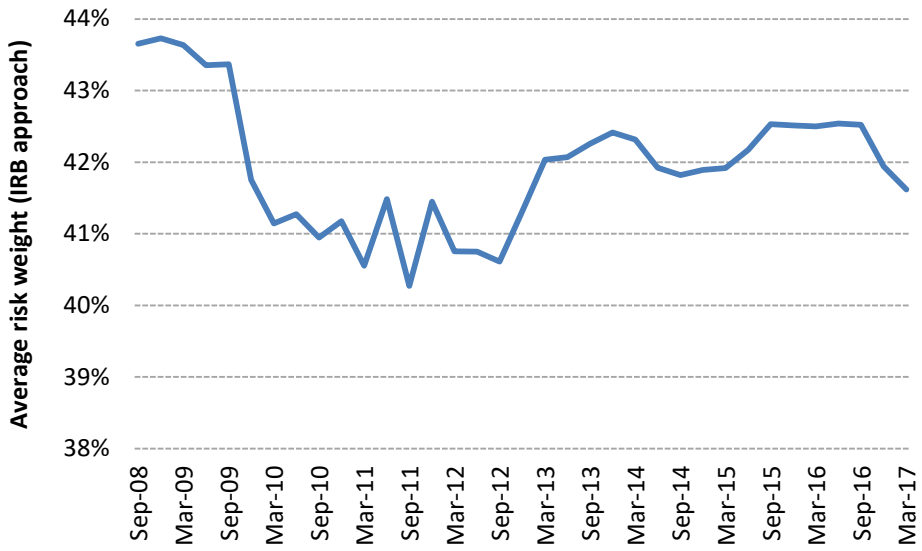


Figure 2: Risk weights under the IRB approach



Source: Bank disclosures and Reserve Bank calculations.

Consistency of, and ability to verify, internal model outcomes

23. There are questions about the consistency of internal model outcomes across banks.

24. Overseas studies carried out by the UK Financial Services Authority, the Basel Committee on Banking Supervision, and the European Banking Authority have showed that different banks determine substantially different risk weights for the same sovereign, bank, or large corporate obligors.

25. Other overseas studies by the European Banking Authority and the Basel Committee have demonstrated similar variability in estimates of risk for residential mortgage and small business lending portfolios. It is, however, more difficult to be definitive in these cases, because the precise composition of the portfolios is uncertain (different banks have different sets of borrowers).

26. For further information about the overseas exercises, see *Appendix 1: studies into the consistency of internal model outcomes across banks*.

27. The results of overseas studies are not necessarily generalisable to New Zealand banks. In the absence of direct New Zealand evidence, the findings of European banking supervisors do not provide any proof that New Zealand banks are producing inconsistent risk weights.

28. However, the studies do highlight some of the difficulties supervisors or other interested parties face if they wish to check the consistency or appropriateness of internal model risk weights. In the Reserve Bank's view, these difficulties are just as present in New Zealand as elsewhere.

29. As *The Economist*, which was beginning from the premise that there had been some manipulation of risk weights, put it in 2012: "figuring out how much trickery is still going on is difficult, even for regulators, since the big banks use complex 'internal models' based on the quality of their own assets".[25]

30. *Appendix 2: methods for verifying internal model outcomes* provides a more detailed discussion of methods that have been used (or are being used) to check the consistency of model outcomes across banks: decomposition of differences in risk weights across banks, exercises where banks rate hypothetical portfolios of named or unnamed borrowers, and back-testing. These methods are resource-intensive, which makes them difficult to use for routine monitoring. They also all have their weaknesses.

Incentives created by internal model approaches

31. Because regulatory requirements take into account the social costs of inadequate capital as well as the private costs, the regulatory minimum is likely to exceed the level of capital that is optimal for bank shareholders or bank personnel. Banks therefore have incentives to reduce their minimum regulatory capital requirements. Acting on these incentives is easier within the flexible internal models framework and – as the discussion in the preceding paragraphs suggest – it is challenging for supervisors to detect any manipulation. This "incentive incompatibility" is a significant theoretical weakness of the internal models approach.

32. There is some indirect empirical evidence of manipulation overseas.

[25] The Economist (2012), DIY Capital, 8 December 2012.

33. An analysis of 115 banks from 21 OECD countries was undertaken to identify the reasons for lower risk weights following adoption of the IRB approach.[26] It distinguished four possible reasons for falling risk weights – portfolio re-allocation, improved risk measurement, faulty risk modelling, and strategic risk modelling (manipulation) – and attempted to identify which of these were consistent with the data. In part because IRB risk weights fell more in countries with weaker supervisory regimes, the authors of the analysis concluded:

> While our evidence does not allow us to completely discount any of the four possible explanations, the hypothesis of strategic risk-modelling is the only one that can explain all of our results. We therefore conclude that the evidence supports Blum (2008)'s hypothesis of risk-weight manipulation under Basel II's IRB, and that the banks' profit maximising motive is likely to be among the non-fundamental determinants of risk-weights identified in EBA (2013).

34. Research by the Federal Reserve Bank of New York considered syndicated loans to see if there was any evidence of bias in risk estimates produced by United States banks using internal models.[27] It was found that banks with low capital ratios tended to report lower estimates of risk using their internal models, "consistent with an effort by low-capital banks to improve regulatory ratios". Risk estimates from these low-capital banks were also less useful in explaining the interest rates charged on loans, indicating that they "incorporate less information".[28]

35. An analysis of European and United States banks concluded:[29]

> […] the association between RWs [risk weights] and bank distress is significant only in the subset of the small (non-IRB)[30] banks, while it is statistically insignificant for the large (IRB) banks. This finding is consistent with a concern that the IRB banks may apply discretion in ways that hamper the association between their reported and real risks.
>
> We provide further evidence in support of this explanation by showing that in response to the negative capital shocks, RWs of large (IRB) banks tend to fall, thus mitigating the effect of the shock on the banks' risk-weighted capital ratio […] In contrast, we show that for the small (non-IRB banks), which have

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[26] Mariathasan and Merrouche (2014), The manipulation of basel risk weights, Journal of Financial Intermediation 23 (2014).
[27] Each bank in the syndicate was required to report its estimate of credit risk for single borrower, making it relatively straightforward to identify biases.
[28] Plosser and Santos (2014), Banks' Incentives and the Quality of Internal Risk Models, Federal Reserve Bank of New York Staff Report No. 704, December 2014.
[29] Cizel et al. (2017), Assessing Basel III Capital Ratios: Do Risk Weights Matter?, http://pages.stern.nyu.edu/~ealtman/Assessing%20Basel%20III%20Capital%20Ratios.pdf (retrieved 21 June 2017).
[30] The classification of large banks as IRB banks and small banks as non-IRB banks is inexact. The authors conducted analysis on the SNL Financial database to determine that most banks with assets of less than US$10 billion are not IRB banks and most with assets of more than US$10 billion are IRB banks. They then used the US$10 billion figure as a way to classify banks in their sample into IRB and non-IRB categories.

less discretion in reporting their RWs, the relationship between the negative capital shocks and RW is significantly weaker or disappears.

36. The Bank for International Settlements has also suggested that there was some manipulation of internal models following their introduction (see paragraph 19 above), but cited only "market commentary" and provided no specific evidence.

The role of stress testing

37. Supervisory authorities require banks to undertake stress tests to see if their capital would be adequate in the event of a major negative shock. Banks also undertake internal stress tests.

38. In past New Zealand and trans-Tasman stress testing exercises, under the hypothetical scenarios imposed by regulators capital has remained above regulatory minimums.[31]

39. Stress tests provide useful information. They provide incentives for banks to think more about how they would manage capital in response to shocks, and they highlight some of the factors which are relevant for capital adequacy.

40. But like other sources of information, stress tests have their limitations. Stress-testing requires a large number of assumptions to be made about the size and nature of negative shocks, as well as the ways in which banks and markets can or will respond to those shocks. There is uncertainty about which assumptions to use, and in any case not all assumptions can be specified or policed by regulators.

41. For example, in previous stress tests capital ratios have been boosted because banks have assumed variously that they will be able to reduce the size of their balance sheets, tighten lending standards, maintain or increase profit margins on existing (good) loans, cut operational expenditure, or obtain additional capital from shareholders. Results of stress tests can be quite sensitive to such assumptions.

42. The main role of stress testing is to test the adequacy of overall capital, but in principle stress testing could also be used to examine whether risk weights produced by internal models are consistent across banks.

The Reserve Bank's view

43. The Reserve Bank's own experience in New Zealand is that it is very difficult to determine in a rigorous way whether differences between banks' risk weights are due to differences in underlying risk (e.g. different portfolios) or to differences in modelling approaches and philosophy (which in turn could include attitudes to capital optimisation).

[31] See https://www.rbnz.govt.nz/financial-stability/stress-testing for the results of some stress tests in 2014 and 2015. At the time of writing there is another trans-Tasman stress-testing exercise in progress.

44. The Reserve Bank makes a weak presumption that for larger portfolios, such as residential property, all internal models banks are participating in the same markets and are unlikely to face substantially different levels of underlying risk, in which case differences in risk weights would be largely the result of model differences.

45. In any case, the Reserve Bank regards as persuasive the international evidence that there are incentives for banks to reduce capital requirements by adjusting internal models, and that banks' internal models can produce widely varying estimates of the same underlying risk for some portfolios (noting again that international evidence cannot necessarily be generalised to New Zealand).

46. The Reserve Bank acknowledges the ability of internal models to take into account many determinants of risk. But this advantage will be illusory if models are being used strategically to reduce regulatory capital requirements. Even if they are not, the advantage may not be significant if:

- the exposure is to an externally rated entity, because the external rating will already take into account a wide range of risk factors; or
- alternative (i.e. standardised) approaches are fine-grained enough to take into account the major determinants of risk.

The gap between the IRB and standardised approaches

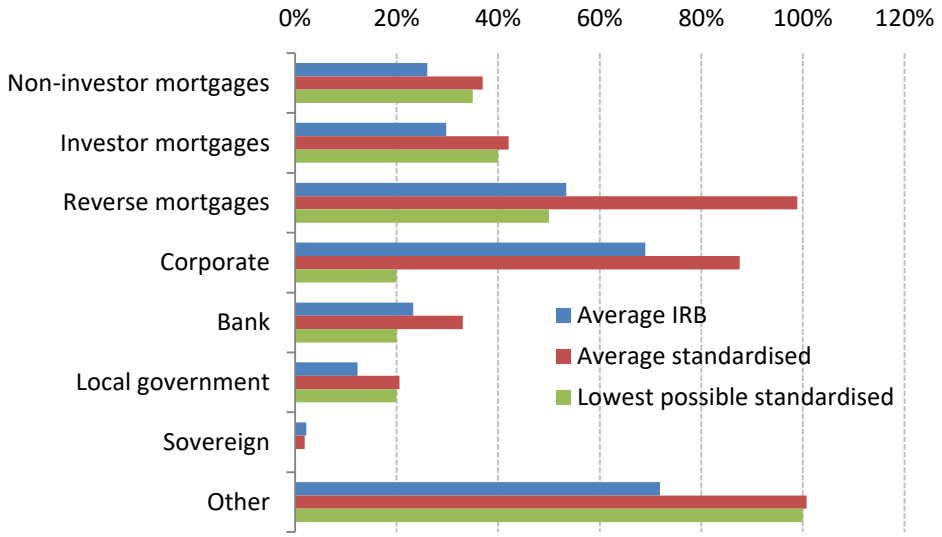
47. Average risk weights under the IRB approach are lower than those under the standardised approach, across most asset classes. For several asset classes IRB risk weights are also lower than the lowest *possible* risk weights under the standardised approaches; these include the residential mortgage and farm lending asset classes, which are very significant in New Zealand.[32]

48. This raises some important questions:

- Is the underlying risk faced by internal models banks genuinely lower than the underlying risks faced by other banks?
- If there is not a significant difference in underlying risk, is it that standardised risk weights are too high or that IRB risk weights are too low?

[32] Comparisons between the IRB and standardised approaches are imperfect. One significant difference is the existence of separate asset classes for defaulted exposures in the standardised approach. This biases portfolio-by-portfolio comparisons if default rates are high. The level of provisions (for expected losses) can also affect the comparison. Risk weights for farm lending exposures are not routinely reported by banks using the standardised approach. The Reserve Bank has made the assumption that the obligor farms are unrated corporates and therefore have a standardised risk weight of 100%. The average farm lending risk weight reported by internal models banks is 89%. Because risk weights vary across banks it is not possible to draw conclusions about individual banks from the aggregate data.

Figure 3: Risk weights by approach (provisional data)



Source: Balance sheet survey data as at 30 June 2017 from four internal models banks and six standardised banks, and Reserve Bank calculations.

49. The Reserve Bank has not undertaken a comprehensive benchmarking exercise involving both standardised and internal models banks to determine how the level of underlying risk relates to risk weights, but theoretical considerations would suggest it is less likely that there would be differences for some risk categories.

50. The underlying risk faced by internal models banks could be lower if they had obligors who were less likely to default than the obligors of other banks, within a particular risk category:

- For some risk categories differences in default probability are hard to justify. For example, it is difficult to understand why an internal models banks' corporate exposure with an external rating between BBB+ and BBB- would be much more or less likely to default than a similarly rated standardised bank's exposure.[33]
- For other risk categories there is more potential for differences to exist, because the variable used for segmentation does not explain all default risk. For example, one bank's residential mortgage exposure with a loan-to-value ratio of 80-90%[34] could be more likely to default than another bank's, if the first bank selects riskier customers within this loan-to-value band.[35]

[33] The BBB+ to BBB- corresponds to a single risk-weight (100%) under the standardised approach.
[34] The 80-90% LVR corresponds to a single risk weight (70%) under the standardised approach.
[35] The Reserve Bank has no definitive evidence that the residential mortgage exposures of standardised banks are any more or less risky than those of internal models banks. As part of its normal supervisory activities the Bank has examined the riskiness of some standardised-bank exposures and internal-model-bank exposures. That examination has identified some matters requiring further analysis. But at a high level, and using the available measures of risk, the Bank did not conclude that riskiness was markedly different between standardised and internal models banks.

- The greatest potential for differences arises when the standardised approach has a blunt approach to determining risk. For instance, most unrated corporate exposures receive a 100% risk weight under the standardised approach, compared to outcomes that (at least theoretically) can range from 0.03% to well over 100% under the internal models approach.

51. The underlying risk of internal models banks could also be lower if they had more collateral than other banks, for an otherwise similar exposure.

52. In New Zealand, collateral for residential mortgage and farm lending must be recognised through the loan-to-value ratio; within a given loan-to-value band all internal models banks are assigned the same level of loss-given-default.[36] For those portfolios, the relative calibration of the two sets of "standardised" information – risk weights under the standardised approach and prescribed losses-given-default under the IRB approach – could create differences. The Reserve Bank does not yet have evidence that there is a difference in the calibration across entire, typical portfolios.

53. For other portfolios, it is possible that there would be differences caused by the actual amount of collateral held by banks.

54. In addition to differences in probability of default and collateral, the underlying risk of internal models banks could be lower if they have better diversified portfolios – within each risk class – than other banks. However, this would not explain differences in observed risk weights in New Zealand.[37]

The Reserve Bank's view on the relative outcomes under the internal model and standardised approaches

55. The Reserve Bank considers that the internal models approach results in a lower capital requirement than the standardised approach.[38] Although in some cases this may be justified by more precise measurement of risk, it is difficult to explain the lower internal model risk weights for exposures to banks and local governments, and for residential mortgage exposures. In these cases the standardised approach is relatively fine-grained and it is also not obvious that internal models banks have less exposure to underlying risk within each risk category.

56. Conceptually, in cases where gaps are not justifiable on the basis of a different level of underlying risk or better information about risk, it is not necessarily the case that the internal models outcome is the incorrect one. For instance, there is a possibility that within individual mortgage lending risk categories the standardised approach might be calibrated inconsistently. However, the Reserve Bank does not have

[36] Technically, the Reserve Bank imposes minimum losses-given-default. In practice, the minimums are usually binding.
[37] Larger banks will potentially find it easier to diversify their exposures and this could reduce the underlying risk faced by the bank. However, the Basel "Pillar I" framework assumes all banks have well diversified portfolios, so this would not explain differences in (Pillar I) risk weights.
[38] There are exceptions for certain exposures or portfolios but in general it seems to be the case.

evidence that standardised risk weights are miscalibrated at a whole-of-portfolio level.

57. The Reserve Bank notes that a more fine-grained standardised approach could help to reduce gaps between the two approaches, particularly in the cases of exposures to unrated corporates and to individuals who are not mortgagors.

Transparency under the IRB approach

58. Internal models banks and standardised banks are both required to disclose information about their capital calculations.

59. In the case of standardised banks the basis for the calculations is reasonably clear; they are undertaken using the risk weights and other calculation rules imposed by the Reserve Bank.

60. For internal models banks the determination of probability of default, loss given default, and exposure at default, takes place mostly in internal models and is opaque to external observers. The results are reported by asset class and internal risk grade, though the risk grades are largely meaningless to those outside the relevant banks. The inputs to the internal models and the mechanics of the models are not required to be published at all in New Zealand.

61. Transparency could be improved in a number of ways, though all of these have their weaknesses.

62. One option is for banks to report standardised risk weights alongside the risk weights they calculate using their internal models. This would make it easier to see cases in which the internal models result is unusually high or low, and might prompt banks to publish an explanation for the difference between the two outcomes.

63. There is some international precedent for this option. The Basel standards for *market* risk that were recently finalised, and will be implemented in G20 jurisdictions, require parallel reporting of internal-model and standardised outcomes. There is also to be some parallel reporting under the new Basel IRB approach, although the precise form of this reporting is yet to be spelled out.

64. Readers of published results would need to be conscious that a difference between standardised and internal models risk weights does not necessarily indicate a problem with the internal models result (by design the standardised risk weights are not expected to vary as much as internal models weights).

65. A second option is for banks to report model outputs broken down by common risk indicators, so that it is easier for informed readers to gauge whether the outputs seem reasonable for the level of underlying risk.

66. For wholesale exposures, metrics such as an external rating, a debt-to-equity ratio, an interest-cover ratio, or a security-coverage ratio could be considered. For retail exposures, metrics such as the loan-to-value ratio or the debt-to-income ratio could be more useful.

67. The drawbacks of this approach are that it is challenging to identify indicators of risk that provide enough coverage, as well as to enforce collection and reporting of these indicators according to a common definition.

68. A third option for increasing transparency is to require banks to report model estimates of probability of default, loss given default, and exposure at default, alongside measures of realised default rates, loss rates, and default exposures. This can show if a particular bank is consistently over- or under-estimating risk. A drawback of this approach is that the accuracy of models may not be apparent for short observation periods or outside an economic downturn.[39] This drawback is exacerbated because models are modified or replaced over time, so that comparisons of estimates to realised outcomes do not reflect the models currently in use.

69. A fourth possibility is to require disclosure of model inputs and model mechanics. This would provide information that could help independent commentators to evaluate the appropriateness of models, but it would be likely to impose a significant burden on banks (to produce new documentation suitable for publication)[40] and on the Reserve Bank as a regulator (to police the level of detail and standard of reporting).

70. Conceptually these options are not mutually exclusive. The first option – report standardised risk weights alongside the risk weights they calculate using their internal models – could be required alongside any (or all) of the other three options.

The Reserve Bank's view on transparency

71. Of these options, the Reserve Bank supports the publication of standardised-approach capital requirements alongside internal models requirements. The Reserve Bank is already collecting standardised-approach outputs from internal model banks, but this is currently on a "best endeavours" basis and poor quality makes the data unsuitable for publication. All published capital requirements should be calculated on

[39] The probabilities of default used in the internal models approach are meant – at least within the theoretical framework of the Basel capital equations – to be averages over time. It is therefore to be expected that they will over-estimate in some parts of the economic cycle and under-estimate in others. If the economic cycle is long it could take a lot of observations to judge accuracy. In contrast, losses-given-default are intended to be the losses that would be suffered if the defaults occurred at the same time as a severe economic downturn. It is therefore to be expected that the model estimate would exceed a normal-year loss-given-default, and the model estimate would only really be tested in a deep recession.

[40] Banks generally have extensive internal model documentation. However, the Reserve Bank does not consider it will be suitable for publication because of privacy and competition concerns, and because the documentation would not be very accessible to a wide audience in its current form.

a robust footing, which in practice means within the capital engine and in accordance with robust compliance processes.

72. The Reserve Bank recognises the need for care in communicating the role of parallel reporting of outcomes. Gaps between standardised and internal models outcomes may be justifiable, just as similar outcomes under the two approaches do not necessarily imply that either is appropriate.

73. The Reserve Bank plans to collect data on modelled and realised outcomes for some portfolios, and will consider whether to collect data by common risk metrics (in addition to what is already collected). At this stage the Bank plans to collect the data for internal analysis, and has not considered the case for publishing the data at individual-bank level.

Changes in global capital standards

74. The Basel Committee on Banking Supervision has made changes to market risk standards and to credit and operational risk standards. The changes to market risk standards were finalised in 2016. The changes to credit and operational risk standards were finalised only in December 2017. Before that time, the Reserve Bank was working on the basis of Basel proposals. Although finalised standards differ from the proposals, sometimes significantly, many of the arguments justifying the proposals remain unchanged and they have remained relevant for the Reserve Bank's consideration of options.

75. New Zealand is not required to adopt the Basel Committee standards because it is not a member of the Committee, nor is it the home supervisor of internationally active banks. But it has generally been the case, with some exceptions, that New Zealand's standards have been very similar to the Basel standards, and there are some advantages in using an internationally accepted approach where they are a good fit for New Zealand circumstances.[41]

Credit risk – New IRB approach

76. The Basel Committee had proposed to restrict the use of internal models in the internal-ratings based approach.[42] The Committee noted:

> One of the lessons from the financial crisis is that not all credit risk exposures are capable of being modelled sufficiently reliably or consistently for use in determining regulatory capital requirements. This is supported by various

[41] New Zealand does not offer the full range of calculation options that are available in the Basel standards but for the options that are available for credit and operational risk the treatment is very similar. The main difference between the New Zealand standards and the Basel standards is the market risk standard. New Zealand's market risk standard is based on an obsolete Basel framework and is quite different from the current Basel standard.
[42] Basel Committee on Banking Supervision (2016), Consultative Document: Reducing variation in credit risk-weighted assets – constraints on the use of internal model approaches, March 2016, https://www.bis.org/bcbs/publ/d362.pdf.

analyses conducted by the Basel Committee that show significant unwarranted variability in RWA calculated under the IRB approaches.

77. For certain wholesale portfolios the Basel Committee noted that although banks were consistently able to determine the relative riskiness of borrowers (i.e. to rank borrowers by risk), there was a lot of variation in *absolute* estimates of riskiness and a lack of historical default data would make it hard to improve the reliability of modelled outcomes.

78. The Basel Committee therefore had proposed to require the use of the standardised approach for all exposures to banks and other financial institutions, to large corporates (those with total assets exceeding €50 billion), and to equities.[43] Exposures to sovereigns were excluded from the scope of their proposal, because of political concerns as the Reserve Bank understands it, but the rationale for applying the standardised approach to banks and large corporates seems to apply equally to exposures to sovereigns. That is, they are exposures for which the probability of default is difficult to model using historical data, and for which internal models have produced unjustifiably variable estimates.[44]

79. The Basel Committee had also proposed to restrict modelling of mid-size corporate exposures (annual revenues exceeding €200 million), allowing only a simplified form of the IRB approach known as the "Foundation IRB approach", or F-IRB. Under F-IRB losses given default are standardised and the conditions for recognition of collateral or other forms of credit risk mitigation are more prescriptive.

80. The finalised framework removes the use of the full IRB approach for large and mid-sized corporate, banks and other financial institutions. These must now be calculated under the F-IRB approach.[45] The F-IRB approach was included in our capital framework in New Zealand as a part of the Basel II changes in 2006. However, it was never used, and a decision to remove F-IRB from our framework was taken in early 2017 and work is currently underway to give effect to that decision. Removal of the F-IRB approach is consistent with reducing unnecessary complexity in New Zealand's capital standards.

81. The Basel Committee had also proposed to require the use of the standardised or "supervisory slotting" approaches for specialised lending. Specialised lending, in broad terms, refers to loans to finance an asset where the repayment of the loan depends mainly on the income generated by the asset. The supervisory slotting approach requires a bank to classify exposures into four categories of risk, each of which has a prescribed (not modelled) risk weight. The Committee has backed away

[43] The treatment of equities is already standardised in the New Zealand IRB framework.
[44] The Basel Committee recently released a discussion document on sovereign exposures. See Basel Committee on Banking Supervision (2017a), Discussion paper: The regulatory treatment of sovereign exposures, December 2017, https://www.bis.org/bcbs/publ/d425.pdf.
[45] Basel Committee on Banking Supervision (2017b), Basel III: Finalising post-crisis reforms, December 2017, https://www.bis.org/bcbs/publ/d424.pdf.

from the standardisation proposal for the time being, but plans to review the treatment of specialised lending exposures.

82. A key part of the new Basel framework is the introduction of floors on model outputs for portfolios where the IRB approach remains available, to "ensure a minimum level of conservatism for [those] portfolios".

83. The floors that are relevant for the current New Zealand framework (which changed slightly between the original Basel proposal and the final Basel framework) are shown in Table 1.

Table 1: Basel Committee's finalised model output floors

Asset class	Probability of default	Loss given default (unsecured)	Loss given default (secured)	Exposure at default
Corporate	0.05%	25%	Varying by collateral type: ■ 0% financial ■ 10% receivables ■ 10% real estate ■ 15% other physical	Sum of on-balance-sheet exposures and 50% of the exposure using credit conversion factors under the standardised approach.
Retail: ■ Mortgages ■ Other retail[46]	 0.05% 0.05%	 n.a. 30%	 5% Varying by collateral type: ■ 0% financial ■ 10% receivables ■ 10% real estate ■ 15% other physical	Sum of on-balance-sheet exposures and 50% of the exposure using credit conversion factors under the standardised approach.

[46] Excludes the "QRRE" exposure class. The Reserve Bank has not permitted any banks to use this class and has announced that it will remove the class from BS2B.

84. There is also a floor on final risk weights under the IRB approach, to prevent the IRB result from diverging too far from the result under the standardised approach. The floor is set at 72.5 percent of aggregate risk weighted assets (across all portfolios and risk types).

85. There are other changes to the IRB approach, relating for example to the amount and quality of data used for estimation of model parameters.

Credit risk – New standardised approach

86. The Basel Committee has also finalised changes to the standardised approach for credit risk.[47] This followed proposals published at the end of 2015, the aims of which were balance simplicity and risk sensitivity, promote comparability by reducing variability in risk-weighted assets across banks and jurisdictions, and to ensure that the standardised approach is a suitable "alternative and complement" to the IRB approach.[48]

87. The new approach is more risk-sensitive than the old Basel approach.

88. There is a new real estate asset class with risk categories for residential and commercial property lending that are relatively fine-grained and which differentiate between investment property and other property. The Basel Committee provides clarification that the lower risk weights in the new asset class are generally available only for certain exposures secured by *fully completed* property. The framework introduces a separate asset subclass – with a minimum 100% risk weight – for land acquisition, development, and construction exposures where repayment of the loan depends on uncertain sale or settlement of residential or commercial property.

89. New Zealand's current implementation of the standardised approach is already quite fine-grained for residential property lending and is generally more conservative than the Basel Committee's new standard.[49] New Zealand's current approach also includes separate risk categories for reverse mortgages. There is no equivalent in the Basel Committee's proposal.

90. There is a new asset class, in the Basel approach, for specialised lending exposures to corporates. With the exception of the real property exposures that are covered by the new real estate asset class, this new class mirrors – in scope – the specialised lending asset class under the IRB approach. Risk weights would be determined by

[47] Basel Committee on Banking Supervision (2017b), Op. Cit..
[48] Basel Committee on Banking Supervision (2015), Second Consultative Document: Standards: Revisions to the Standardised Approach for credit risk, https://www.bis.org/bcbs/publ/d347.pdf.
[49] That is, the Reserve Bank expects the current New Zealand approach would result in higher capital requirements than the new Basel approach. The Basel Committee's approach does explicitly note that the relatively low risk weights "will apply to jurisdictions where structural factors result in sustainably low credit losses associated with exposures to the real estate market" and recommends that supervisory authorities "evaluate whether the risk weights in the corresponding risk weight tables are too low for these types of exposures in their jurisdictions based on default experience and other factors such as market price stability".

issue-specific external ratings, if available, or would be 80-130% in the absence of such a rating.

91. The new classes for commercial property, development and construction, and specialised lending would allow a wider range of risk-weights for corporate lending. Under the current New Zealand standardised approach there is a single risk weight of 100% for almost all exposures to unrated corporates.[50]

92. The new standardised approach introduces a risk weight "add-on" for cases where the currency of the loan is different from that of the borrower's main source of income and there is no hedge against currency risk. This add-on applies to retail (including residential mortgage) exposures to individuals, and would increase the applicable risk weight by 50%.

93. The new Basel framework also makes changes to the definition of default to better align it with the definition in the IRB approach, and makes slight changes to the risk weights for defaulted exposures. The current New Zealand standardised approach uses a 90-days-past-due definition, which is narrower than the definition of default in the IRB approach.

94. Finally, the new standardised approach adjusts credit conversion factors for unconditionally cancellable commitments.[51]

Operational risk – New standardised approach to replace all current approaches

95. The Basel Committee has decided to replace both the internal model and standardised approaches for determining operational risk with a new standardised approach.[52] As reported in the Issues Paper we released on 1 May 2017, operational risk modelling frameworks were under-developed at the time the internal models approach was first allowed. The Basel Committee had hoped that they would mature but they did not do so sufficiently. In New Zealand, uncertainty about the appropriate modelling approach for operational risk has been dealt with by imposing floors on the model outputs of internal model banks. Those floors are often binding.

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[50] The current Basel standardised approach includes a "Regulatory Retail Portfolios" asset class, with a risk weight of 75%, for small retail exposures to individuals or small businesses that do not fit in the residential mortgage subclass. New Zealand has not adopted this part of the approach and the risk weight for such exposures is generally 100%. The proposed Basel approach keeps the retail asset class and also adds a corporate asset subclass (with a concessionary risk weight of 85%) for exposures to small and medium-sized businesses that do not fit in the retail class. The Basel Committee considered whether to provide a more fine-grained approach for unrated corporates generally, but rejected this because of concerns about "comparability and subjectivity" and the "additional burden on bank supervisors and banks".

[51] When a bank has given a commitment to provide funding, the bank must recognise some exposure even if the funding has not yet been drawn down. Under the current approach, a bank can record a nil exposure if the commitment is unconditionally cancellable (in New Zealand the precise wording is "cancels automatically when the creditworthiness of the counterparty deteriorates or which can be cancelled unconditionally at any time without prior notice").

[52] See Basel Committee on Banking Supervision (2017b), Op. Cit., and Basel Committee on Banking Supervision (2016), Consultative Document: Standardised Measurement Approach for operational risk, http://www.bis.org/bcbs/publ/d355.pdf.

96. The new approach makes use of two measures. The first is a "business indicator", which is a combination of gross and net income and expenses across various areas of a bank's business. The second measure, to be used only by larger banks, is an adjustment based on the historical operational loss experience of the bank. The adjustment makes the new approach marginally more fine-grained than the current standardised approach, for the institutions that can use it.

97. In response to the proposed standardised approach, the Institute of International Finance and the Global Financial Markets Association have argued that internal models for operational risk help to promote the identification and management of risk within a bank and allow for a wider range of relevant risk factors to be reflected. In contrast, they argue that "capital requirements under [the proposed approach] would in many cases be well above the economic capital banks have allocated to operational risk", and that the approach could result in "a measure of risk not reflecting the real potential exposure of an individual bank".[53]

98. Linking internal modelling to regulatory capital is not the only way to give banks incentives to have good operational risk management. It is open to a regulator to require an advanced approach to identifying and dealing with operational risk, even though it is not used to determine regulatory capital. Indeed, this would be the only way to provide incentives, should they be required, for banks which do not use the internal models approaches (that is, most banks).

Market risk

99. The Basel Committee has approved new internal model and standardised approaches to calculate regulatory capital for market risk[54] and has proposed an additional, simplified standardised approach.[55]

Market risk – New modelling approach

100. The Reserve Bank does not currently allow an internal models approach for market risk and does not intend to introduce one as part of the capital review. However, the Bank does note that one aspect of the proposed new internal models approach is the requirement to report results of the standardised approach alongside internal model results.

Market risk – New standardised approach

101. New Zealand's current approach to market risk is a standardised approach and is based on a Basel framework from the 1990s.

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[53] Institute of International Finance (2016), Submission to Basel Committee on Banking Supervision on standardised measurement approach proposal, www.iif.com/publication/regulatory-comment-letter/iifgfma-response-bcbs-sma-operational-risk.
[54] Basel Committee on Banking Supervision (2016), Standards: Minimum capital requirements for market risk, http://www.bis.org/bcbs/publ/d352.pdf.
[55] Basel Committee on Banking Supervision (2017), Consultative Document: Simplified alternative to the standardised approach to market risk capital requirements, https://www.bis.org/bcbs/publ/d408.htm.

102. New Zealand's approach corresponds roughly to the "general market risk" component of the "Basel II" standardised approach.[56] 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", while the New Zealand approach is applied to assets and liabilities in the "banking book" as well.[57] In New Zealand capital requirements for interest rate risk are determined by taking a net exposure (assets less liabilities but with imperfect netting) at each maturity and multiplying by a factor to represent the risk of interest rate changes at that maturity. Some limited offsetting across maturities is permitted. Capital requirements for foreign exchange and equity risk are determined by multiplying net exposures by 8%.

103. Basel approved a new standardised approach in 2016. The Reserve Bank has not thoroughly analysed the new approach, but understands that it determines capital requirements in several parts.

104. Firstly, there is a capital requirement to reflect the risk of changes in the value of the instrument due to changes in risk factors. For example, for a bond the risk factors would include market interest rates along the relevant parts of the yield curve, credit spreads, and – depending on the type of bond – perhaps inflation and exchange rates. The general approach is to assume a significant movement in each risk factor and to use the bank's normal pricing model to work out how much this would change the value of an asset or liability. This determines how much capital must be held. The new standard refers to separate requirements for *delta* and *curvature*.[58]

105. Secondly, there is a requirement to reflect the risk of changes in implied volatility. The new standard refers to *vega* risk, and calculates the capital charge using the instrument's *vega* and current implied volatility. [59] This requirement is imposed only for options or instruments with optionality.

106. Thirdly, there is a requirement which reflects the risk that there will be a default which affects the instrument or – in the case of a derivative[60] – the underlying instrument. For example, if the bank holds a bond or has sold a put option on a bond, there is a

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[56] See Basel Committee on Banking Supervision (2006), International Convergence of Capital Measurement and Capital Standards: A Revised Framework: Comprehensive Version, http://www.bis.org/publ/bcbs128.pdf.
[57] The Reserve Bank has not defined "trading book" and "banking book" because, in the context of market risk, there has been no need to do so. In the Basel II standard the term 'trading book' is defined (see Basel Committee on Banking Supervision (2006), *Op. Cit.*).
[58] The calculation requires a full re-pricing of the instrument. Conceptually the charge is split into a linear component (reflected in the *delta* of the instrument – see the glossary on page 55) and a residual which reflects the non-linearity of value changes with respect to risk components (the *curvature* – also see the glossary). The new approach calculates these components separately. Commentators have noted potential problems with splitting the charge. See for example pwc (2015), FRTB: Looking Closer Into the New Standard Approach: Curvature Risk, https://news.pwc.ch/20489/frtb-looking-closer-new-standard-approach-curvature-risk/. The non-linear component is only calculated for options or instruments with embedded options.
[59] *Vega* measures how sensitive the value of a derivative is to the price volatility of the underlying asset. For example, for an option to buy a share *vega* is sensitivity of the option value to the volatility of the share price. Consistent with the way options are priced, the volatility is the *expected* volatility that is implied by the pricing equation and current market prices, as opposed to the historical volatility.
[60] A derivative is a financial instrument, security, or contract between two or more parties where the price is dependent on (derived from) one or more underlying assets.

risk that the issuer of the bond will default. In the current New Zealand framework this risk is partially included in general capital requirements for credit risk.[61]

107. Lastly, there is a "residual risk add-on" which imposes an additional capital requirement for more complex instruments. The proposed standard recognises two classes of such complex instruments. One class contains instruments with underlying risk factors which are not picked up in the delta, vega, or curvature requirements (e.g. where the bank has bought or sold an agricultural commodity derivative for which the payoff depends on the weather). The other class includes certain securitisation and credit default swap exposures.

108. Compared to New Zealand's current approach, there are 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.

109. However, the new standardised approach would be incompatible with parts of our 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.

110. The new approach could be difficult to extend fully to assets and liabilities in the banking book. The bank would need to have systems for quantifying how the value of every individual loan or deposit responds to changes in interest rates and credit spreads at all relevant maturities. This is potentially complicated by the interest-rate insensitive nature of some balances in the banking book.[62,63]

111. The new standard is also more complex than the one New Zealand uses now, relying more heavily on trading terminology and concepts. Given our current priorities and

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[61] Because the New Zealand approach makes no distinction between the banking and trading books, the standard capital requirements for credit risk pick up the risk of an obligor defaulting: if a bank held a bond, there would be a capital requirement to reflect the risk of the bond issuer failing. The New Zealand approach does not explicitly pick up the risk of default of an entity which is not a direct obligor of the bank. If the bank had sold a put option over a bond but didn't hold the bond itself, there would not be a separate capital requirement to reflect the risk of the bond issuer failing. There would be a general market risk charge to reflect the risk of changes in the value of the option, but this does not explicitly include a component for issuer default.

[62] For instance, call deposit accounts may have interest rates that are zero or very close to zero and remain there regardless of changes in the market interest rate. The *value* of such accounts should vary more with market interest rates than the value of other accounts, such as floating-rate mortgage accounts for which the interest rate tends to respond quickly and substantially to changes in market rates.

[63] The Basel Committee recently finalised a new standard for interest rate risk in the banking book (IRRBB), which contains an optional standardised approach (see Basel Committee on Banking Supervision (2016), Standards: Interest rate risk in the banking book, http://www.bis.org/bcbs/publ/d368.pdf). This approach might be combined with the market risk standard to achieve similar coverage to our current market risk standard. The Reserve Bank has not yet closely analysed the optional IRRBB approach but notes that further empirical work would be required to make it suitable for New Zealand (for instance, adding NZD interest rate shocks and determining appropriate ranges for prepayment or early redemption assumptions).

resourcing, the Reserve Bank considers that it might be impractical to undertake policy development of our market risk requirements at this point.

112. The Reserve Bank is also unsure if all New Zealand-incorporated banks would be in a position to implement the new Basel standard, or see it as cost effective. The Bank welcomes readers' views on this.

Market risk – New simplified standardised approach

113. The Basel Committee has recognised that the complexity of the new standardised approach "may pose implementation challenges for some banks (e.g. banks with a low concentration of trading book activity and smaller banks that typically do not have sufficient infrastructure for computing the [new approach])" and could also be unnecessary in jurisdictions where "large banks face less complex risks". Consequently, in June this year the Basel Committee published a proposal to add another, simpler approach for calculating market risk.[64]

114. The simplified approach, which would be available only to non-systemically important banks without complex trading operations, would match the ordinary standardised approach except that:

- there would be no requirements relating to curvature or vega;
- for delta risk, risk factors and corresponding risk weights would be less fine-grained;
- for delta risk, the method for combining assets (e.g. to recognise diversification) would be simplified.

115. The proposed simplifications would make it easier to implement the new standardised approach to market risk. It would still, however, be a fundamental departure from the current New Zealand approach. Difficulties caused by the scope of the market risk rules, as discussed in paragraph 110, would not be solved by the simplification.

Seeking your views: questions about issues identified

Question 1.1: This consultation paper lays out some arguments for the use of internal models to determine capital requirements. Are there other arguments that should be considered?

[64] Basel Committee on Banking Supervision (2017), Consultative Document: Simplified alternative to the standardised approach to market risk capital requirements, https://www.bis.org/bcbs/publ/d408.pdf.

Question 1.2: This paper has commented on studies used by supervisors and other stakeholders to assess the consistency and accuracy of results produced by internal capital models. Do you agree with the Reserve Bank's conclusions about these studies? Are there other methods for assessing consistency and accuracy which should also be considered?

Question 1.3: A key issue in this paper is whether or not the differences between risk weights across banks, including those between IRB and standardised banks, are justified by differences in the underlying risk of portfolios. Are you aware of evidence that the underlying risk of portfolios – within an asset class – is substantially different across banks, or not substantially different?

Question 1.4: This paper has summarised BCBS changes (or proposed changes) to capital requirements for credit risk and operational risk. Do you consider that the summary accurately reflects what has been changed (or proposed)?

Question 1.5: The Reserve Bank has in the past followed Basel standards, but has made exceptions where it has been appropriate for New Zealand's circumstances. For example, in 2015 the Reserve Bank announced it would drop the F-IRB approach to improve the clarity of the capital standards, because the F-IRB approach was not being used in New Zealand and (even if it were being used) there is flexibility to modify the A-IRB approach in a way which achieves the same outcomes. Over time these sorts of changes have taken the New Zealand standards somewhat further from the Basel standards. Do you have any comments on the Bank's approach to adopting the Basel standards?

Options

116. In the light of the issues and developments discussed in this paper the Reserve Bank has identified the following options for consultation, which are discussed in subsequent sections.

Table 2: Summary of policy options (Reserve Bank's provisional preferences in italics)

Credit risk	
IRB approach	1. Status quo. 2. Adopt BCBS changes to limit modelling of risk parameters and impose an overall risk-weight floor. Preserve existing New Zealand variations such as prescribed losses given default for mortgages and farm lending. *3. Adopt the BCBS's original proposal to require the standardised approach for bank, large corporate, and specialised lending exposures, and impose limits on IRB model inputs and outputs in other cases. Extend the proposal to also require the standardised approach for any other externally rated exposure (including sovereigns). As in (2), preserve New Zealand variations.* 4. As (3) but additionally require the standardised approach for all exposures except unrated corporate exposures. 5. Entirely replace the IRB approach with the standardised approach. For (2)-(4), risk weight floor could be aggregate or fine-grained (e.g. one floor per asset class) and the level of the floor would be calibrated at the conclusion of the capital review. For all of (1)-(5) , capital requirements could be made more transparent by *dual reporting of IRB and standardised requirements*, more reporting of risk weights by indices of risk (e.g. security coverage), or disclosure of internal model documentation.
Standardised approach	1. Adopt the new BCBS standardised approach with risk weights that are more finely grained than the current international approach. 2. As (1) but with risk weights recalibrated for New Zealand circumstances. *3. Status quo.*
Operational risk	1. Status quo. *2. Adopt new BCBS framework which replaces the existing standardised and internal models approaches with a new standardised approach (with precise calibration to be determined at a later stage of the capital review).* 3. As (2) but with the addition of explicit requirements for advanced risk management processes and systems.
Market risk	*1. Status quo.* 2. Replace the current approach with the new Basel Standardised approach.

Credit risk

117. Options for credit risk would involve changes to the internal models (IRB) approach, changes to the standardised approach, or improved disclosure (or combinations of these).

Credit Risk, IRB approach option 1 – Status quo

118. One option is to continue to allow internal models banks to operate under the existing rules.

Credit Risk, IRB approach option 2 – Follow BCBS changes (preserving existing variations)

119. A second option is to adopt the changes to international standards the Basel Committee recently finalised. That is, the IRB approach would be more limited than it is now, with only the F-IRB approach available for bank and large corporate exposures and with more limitations on model inputs and outputs (for specific measures see the discussion beginning at paragraph 80).

120. With this option, the Reserve Bank would preserve existing differences between the New Zealand implementation and the Basel framework, such as higher correlations for residential mortgage loans and minimum losses given default for mortgages and rural lending.

Credit Risk, IRB approach option 3 – Extend BCBS proposals to all externally rated exposures

121. A third option is to adopt the changes originally proposed by the Basel Committee, again preserving New Zealand's existing variations, and to logically extend them. Specifically, as in the original Basel proposal the standardised approach would be required for bank, large corporate, and specialised lending exposures (no IRB approach would be allowed), the F-IRB approach would be required for other corporate exposures over €200 million, and there would be more limitations on model inputs and outputs. This would be extended by also requiring the standardised approach for sovereign exposures and *any* other exposure with an external credit rating. With this extension, sovereigns and a relatively small number of New Zealand corporates with external credit ratings but not big enough to meet the Basel threshold for "large" (assets over €50 billion) would also be brought into the scope of the standardised approach.[65]

122. The Reserve Bank considers this option is well supported by the arguments that appear earlier in this document. Those arguments and the evidence for them have not changed, and they remain sound in spite of the Basel Committee's final decision to draw back from its original proposals. Moreover, the Reserve Bank has

[65] A feature of the current standardised approach for sovereign exposures is that it permits a zero risk weight for highly rated exposures. It is questionable whether any sovereign exposure is truly free of risk. Whether or not option 3 is adopted, the Reserve Bank may reassess the suitability of a zero risk weight.

announced it is removing the F-IRB approach from the New Zealand standards, and while it would be possible to reverse this position and retain F-IRB, it would be inconsistent with the objective of minimising unnecessary complexity in the standards.

123. Addressing specifically the extension of the original Basel proposal to sovereign and other externally rated exposures, the Reserve Bank notes that risk categories for rated entities are relatively fine-grained under the standardised approach and it is questionable whether banks' internal models can provide more reliable information than external ratings produced by recognised rating agencies, particularly for exposures which have historically had low default rates. The Reserve Bank considers that the case for the standardised approach is convincing for these exposures.

124. A drawback of reliance on external ratings is that errors by rating agencies could have wider consequences. Poor external rating practices were implicated in the global financial crisis, and in the aftermath the United States made changes to its banking regulations to reduce reliance on external ratings. It is worth noting that much, but not all, of the criticism of rating agencies was directed towards ratings on innovative instruments rather than corporate exposures. Nevertheless, because the role of ratings in the Basel requirements had become contentious, in its new IRB approach the Basel Committee has imposed new obligations on regulators to continuously vet rating agencies and their ratings, and on banks to override external ratings where due diligence indicates the rating should be worse than it is.[66]

Credit Risk, IRB approach option 4 – Extend BCBS proposals to all exposures except unrated corporate exposures

125. Another possibility is to go further than the third option and to replace the IRB approach with the standardised approach for all exposures except unrated corporate exposures. In particular, this would mean also applying the standardised approach to residential mortgage exposures and to other exposures to non-corporates (e.g. personal loans).

126. For the residential mortgage portfolio the standardised approach is quite fine-grained, with risk weights varying according to security coverage (loan-to-value ratio), investment versus owner-occupation, and mortgage insurance. Moving from internal models to a standardised approach might therefore not involve much loss of risk sensitivity, and would at the same time reduce the problems associated with the internal models approach.[67]

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[66] The proposed standardised approach also provides an alternative to the use of external ratings for banks in countries where the use of external ratings is not permitted, using a somewhat subjective three-step scale of risk (Grade A, Grade B, Grade C). This was felt to be suitable only for exposures to financial institutions, not for corporates more generally, because of concerns "about comparability and subjectivity, as well as the additional burden on supervisors and banks".

[67] One shortcoming of the standardised approach for this portfolio is that it lacks a direct measure of debt-servicing capability such as a debt-servicing ratio or a debt-to-income ratio. A possibility would be to add a further dimension of risk to the standardised approach to reflect debt-servicing capability. The Basel Committee

127. For other exposures to non-corporates, such as credit cards and personal lending, standardised approaches are crude but these portfolios are generally small for the banks that currently use the IRB approach and so moving to the standardised approach would not necessarily cause a material loss of risk sensitivity (across a bank's entire business).[68]

128. Under this option, the IRB approach would continue to be permitted for exposures to unrated corporates (including small and medium-sized enterprises) because the value of such exposures is relatively material and the standardised approach applies bluntly to them, assigning a 100% risk weight in most cases. The changes to the Basel framework for the standardised approach distinguish real estate and specialised lending exposures from other corporate exposures, but within the latter it is not obvious how a simple standardised approach could be made more risk-sensitive.[69]

Credit Risk, IRB approach option 5 – Replace IRB approach entirely with standardised approach

129. A fifth option is to replace the IRB approach entirely, so that the standardised approach would be used for all exposures. This option has the advantage of the greatest simplicity, but the drawbacks of less risk sensitivity (notably for unrated corporate exposures) and lessened responsibility (for banks) for risk assessment.

Credit Risk, IRB approach companion option – Higher or more finely grained floors

130. Under options 2–4 there would be a 72.5 percent floor on risk weights produced by internal models.

131. The level of the floor (or floors) could be set higher than this, if justified by New Zealand circumstances. Of course, if portfolios are not sufficiently similar across banks and internal models do accurately take risk into account, a higher floor would reduce risk-sensitivity and so could be inefficient.

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once proposed a standardised approach using loan-to-value and debt-service coverage as the dimensions of risk. See Basel Committee on Banking Supervision (2014), Consultative Document: Standards: Revisions to the Standardised Approach for credit risk, https://www.bis.org/bcbs/publ/d307.pdf. In its finalised standard the Committee dropped the servicing dimension, following earlier noting of "concerns about the consistency of its definition and the appropriateness of the proposed threshold across jurisdictions". In this vein, the Reserve Bank notes that while banks in New Zealand already collect borrower income information, they currently use different definitions and the data is sometimes incomplete. Requirements could be imposed to reduce incompleteness achieve greater consistency, but it can be practically difficult to apply such requirements to existing loans (as opposed to new business) and so it can take some time for requirements to be fully effective.

[68] The Basel Committee found that the following two factors produced some indication of risk for retail loans: whether the loan was secured or not, and the length of the bank's relationship with the customer. However, the Committee did not incorporate these measures into its final standardised approach, having earlier reported concerns about comparability of the data it was using for analysis.

[69] The Basel Committee assessed leverage and revenues as risk indicators but were not able to find strong and consistent relationships with probability of default in the international data. See Basel Committee on Banking Supervision (2015), Second Consultative Document: Standards: Revisions to the Standardised Approach for credit risk, https://www.bis.org/bcbs/publ/d347.pdf, page 63.

132. The Reserve Bank does not consider that the gap between standardised and IRB model outcomes should be too large, and notes that the 72.5 percent-of-standardised level would be lower than the level arrived at in previous calibration exercises in New Zealand for the rural and residential mortgage lending portfolios. The Reserve Bank will consult on the precise level of the floor as part of its overall calibration of capital requirements at the conclusion of the capital review.

133. An alternative to an aggregate floor would be to have floors apply in a more fine-grained way, either at the level of individual exposures or by exposure class (e.g. residential mortgages, other retail, corporate). This would allow for fine-tuning of the floors, so that more or less variation was permitted for certain types of exposure. This would increase the complexity of the capital requirements. In the absence of any recalibration of the level of the floor it would also tend to increase the overall capital requirement because it would not be as easy to offset exposures with higher-than-standardised risk weights against those with lower-than-standardised risk weights; this could only be done within an exposure class, or not at all if the floor applied to individual exposures.

134. If an aggregate floor is chosen, the Reserve Bank would consider setting the floor at a higher level than if fine-grained floors were used. In either case, the Reserve Bank notes that it already has the ability to impose *ad hoc* floors on individual banks (or all banks) for particular exposures, and will retain this ability.

Credit Risk, IRB approach companion option – increased transparency

135. Whatever scope and detailed calculation rules are decided upon for the IRB approach, there are also options for increasing the transparency of reporting about IRB models and outcomes.

136. One option is to leave the reporting requirements as they are.

137. Another option is to require reporting of standardised risk weight outcomes alongside IRB risk weight outcomes ("dual reporting"). That is, banks would be required to calculate capital under *both* the internal model and standardised approaches, and publish the results.

138. The Reserve Bank sees merit in the dual reporting option. The Reserve Bank acknowledges that standardised results can legitimately vary from internal model results, but also considers that it is appropriate that large differences should be questioned and that banks should explain why their models are producing them.

139. Dual reporting would increase banks' costs of complying with regulation, but if the proposal to impose a risk weight floor proceeds (see paragraph 130) then a standardised capital requirement will already have been calculated and the marginal cost of reporting it is likely to be small.

140. Other transparency-enhancing options are to require 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.

Credit risk, Standardised approach option 1 – Follow BCBS changes (preserving existing variations)

141. One option is to adopt the Basel Committee's new standardised approach. The approach proposed by the Committee is more risk-sensitive than the existing Basel standard, introducing new asset classes for specialised lending and real estate. It is, however, not much more risk-sensitive than the standard implemented in New Zealand, because New Zealand's implementation already provides a more fine-grained classification of residential mortgage exposures.

142. Under this option New Zealand would preserve some existing variations such as the classification of local government exposures as non-sovereign, and non-adoption of the 'retail' asset class.[70]

Credit risk, Standardised approach option 2 – Follow BCBS changes but alter calibration

143. The new standardised approach is more conservative in some areas but permits lower risk weights for some real estate exposures with low loan-to-value ratios.

144. As a result of the loan-to-value "speed limits", loan-to-value ratios in New Zealand have decreased. Therefore, adoption of the new Basel Committee framework might be expected to reduce average risk weights for some banks with significant real estate exposures.

145. In calibrating revised capital regulations at the conclusion of the capital review, the Reserve Bank will need to carefully consider whether or not it is appropriate for capital ratios to decline for any bank. The Reserve Bank could conclude that it is appropriate to retain the lowest existing risk weights for real estate, or to increase the minimum risk weights in the Basel Committee's framework.[71]

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[70] In the existing Basel II standard the regulatory retail class is used for certain small exposures to individuals or small businesses, and allows for a preferential 75% risk weight. It has been argued that the lower risk weight is justified because these exposures are better diversified than, for instance, exposures to larger businesses (see the 2014 consultation document on the proposed new standardised approach, *op. cit.*, at page 14). The concession may be contrasted with the treatment under the IRB framework: the IRB framework implicitly assumes that there is full diversification across *all* portfolios, including larger businesses, but encourages regulators to impose *additional* Pillar 2 capital requirements if the assumption is not satisfied. Another argument for a low risk weight is that individuals or small businesses are relatively more likely than other obligors to fail for idiosyncratic reasons – such as poor management – rather than because of the economic cycle, reducing the need for additional capital over and above the level of provisions. A difficulty with this argument is that the standardised approach, unlike the IRB approach, does not ensure the consistency of provisions and (regulatory) expected losses, so the combination of actual provisions and concessionary capital could be too low.

[71] If implemented unchanged in New Zealand, it is expected that the Basel standardised framework would increase consistency with the IRB framework, which allows for considerably lower risk weights for the lowest-LVR exposures. However, an alternative means to improve consistency would be to increase the minimum loss-given-default parameters for low LVR loans under the IRB framework.

Credit risk, Standardised approach option 3 – Status quo

146. Another option would be to make no change to the New Zealand standardised approach for the time being.

147. The Reserve Bank favours this option.

148. Given that New Zealand's standardised approach is already more risk sensitive than the existing Basel II standardised approach – for example, within the residential mortgage asset class – the benefits of moving to the Basel Committee's proposed approach may be limited.

149. The Reserve Bank also notes that the existing approach is also more conservative than the new Basel approach – in that the existing approach is likely to require more capital – for the sorts of mortgage exposures that currently dominate banks' books. The Reserve Bank would want to be very confident about changing this.

150. As an exception, the Reserve Bank favours reviewing the zero risk weight for certain sovereign exposures. The theoretical basis for a zero weight is unclear, and the proposed standardisation of the sovereign asset class under the IRB approach means there could be significantly more exposures receiving the weight. The Reserve Bank notes that the Basel Committee has recently released a discussion document on the treatment of sovereign exposures.

Seeking your views: questions about options for credit risk

Question 2.1: Several options are presented for limiting the use of IRB models. Under three of those options IRB models would be replaced by the standardised approach for bank, sovereign, and large corporate exposures. For these exposures do you consider that internal models can provide more information about risk than external credit ratings? Why or why not?

Question 2.2: One of the options for credit risk would also involve removing the IRB approach for retail portfolios, on the grounds that the standardised approach is quite risk-sensitive for mortgages and other retail exposures are relatively small. Do you agree that the standardised approach for mortgages is risk-sensitive? If not, how could it be made more risk-sensitive? Do you agree that other retail exposures are relatively small? Are there other grounds for retaining or dropping the IRB approach for retail exposures?

Question 2.3: One of the options for credit risk would involve entirely replacing the IRB approach with the standardised approach. This paper notes that the standardised approach is not very risk-sensitive for exposures to corporates without external credit ratings. Would the lack of sensitivity for unrated corporates pose a significant problem? Why, or why not? How might the lack of sensitivity be remedied within the standardised approach (noting that the BCBS failed to find variables which reliably distinguished risky exposures from less risky exposures)?

Question 2.4: In the options for limiting the use of IRB models, there would be a floor on risk weights produced by internal models. This floor would be set as a percentage of the corresponding risk weights under the standardised approach. The floor could be set on a portfolio-wide level (average risk weight of all exposures would be higher than some level), by asset class (e.g. average risk weight of residential mortgage exposures would be higher than some level), or by individual exposure (actual risk weight of single exposure would be higher than some level). What do you see as the advantages and disadvantages of each of these possibilities?

Question 2.5: Do you consider that current public disclosure by banks provides enough information / not enough information / too much information about the way in which capital requirements have been determined under the IRB approach? What further information, if any, would be desirable and what would you use it for? If you favour less disclosure or no more than at present, what are your concerns about additional disclosure? Do you have any comments on the Reserve Bank's preferred option of dual reporting of IRB and standardised outcomes?

Question 2.6: This paper suggests that New Zealand's standardised approach is already relatively risk-sensitive ("fine-grained"). Do you agree or disagree with this statement? Are there aspects of the BCBS' new standardised approach which should be introduced here? If so, why should they be introduced? (You might wish to cross-refer to your responses to Questions 2.2 and 2.3, which address specific aspects of the standardised approach which could be relevant for IRB banks).

Question 2.7: The Reserve Bank is planning to reconsider the zero risk weight for highly rated sovereign exposures in the standardised approach for credit risk. Do you consider that a zero risk weight is justified? If so, what is the justification? If not, why not? Apart from a change in capital requirement, would there be other effects of moving away from a zero risk weight?

Question 2.8: Would any of the options for credit risk have consequences that are not discussed in this paper? If you are responding to this consultation paper on behalf of a bank it would be helpful if you would provide quantitative estimates of the effect on capital ratios and other relevant metrics (though a more formal quantitative impact study is also planned for a later stage of the review).

Question 2.9: What are your preferred options for the IRB approach (including options for increasing transparency) and the standardised approach for credit risk? Please tell us why you prefer these options.

Operational risk

Operational risk option 1 – Status quo

151. For operational risk, one option is to leave the current rules as they are, allowing internal models banks to use the AMA and the standardised banks to use the current standardised approach.

Operational risk option 2 – Follow BCBS framework (replace all approaches with new standardised approach)

152. Another option for operational risk is to adopt the new Basel standardised approach. The Basel Committee has removed the existing internal model approaches. It noted that it hoped for some sort of consensus to develop about appropriate modelling techniques for operational risks, but had been disappointed.

153. The new standardised approach is somewhat more sensitive than the existing standardised approach, at least for the banks that currently use the internal models approach, because it allows large banks to take their previous operational risk experience into account.

154. The Reserve Bank finds the Basel Committee's position on replacing the internal models approach persuasive. The Reserve Bank has imposed floors on capital requirements for operational risk for some time, partly because of concerns like those expressed by the Basel Committee. The Reserve Bank notes that final calibration of a new standardised approach will be decided at a later stage of the capital review.

Operational risk option 3 – Follow BCBS approach but also require advanced risk management

155. A drawback of replacing the internal model approach, which has been raised by the banking industry, is that banks might focus less on improving their systems for identifying and modelling operational risk.

156. One possibility is therefore to supplement a new standardised approach for calculating capital with a set of explicit requirements for operational risk management processes and systems.

157. Australia has floated such a possibility, in a different context, for smaller banks that might achieve internal model accreditation for credit risk but not for operational risk; these banks would need to have an advanced capability to deal with operational risk

even if they were not using an internal models approach for the operational risk capital calculation.

158. Although the Reserve Bank generally encourages all banks to have strong operational risk management procedures and will continue to do so, at this time it does not have a firm view about the desirability of explicit requirements in the capital standards. The Reserve Bank will need to give further consideration to the need for such requirements if the decision is taken to remove the internal models approach.

Seeking your views: questions about options for operational risk

Question 3.1: The BCBS has replaced AMA with a new standardised approach for operational risk. Do you agree with the BCBS's assessment of internal operational risk models (i.e. that they have not evolved so that there is an accepted approach which produces accurate and consistent outcomes)? Please explain why you hold this view.

Question 3.2: If the AMA was replaced, banks currently using AMA would not have to meet all the procedural and systems requirements currently contained in that approach (the new standardised approach is essentially formulaic). Do you consider that similar requirements should be imposed in any new approach? Should such a requirement apply only to banks formerly using AMA, or to all banks? Please provide reasons for your view.

Question 3.3: Would any of the options for operational risk have consequences that are not discussed in this paper? If you are responding to this consultation paper on behalf of a bank it would be helpful if you would provide quantitative estimates of the effect on capital ratios and other relevant metrics (though a more formal quantitative impact study is also planned for a later stage of the review).

Question 3.4: What is your preferred option for operational risk? Please tell us why you prefer this option.

Market risk

Market risk option 1 – Status quo

159. New Zealand's current approach to calculating capital requirements for market risk is very rudimentary, which has the advantage of reducing the amount of computation banks need to carry out. However, the current approach also has some shortcomings. For example:

- The calculation is blunt and does not recognise the particular characteristics of individual exposures, particularly for exchange rate and equity risk.

- The approach applies to market risk in both the trading and banking books but is calibrated on the assumption that positions can be rapidly liquidated, which is unrealistic for the banking book.
- Default risk is not comprehensively taken into account.[72]

160. One justification for the rudimentary approach is that the Reserve Bank has traditionally regarded market risk as less significant than other risks, because New Zealand banks have tended to focus on mortgage and business lending rather than trading in financial markets.

Market risk option 2 – Follow Basel standardised approach

161. The new Basel standardised approach addresses some of the shortcomings of the current New Zealand approach.

162. The Reserve Bank sees value in modernising our market risk capital requirements, but has some reservations about adopting the new Basel standards in their raw form. Dealing with these reservations might push the time frame for change beyond the current capital review.

163. For instance, a significant difficulty with the Basel standardised approach is that parts of it apply only to exposures in the trading book and are unlikely to be suitable for the banking book, which means that it is not a full replacement for New Zealand's current market risk approach.

164. To deal with this problem, the Basel market risk standard could be combined with an optional standardised approach for interest rate risk in the banking book (IRRBB). But further development of the IRRBB approach would be needed before it could be implemented in the New Zealand context. In addition, the use of separate treatments for the banking and trading books would be a significant departure from current settings. It is likely that defining the boundaries of each book would introduce additional complexity and uncertainty into the minimum capital regulations.

165. The Basel Committee's approach is also more complex than the current standard, making it more challenging to administer and supervise. It is possible that it would be difficult for some banks to implement, though the simpler standardised approach recently proposed by the Basel Committee might help here.

[72] For example, if a bank has sold a put option on a bond then the risk of the bond issuer defaulting is not explicitly recognised.

Seeking your views: questions about options for market risk

Question 4.1: New Zealand's market risk standard is rudimentary and quite old. Do you have any specific concerns about risks the standard is omitting, or under- or overstating? Would the new standardised approach recently introduced by the BCBS be an improvement? Or the simplified standardised approach proposed by the BCBS?

Question 4.2: The new standardised approach introduced by the BCBS requires more complex calculations than the current New Zealand approach. In your view, would it be practical to apply it in New Zealand? (e.g. would the necessary information and expertise be available to undertake the calculations?). Would you have the same view about the simplified standardised approach?

Question 4.3: Would any of the options for market risk have consequences that are not discussed in this paper?

Question 4.4: What is your preferred option for market risk? Please tell us why you prefer this option.

Summary evaluation of options

166. In May the Reserve Bank set out six high-level principles which would guide the capital review (see paragraph 2). The Reserve Bank has also indicated that the capital framework should seek to avoid inefficiency.

Evaluation of credit risk options

167. Table 3 summarises the options for changes to the IRB approach for credit risk, and the effect on each of the six principles and efficiency.

Table 3: Options for credit risk (IRB)

	IRB	***vs status quo***	
	Status quo	*New Basel standard*	*Extend Basel proposal to further limit IRB use*
Effective	Mixed	Unclear	Unclear
Reflects risk	Mixed	Better	Better
Method doesn't affect outcome	Poor	Better	Better
Conservative	Mixed	Better	Better
Practical	Poor	Better	Better
Transparent	Poor	Better	Better
Efficient	Mixed	Unclear	Unclear

168. The assessment in the table reflects an assumption that IRB models often do not, in practice, produce meaningful differentiation of credit risk. The models are fine-grained and so could be more risk-sensitive than the standardised approach, but the additional differentiation has often been spurious (especially in the case of non-retail exposures). This assumption is based on international evidence that is not necessarily generalisable to New Zealand. The Reserve Bank is continuing to work to build up the New Zealand evidence. In the meantime, it can be said with confidence that it is at least difficult to assess the accuracy and consistency of internal models across banks.

169. For capital to be effective, it needs to be available at the right time. A feature of current IRB models is that they can be quite "point in time", so that the minimum capital requirement is lower at the high point of the economic cycle and higher at the low point of the economic cycle. In general this is not desirable, because it forces banks to raise capital in an economic downturn, when it is most difficult to do so. Standardisation of some portfolios and the imposition of a capital floor that refers to the standardised outcome might be expected reduce this cyclical variation for moderate cycles, though not necessarily for more marked cycles.[73]

170. As far as risk-sensitivity is concerned, the question is largely whether the existing IRB approach leads to an accurate reflection of risk. If it does, then the proposed variations are likely to be less risk-sensitive. If it does not – and that is the Reserve Bank's view for at least some portfolios – then the proposed variations should be an improvement.

171. In terms of the effect of the method on capital outcomes, there is a significant difference in outcomes between the IRB and standardised approaches for credit risk. If that gap genuinely reflects differences in the portfolios of banks using the different approaches, then proposed changes would be inappropriate. But at this time the Reserve Bank does not see clear evidence that the difference is warranted, and the proposed changes – which should narrow the gap – would be an improvement.

172. The proposed changes are expected to lead to higher risk weights, so are more conservative – capital requirements will be higher – than the *status quo*. The Reserve Bank notes that it is difficult to assess the conservatism of these changes on their own: decisions made about the numerator and minimum capital ratios will also have an effect and there will need to be an overall calibration at the end of the capital review.

[73] Under the standardised approach capital requirements for sovereign, bank, and corporate exposures can change through the cycle, if there are changes in external ratings. It is less likely that capital requirements for individual residential mortgage exposures or unrated corporates would change through the cycle, except in the event of default.

173. The practicality of the existing IRB approach is questionable. The Reserve Bank finds it difficult to administer the IRB approach and it seems that overseas jurisdictions, even those with considerable resources, are similarly struggling to ensure consistent outcomes. Some banks have struggled to implement the approach.[74] The Reserve Bank is of the view that the standardised approach is easier for a bank to implement and easier to administer.

174. The existing IRB approach lacks transparency. Although banks disclose some information about model outcomes it is difficult for an external observer to know how these were arrived at or whether they are reasonable. If some portfolios are standardised there will be increased transparency about how capital requirements are arrived at.[75]

175. For economic efficiency, conceptually a pure IRB approach which *in practice* produces accurate risk differentiation and loss estimates is preferable; standardisation of some portfolios will lead to some holding too much or too little capital, which at the margin could lead to inefficient lending decisions. However, it is not yet apparent that the IRB approach in practice adds meaningful risk differentiation, outside of some specific portfolios such as unrated corporates. It is particularly uncertain that the IRB approach adds much for sovereign, bank, and large corporate exposures and in those cases the efficiency cost of standardisation is likely to be low.

176. Proposed changes to disclosure under the IRB approach would improve transparency relative to the *status quo* and are expected to have only a small effect on compliance costs (recalling that under the other proposals the required information would have already been calculated).

177. The Reserve Bank's preferred option for the standardised approach to calculating credit risk is the *status quo*. The new Basel standard would improve risk sensitivity for some unrated corporate exposures but could lessen it for residential property exposures compared to the current New Zealand requirements. It is also probable that the new Basel standard would reduce capital requirements for the locally incorporated banks that use the standardised approach. While this would lessen the gap between the IRB and standardised approaches, it would also result in a less conservative outcome (the gap in any case is expected to be somewhat closed by changes to the IRB approach).

Evaluation of operational risk options

178. The Reserve Bank considers that the proposal to replace the current approaches to calculating operational risk with a new standardised approach will not significantly

[74] Bankwest, a subsidiary of the Commonwealth Bank of Australia, was temporarily stripped of its ability to use the IRB approach because of shortcomings in its processes. Closer to home, Westpac New Zealand has been subjected to higher capital requirements as a consequence of IRB compliance shortcomings.
[75] As already indicated, standardisation could also lead to less risk-sensitivity, but only if the claimed risk-sensitivity of existing IRB models is not spurious.

worsen risk sensitivity and might improve it. The BCBS has strongly expressed its reservations about the accuracy of the internal operational risk models that banks use to calculate regulatory capital ratios, and the new approach still permits larger banks to take into account their historical risk experience.

179. The proposed approach is likely to be more conservative than the *status quo*.[76] However, the standardised approach is also considerably easier to implement and administer than the internal models approach.[77]

Evaluation of market risk options

180. The Reserve Bank's position on the capital requirements for market risk is based mainly on prioritisation, in part because of questions about the feasibility of the alternatives, at least at the current time.

[76] Final calibration of the approach will need to be determined by the Reserve Bank.
[77] This is not meant to imply that banks will save money by ceasing to monitor operational risk; as already noted, banks will still be encouraged to have good processes and systems for assessing and managing operational risk.

Plan for Quantitative Impact Study

181. The Reserve Bank plans to conduct a Quantitative Impact Study (QIS) to assess the effects of proposed changes to the calculation of risk weighted assets (as outlined in this paper) and to the definition of capital (see the consultation paper we published in July 2017).

182. The intention is that locally incorporated banks will be required to calculate minimum capital requirements and actual capital ratios under alternative policies, once the Reserve Bank has evaluated feedback from consultation and decided on a set of preferred options.

183. The results of the QIS will be used when making final decisions about capital requirements.

Appendix 1: studies into the consistency of internal model outcomes across banks

184. In the United Kingdom in 2009, the Financial Services Authority asked 13 firms to use their internal (IRB) models to calculate probabilities of default for 50 sovereigns, 100 banks, and 200 corporations.[78] Not all firms rated all obligors but for a commonly rated sample IRB models generated a wide range of probabilities of default.[79] For example, Figure 4 shows that 10 of the firms all rated the same 17 sovereign obligors. One of those firms estimated a mean probability of default, across those 17 obligors, of 0.006%. Another estimated a mean probability of default of 0.031%.

Figure 4: Mean probabilities of default for portfolio

Portfolio	Number of obligors	Number of firms rating	Lowest of respondents	Average of respondents	Highest of respondents
Sovereigns	17	10	0.006%	0.019%	0.031%
Banks	34	13	0.030%	0.054%	0.086%
Corporations	13	7	0.032%	0.091%	0.188%

185. Similar analyses of sovereign, bank, and corporate exposures were published by the Basel Committee on Banking Supervision (BCBS) in 2013[80] and the European Banking Authority (EBA) in 2014.[81]

186. The BCBS obtained risk estimates from 32 banks for a hypothetical portfolio of named obligors. Significant differences between banks were identified. It was estimated (by a "rough translation") that for 10 of the 32 banks the differences would raise or lower overall capital ratios by more than a percentage point. The BCBS summarised its findings in this way:

> The study found a high degree of consistency in banks' assessment of the *relative* riskiness of obligors. That is, there was a high correlation in how banks rank a portfolio of individual borrowers. Differences exist, however, in

[78] Financial Services Authority (2010), Results of 2009 Hypothetical Portfolio Exercise for Sovereigns, Banks and Large Corporations, 1 March 2010. At the time of the exercise 12 of the 13 firms were approved to use internal model approaches to calculate regulatory capital.
[79] At the time the Authority did not regard this as a systematic problem. It concluded that although there were some unusually low probabilities, these were not widespread. In addition, it noted that the median probability of default was broadly consistent with historical long-run default rates.
[80] Basel Committee on Banking Supervision (2013), Regulatory Consistency Assessment Programme (RCAP): Analysis of risk-weighted assets for credit risk in the banking book, July 2013.
[81] European Banking Authority (2015), Results from the 2014 low default portfolio (LDP) exercise.

the *levels* of estimated risk, as expressed in probability of default (PD) and loss given default (LGD), that banks assign. The low-default nature of the assessed portfolio, and the consequent lack of appropriate data for risk parameter estimation, may be one of the factors leading to differences across banks, especially for banks' estimates of LGDs in the sovereign and bank asset classes. A separate survey of bank practices for estimating exposure at default (EAD) also found significant differences.

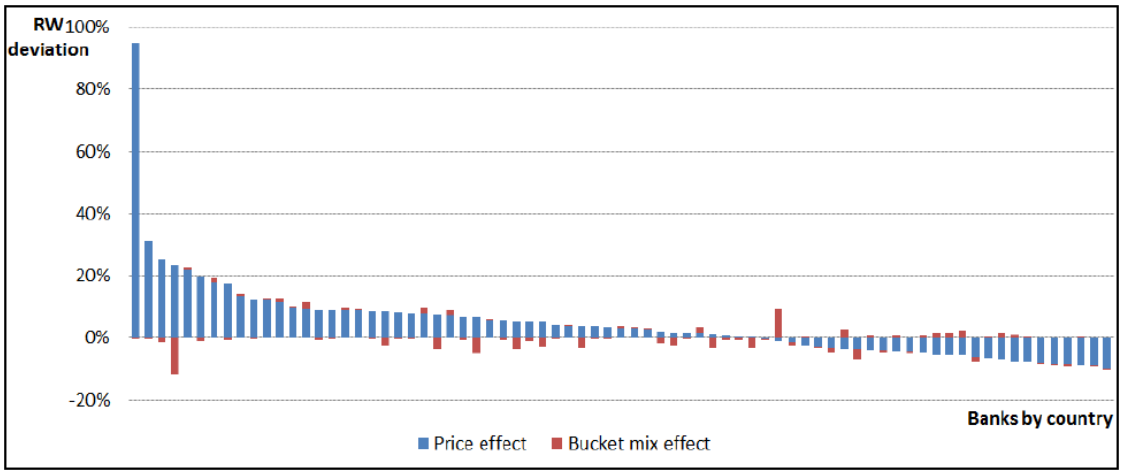
187. The EBA's analysis incorporated IRB risk estimates from 41 institutions for 1,810 named obligors. For each institution, the difference between its estimated risk weight and the median of all institutions' risk weights was decomposed into differences due to estimated probabilities of default, estimated losses given default, and estimated maturities. There was substantial variation in the estimates of probability of default and loss given default that individual institutions gave the common portfolio.[82]

188. In 2014 the European Banking Authority published an analysis of variations in risk weights for residential mortgages, using 2012 data from 43 European banks.[83] In concept, the EBA decomposed differences in risk weights into two parts: differences due to the mix of risks a bank faces (the "bucket mix"), and differences due to varying risk weights for the same level of risk (the "price effect").[84] The Authority found that "the price effect is much more significant than the bucket mix effect across all drill-down variables".

189. Figure 5, which is from the European Banking Authority's publication, shows the results when loans are divided up into buckets based on loan-to-value at origination. Each column represents the difference between the average residential mortgage risk weights of: a single bank operating in a single country; and the whole sample of banks.[85] The red component of the column shows the part of the difference that is due to the single bank having a portfolio which differs from the average in its underlying characteristics (e.g. a greater share of loans in high LVR buckets). The blue component of the column shows the remainder of the difference, which is either unexplained or due to influences other than LVR.

[82] The EBA also asked banks to provide standardised risk weights for the exposures, and found that variation of these weights was even greater than for the internal models-based risk weights. The EBA explained this unexpected result by noting that banks provided standardised risk weights on a "best efforts" basis and that data quality was therefore suspect.
[83] European Banking Authority (2014), Fourth report on the consistency of risk weighted assets: Residential Mortgages drill-down analysis, 11 June 2014.
[84] Exposures were divided into "buckets" based on loan-to-value ratios (at origination and at 31 December 2012), debt-servicing ratios at origination, and debt-to-income ratios at origination. Each bank's risk weight for a bucket was compared to the average risk-weight (across all banks) for that bucket. Differences between banks were decomposed into differences in portfolio (a different mix of buckets) and differences in risk weights within buckets. Differences within buckets were further decomposed into differences due to increments in risk weights from bucket-to-bucket and differences in the overall (across all buckets) level of risk weights.
[85] There are more than 43 columns because some banks operate in more than one country.

Figure 5: Break-down of bucket mix and price effects (loan-to-value ratio buckets)



190. The EBA and the BCBS have also used "back-testing" exercises to assess risk estimates for retail (including home mortgage) and small business exposures. In a back-testing exercise, estimates of probability of default (PD) and loss given default (LGD) from banks' internal models are compared to actual default rates and losses.[86]

191. The BCBS surveyed 35 internationally active banks in 13 jurisdictions and in 2016 wrote:

> For PD, averaged across all banks for all portfolios, there is a close alignment of actual default experience and the PD estimates assigned by banks for retail and SME portfolios. The ratio of actual defaults to estimated defaults ranges from 0.87 to 0.97, on average, depending on the portfolio. That is, on average, banks experience fewer defaults than estimated across the sample period. The ratio however varies considerably across banks – across all portfolios the ratio for some banks is below 0.5, while for others it exceeds 1.5. […] The dispersion in [the actual-to-expected LGD ratio] is comparable to that observed for PD. That is, the [ratio] varies by a factor of 3 to 4 across banks, ranging from well below 0.5 in some cases to much greater than 1 in other cases.

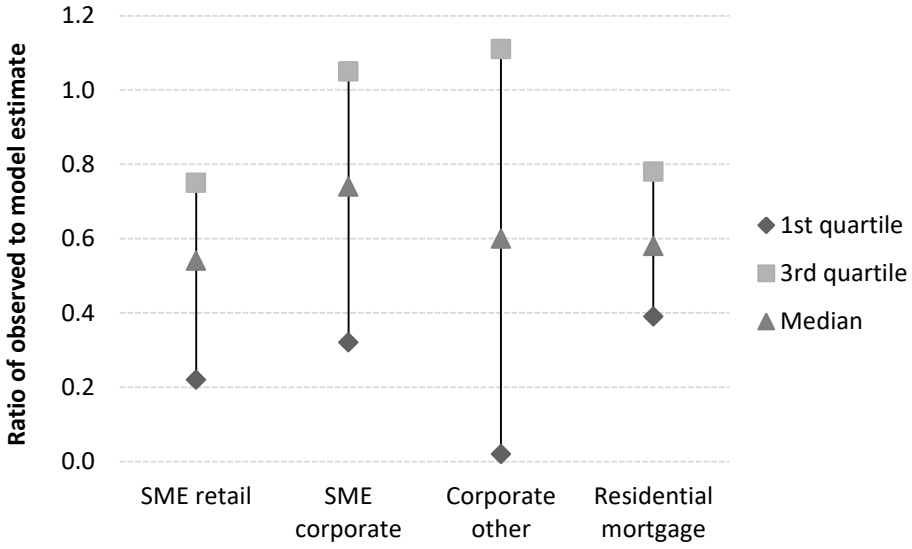
192. The EBA summarised similar findings of back-testing of 99 banks in a 2017 report:[87]

> This approach shows that the estimated values for PDs and LGDs are, in general, higher than the observed default rates and loss rates, which suggests that banks are, on average, conservative. However, some banks present observed values (latest year and the average of the past 5 years) of defaults and losses above the estimated values of PDs and LGDs [for

[86] A back-testing exercise provides useful information but is not ideal for checking the consistency of model outcomes across banks because it does not control for the composition of portfolios. An unusually high or low back-testing result could be the result of unusual modelling practices but could also, for example, be explained by one bank having an exposure to a niche market that other banks are not exposed to.
[87] European Banking Authority (2017), Results from the 2016 high default portfolios (HDP) exercise, EBA BS 2017 027.

example, see Figure 6] and these banks need to be more closely analysed. The analysis confirms that the country of the reporting bank and of the counterparties is an important driver of RW [risk weight] variability and this may be due not only to the underlying risk but also to bank and supervisory practices.

Figure 6: Ratio of actual default rate in latest year to PD (range of values reported by a sample of European banks)



Appendix 2: methods for verifying internal model outcomes

Methods for sovereign, bank, and large corporate portfolios

193. The European Banking Authority commented, in its report on risk-weighting of large sovereign, bank, and large corporate exposures, that the "most challenging part of comparative RWA studies is to distinguish the influences of risk-based drivers and practice-based drivers", that is, the difference between true underlying risk and differences in modelling or supervision. The EBA noted that back-testing is not suitable for these kinds of exposures because defaults are too infrequent for historical comparisons to be statistically significant. The EBA instead relied on a hypothetical portfolio exercise for these "low default" exposures.[88]

194. Hypothetical portfolio exercises which use named obligors ensure that there is the same level of true underlying risk for all banks, but they are suitable only for well-known entities such as governments and large corporations. They are also open to the criticism that banks which have real exposures to an obligor may have more information about the obligor than banks which do not, leading to biases in estimates of risk. For example, banks that do not have exposures to a named obligor might have to rely solely on external ratings, whereas others might have access to private information.

Methods for retail portfolios

195. The European Banking Authority considered running a hypothetical portfolio exercise for residential mortgages in 2013. The EBA noted that one country (it did not say which) had tested such an approach, but concluded that "considering the limited experience and complexity in providing all the relevant details to specify the transactions, a hypothetical facility would not be used" in the EBA's assessment of consistency across banks.[89]

196. The Reserve Bank is currently running hypothetical portfolio exercises ("benchmarking") for residential mortgages and rural lending. Each of the four IRB banks incorporated in New Zealand requires different information about the exposures in order to be able to use their models. A challenging aspect of the exercise is ensuring that the different information the Reserve Bank provides to different banks remains consistent – as an indicator of credit risk – across banks. A finding of the work so far is that banks have different internal definitions of even simple variables, such as the loan origination date for a residential mortgage, which makes it more difficult to provide consistent data for benchmarking exercises as well as to analyse existing portfolios.

197. The European Banking Authority's alternative to a hypothetical portfolio exercise for assessing the consistency of mortgage risk weights was to divide real exposures into

[88] European Banking Authority (2015), *Op. Cit.*, page 12.
[89] European Banking Authority (2014), *Op. Cit.*, page 7.

buckets by indicators of risk such as the loan-to-value ratio and to compare average risk weights within those buckets (see paragraph 188). In this kind of analysis there is an implicit assumption that the chosen indicators reflect true underlying risk.[90]

198. Less obviously, there is also an assumption that all the banks have the same definition of the relevant risk indicator. In respect of its exercise, the EBA noted:

> Overall, the documentation provided by banks, although succinct, highlighted the banks' use of different definitions for similar concepts. Sometimes they reflect country-specific features, but overall the definitions are bank specific.
>
> Although it is not possible to assess the materiality of such differences in influencing the variation observed in the RWs [risk weights] in the EU sample, the difference in definitions is an important caveat to consider when reading the findings of the study.

199. Back-testing is another approach which has been used to assess the consistency of risk estimates across banks. Back-testing can show whether or not a particular bank has consistently over- or under-estimated risk. However, back-testing might not be very informative if the historical data period does not include a sufficiently wide range of economic outcomes (e.g. a sharp economic downturn). It might also be difficult to determine whether any mis-estimation is due to poor modelling or to some random, temporary event that affects one bank more than others. For example, a bank might be particularly exposed to an industry that experiences an unexpected price shock and other banks might not be so exposed.[91]

Data quality and availability

200. Comparisons of risk estimates are made more difficult by a lack of comparable, accurate, and comprehensive data.

201. The EBA, in its comparison of risk weights for "low default" portfolios, highlighted incomplete submissions and the poor quality of data as hindrances in their work to monitor risk weights.[92]

202. In New Zealand, the Reserve Bank has been undertaking a benchmarking exercise to compare the risk weight estimates of the internal models banks for residential mortgages and farm lending exposures (see paragraph 196).

203. The Reserve Bank has found it difficult to obtain consistent (and sufficient) data from banks for the benchmarking exercise. In most cases the variables used in banks'

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[90] If the chosen indicators are a good indication of "true risk", then it seems hardly necessary for banks to have internal models: the regulator could simply prescribe minimum risk weights for each bucket. If they are not the best indicators of risk, then the results of the consistency test could be misleading.
[91] Problems due to localised shocks could be lessened if the comparison was undertaken over a sufficiently long period.
[92] European Banking Authority (2015), *Op. Cit.*, p.13.

internal models are readily available but in a significant number of cases important data is implausible, missing, truncated, or inferred from relationships with other variables rather than provided in raw form.

204. Internal model banks have also not been able, in some cases, to supply raw data used to construct model variables (e.g. the components of income which make up the total income variable used in a model), or sufficiently detailed and unambiguous definitions of the model variables. The Reserve Bank would like to be able to control for differences between banks' definitions of variables by making adjustments using detailed raw data, but the inability of banks to supply precise definitions and underlying data makes this more difficult.[93]

205. The Reserve Bank notes that in spite of data limitations it intends to complete the benchmarking exercise and to use the results, cognisant of their limitations, when making decisions about the detailed calibration of internal models. But the limitations do highlight a difficulty in the supervision of internal model banks.

[93] Even variables which are collected for other regulatory (or potential regulatory) purposes, such as the loan-to-value ratio and debt-to-income ratio, are not calculated on a truly common basis. For example, the loan-to-value ratio is calculated for groups of related loans and securities and the rules for determining the groups differ significantly between banks.

Glossary of terms and acronyms

The following terms and acronyms are used in this consultation paper:

AMA – one of the methods banks can use to calculate capital requirements for credit risk. Under this approach banks use their own risk models, internal operational risk experience, and industry risk data, to determine capital requirements.

BCBS – Basel Committee on Banking Supervision.

Curvature – in the context of the BCBS's standardised approach for calculating market risk capital, a measure of the sensitivity of asset values to a significant change in an underlying factor such as an interest rate or a credit spread, over and above the sensitivity suggested by the delta.

Delta – in the context of the BCBS's standardised approach for calculating market risk capital, a measure of the sensitivity of asset values to a change in an underlying factor such as an interest rate or a credit spread (in the BCBS approach it is assumed that delta remains constant as asset values change).

Denominator – the denominator in the capital ratio; the amount of risk-weighted assets that a bank holds.

Derivative – a financial instrument or contract between two or more parties where the price is dependent on (derived from) one or more underlying assets.

EAD – estimated exposure at default.

EBA – European Banking Authority.

IRB – internal ratings-based approach. One of the methods banks can use to calculate capital requirements for credit risk. An "IRB bank" is a bank that is accredited to calculate how much regulatory capital it must hold using its own internal modelling rather than a standardised model imposed by the regulator.

LGD – loss, given default. The estimated amount of money a bank would lose if a borrower defaulted on a loan.

LVR – loan-to-value ratio.

Numerator – the numerator in the capital ratio; the amount of regulatory capital that a bank has.

OECD – Organisation for Economic Cooperation and Development.

PD – probability of default. The estimated likelihood that a borrower will default on a loan in the next year.

RWA – risk-weighted assets.

Vega – a measure of the price sensitivity of a derivative to the volatility of the underlying asset.