Volume 74 No. 2, June 2011

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Editorial Committee
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ISSN 1174-7943 (print)
ISSN 1177-8644 (online)

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Editor's note

This issue of the Reserve Bank *Bulletin* contains four articles touching on various aspects of the Reserve Bank's financial stability and financial markets responsibilities.

Rural lending represents a much larger proportion of bank lending in New Zealand than in most other advanced economies. Kevin Hoskin and Ian Harrison outline how the Reserve Bank has gone about setting new minimum requirements for how much capital has to be held against rural lending by the four large banks accredited to use their own risk models under the Basle II regime. An extensive process involving modelling, and consultation with affected parties, has taken place over the last couple of years, to help ensure that the risk weights used for rural exposures adequately capture the relative risks of rural lending. Events of the last few years have reminded both borrowers and lenders that rural lending can be quite risky. The finalised rural capital requirements will, on average, require these banks to hold slightly less capital against rural exposures than was the case under the Basle I regime that was in place until the end of 2007. The impact on banks' rural lending margins seems likely to be small.

In a complementary article, David Hargreaves and Gina Williamson report on a "stress test" the Reserve Bank has undertaken to help understand the implications for banks of severe adverse shocks in the dairy industry (lending to dairy farmers makes up the bulk of total rural debt). Using detailed data obtained from banks, they test the impact of a variety of severe shocks (to land prices, to the payout, to interest rates). Sustained multi-year downturns in the payout and in farm land prices pose the largest risks to lenders.

In various parts of the Reserve Bank Act, the Reserve Bank is required to promote, or have regard to, not only the soundness of the financial system, but also the efficiency of the system. Chris Hunt and Chris Bloor report on some developing work about how to think about the efficiency of the financial system, and how these statutory provisions should influence the Reserve Bank's analysis and policy development. They also report some interesting preliminary cross-country results on rates of return in banking. Those data appear to suggest unusually high rates of return are earned in New Zealand, although more work is required to reach a definitive understanding of what these data mean.

Finally, Aidan Yao and Enzo Cassino review the range of extraordinary measures the Reserve Bank took during the international financial crisis of 2007 to 2009 to help manage domestic liquidity conditions and to avoid the risk of a more severe domestic credit crunch. International stresses quickly spilled over into domestic markets, and the vulnerability of the short-term wholesale foreign funding that banks had relied on heightened New Zealand's exposure to the stresses, even though the credit quality of the Australian banks was not in question through this period. Formal statistical tests help illustrate the announcement effects of the various measures, although the authors note that a variety of factors, including the pre-emptive nature of several of the announcements, means that the overall impact was much larger than the effects that can be captured using these formal techniques.

Michael Reddell
For the Editorial Committee

ARTICLES

Bank farm capital: does it cost the earth?

Ian Harrison and Kevin Hoskin[1]

Loans to the rural sector represent a significant exposure for banks in New Zealand. In 2008, under the Basel II capital framework, the Reserve Bank accredited the four major banks in New Zealand to use their own models of relative riskiness in calculating capital requirements for different types of lending. A condition of accreditation was that banks addressed, to the Reserve Bank's satisfaction, weaknesses in their modelling of rural capital exposures and potential losses.

In this article, we explore the work that has been undertaken since accreditation to seek to strengthen the modelling of risk on bank loans to the rural sector. The primary objective of this work was to ensure that the risk weights used in determining regulatory capital requirements are aligned with the underlying relative risk of the exposures. The finalised risk weights for rural lending will be lower than those used under the previous Basle I regime. We also discuss the impact of recent developments in the sector on bank behaviour, and consider the potential impact of the Reserve Bank's new requirements, concluding that any impact should be relatively small.

1 Introduction

Minimum capital requirements are an important element of the Reserve Bank's supervisory framework for registered banks. Banks are required to hold capital against each category of exposure according to the relative riskiness of that type of exposure.

Broadly speaking, this is done by applying different 'risk weights' to different categories of loan. The minimum capital ratio is fixed at 8 percent of risk-weighted assets; so the amount of capital required to be held against each loan is determined by the risk weighting for that type of loan. For every additional dollar lent on an exposure with a 100 percent risk weighting, a bank will be required to hold an additional 8 cents of capital, whereas for a less risky loan with a risk weighting of 50 percent, only 4 cents of additional capital will be required.

In New Zealand, banks' largest exposures are in the housing, business and rural sectors. Whilst the rural sector only accounts for around 15 percent of total exposures, such lending is typically more risky than housing exposures, and thus would generally be expected to carry a higher risk weighting for any given degree of leverage. This is primarily due to the exposure of rural lending to international commodity prices, which are significantly more volatile than the economy as a whole. It is relatively more important in New Zealand to ensure that farm lending carries the appropriate level of capital, compared to other countries where banks generally have, proportionally, a much lower exposure to the rural sector.

This article provides an outline of the treatment of farm lending within the Reserve Bank's capital framework for registered banks, and discusses possible linkages between prudential capital requirements and bank lending margins. The article proceeds as follows. Section 2 provides a brief description of how farm lending fits into the wider capital frameworks. Section 3 outlines the Reserve Bank's initial proposals for revised farm capital requirements. Section 4 provides a discussion of the development of the new requirements in light of emerging evidence from the sector. Section 5 provides a brief discussion of how regulatory capital requirements interact with banks' pricing decisions, and section 6 provides a brief conclusion.

2 Capital frameworks and the treatment of farm lending

Capital adequacy frameworks developed by the Basel Committee on Banking Supervision (the Basel Committee) have been adopted by virtually all countries with developed banking systems. The original Basel Capital Accord (Basel I) was developed in 1988, and was intended to align

[1] **The authors are grateful to the following Reserve Bank colleagues for their valuable comments: Michael Reddell, David Hargreaves, Stuart Irvine and Ian Woolford.**

international capital adequacy requirements. One of the objectives of Basel I was to provide a better link between capital requirements and the credit risks associated with the assets held on banks' balance sheets, although the risk measurement model was rather crude. For example, differential risk weights were adopted for secured housing lending and lending to sovereigns, while all commercial loan exposures – including farm lending – were assigned a common risk weight of 100 percent.

In 2004, the Basel Committee released details of a new framework known as Basel II. This built on the original accord by extending the capital requirements to cover operational risk and market risk. The other major development in Basel II was to increase risk sensitivity of the credit risk capital requirements. Under the simplest option, the risk-weighted assets are calculated according to a set list of types of loans and risk weightings that are applied mechanically. This is known as the standardised approach, and is quite similar to Basel I in terms of calculating capital for credit risks such as farm loans.

Under Basel II, another option is to adopt the more complex internal ratings-based (IRB) approach, which allows banks individually to align their regulatory capital requirement more closely with their respective risk profiles. Banks must hold capital at least equal to 8 percent of risk-weighted assets; the role of modelling is in determining the risk weights for each type of exposure. In New Zealand, banks that wish to adopt this approach must be accredited to do so by the Reserve Bank. If a bank is accredited under this approach, credit risk capital requirements are calculated with reference to the bank's own internal modelling of factors that drive the risk profile of that asset, subject to any minimum requirements that might be specified by the Reserve Bank. These factors include the exposure at default (EAD), the long-run average probability of default (PD), and the loss given default (LGD). Box 1 provides a more detailed explanation of the Basel II credit risk formulas.

The Reserve Bank implemented the Basel II framework in New Zealand in the first quarter of 2008. For the banks using the standardised approach, this did not have any direct implications for the level of capital held against farm lending, as farm loans were assigned a 100 percent risk weighting under both the Basel I framework and the Basel II standardised approach.[2]

However, the four largest banks in New Zealand were accredited by the Reserve Bank to use the IRB approach. The accreditation was done on the basis that some areas of modelling – including farm-lending risk – would need to improve. The Reserve Bank was particularly concerned that the banks were not directly modelling key elements of risk. For example, estimates of the key downturn LGD inputs were typically based on the banks' Australian corporate LGDs, which were unlikely to accurately reflect the risks associated with New Zealand farm exposures.

As an interim step, the Reserve Bank required two of the banks with large farm-lending portfolios to increase their LGD assumptions when they switched to the Basel II advanced model. Looking towards a longer term solution, the Reserve Bank also determined that as there was a high degree of commonality of risk drivers across the sector, it would make sense to impose certain industry-wide minimum requirements on IRB bank rural models, and the Reserve Bank undertook to lead modelling work in this area.

Setting appropriate risk weights is not about determining what sort of lending banks should and should not prioritise, but is simply about getting the relative riskiness of different types of lending roughly right, to ensure that each bank holds an appropriate level of capital in aggregate. Where differences in risk weights reflect differences in economic risk, regulatory capital requirements should have no impact on the allocation of credit across sectors.

[2] **In the capital framework for non-bank deposit takers farm loans may fall under a number of categories, with risk weights ranging from 100 percent to 200 percent depending on the nature of the loan, and any associated security. Full details are available at http://www.rbnz.govt.nz/finstab/nbdt/requirements/3857852.html**

Box 1

Basel II capital requirements

Under the Basel II model, different asset classes use different equations to calculate the appropriate level of capital. For farm loans, the formula for assessing non-defaulted corporate, sovereign and bank exposures is used. The main inputs into the capital equation are as follows:

- Probability of default **(PD)**: the likelihood of a borrower defaulting on a contractual loan. IRB banks determine the long-run average PD. All other things being equal, a higher PD would result in a higher capital requirement.
- Loss given default **(LGD)**: the proportion of the loan that the bank expects to lose in the event of a default. IRB banks are expected to determine LGD in an acute downturn. A higher LGD would result in a higher capital requirement.
- Maturity **(M)**: the remaining contractual term of the loan. The longer the remaining term of the loan, the more scope for loss, and hence the higher the regulatory capital requirement.
- Correlation **(R)**: a measure of how the individual exposures in a portfolio are correlated with other exposures in the portfolio. This provides a measure of how well risk is diversified. The higher this coefficient the more likely it is that there will be larger overall loss when the portfolio is hit with a systematic shock. Each asset class has a set correlation assumption in the Basel model. The higher the degree of correlation assumed, the higher the regulatory capital requirement.
- Firm size adjustment **(S)** (based on turnover, up to $50m): this adjustment, within the correlation formula, rests on the assumption that smaller firms exhibit lower levels of correlation, and hence a larger proportion of loans to smaller firms reduces, all else equal, the regulatory capital requirement.

These inputs feed into the calculation of the capital requirement **(K)** per dollar of exposure. The full equation, and definitions of the remaining terms, is set out from section 4.134 of the Reserve Bank's banking supervision handbook document BS2B, which can be accessed at: http://www.rbnz.govt.nz/finstab/banking/regulation/3272068.pdf

A detailed description of the Basel model specification was published by the Basel Committee in July 2005, and its application to advanced banks in New Zealand is available in document BS2B of the Reserve Bank of New Zealand Banking System Handbook. Full references are contained at the end of this paper.

3 The Reserve Bank's initial proposals

The Reserve Bank began work on calibrating the farm loan inputs in early 2009. One of the primary focuses was on the LGD assumptions.[3] When determining LGD inputs for the purposes of assessing capital adequacy requirements, an important input is the severity of downturn that is being assumed. For example, the Basel model is calibrated to a 1 in 1000-year shock. This means that, in principle at least, a bank is required to hold sufficient capital to meet unexpected losses with a probability of 0.999 over one year.

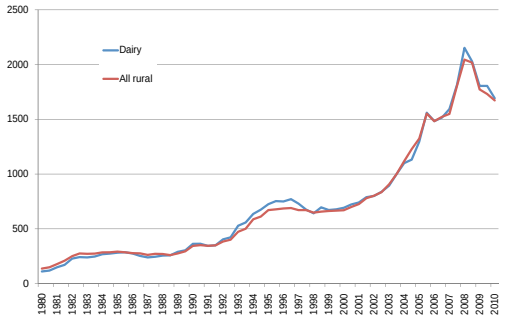
Farm lending risk in New Zealand is now substantially driven by lending to the dairy sector. This sector now constitutes around 65 percent of total agricultural lending and has had an indirect effect on land values, and hence risk, in the sheep and beef sectors, which account for around a further 25 percent of farm lending.

[3] **The Reserve Bank focused on LGDs, as this was considered the primary weakness in the banks' existing modelling. It was broadly content that the banks' own PD assumptions were reasonable.**

One of the key drivers in the evolution of dairy farm lending risk is fluctuations in land prices. There was a very sharp increase in dairy land prices (and rural land prices generally) between 2001 and 2008, as displayed in Figure 1. This increase was partly driven by increases in land productivity being embedded into prices, partly by favourable expectations about future dairy payout prices (notwithstanding the rise in productivity), and perhaps by expectations of continuing capital gains. Banks actively competed for market share in rural lending during this period, and so relatively easy credit conditions helped to fuel the boom in land prices.

Figure 1

Land prices (2003 = 1000)



Source: RBNZ calculations, Quotable Value Ltd.

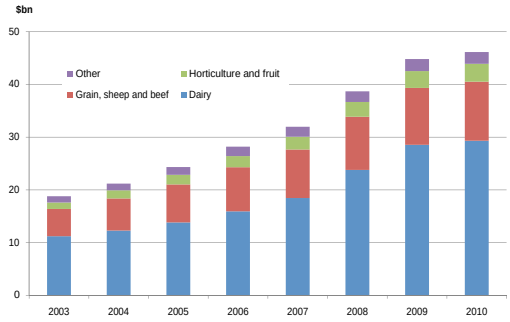
A sharp increase in prices of this nature can have a number of effects. First, it opens up the possibility that existing borrowers will take on more debt, effectively maintaining their original level of leverage. To the extent that prices increase above a long-run sustainable level, additional borrowing of this nature increases the risk that borrowers will be over-exposed when land prices fall back. The alternative is debt levels of existing loans remain much the same, in which case the loan-to- (market) value ratios (LVR) fall as land prices increase. Under the Basel II capital model, this would require banks to hold less capital against existing exposures, potentially fuelling more aggressive lending.[4] This is an example of the sort of pro-cyclicality concern that the international regulatory community is seeking to address. In practice, during sustained land price booms, the stock of debt tends to rise relative to market value of rural land.

During the New Zealand boom, there was an increase in demand for borrowing at high LVRs optimistic farmers and new entrants sought either to increase the size of home farms or buy new or additional farms, or to undertake large conversions. Whilst banks have always held a proportion of high LVR loans on the books to fund new entrants, the market trends – including the drive for market share – around this time resulted in an increase in the proportion of these types of exposure.

Data also suggests that this increase in high LVR lending was also accompanied by significant growth in aggregate debt (as shown in figure 2) and an increase in the average LVR across the sector (figure 3). This combination of factors made bank lending portfolios vulnerable to shocks to the dairy payout and any subsequent fall in land values.

Figure 2

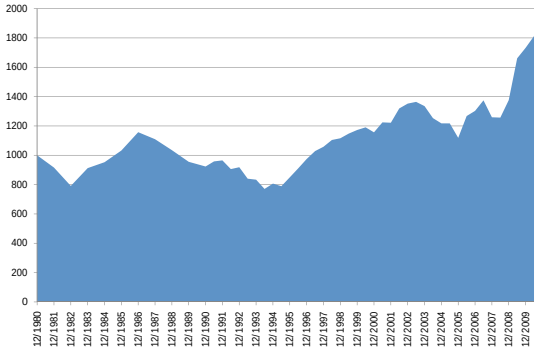
Agriculture sector credit



Source: RBNZ.

Figure 3

Debt-to-farm price (1980 = 1000)



Source: RBNZ calculations, Quotable Value Ltd.

To assess whether IRB banks were appropriately modelling the amount of capital for rural lending, the Reserve Bank developed a model of dairy farm income and asset prices to generate downturn LGD estimates. Using this model, the Reserve Bank assessed the impact of a shock to the milk

[4] If LVRs were to fall in this way, PDs would also fall if they were assessed on a point-in-time basis (there are few defaults while a boom is in full swing), hence the requirement for banks to adopt long-run (through-the-cycle) PDs.

Table 1

The Reserve Bank's initial proposals for LGDs

LVR %	0-30	30-40	40-50	50-60	60-70	70+
Proposed LGDs (as % of exposure)	10	15	22.5	35	45	52.5

solids payout rate that could be considered to be broadly consistent with the solvency standard in the Basel capital framework. On this basis, the three-year average payout was assumed to fall to $3.90 (a payout that, in real terms, would be low, but not unprecedently so), which resulted in a 55 percent fall in farm land prices. Using this price fall, a set of downturn LGDs were generated for various LVRs,[5] as shown in table 1.

Whilst the Reserve Bank calibrated the model with the Basel standard in mind, it should be noted that the modelling was carried out at the peak of the land price boom, and as such, the 55 percent fall in land prices at that point would only result in the land prices falling back towards the sort of levels recorded ten years previously. However, the LGDs estimated from the Reserve Bank's modelling were still around 30 percent higher than the LGDs that the IRB banks were using at that time to generate the capital requirements for farm lending.

The Reserve Bank also had concerns about the level of sensitivity in the models to contractual maturity, and assumptions on correlations that were embedded into the Basel model calibration.

Most farm lending incorporates the small business concession in the correlation coefficient calculation. This can result in a capital reduction of up to around 20 percent in respect of loans to businesses with a turnover of $5 million or less. The adjustment to capital calculations might be appropriate in sectors with very heterogeneous small businesses, which are not vulnerable to single-sector systematic shocks. However, farm lending in New Zealand is quite homogeneous, with most loans being exposed to similar shocks, and hence a portfolio of small farm loans provides relatively limited diversification for banks. The dominant dairy sector, in particular, is vulnerable to shocks to global dairy prices that can have a marked impact on every farm's profitability and eventually on the land values, which in turn affects the value of a bank's security. Accordingly, the Reserve Bank did not consider that there was a justification for retaining a concessional treatment within the rural capital framework. Indeed, given the exceptionally high degree of homogeneity, a case could have been made for increasing the correlation coefficient.

On maturity (the variable 'M' in box 1), the Basel model assumed that an exposure with a contractual term of five years is 60 percent more risky than an equivalent loan with a one-year contractual term. The basic intuition is sound – all else equal, a shorter term exposure provides less time for things to go wrong, and more scope for the lender to take remedial action earlier. However, this calibration was largely based on mark-to-market pricing of traded instruments (such as government securities) in relatively benign times. That pricing experience is not necessarily directly relevant to the measurement of risk in a banking book, and, importantly, relies critically on the assumption that an exposure can be terminated at the point of contractual maturity.

In practice, given the high degree of homogeneity of rural loans, during a severe downturn, all participants in the rural sector will be facing the same stresses, and the market for collateral (farms) tends to become highly illiquid (as happened in the dairy farm market over the last couple of years). As a result, it is highly unlikely that a farmer could repay a loan at maturity by refinancing it with a loan from another bank, and it would be difficult for a large number of farmers to sell up at the same time. Thus – when it matters – the effective, or economic, maturity of the loan will be longer than the contractual maturity. While in principle it may be

[5] **Different LGDs apply to different LVRs as the risk of the lender incurring losses will vary depending on the proportion of debt. If a farmer has only 5 percent of asset value in debt, it would be all but impossible for the lender to lose money. However, at an LVR of 75 percent, it is much more likely that the lender will incur losses in a default. LGDs exceed the level that might be implied solely by the price fall, due to additional factors such as transaction costs.**

possible for a single institution to gain a small advantage by writing loans with short maturities and passing on its bad exposures at maturity, it is not possible for the system as a whole to benefit from such an approach, as there simply will not be anybody to take on the exposures.

Furthermore, the calibration of the maturity driver based on contractual term provides an incentive to rewrite contracts with shorter maturities simply to reduce regulatory capital, without in any material way reducing the nature of the economic exposure in a severe stress event. To counteract this effect, the Reserve Bank initially proposed to the IRB banks a minimum maturity of 3.5 years be applied to farm exposures.

The Reserve Bank's estimate was that implementing actions to address these various concerns would increase the average farm lending risk weights to around 80-90 percent. That would have represented an increase on the prevailing levels post-Basel II accreditation, but it would still have been slightly below the standardised rate of 100 percent used by other banks that are undertaking rural lending in New Zealand, and below the risk weight that would have applied when the bulk of farm loans were originally advanced (given that banks operated on a 100 percent risk weight for farm lending under Basel 1, for roughly 20 years).

4 Revised farm capital proposals

The Reserve Bank consulted the banks on its initial proposals for a revised treatment of farm exposures in the first half of 2009. After the Reserve Bank conducted its initial analysis of farm lending risk in late 2008, there was a rapid deterioration in the situation facing the dairy sector. Expectations for future milk solids payouts were considerably down on the levels experienced during the height of the boom. As noted, the market for dairy farms effectively seized up. Whilst actual transactions were limited, discussions with banks suggested that, on average, they were factoring in farm price falls of around 25-30 percent in their reassessments of LVRs. The price that would have cleared the market had clearly fallen significantly.

In developing its final proposals, the Reserve Bank had regard to both market developments and feedback received from the banks. Taking account of these points, the final requirements for the farm lending capital treatment are as follows:

- LGD inputs: As land prices began to fall from the peak, banks' own models naturally tended to generate a requirement to hold more capital. This is because some exposures will migrate to higher LVR buckets, increasing the risk weight applied to those loans. Given the emerging market developments, the Reserve Bank considered that it would be prudent to delay the implementation of new requirements to allow time to reassess the impact of lower land prices on banks' existing models.

  Around this time, the Reserve Bank was also conducting an exercise to develop an industry-wide stress testing model for the dairy industry (reported in the following article in this issue of the *Bulletin*). Whilst the stress testing model cannot directly be used to estimate capital requirements, this exercise nevertheless provided a useful data source and further insights into the likely resilience of banks' rural portfolios.

  In setting the regulatory capital requirements, the Reserve Bank seeks to adopt a through-the-cycle approach, which sets capital requirements at an appropriate level for stages of the business cycle. In practice, though, any through-the-cycle requirement is to some extent calibrated based on the point at which the requirement is set. As the Reserve Bank's initial proposals were set at a time when land prices peaked, it was appropriate to reconsider these in light of market developments

  Taking account of these factors, the Reserve Bank generated revised LGD numbers based on a lower, but still significant, downturn land price fall of between 40 and 50 percent. The revised LGD numbers are set out in table 2.

  The Reserve Bank considers that, under most conditions, these LGD inputs will generate appropriate levels of regulatory capital. However, whilst these inputs reflect a through-the-cycle approach, it remains open to the Bank

Table 2

The Reserve Bank's revised LGDs

LVR %	0-30	30-40	40-50	50-60	60-70	70+
Proposed LGDs (as % of exposure)	10	15	22.5	32.5	40	42.5

to revisit them, or adopt alternative macro-prudential overlays, should the nature of the risks associated with the rural loan books be assessed to have changed.

The aim of the new capital requirements is not to further aggravate the position of stressed borrowers at the point of implementation, but to ensure that through time banks hold sufficient capital in New Zealand to cope with the risk of the loans they are making. In practice, little farm lending is originated with an LVR more than 70 percent.

- Correlation coefficients: During the consultation period the Reserve Bank did not identify any reasons not to remove the concessional SME correlation treatment from farm lending. This position was supported by both the stress testing model outputs, which showed that losses in deep stress events were much greater than they would be if the Basel SME model correctly represented the extent to which individual exposures were correlated, and by recent non-performing loan data. Figure 4 shows the impact of the recent downturn on loans across various sectors of the economy. Whilst the sector was experiencing a dairy-led boom at the time the downturn hit, which will explain some of the increased impact, the data does not support a concessional treatment for the rural sector.

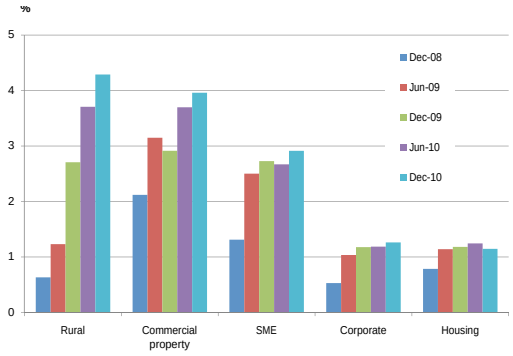
- Loan maturities: At the outset of the consultation period, the IRB banks had existing average contractual maturities on rural loans ranging from 2.5 years to 4.0 years. Since then, some banks have been actively reducing the contractual maturity of their exposures in the farm sector.

  Given its existing concerns about the minimal difference in economic risk in a stress event between otherwise similar loans with different contractual maturities, the Reserve Bank has concluded that it would be appropriate to neutralise the impact of maturity on the capital treatment of farm loans. Banks now have the option of fixing the maturity of their farm loans at 2.5 years for capital purposes, or using their own estimates of M but subject to a minimum value of 2.5 years.

  Making this change raised a wider question about the appropriateness of the Basel model's assumed impact of maturity on other exposures held by New Zealand banks. The Reserve Bank is engaged in a period of consultation with banks to consider this issue further.

Figure 4

Sectoral impaired and 90-day past due assets (as a percentage of sectoral lending)



Source: RBNZ calculations based on private reporting data from 8 registered banks.
Note: Data are not standardised and definitions may vary across banks

The changes outlined above will lead to an increase in the average risk weights applied to farm exposures by New Zealand banks, thereby moderately increasing regulatory capital requirements for rural lending. The banks will see average risk weightings of around 80-90 percent, compared to the 70-80 percent that resulted from the LGD assumptions we had imposed in 2008 on the two largest lenders. Whilst these average risk weights are below the 100 percent risk weight required under Basel I and used by the banks operating under the standardised Basel II models, a lower risk weighting is reasonable, given the greater degree of risk

differentiation inherent in the IRB models. Risk weightings on higher risk rural loans are likely to be above 100 percent, and those on low risk loans will be well below 100 per cent.

5 Impact of changes to regulatory capital requirements

When there is a change in regulatory capital requirements, it is natural to ask whether and, if so, how the capital change will impact on banks' lending margins.

Banks' own cost of funds (debt and equity), their assessment of the riskiness of the loan/sector, and their competitive positioning are and always will be the most important factors that determine the pricing of any loan facility.

During the boom years, pricing on rural loan facilities appeared to be quite aggressive, as various participants in the market sought to build or maintain market share, while rapidly growing the total rural loan book. The rural lending market has changed materially in the last few years: both borrowers and lenders have become much more cautious, each conscious of the fall in farm values, and actual loan losses, seen over the last couple of years. That change – entirely a market phenomenon – appears to have led to an increase in the average lending margin on rural loans.

What of the role of regulatory capital requirements? There is no doubt that banks regard regulatory capital requirements as factors that influence the bank's cost of capital,[6] and hence that changes in those requirements – at least when they reflect regulatory perceptions of risk that are not shared by banks – can influence the pricing of loan products. There is, however, good reason not to overstate the likely effect. Under Basel I, a single regulatory risk weight was applied to all corporate exposures but, obviously, banks did not price all these loans the same. Informal and, increasingly, formal risk models were used to guide pricing, such that risky customers typically attracted higher margins.

The situation did not change with the introduction of the Basel II advanced regulatory capital models. While regulatory capital requirements now better match economic risk, banks can continue to use their own risk models, or their assessment of the Basel model inputs, for capital budgeting and internal pricing purposes.[7]

In some instances, work on refining the regulatory regime may have a less formal impact on pricing. The move to more risk-sensitive regulatory models may itself have helped move the industry to more risk-sensitive loan pricing. During the recent rural land boom, which was well under way prior to the introduction of the IRB models, some IRB banks were pursuing market share and, in the process, the margins on what were some of their riskiest exposures – large loans with high LVRs –were driven to levels that might have been inadequate to compensate banks for the risks they were running. One consequence of improving risk differentiation is that margins should better reflect the underlying economic risk of the loan, such that less risky and lower LVR loans attract tighter margins, and similarly, more risky and higher LVR loans are priced at higher margins.[8]

The regulatory regime may also have an impact on pricing if a bank has an internal pricing rule that uses a regulatory measure of risk rather than the bank's own assessment of risk. Box 2 presents an illustration of how revised capital requirements might flow through into prices, illustrating that under these assumptions the likely effects on pricing are relatively small.

Banks will also consider the views of the rating agencies, and often target a desired credit rating. In practice, this

[6] Although there are some reasons to doubt whether capital requirements affect a firm's weighted cost of capital over the longer term. Under the Modigliani-Miller hypothesis, as the share of a bank's assets financed by capital (as distinct from deposits and other debt instruments) rises, the market should, over time, perceive the banks as becoming less risky (less variance in actual and expected earnings) due to the fall in leverage. If so, the market's required rate of return on equity would fall.

[7] This is particularly relevant for banks that operate as part of a wider international group. While New Zealand capital requirements affect the amount of capital held within the New Zealand subsidiary, capital requirements for the group will be determined at group level. How the banking group chooses to allocate its group cost of capital across various subsidiaries and different business lines is a matter for that group, and may change over time.

[8] Any impact of improved differentiation will have taken place against the backdrop of an underlying widening of lending spreads generally across all sectors of the economy following the global financial crisis.

means that banks typically hold capital above the regulatory minimum. For example, one of the major rating agencies, Standard and Poor's, has developed a more explicit model for assessing a bank's capital adequacy that is expected to assign a risk weighting of around 100 percent to New Zealand bank farm loans. If a bank were to hold capital to meet a ratings target based on higher alternative risk weights, then the Reserve Bank's capital requirements would have relatively little impact on that bank's overall assessed cost of capital.

6 Conclusion

After a lengthy process of analysis and consultation, the Reserve Bank has finalised the capital requirements for farm lending. The new requirements will take effect from 30 June 2011, and the impact on the major banks is to take average risk weights back to slightly below the 100% risk weight that applied under Basel I. This article has explained the underlying economic analysis across the components that make up farm lending capital requirements.

It is sometimes argued that the Reserve Bank's capital requirements will have a negative effect on banks' farm lending business, or result in higher margins charged to customers. The impact of individual changes in regulatory capital requirements on the banks' business is often exaggerated, and it is important to distinguish any effects of these regulatory changes from underlying changes in banks' own perceptions of the riskiness and likely returns on rural lending. Developments over recent years have highlighted just how risky rural lending can be and this has been reflected in banks raising margins on rural lending from levels that had become unrealistic during the boom period. This trend was established well before the completion of the current review of regulatory capital requirements.

The Reserve Bank's goal is to ensure that banks, and especially the IRB banks, hold an appropriately conservative amount of capital, reflecting their particular circumstances and portfolios. Recent changes to farm lending capital requirements reinforce this goal and hence promote the longer-term efficiency and soundness of the financial system.

7 References

Basel Committee on Banking Supervision (2005), 'An explanatory note on the Basel II IRB risk weight functions', July.

Reserve Bank of New Zealand, "Capital adequacy framework (internal models based approach)", http://www.rbnz.govt.nz/finstab/banking/regulation/3272068.pdf

Reserve Bank of New Zealand, *Financial Stability Reports* at http://www.rbnz.govt.nz/finstab/fsreport/

Box 2

Possible impact of regulatory capital changes on loan prices: an illustration

This box illustrates, using a simplified pricing model, the potential effect of the farm regulatory capital changes if they flow through into prices. Note that the inputs into the model are illustrative only and do not purport to represent any bank's actual pricing model or practices.

The model shows the impact of an increase in the average risk weight from 70 percent to 85 percent for a portfolio as a whole. The impact of this change is modelled on a notional balance sheet containing a single type of exposure. It is assumed that the loan book is funded through capital, at an equity risk premium of 8 percent, with the remainder funded at a single notional deposit interest rate of 5 percent.

In this simplified model, the increase in margins that would result from the increase in the risk weight is only 16 basis points. Furthermore, this calculation assumes that the equity risk premium remains fixed under both risk weightings.

Table 3

Stylised example of potential pricing implications of increased risk weights

Component	70% risk weight (a)	85% risk weight (a)	Change in margin
Cost of equity	0.13	0.13	
Tax	0.28	0.28	
Required return on equity (b)	0.1806	0.1806	
Capital ratio (c)	0.08	0.08	
Assets (d)	1000	1000	
Risk-weighted assets (e = a x d)	700	850	
Capital requirement (f = e x c)	56	68	
Deposits (g = d – f)	944	932	
Required income			
Equity (h = b x f)	10.11	12.28	
Deposits (i = g x 0.05)	47.20	46.60	
Total (j = h + i)	57.31	58.88	
Required rate of return (k = j/d)	5.73%	5.89%	
Margin over deposit rate (k – 5%)	73 basis points.	89 basis points.	16 basis points.

Stress testing New Zealand banks' dairy portfolios

David Hargreaves and Gina Williamson[1]

Stress testing a bank loan portfolio by estimating potential losses in a severe economic scenario provides a useful way of evaluating the risks that lenders face. This article describes a model that the Reserve Bank has constructed to analyse the risks facing banks that are lending to New Zealand's dairy farming sector, which uses detailed information gleaned from bank loan portfolios. Simulations using the model show that simultaneous declines in both the dairy payout and security values have the potential to cause the greatest loan losses for banks. This is to be expected because the reduced earnings tend to increase farm borrowing initially, while falling rural land values erode the banks' security values, making it more likely that a farm will exceed its borrowing limit. It is hoped that this exercise will assist banks to enhance their individual stress testing programmes and internal risk modelling by providing a base model for assessing credit risks in the dairy sector that can be customised for internal use.

1 Introduction

Stress testing a portfolio of assets (such as loans) involves evaluating what would happen to the portfolio in the face of various adverse events. Applied across a bank, a stress test can be described as "the evaluation of a bank's financial position under a severe but plausible [economic] scenario."[2] Stress testing is an important risk management tool for banks in evaluating their vulnerability to various types of risk across their balance sheet. The Basel II international capital framework has a specific role for stress testing to help ensure banks have sufficient capital to absorb unanticipated losses in severe economic downturns.[3]

As a central bank with a financial stability function, the Reserve Bank is also interested in stress testing at an aggregate level. Stress testing is particularly useful for assessing financial stability by highlighting the vulnerability of the financial system to certain risks. Stress testing can assist the supervision of individual banks, and help in the formulation of prudential policy.

A stress test may examine the consequences for banks of a full macroeconomic scenario that affects multiple aspects of the banks' business, or concentrate on a downturn in a particular sector. Stress tests can also be classified by the source of the models used for the test. Bottom-up stress testing sees participating institutions use their own models to determine the effects of scenarios determined by the regulator. The regulator then collates results to provide insights into the system-wide impact. This is the type of stress test the Reserve Bank undertook in 2003 (see RBNZ 2004) and again in 2009 in collaboration with the Australian Prudential Regulation Authority (APRA) and the Reserve Bank of Australia (RBA).[4]

A top-down stress test involves the regulator collecting data on the whole financial system or a particular part of it and applying a modelling framework themselves. The Reserve Bank has previously done work of this sort to analyse the residential mortgage lending of the banks (see Harrison and Matthew 2008). In this article, we describe a model the Reserve Bank has recently constructed to analyse risk in the dairy farming sector.

The dairy stress testing model presented in this article is a model of credit risk – the risk that a bank will take losses because borrowers do not repay their loans. A credit risk stress testing model involves imposing changes to key macroeconomic variables that affect performance in the sector of interest, relating these changes to borrower default behaviour, and estimating the losses to the lending banks from these defaults and foreclosures.

[1] The authors thank Ian Harrison, Bernard Hodgetts, Michael Reddell and participants in Reserve Bank seminars for helpful comments, and contacts at the major banks for data and comments.

[2] Basel Committee on Banking Supervision (2009) .

[3] This requirement is unchanged in the recently released Basel III framework. For a discussion of the Reserve Bank's approach to the capital treatment of rural exposures under Basel II, see the accompanying article in this issue and also Hoskin and Irvine (2009).

[4] For more information on the 2009 stress test, see box D in the May 2011 *Financial Stability Report*.

The purpose of the dairy stress testing model is twofold. First, it may enhance banks' individual stress testing programmes by providing a base model for assessing credit risks in the dairy sector that the banks may wish to customise for internal use. Second, the model provides valuable insights into the vulnerabilities within the dairy sector and potential impacts of stress in this sector on New Zealand banks collectively.

International experts have noted that stress testing prior to the financial crisis often did not identify many of the important risks that had built up prior to the crisis and caused problems during it (see BCBS 2009). For example Geradi *et al* (2008) note that many analysts looking at the US housing market around 2005 felt nationwide house prices were extremely unlikely to fall substantially, partly as this had not happened in most of the historical datasets used by analysts. As residential loan defaults had also not occurred in great quantity in recent history, a historical analysis such as a regression would have had trouble identifying the risks of substantial loan defaults occurring in the future. Additionally, when large defaults did begin, the regression relationship would be likely to suddenly revise up estimated risks, potentially leading banks to reduce credit supply in order to safeguard their balance sheets. This would make perceived risk 'procyclical' rather than the stable 'through the cycle' view of risk that models should ideally provide.

The recent financial crisis has demonstrated that expectations in credit markets (about property prices, for example) often become unrealistic during long economic expansions, and no modelling approach can completely counteract this inherent 'procyclicality' of the attitudes of banks and their customers. However, we consider that the modelling approach used in this paper overcomes some of the limitations described above. First, with recourse to a much larger historical dataset (including data from other countries), we are able to come to a more realistic view about plausible downturn scenarios. Second, rather than relying on a fully reduced form approach like a regression, we design a deeper model of the farming sector that incorporates cross-sectional data and considers realistic assumptions about what sort of events would lead a farm into default. These principles were also employed in the Reserve Bank's analysis of credit risk in the housing market.

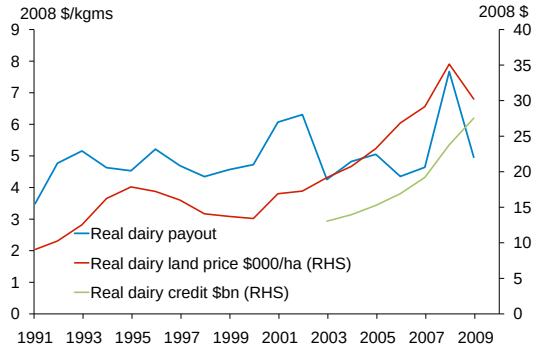
In the remainder of this article, we provide some introductory material on the dairy farming sector in New Zealand and the data we gathered for the stress testing exercise. We then describe the model methodology in more detail and consider appropriate downside scenarios. Finally, we outline our results and provide some concluding comments.

2 The dairy farming sector

Debt levels in the dairy sector have increased markedly over the past decade, with high commodity prices and rising farm prices encouraging farmers to expand existing operations or to convert farms to dairying. Much of this activity was bank financed, with credit to the agricultural sector increasing at annual rates in excess of 15 percent. Following the peak in dairy prices at the end of 2007, dairy commodity prices fell sharply, leading to a large reduction in the dairy payout, and dairy land prices fell 16 percent in the year to June 2008. This downturn placed some farmers under significant financial stress. While the subsequent recovery in dairy returns has alleviated much of this stress, the experience served to expose the vulnerabilities associated with the dairy sector's heavy debt load.

Figure 1

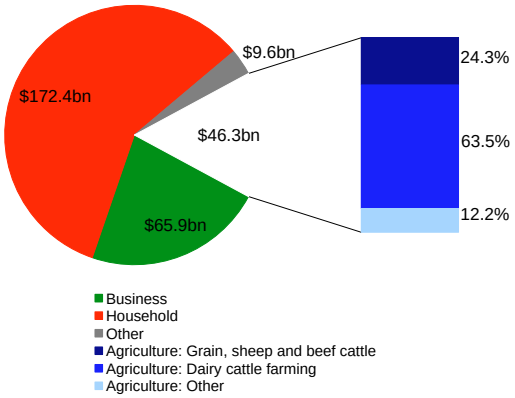
Dairy land prices, commodity prices and credit



The agriculture sector comprises around 16 percent of total bank lending in New Zealand, up from around 9 percent a decade ago. The dairy sector alone accounts for 64 percent of agricultural lending and around 10 percent of total bank lending (figure 2). While the volume of lending to the agriculture sector is lower than the volume of residential mortgages, when adjusted for risk, it takes on much greater significance in banks' lending portfolios. A significant portion

of the dairy sector has substantial borrowings and are thus vulnerable to declines in land prices. The income earned in the sector is also closely linked to commodity prices, which directly impacts on the ability of farmers to service their debt. The dairy sector also has an indirect effect on broader rural land values and therefore on risk in the sheep and beef sector, which accounts for a further 24 percent of bank lending to agriculture. A significant downturn event in the dairy sector could therefore inflict significant losses on banks' agricultural portfolios.

Figure 2
Registered bank lending by sector
(as at June 2010)



3 Constructing the data set

To obtain estimates of the likely extent of credit losses in a downturn event, it is necessary to have information on the cross-sectional distribution of debt and other important variables across the dairy sector. For example, if debt is concentrated in a few very highly leveraged farms, this would imply a greater risk of credit loss than if debt was spread more evenly across the sector.

In 2010, the Reserve Bank gathered this information by surveying the four largest New Zealand banks, requesting an anonymised sample of the financial records they hold on each dairy farming exposure. These four lenders accounted for 91 percent of lending to the dairy sector as at June 2008. The organisational unit we were interested in was the farming group (henceforth also referred to simply as a farm). A farming group treats all directly connected borrowers (eg, family, farming partnership, family trust) as one entity with one set of consolidated financial accounts. In many cases these entities will have cross-guaranteed borrowing by other entities in the group, and even if they have not, they are likely to generally be willing to support each other.

We collected basic data on dairy lending from the four banks and applied a stratified random sampling strategy to this data to select the sample. Stratified sampling involves splitting the population into subgroups based on a common feature of the data prior to sampling. This approach generally improves the representativeness of a sample. We divided the data into three strata on the basis of the size of farm exposures – $1 million to $7 million, $7 million to $25 million, and greater than $25 million.[5] All of the exposures in the upper strata were included in the sample, along with 150 individual observations for each of the lower two strata.[6] This structure weighted the sample toward larger, potentially higher risk, farming operations, as it was deemed most important to gather details about the balance sheet of large borrowers.[7]

The final sample consisted of 347 farming groups, each with greater than $1 million of debt outstanding to one of the four banks. The banks provided us with detailed financial data from the balance sheets and income statements of each of these farms for the 2007-08 financial year.[8] The sample data was adjusted as appropriate. For example, the data was filtered to remove the effects of the 2007-08 drought on farm costs, and farm asset values were adjusted to make valuation dates more consistent.

5 Statistical tools such as the cumulative F rule were employed to assist in the selection of strata boundaries. However, the final determination of strata boundaries is a largely judgmental exercise.

6 Stratification could have proceeded on the basis of various financial variables. The best variable would have been the LVR on each farm exposure. However, this is subject to measurement difficulties, particularly with regard to the consistency of security valuations. Stratification by the size of the exposure was chosen as a next best alternative.

7 The sample sizes across strata mean we sampled around 4 percent of all farming groups in the lowest strata, and around 20 percent of farming groups in the middle strata.

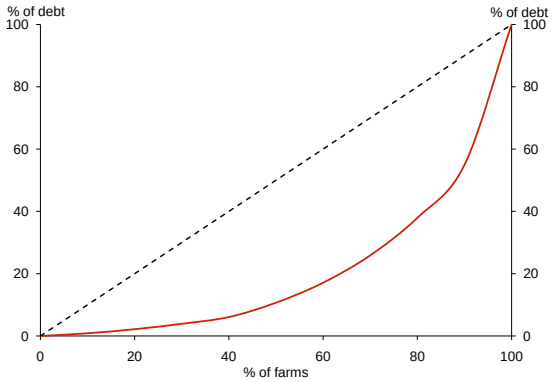
8 The 2007-08 year was the most recent year for which financial accounts were available at the time of collecting the data. The financial year and dairy season broadly coincide.

The sample data excludes farming groups with $1 million or less of debt. The sample data was therefore supplemented with a set of representative data for these low-debt farms. We used the Ministry of Agriculture and Forestry's National Dairy Model[9] as a benchmark in the construction of the financial accounts of these farms. To introduce some variation in this part of the dataset, we varied production and costs around these benchmark figures. Debt levels for these farms were inferred from the unit record data provided by the banks and official Reserve Bank data sources. When aggregate statistics were computed on the basis of the sample, the different strata were weighted to reflect the fact that a smaller proportion of farms in the lower strata were sampled.

The data collected provides a detailed snapshot of the financial position of the dairy sector at a point in time. It indicates that the total debt outstanding to the dairy sector at the end of June 2008 was around $20 billion; undrawn credit facilities amounted to a further $2 billion.[10] Figure 3 presents the distribution of debt across the sector. This distribution is heavily skewed – the most indebted 10 percent of dairy farms appear to carry 45 percent of the sector's total debt.

Figure 3

Distribution of debt across the dairy sector



The sample data suggests that over the 2007-08 season the average farming group was profitable and comfortably able to service its debts. This is to be expected given the 2007-08 season was one of high commodity and land prices. However, the data also reveals a significant number of farming groups that appeared vulnerable to a substantial downturn in the sector due to high loan-to-value ratios (LVRs), high cost structures, and/or low earnings relative to debt servicing obligations. It is the degree of vulnerability in these areas that the stress testing model presented in the remainder of this paper is designed to examine.

Figure 4

LVRs for sample farms

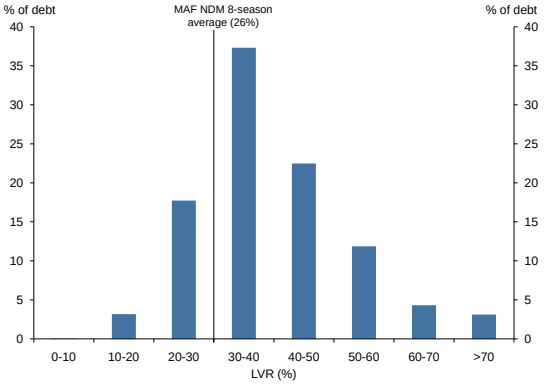
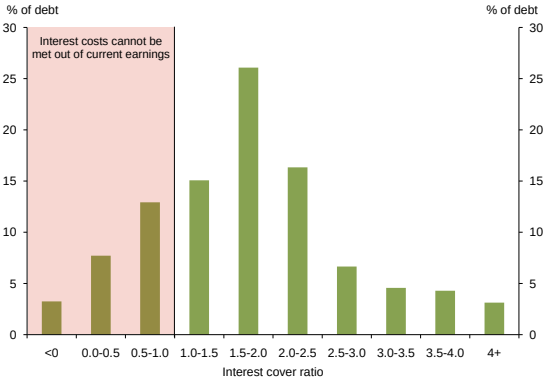


Figure 5

Interest cover ratios for sample farms



3 Modelling methodology

Having gathered data on the sector, we set about constructing a model of how a downturn scenario would affect farm accounts and potentially lead to loan defaults (the default model), as well as considering what a serious but plausible downturn scenario might look like.

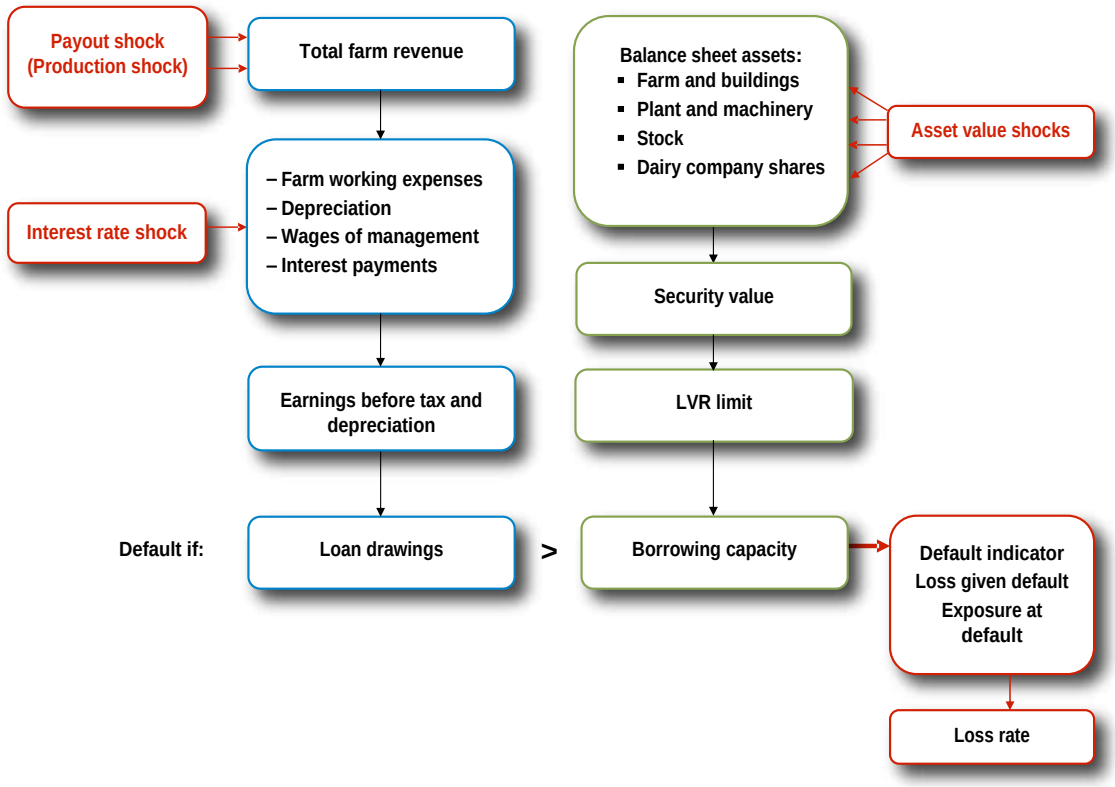
A loan default model is typically designed to predict bank losses under various macroeconomic scenarios using a series of behavioural relationships. Again, the precise form of the default model varies based on the type and complexity of

[9] The National Dairy Model is constructed from a sample of dairy farms that is generally believed to concentrate on small-to-medium sized farms rather than very large 'corporate operations', so it should provide useful information about the low-debt farms.

[10] This is consistent with figures on dairy lending in the RBNZ Annual Agricultural Survey.

Figure 6

Structure of the model for defaults on dairy lending



the overall stress test and the data available for use in the model. To generate a loss rate, the model requires a default rule, and estimates of loss given default (LGD).

*Loss rate (%)=Default rate (PD)*loss given default(LGD)*100*

The default rate or probability of default (PD) expresses the likelihood that an individual borrower will default on their loan. This will be based on indicators of debt servicing ability and/or leverage (loan size relative to collateral value, or LVR).

The LGD is the loss that a bank will incur in the event that a borrower has defaulted, once the collateral held against the loan and the costs of realising this collateral are accounted for. The LGD is expressed as a percentage of the borrower's total debt outstanding to the bank upon default (termed the exposure at default). The aggregate loss for the bank is simply the sum of the loss rates on individual exposures weighted by the size of each exposure.

The structure of the model

We elected to allow three variables to shift from their 2007/2008 base values in order to generate a downturn scenario: the dairy payout, interest rates, and land prices (asset values).[11] We refer to the changes in these variables as 'shocks' in the model. Falls in the dairy payout (which relate to movements in commodity prices and the exchange rate) can systematically reduce farm income. These reductions are generally nationwide and can last multiple years, making it an obvious stress variable to examine. Declining land prices reduce the prospect of an owner selling a farm to escape a mortgagee sale and can increase the losses to a bank in the event of a default, making it another key variable. Interest rates impact on the ability of the farm to meet its debt servicing obligations. Figure 6 illustrates the basic structure of the default model and the path of the shocks through to the default rule and determination of losses.

A shock to the dairy payout affects farm earnings by reducing revenue. However, during periods of stress when farm cash flow is reduced, farmers are likely to respond to

[11] The model also has the capacity for a production shock in the form of a drought. A drought reduces milk solids production by a specified proportion in the year of drought. Production rebounds to the level prevailing in the 2007-08 season in the year following the end of the drought. At this stage, the model does not allow for this production shock to flow through to higher dairy prices but the model could be extended to incorporate this.

lower revenue by reducing costs. In our model, we allow working expenses to vary with the payout – costs decline as the payout falls and increase as the payout rises.[12] This cost adjustment mechanism dampens the effect of the drop in revenue on farm earnings to some degree. We also allow working expenses to increase in the presence of drought and incorporate an upward trend in costs over time.

Wages of management also adjust in a stress situation. Wages of management generally fluctuate with the value of a farm's balance sheet assets. However, in the model, wages of management cannot fall below a minimum allowance for labour and are limited in size by farm earnings. If a farm has near zero or negative earnings (before wages of management are subtracted), it is assumed that the ability to pay wages of management is curtailed.

The interest rate shock affects the interest payments a farm is making on its outstanding debt. A positive interest rate shock will increase interest payments and decrease earnings. In the model, all debt is assumed to be floating rate and therefore is affected by a change in interest rates almost immediately.[13]

The payout and interest rate shocks ultimately affect farm earnings. The level of farm earnings determines the change in a farm's outstanding debt from year to year. It is assumed that any cash shortfall is met by drawing down additional funds from the bank. If earnings are negative, loan drawings and outstanding debt increase by the amount of the cash shortfall. If earnings are positive, a portion of the cash surplus is committed to principal repayments.

Shocks to farm asset values affect the value of security held by the bank against a farm's borrowings and affect the LVR on the exposure. A farm's LVR directly affects its borrowing capacity and is a key determinant of default. While each class of farm assets (ie, farm land and buildings, plant and machinery, stock, dairy company shares) can be subjected to shocks of differing magnitudes, the main focus of our interest is on land prices. An idiosyncratic term is also included in the asset value shock to alter the magnitude of a given shock across farms. This allows for variation in farm values around the average market price change and recognises that the value of certain farms may be more susceptible to price shocks (and others may be less affected) due to, for example, the quality of the farm or its location.[14]

Banks will generally only periodically attempt to mark to market the value of the security they hold (eg, annually). During a severe downturn, particularly if the farm sales market is very thin, valuations recorded by banks may change a bit more gradually than the prices that can be realised in the market. We allow for this potential delay, but assume that banks fully mark asset values to market in the final year of the simulation. This mostly affects the timing of losses rather than the total losses incurred.

Default analytics

There is a range of different rules that could be used to describe default. We define a farm as being in default when:

(i) the farm's drawn exposure has exceeded a specified borrowing limit, ie, it has exceeded its maximum LVR;[15] and

(ii) the farm has negative cash flow.

Both a farm that is within its borrowing limit but has negative cash flow and a farm with positive cash flow but above its borrowing limit would not be regarded as being in default by this definition. We assume that so long as a farm has positive cash flow it will continue to service its debt and the bank will not take enforcement action despite the eroded equity position. We also assume that a farm with negative cash flow but sufficient remaining equity to borrow against will not be foreclosed on, as the farm can either borrow to meet its working capital needs or can sell the farming

12 The relationship between costs and the payout, the presence of drought, and a trend were determined using simple regression techniques. Working expenses fall approximately 14 cents per kilogram of milk solids in response to a $1 decline in the payout.

13 We do not allow for penal interest rates for farms that are not generating enough cashflow to meet interest payments or breaching other covenants – this is a possible future extension.

14 The idiosyncratic shock factor for each farm is a random draw from a normal distribution. The mean of the distribution is set to 0 and the standard deviation is set at 0.075.

15 The borrowing limit and maximum LVR are based on the book value of the security as recognised by the bank rather than the market value.

operation itself and repay the bank debt without the bank incurring a loss.

In our framework, we distinguish between two default states: non-performance and foreclosure. A farm is assumed to be in a non-performing state when it is not servicing its debts, and has a LVR on land and buildings that has reached 75 percent (which would typically exceed limits agreed in the loan documentation).[16] While many farms in this position may technically be classified as in default at this stage, rather than immediately foreclosing and possibly realising a loss, banks may well exercise forbearance in the hope that the farm will return to profitability and resume servicing the loan. Banks tend to exercise a high level of forbearance with their rural clients, due in part to recognition of the cyclical nature of farm earnings and the long-term nature of these lending relationships. A farm in non-performing status is not in severe enough condition in terms of potential losses to a bank to typically motivate enforcement action. Banks may behave differently in a severe downturn, possibly adopting unduly pessimistic assumptions themselves. On the other hand, they will be aware that pushing large numbers of farms onto the market during a downturn may push prices down, increasing their losses on those loans and potentially weakening the financial position of other customers.

The LVR threshold for the foreclosure rule is assumed to be 90 percent on farm land and buildings.[17] At this point, it seems likely that if the loan is not being serviced, the bank will choose to recognise an economic loss on the loan and either dispose of the security or come to some other arrangement. The foreclosure rule identifies realised bank losses, while the non-performance rule reflects the broader degree of stress in the sector. The results reported in the next section of this paper focus mainly on the foreclosure losses to which the banking sector is exposed.

Loss given default is the loss that the bank will suffer once a farm has defaulted and the collateral held against the loan and the costs of realising this collateral are accounted for. The costs of realising the collateral include disposal fees, a foreclosure discount, and the cost of holding the property until such time as it sells.

Selling properties in a market that is already depressed due to a stress event may well have the effect of further depressing farm prices, particularly if the foreclosing bank attempts to achieve a quick sale and buyers widely perceive 'fire sales' to be occurring. The foreclosure discount captures the likelihood of a lower sales price than might otherwise prevail.

The disposal fees are the costs associated with actually selling the property, such as listing fees and commissions. The discount rate reflects the cost of holding the farm property while pursuing a foreclosure sale. It comprises the average interest rate on lending plus a risk premium.

We assume transaction costs are 5 percent of the sale price of the property and the foreclosure discount is 7.5 percent.[18] The discount rate is set at 13 percent. The time to collection on a defaulted loan in a stress situation is set at 1.25 years. These parameters imply that a bank may face a loss in the event of default when a farm's LVR exceeds 79 percent. A lower limit of 0 is set on the LGD as a bank cannot make money from a foreclosure sale – surplus funds are returned to the borrower.

Realistic downturn scenarios

As outlined above, our a priori assumption was that the macroeconomic shocks most relevant to dairy farm stress would include shocks to land prices, dairy output prices and interest rates. In hindsight, the 2007-08 data on farms we collected marked an apparent high point in dairy land prices, as well as being a strong year in terms of output prices. We used data on falls from previous high points over history to gauge what a severe but realistic downturn scenario might look like.

[16] **The overall LVR threshold for a given farm is calculated using different thresholds against different types of collateral reflecting the likely recovery value to a bank. For non-performance these LVR thresholds are set at 75 percent for farm land and buildings, 75 percent for dairy company shares, 50 percent for stock and 20 percent for plant and machinery.**

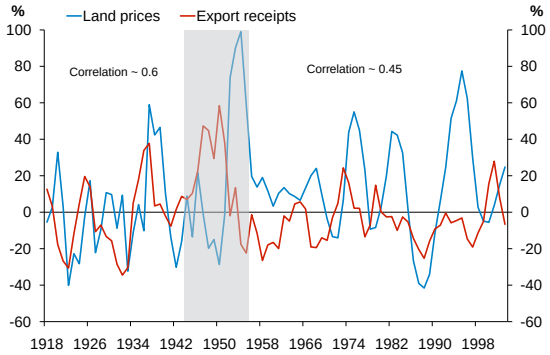
[17] **For the foreclosure rule, the LVR thresholds are set at 90 percent for farm land and buildings, 75 percent for dairy company shares, 75 percent for stock and 25 percent for plant and machinery.**

[18] **Some of the foreclosure discount will be picked up in the depressed market value of the property.**

We examined historical data from New Zealand and the US (being another agricultural country for which a good time series of data was available) to form an idea of the frequency and size of movements in land prices and commodity prices. Real land prices have declined substantially twice in the past century in both countries. The initial decline in each country began around World War I and appears to have been quite prolonged (see figure 7). The second decline occurred through the 1980s. Real land prices fell 40 to 50 percent in each of these episodes, with 25 to 40 percent of that decline concentrated in a five-year period.[19]

Figure 7

Five-year changes in real land prices and export prices in New Zealand (1918-2003)



Source: SNZ long-term data series spreadsheets, Greasley and Oxley (2005), New Zealand Official Yearbook (1949), RBNZ calculations.

Note: The shaded area represents a period of caps on nominal land prices. The correlation between export prices and measured land prices breaks down through this period.

There is a positive correlation between the change in land prices and the change in export prices over long (approximately five-year) periods. The correlation tends to be stronger in downturns. The sharp falls in land prices discussed above were coincident with export prices falling about 30 percent over a five-year period. These export prices are not just for agricultural exports, but much of the volatility comes from agricultural exports. Thus export receipts from farming will have a similar profile, but are likely to be more volatile.

[19] New Zealand had another measured decline in real land prices around World War II, but this stemmed from nominal caps on official land prices (which meant transactions typically involved unofficial side payments).

The importance of interest rate shocks has likely varied over time. Before World War II, the government was an important lender to the agriculture sector and the role of commercial banks was much smaller. The government retained an important role in the sector in the 1980s via the Rural Bank. In contrast, almost all lending is now provided by the commercial banks (although a small amount of informal lending still occurs), which is likely to limit the offering of concessional interest rates and the level of forbearance by lenders. In addition, interest rates were regulated until the 1980s and were often very high in nominal (and sometimes also real) terms in the 1980s. Since the early 1990s, nominal interest rates have declined on average and have become more stable. Partly reflecting the monetary policy framework, interest rates now tend to move lower during economic downturn (which reduces the risk that interest rates will be high during a prolonged rural downturn). However, there remains the potential for an inflationary shock or a funding shock to the financial system, which could raise interest rates and also potentially depress land prices. For these reasons a scenario with rising interest rates and falling dairy and land prices is not out of the question.

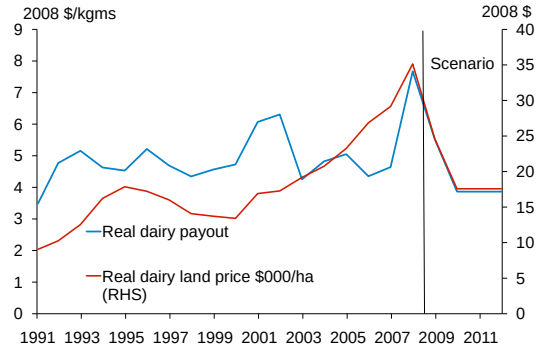
It is possible to formally write down a joint distribution for the multi-year movements in the macroeconomic drivers discussed here, and do a Monte Carlo analysis where a large number of randomly generated scenarios are then analysed. This can be used to determine the distribution of possible losses (for example, given model assumptions, what is the loss that will occur in the worst year in any given century?) We experimented with this approach when working with prototypical versions of our model, but do not use it for the results presented below, which instead use some simple representative shocks to illustrate the model output.

The historical analysis showed that it is possible for real land prices to fall 40 percent or more over a five-year period, alongside a fall of around 30 percent in export prices (which would involve a larger fall in agricultural export prices). It is interesting to note that falls of this magnitude from the highs recorded in 2007-08 would keep land and commodity prices still remaining well above their longer-term averages. More stressful scenarios could also be tested. For example, a fall in the dairy payout to below its long run average and

a consistent fall in land prices to return the land price to farm earnings ratio to around its longer-term average could have seen the payout roughly halve from 2007/08 levels (to around $3.80/kgms) and land prices also approximately halve. This scenario, shown in the graphs below, is the most serious of the downturn scenarios we examine in our modelling work in the next section. It is clearly substantially different to what actually happened after the end of 2009 (land prices have not fallen this much, and the dairy price recovered in the current season after a weak 2009/10 price).

Figure 8

Dairy land prices and dairy output prices (actual and scenario)



4 Results and insights from the model

In this section, we take representative shocks from the macro analysis undertaken above and feed them into the stress test model to investigate the magnitude of losses they would generate. The period for the results reported below is five years. Results are compared to a baseline where interest rates and security values do not change, while the payout drops to around historical average in real terms ($5.50) in year one. The further shocks around this baseline occur over the following two years in the case of land prices and interest rates, and in year two in the case of the dairy payout. Shocked variables then remain at their new levels for the remainder of the simulation. Sudden shocks like this tend to cause somewhat larger losses than more gradual (though still severe) downturns.

Results of various runs of the model are summarised in table 1. Scenarios 1 to 3 test the response of the model to single shocks to one of the macroeconomic variables around the baseline. Scenarios 4 and 5 show the effects of a substantial decline in commodity prices and land prices simultaneously (something the historical data suggests has occurred before).

Banks' loan losses are relatively insensitive to payout and interest rate shocks on their own (scenarios 1 and 2 in table 1). Losses are larger in the case of independent asset value shocks (scenario 3 in table 1). However, the condition in the default rule dictating that a farm in default must have

Table 1

Indicative results from stress test model[20]

				Foreclosures (5-year scenario)	
	Payout	Security value	Interest rate	farms (%)	Loss rate (%)
Baseline	$5.50	No change	No change	0.15	0.05
Scenario 1	-30% ($3.80)	-	-	2.5	0.63
Scenario 2	-	-	200bp	2.6	0.61
Scenario 3	-	-35%	-	6.5	6.0
Scenario 4	-30%	-35%	-	15.1	10.1
Scenario 5	-30%	-50%	-	32.9	20.6

Scenarios shown as deviation from baseline.

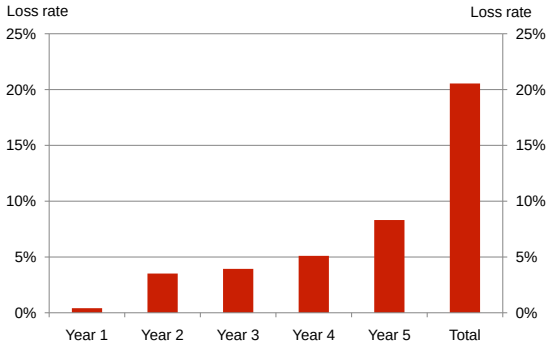
[20] We remove the idiosyncratic shock term from these results so the results are reproducible rather than random. A more sophisticated analysis would run the model (with idiosyncratic shocks turned on) multiple times and look at the distribution of results.

negative earnings limits the extent of losses for even very large security value shocks.

Farms are most vulnerable to contemporaneous declines in both the payout and security value and it is therefore these combined shocks that cause the greatest loan losses for banks in the model. This is not surprising as the payout decline reduces earnings and increases farm borrowings while at the same time the security value is being eroded, making it more likely that a farm will exceed its borrowing limit.

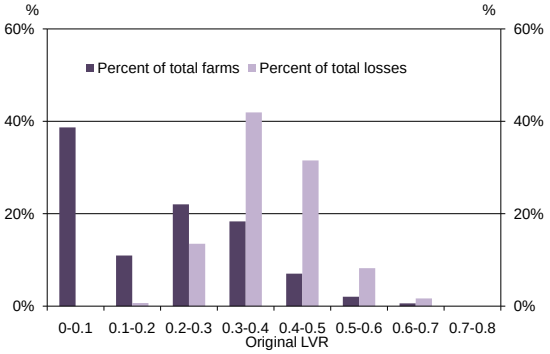
A bad downturn in land prices and the dairy payout (scenario 4 in table 1) pushes around 15 percent of farms into foreclosure, generating expected losses of around 10 percent of total exposure. A more severe downturn (scenario 5) pushes around 33 percent of farms into foreclosure. The expected loss rate for the banks is around 20 percent. The loss rates are quite high, which partly reflects the fact that the largest farms tend to be relatively more indebted and likely to get into financial difficulty. By construction, the worst losses tend to occur in the final year of the scenario period, which is when the banks are assumed to mark security values to market (figure 9).

Figure 9
Year-by-year loss profile in severe five-year downturn



When loans within the sample portfolio are grouped according to their starting LVR, there is a natural tendency for losses to be higher in high LVR buckets. However, while farms with very high starting LVRs (greater than 50 percent) display higher loss rates, it is farms with starting LVRs in the range of 30 to 50 percent (still reasonably high) that have the greatest impact on banks in terms of dollar losses, simply due to the greater volume of farms in these categories (figure 10).

Figure 10
Losses by initial LVR



5 Conclusions

The results presented above imply that losses and foreclosure in lending to the dairy sector will be low in most years. However, the severe downturn scenario shows the potential for a very bad multi-year scenario to cause significant losses for the lending banks. To some degree, this reflects the fact that borrowers in this industry are all exposed in a similar and major way to some factors that have shown they can be volatile (particularly dairy prices). This differs from (for example) residential lending, where a key risk factor like unemployment will only affect a small proportion of New Zealand households at any point in time.

Our analysis is consistent with the discussion in recent *Financial Stability Reports*, where we have identified dairy lending as a potential credit risk factor for the New Zealand banks. Land prices have fallen significantly but relative to the scenarios we consider here, the actual cash returns from dairy farming have remained quite resilient, and interest rates have fallen substantially. Our model is consistent with the low rates of foreclosure anecdotally seen to date in dairy lending, but implies that the outcome could have been worse if interest rates had not fallen and dairy output prices had been substantially weaker.

While our model is not designed to be used in formal risk weighting for bank capital allocation, it does provide a view of the potential downside risks in the sector and illustrates some characteristics of dairy lending that a risk-weighting model might want to address. We have made our results

and model available to the participating banks, who can utilise the model at the level of their individual institutions.

As noted in the introduction, we think our modelling approach is likely to be more resilient than the sorts of stress test models criticised recently by the Basel Committee on Banking Supervision (2009). For example, we are not reliant on a short historical sample of possible downturns, or a reduced form regression approach to determining default likelihood. In the case of the dairy farming sector, which has faced pretty low losses in recent years, our approach will tend to produce higher (but more realistic) estimates of potential downside risk than those approaches.

References

Basel Committee on Banking Supervision (2009), "Principles for sound stress testing practices and supervision", Bank for International Settlements.

Gerardi, K, A Lehnert, S Sherlund and P Willen (2008), "Making sense of the subprime crisis." *Brookings Papers on Economic Activity*, vol 2, 69-159.

Greasley, D and L Oxley (2005), "Refrigeration and distribution: New Zealand land prices and real wages 1873-1939", *Australian Economic History Review*, 45(1), 23-44.

Harrison I and C Matthew (2008), "Project Tui: A structural approach to the understanding and measurement of residential mortgage lending risk", mimeo, Reserve Bank of New Zealand.

Hoskin, K, and S Irvine (2009), "Quality of bank capital in New Zealand", Reserve Bank of New Zealand *Bulletin*, 72 (3), pp5-16.

Reserve Bank of New Zealand (2004), *Financial Stability Report*, October.

Reserve Bank of New Zealand (2011), *Financial Stability Report*, May.

Understanding financial system efficiency in New Zealand

Chris Bloor and Chris Hunt

This article examines the concept of financial system efficiency in the New Zealand context. The primary function of the financial system is to facilitate the allocation of society's scarce resources, both across the economic system and over time, in an environment of inherent uncertainty. If the financial system performs this role well, then it will be contributing to economic growth and prosperity in a positive way. The article develops a conceptual framework for evaluating financial system efficiency and applies this to the New Zealand financial system. In particular, we focus on whether the high return on equity enjoyed by the New Zealand banking system, relative to other jurisdictions, is indicative of a banking system that is any less competitive and efficient than elsewhere. Our research to date suggests these high relative returns can be explained by a number of factors including relatively high cost of capital in New Zealand and the implicit support the major banks receive from their Australian parents.

1 Introduction

The financial system plays several critical roles in any modern economy, which include providing facilities to make and settle financial transactions, channelling funds from savers to borrowers, and providing a means for households and firms to manage financial risk and uncertainty. If these functions are performed well, the financial system will contribute positively to economic development and prosperity. If the functions are performed ineffectively, however, additional costs will be imposed on society, potentially undermining economic performance. Symptoms of inefficiency could include high transaction costs, limited or poor quality financial services and products, a lack of responsiveness to customer needs and a misallocation of resources throughout the economy over time.

The Reserve Bank has a specific concern for the performance of the financial system, given the legislative requirement to promote a "sound and efficient financial system". The soundness objective is about promoting resilience in individual financial institutions and in the financial system at large so as to minimise any disruption to economic activity. The efficiency criteria relates to the financial system's ability to perform its functions in a cost-effective way, while helping to allocate scarce resources to their most productive uses. Over the past year, the Reserve Bank has been developing a more systematic framework for analysing and reporting on efficiency-related issues across the financial system.

A focus on financial system efficiency is pertinent for two reasons. First, there has been an ongoing concern about New Zealand's economic performance over the past two decades. A key question is whether there may be something in the structure or operation of the financial system that could help explain why the economy may have under-performed relative to other advanced economies.

Second, the global financial crisis has highlighted the potential for problems in the financial system to cause wider economic instability. It has also demonstrated how inefficiencies in the financial system can contribute to vulnerabilities and imbalances over time. In the US, for example, financial innovation in housing lending appears to have led to a fundamental misallocation of resources and a general mis-pricing of risk. Moreover, financial systems in many countries have grown markedly relative to the size of the economy, amplifying the negative effect when problems in the financial sector arise.

In the aftermath of the crisis, policy makers around the world are endeavouring to make their financial systems safer and more resilient to shocks. The global reform agenda, now commonly known as Basel III, has seen policy makers confront not just the benefits of improved financial stability, but also the various costs of the reforms, suggesting there

may be a trade-off between soundness and efficiency in certain circumstances.[1]

Efficiency concerns have also been prompted by changes in the competitive environment in a number of countries following the global financial crisis, which has seen some mergers and closures of financial institutions and reduced willingness to compete for new business. This has driven the recent Senate Inquiry into Banking Competition in Australia, a response to the increased dominance of the big four banks within the Australian financial system.[2] Similar issues are also to the fore in the UK Independent Commission into Banking.[3] In New Zealand, the banking system is also highly concentrated and competition across the financial system may have declined as a result of contraction in the finance company sector.

In section 2 of this article, we briefly review the Reserve Bank's legislative mandate as a basis for considering our approach to the efficiency objective. Section 3 provides a conceptual framework and definition of financial system efficiency as well as a guide to how we can potentially evaluate or measure efficiency. We argue it is not possible to measure financial system efficiency with a single quantifiable metric. Rather, analysis must be undertaken across a number of different levels – from the economic system as a whole right down to the level of individual financial products or services. Section 4 discusses the relationship between financial system efficiency and stability as the two key set of criteria to evaluate financial system performance. Section 5 provides some observations on financial system efficiency in New Zealand based on existing research. Section 6 details some of the Reserve Bank's internal work focusing on specific aspects of New Zealand banking system efficiency, centred on explaining why our banks appear to be particularly profitable relative to other banking systems.

2 The central bank mandate for efficiency

The Reserve Bank Act 1989 (as amended) requires the Reserve Bank to exercise its prudential powers to promote the maintenance of a sound and efficient financial system. The Act requires the Reserve Bank to promote efficiency in its statutory duties related to banks, non-bank deposit takers, and the oversight and designation of the payment system.[4] In addition, the Reserve Bank must have regard to efficiency in relation to the conduct of monetary policy. The Reserve Bank is obliged to report in its semi-annual *Financial Stability Reports* on both soundness and efficiency matters. More generally, section 33 of the Act states that the Reserve Bank has a role in providing advice to the Minister of Finance on any matter related to its responsibilities.

However, efficiency is not explicitly defined in the Act, nor is there any specific guidance as to how the Reserve Bank might interpret the efficiency objective along the lines of that contained in the Policy Targets Agreement (PTA) governing monetary policy. This raises the question of how the Reserve Bank should interpret the legislative mandate for efficiency, and in particular, the relationship between efficiency and soundness.

In practice, the Reserve Bank has tended to view the pursuit of soundness through prudential regulation as the key objective, whilst viewing the efficiency mandate chiefly in terms of minimising or avoiding excessive compliance costs for financial institutions (Morrell 1990, p. 272). Efficiency in this regard can be seen more as a behavioural constraint on a primary objective, in the same way the Reserve Bank must have due consideration for the volatility of output, interest rates and the exchange rate in the pursuit of price stability.

This interpretation is one that accords with the priority other central banks assign to financial stability, relative to any consideration given to the promotion of financial system efficiency. Indeed, a review of other central bank legislation and objectives reveals that efficiency is usually very much a second order concern. In short, no central bank places

1 For a flavour of the costs and benefits of Basel III, see Angelini *et al* (2011). This paper examines the possible impact of the Basel III reforms on longer-term economic performance.

2 See www.aph.gov.au/senate/committee/economics_ctte/banking_comp_2010/index.htm for a copy of the Inquiry's report released May 6.

3 The Commission released an interim report on April 11, which can be found at bankingcommission.independent.gov.uk/

4 The Insurance (Prudential Supervision) Act 2010 contains similar wording with respect to licensed insurance companies.

financial system efficiency on a par with stability, which explains, in part, why there is not an equivalent 'financial efficiency report'.

Nevertheless, the Reserve Bank takes an ongoing interest in matters affecting the broader efficiency of the financial system aside from the direct impacts of its prudential regulation and regularly addresses such issues in its semi-annual *Financial Stability Reports*. For example, the Reserve Bank has recently given considerable attention to whether the financial system has been able to provide credit on acceptable terms to businesses, while under pressure related to the global financial crisis. However, the Bank's recent efficiency research programme has sought to provide a more coherent framework within which to understand and evaluate financial system efficiency.

The Reserve Bank shares its concern for financial sector performance in general, and efficiency in particular, with a number of other public sector agencies. These include the Commerce Commission, whose task is to address anti-competitive behaviour across the business sector and promote efficiency, where possible, in those industries that are heavily regulated. The newly created Financial Markets Authority also contributes to financial system efficiency by enforcing clear and transparent rules for financial market conduct.

3 Defining financial system efficiency – a conceptual framework

Merton and Brodie (1995) state that the primary function of the financial system "is to facilitate the allocation and deployment of economic resources, both across borders and across time, in an uncertain environment" (p. 12). As figure 1 highlights, the financial system has a number of more specific functions, including facilitating trade through clearing and settling payments, intermediating funds between borrowers and lenders, and providing products to manage risk.

Efficiency, broadly speaking, is how well the financial system performs these various functions. The criteria used to assess this performance involves whether the financial system is helping to allocate resources to their best use (allocative efficiency); doing so in a cost-effective manner (technical efficiency); and whether it is responding to both changing demand and uncertainty over time through the development of new financial processes, services and products (dynamic efficiency).

Efficiency criteria

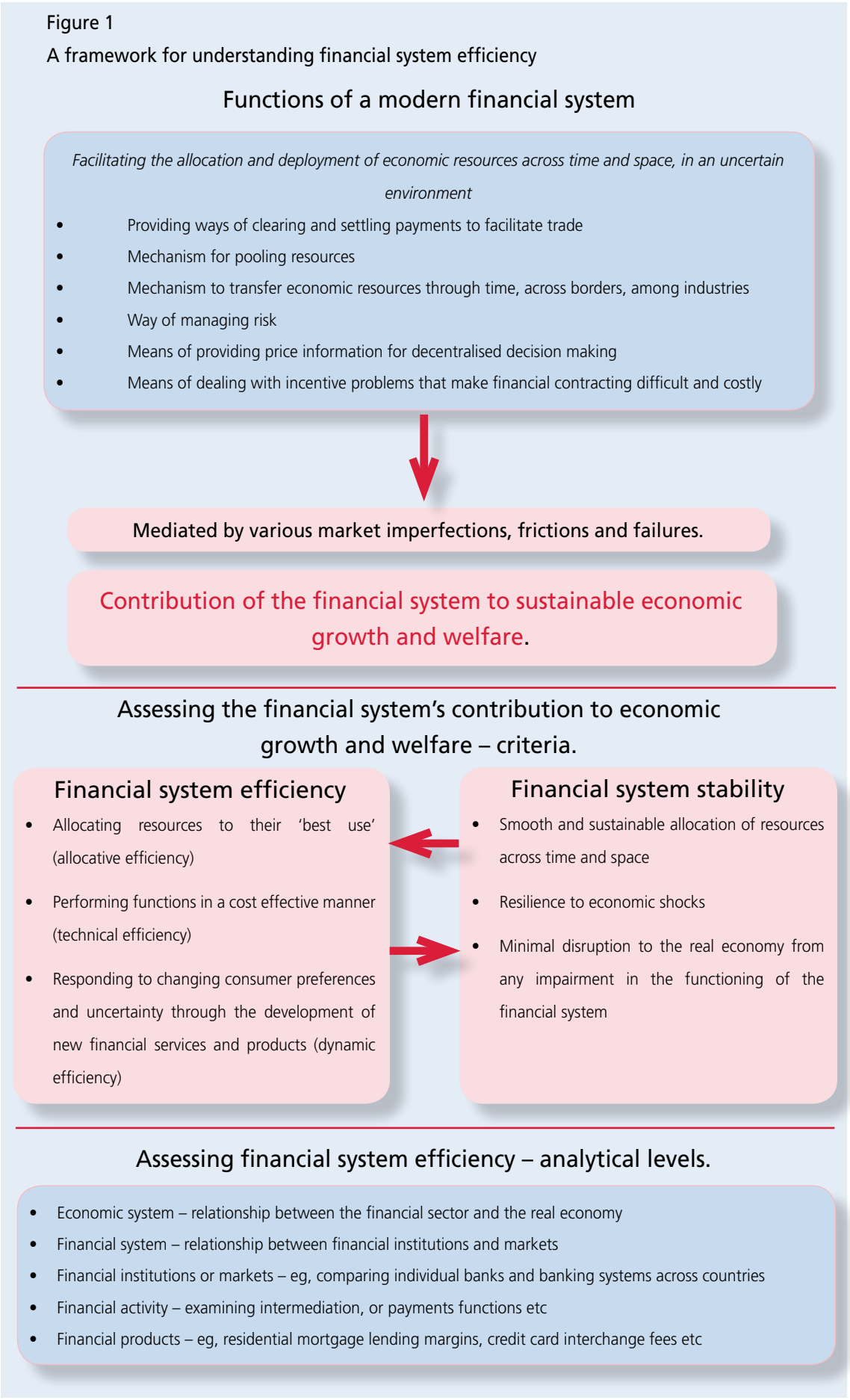
The *allocative* criterion refers to the degree to which the financial system helps direct an economy's scarce resources towards sectors with high returns and withdraw them from sectors with poor prospects. In principle, financial markets and institutions help this process and hence contribute to economic growth. Financial markets (such as equity markets) identify good investments directly through the price information contained in financial products that are traded in secondary markets, while financial intermediaries (banks and other financial institutions) provide an important screening and monitoring function as they lend out funds to borrowers.

In an advanced economy, prices generally provide the signalling mechanism that facilitates (re)allocation of society's resources. Prices that incorporate all available information, including risk, are more likely to produce allocatively efficient outcomes. However, as the global financial crisis has underlined, market prices can at times under-price risk, thereby distorting allocation. This appears to have been the case in the US in the subprime housing market in the lead-up to the crisis and in parts of New Zealand's property development sector serviced by finance companies in recent years.

The *technical efficiency* criterion refers to the provision of financial products and services at least cost. A competitive and efficient financial system will be one where financial services and products are produced at the lowest cost with these low costs passed on to consumers. However, as discussed later, there may well be a trade-off between technical efficiency and financial system stability. A competitive dynamic that results in razor-thin profit margins for financial institutions might not be optimal for financial stability if institutions

Figure 1

A framework for understanding financial system efficiency



have little in the way of financial buffers to absorb negative shocks. Moreover, cost-savings that compromise the quality of the financial services or products supplied by financial institutions may not be desirable.

The *dynamic efficiency* criterion refers to improvements in allocative efficiency and cost effectiveness over time, or innovations in the way the various functions of the financial sector are performed. The development of new products and services in the finance sector can be an engine of economic growth (Lerner and Tufano 2011). However, financial innovation does not always improve welfare or contribute to sustainable economic growth, particularly if it is motivated by short-term profit-seeking behaviour. The repackaging of subprime housing mortgages into tradable financial products in the US, and sold to investors all around the world, is one example of an innovation that may have ultimately undermined sustainable economic growth.

If a financial system was genuinely *fully* efficient across each of these three dimensions it would be making its maximum contribution to sustainable economc growth and welfare. However, economic theory reminds us that the conditions required for the socially optimal outcome are very stringent and unlikely to hold in practice. For example, the lack of perfect competition among the providers of financial products and services may see them extract economic rents from consumers through their market pricing, a form of social cost or inefficiency. While regulatory interventions could be employed to increase the competitive environment or to curb other market failures, the outcomes are likely to fall short of the theoretical ideal. Thus, the analytical challenge is to assess the degree of financial system efficiency, the factors that may be hindering it, and the steps that might be taken to produce incremental improvements.

Assessing financial system efficiency – levels of analysis

The conceptual framework outlined above can help us to think about financial system efficiency in the New Zealand context but does not provide a single quantifiable metric to assess how efficient the financial system might be.

Ideally, the assessment of efficiency would be conducted at the level of the *economic system* as a whole. This would focus on the relationship between the financial sector and the real economy and the extent to which the financial system might be helping to maximise economic performance. Economists have for many years focused on the relationship between a country's *financial development* and its economic growth and, in the mid-1990s, an empirical literature began to emerge.[5]

This cross-country literature has found a clear positive correlation between the basic level of financial system development – proxied by a number of banking system and stock market metrics related to size, activity and efficiency – and long-run economic growth. Underdeveloped banking and capital markets appear to retard economic growth, as the financial system is not able to effectively perform the six functions listed in figure 1. This empirically-based literature usually concludes that the basic channel is through improved allocative efficiency, as more developed financial systems do not necessarily have a higher level of investment or capital accumulation relative to less developed systems (Wurgler 1998). Alas, whilst relevant for the study of developing economies, the relatively crude approach adopted in the financial development literature provides limited insights into the complex issues influencing efficiency in advanced economies.

The next level down is an assessment of efficiency at the *financial system* level. This can include an examination of the efficiency outcomes from different institutional arrangements such as bank-dominated systems rather than systems that rely more heavily on securities markets. This approach is of relevance to New Zealand, where the financial system is bank-dominated with small and underdeveloped equity and corporate bond markets. Typically, the "capital markets provide low cost arms-length debt or equity finance to a smaller group of firms able to obtain such finance, whereas financial intermediaries such as banks offer finance at a higher cost reflecting the expenses of uncovering information and ongoing monitoring" (Claus, Jacobsen, Jera 2004, p. 6). However, banks and capital markets are

[5] **See for example: Beck and Levine (2000), Demirguc-Kunt and Levine (2008) and Wurgler (1998).**

not pure substitutes for one another, as large banks often underwrite debt issuance in corporate bond markets and provide a range of other services for financial market participants not necessarily directly available from the capital markets themselves.

The empirical evidence suggests that, for a given level of financial development, differences in financial structure do not help explain cross-country differences in long-run economic performance. Beck and Levine (2000) argue that firms that are heavy users of external financing (from banks or borrowing from capital markets) grow faster in countries with higher overall financial development, but the structure of the financial system per se does not explain any differences in new firm formation and patterns of industrial growth. The legal system and the ability to protect property rights might be more important for economic development than whether the financial system is either bank or capital markets based.

Drilling down further, efficiency can also be evaluated through an *institutional or sectoral* lens. For example, individual New Zealand banks can be compared to each other, or the New Zealand banking system can be compared with other jurisdictions. Likewise, one can assess the efficiency of non-bank deposit-takers, the insurance sector or particular markets. Indeed, most financial sector efficiency research appears to be of this type, with numerous studies aimed at assessing the efficiency of individual banks or sets of banks. These studies use techniques ranging from simple balance sheet ratios to more sophisticated statistical and econometric techniques.[6]

Another approach in assessing efficiency is to examine the various *financial activities or functions* provided by the financial system. For example, one could look at the wedge between what financial institutions and markets pay for funding and what they charge borrowers in the form of lending rates – the cost of financial intermediation. A lower wedge would usually suggest a more competitive environment and a more efficient outcome.

Finally, one could compare the cost, availability and quality of individual *financial products and services* in New Zealand, or in a cross-country perspective. From a dynamic viewpoint, we might ask whether the financial system is missing any particular financial products that might be necessary to improve the system's contribution to economic performance. All else equal, specific products and services (eg home loan lending products, credit cards, internet banking services etc) that are provided at least cost may be consistent with more efficient outcomes. However, as noted above, a relatively 'cheap' product may not be socially optimal if it arises due to unsustainable competition, or a subsidy of some kind.

[6] See, for example: Banker and Cummins (2010) and Berger and Humphrey (2000).

4 Competition, efficiency and stability – theory and evidence

Competition and efficiency

A key assumption that is usually made when discussing the structure and efficiency of the financial system (or indeed most markets in general) is that a more competitive environment will produce the preconditions necessary for efficiency – that is, improved allocative efficiency; products and services being produced at lower cost; and a dynamic financial system that is able to innovate over time.[7] This basic premise has guided financial deregulation based on lowering entry and exit barriers in any given market, the liberalisation of product markets and the removal of restrictive trade practices across most industries, including the finance sector since the mid-1980s.

The assumed link between competition and efficiency provides a rationale for policies to improve financial system performance by enhancing the competitive environment, particularly in financial systems that are characterised by a high degree of concentration, such as New Zealand's. High profits and a concentrated market structure are often viewed as markers of an uncompetitive market and an inefficient outcome. High or 'supernormal' profits are usually seen as imposing higher costs on customers relative to the case under more competitive conditions.[8]

[7] For a useful overview of the relationship between competition and financial system efficiency see: Amel *et al* (2004) and Claessens (2009).

[8] The generation of these supernormal profits or rents based on market power might also reduce the incentive for firms to manage operating costs – the so-called 'quiet-life hypothesis'.

However, there are several possible objections to this viewpoint. First, a market may be dominated by a few large firms simply because they are the best at what they do and have out-competed their rivals, gaining market share as a result. Second, the 'natural monopoly' argument suggests that large firms can generate cost savings and efficiency gains through economies of scale, by engaging in a broad range of activities or by operating across borders (economies of scope). Paradoxically, policies that break up these large firms, or policies preventing mergers and acquisitions, may actually reduce efficiency in a given industry.[9] Third, there is an argument that dynamic efficiency – the ability of a firm to innovate – requires a degree of market power to compensate these firms for the large costs typically associated with innovation and product development.

Moreover, it is possible that market structure is less important for efficiency than the various barriers to entry and exit to that market. The threat of entry to the market by potential new players may influence the behaviour of incumbents. These barriers include not only formal regulatory barriers but informal ones related to switching costs, for example. Switching costs are the range of costs associated with transferring banking or financial relationships (Matthews, Moore and Wright 2008). These costs, which can have both financial and non-financial dimensions (such as breaking a long-standing personal relationship with a financial provider) may be an important barrier to entry. New entrants may be unable to spur an increase in competition if customers are unwilling to switch. This issue has been one point of focus for the Australian Senate Inquiry into Banking Competition. The Australian Government is currently examining the feasibility of full bank account number portability to reduce switching costs and enhance competition.

Thus, competition can potentially exist in heavily concentrated markets if these markets remain contestable, as might be the case for New Zealand's banking system, which is dominated by four large banks. Conversely, a market with many institutions need not be competitive if switching costs remain high.

Efficiency and stability

There is no clear and unambiguous relationship between financial system efficiency and stability in either the theoretical or empirical literature.[10] At times, stability and efficiency appear to conflict with one another, whereas in other circumstances a more efficient financial system is associated with greater financial stability.[11]

Central to the view that more competition will produce greater financial system instability is the argument that financial institutions have franchise or charter value based on their market share and underlying profitability. Banks endeavour to protect this implicit value by not engaging in riskier lending. High profits serve as a buffer against potential losses. Anything that increases competition erodes the market power of incumbent institutions, reducing profit margins and hence franchise value. When this franchise value is low, banks have greater incentive to engage in potentially riskier activity to increase their rate of return – behaviour that may undermine the stability of the financial system.

Empirically, the higher incidence of financial crises since financial deregulation and liberalisation in many countries in the mid-1980s supports the view of a trade-off between greater competition and financial stability. This trade-off also works the other way. Efforts to maintain or enhance the safety and soundness of the financial system may reduce competition and efficiency, by adding to the costs faced by financial institutions, which they may pass on to their customers through higher fees or higher lending rates.

Conversely, efficiency and stability could move together in some circumstances. For example, in a market characterised

[9] However, this argument might be overstated. Many empirical studies find that economies of scale may be exhausted at an early stage, given the inherent difficulty in managing large and complex organisations or if the geographical scope of operations is large (Amel *et al*, 2004). Haldane (2010) makes a similar point, arguing that the alleged costs (from diseconomies of scale) from reducing the size and complexity of large financial institutions to improve financial system stability are overstated.

[10] For a review of this literature see: Beck (2008), Beck *et al* (2010), Berger, Klapper and Turk-Ariss (2008).

[11] See Berger, Klapper and Turk-Ariss (2008) for a discussion of the competing *competition-fragility* and *competition-stability* hypotheses, used to describe the complex relationship between stability and efficiency.

by a few large banks that are widely considered 'too-big-to-fail', the owners and managers of those banks may engage in risky lending behaviour under the expectation that such activities will be underwritten by the government in the form of a future bailout. This is likely to be both inefficient, since these banks have a competitive advantage over their rivals, and potentially destabilising for the system as a whole.

Periods of financial distress and crises are likely to be inherently inefficient, since the economy is likely to be operating below capacity, with financial institutions deleveraging and restricting their lending to creditworthy firms and households. Moreover, the boom that invariably precedes the bust is typically associated with over-investment and over-borrowing when risk is under-priced, indicative of a fundamental misallocation of resources.

5 Assessing the efficiency of the New Zealand financial system

As emphasised above, explicitly measuring financial system efficiency is challenging, given its multifaceted nature, and it is not possible to arrive at one definitive measure. At best, we can hope to glean a mix of qualitative insights and some quantitative measures across a number of analytical levels described in section 3.

Most existing studies of New Zealand financial system efficiency have been fairly piecemeal, focusing mainly on issues surrounding the banking sector, given its dominant role within the financial sector.

At least prior to the crisis, these studies painted a fairly sanguine picture of the efficiency of the banking sector. Analysis by NZIER (2002) found that the markets related to lending and borrowing were more or less competitive, while the markets for some transaction services (surcharge rules on credit cards, for example) did have some competitive issues. NZIER (2004) found that the New Zealand banking market was fairly competitive despite a high level of concentration, a finding supported by Chan, Schumacher and Tripe (2007).

Using quantitative techniques to assess the relative efficiency of New Zealand's banks, Tripe (2004 and 2007) found that the major New Zealand banks were at least as efficient as their Australian parents. However, this analysis was based on a ranking of individual banks against one another and thus does not necessarily reveal much about the efficiency of the banking system in an absolute sense.

The results of such analyses, moreover, relate only to the time period over which they are conducted. Thus, although OECD (2006) concluded that formal regulatory barriers to entry and exit are low in New Zealand, contestability within the financial system could well have changed since the financial crisis and as a result of the contraction that has occurred within the domestic finance company sector. The predominant position of the big four banks in the New Zealand financial system has arguably increased as a result of these events.

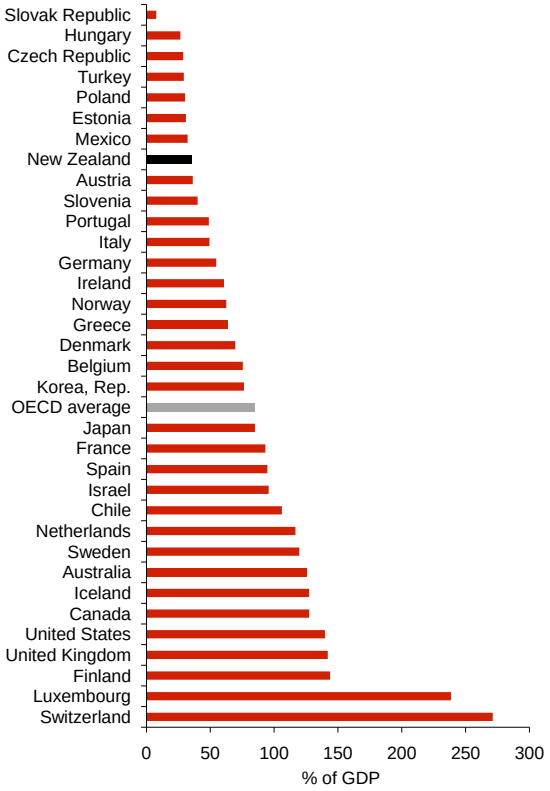
Looking beyond institutions raises broader efficiency questions for New Zealand. For example, there have been a number of policy-related papers questioning the role of the financial sector in facilitating economic growth and improvement in living standards (Cameron *et al* 2007, CMD Taskforce 2009, Savings Working Group 2011). Situated within the highest level of analysis described in section 3, this work has suggested that "among other factors, a lack of savings and financial development may be constraining growth and the productivity performance of New Zealand firms" (Cameron *et al* 2007, p. 2). Specifically, concern has been directed at New Zealand's small equity (figure 2) and corporate bond markets, which lack depth and liquidity and may be a factor impeding the formation of new firms and economic development in general.[12]

[12] **Improving the functioning of New Zealand's capital markets has also been identified as a goal of the recently established Financial Markets Authority (FMA), primarily through ensuring investor confidence and the enforcement of a clear set of rules governing market behaviour. The Reserve Bank also contributes to the functioning of financial markets through its domestic market operations and foreign reserves management, aspects of which have helped to create liquidity in various markets.**

Figure 2

Stock market capitalisation – OECD comparison

(average 2000–09)



Source: World Bank Financial Structure database (updated November 2010).

6 The efficiency of the New Zealand banking system – a preliminary investigation

The concentrated nature of the New Zealand banking system raises questions over the level of competition in the New Zealand market. This concentration would be of concern if it allowed banks in New Zealand to maintain excessive margins on lending or high fees on other products. The Reserve Bank has recently been assessing the profitability of the New Zealand banking system and the cost of financial products. The first strand of this work has been to compare balance sheet data on the New Zealand banking system with that of other banking systems to get an idea of the various costs and profit margins that are built into banks' pricing of financial products. The second strand has been to directly compare the pricing on individual financial products across countries.

Balance sheet ratio analysis

Comparing balance sheet ratios across countries can give some insight into the efficiency of the banking system and relative rates of return. However, such comparisons are fraught with difficulties. For example, differences in product mix and capital and funding structures can result in material differences in observed ratios that are unrelated to the efficiency of the system (see Vittas 1991 for a discussion of some of the factors that can affect these ratios). In addition, differences in accounting standards, particularly around the treatment of goodwill, can affect the measurement of various ratios.[13] At best, such analysis can merely point to differences between banking systems that may merit further investigation.

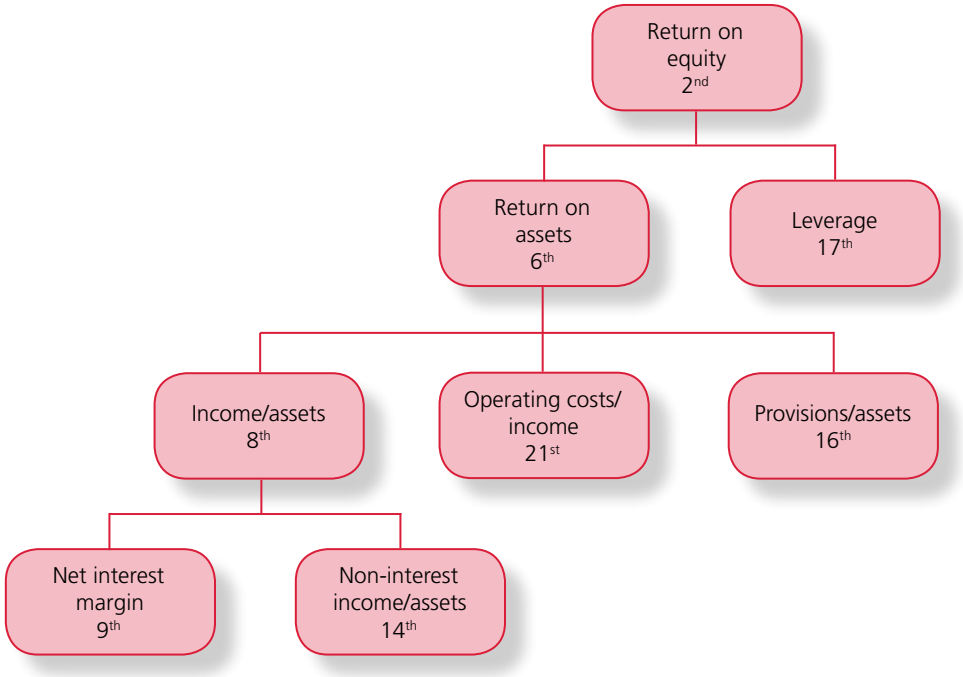
From figure 3, it can be seen that the return on equity (ROE) in the New Zealand banking system appears to have been very high by OECD standards (see figure 4 for a full ROE comparison by country). From an accounting point of view, the high New Zealand ROE appears to be explained by relatively low operating costs as a share of income, and relatively low loan losses. In many ways, this reflects the low risk profile of the New Zealand banks' loan books and the traditional nature of the New Zealand banking system. New Zealand banks mostly focus on core banking activities, with relatively less securitisation, insurance and investment banking activity than international counterparts. These less traditional activities tend to entail higher cost structures and correspondingly higher fees. It appears that the New Zealand banks have been able to earn relatively high net interest margins and non-interest income despite the low-risk, traditional nature of the banking system.

[13] **Goodwill usually appears on the balance sheet of a bank following a merger or acquisition, and reflects the difference between the book value and the purchase price of the acquired firm. Where goodwill is recorded on the bank balance sheet, this will boost the measured level of equity, and hence lower observed returns on equity. In New Zealand, only ANZ National Bank Ltd has significant amounts of goodwill on their balance sheet, as a result of the merger between ANZ and National bank. For the purposes of this comparison, the goodwill has been removed from the ANZ National Bank Ltd numbers.**

Figure 3

Decomposition of ROE: New Zealand banks' ranking relative to 22 OECD countries

(2002–07 averages)



Source: OECD, Australian Prudential Regulation Authority, RBNZ calculations.

Note: ROE and return on assets are both expressed in after-tax terms. This produces slightly different results than presented in the May 2011 *Financial Stability Report*, which used pre-tax returns. The sample period of 2002–07 was chosen to reflect a recent period of stability. Over a longer sample, the ROE in the New Zealand banking system still looks exceptional, but the drivers have changed over time. For example, in the early 1990s, the New Zealand banking system had very high operating costs and net interest margins, but both of these metrics have declined over time – both in absolute terms, and relative to the OECD average.

A potential explanation of the relatively high ROE in New Zealand is that it could relate to higher costs of capital facing New Zealand. Risk-free interest rates have been consistently higher in New Zealand than in most other countries, and this could account for part of the higher observed ROE in New Zealand.[14]

Measuring differences in the cost of capital across countries is difficult, and it is especially hard to compare cost of capital estimates with accounting measures of ROE, since many firms have unmeasured goodwill. Another way to determine whether high ROEs for the New Zealand banks are due to high costs of capital is to compare ROEs with other New Zealand companies.

Figure 5 compares the ROE of companies listed on the NZX 50 with those of the New Zealand banking system. Over the 2000–09 period, banks have earned ROEs around 2 percentage points higher than the NZX 50 average. However, many companies have achieved much higher rates of return than the banking sector, and both the goods (mostly manufacturers) and services industries have achieved higher average returns. Nevertheless, the average profitability of the New Zealand banking system does appear somewhat high, given the relatively low volatility of returns compared to other industries.

[14] Over this period five-year risk-free rates in New Zealand were 2.1 percent higher than the OECD average. Given that, on average, banks tend to have a market value of equity that is twice as large as their book value, this difference in risk-free rates can justify as much as a 4.2 percent difference in returns on book equity.

Figure 4

Post-tax ROE

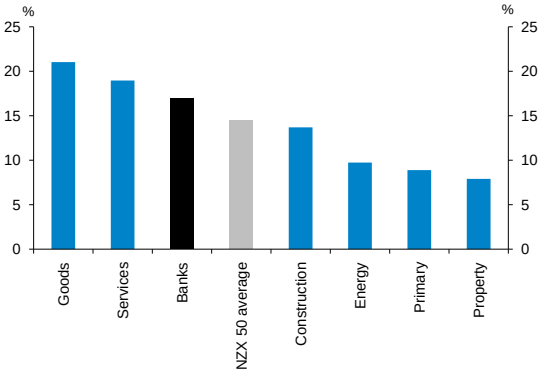
(average 2002–07)

Source: OECD, Australian Prudential Regulation Authority, RBNZ calculations.

Figure 5

ROE across industries

(average 2000–09)



Source: Bloomberg, RBNZ calculations, OECD.

Note: Only firms that are listed on the NZX 50, based in New Zealand, and have data available for the full 2000–09 period have been included in this sample. The sample comprises 28 non-bank firms.

Another potential explanation of the high returns on equity in the New Zealand banking system is the degree of support that the major New Zealand banks receive from their Australian parents. This allows them to maintain lower capital levels than would otherwise be the case to maintain their credit ratings. Nevertheless, the capital ratios of New Zealand subsidiary banks are similar to those of the Australian parents, and it remains an open question why the Australasian banking system as a whole has been relatively profitable.

Product level comparison

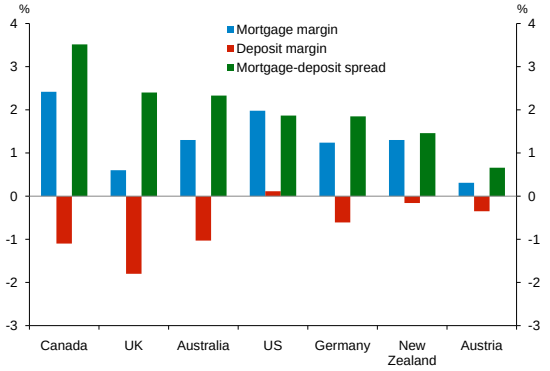
Given the difficulties of comparing balance sheet ratios across countries, an alternative is to compare the pricing of individual financial products. However, differences in financial services across countries, as well as a lack of data, make it difficult to perform comparisons for many products. The simplest products to compare are residential loans and retail savings, as these products tend to be relatively similar across countries and data are widely available. Figure 6 shows average mortgage and deposit rates for maturities of around two years relative to benchmark interest rates in a number of countries. On average, New Zealand mortgage interest rates have been priced at a similar margin to swap rates as in the other countries in the sample. However, New Zealand deposit rates have been more generous than average at only a small discount to swap rates. Overall, the margin between lending and deposit rates has been relatively low in New Zealand, which suggests that high profitability has not been due to banks earning excessive interest margins on either of these products.[15]

[15] Since 2009, there has been a major structural break in how both loans and retail deposits have been priced relative to swap rates in a number of countries, reflecting rising bank funding costs relative to benchmark rates. This has been particularly pronounced in New Zealand, with both products now being priced at a larger margin to swap rates than in most other countries. However, the spread between lending and deposit rates has remained relatively constant and comparatively low in New Zealand in the post-crisis period.

Figure 6

Mortgage and deposit interest margins

(spread to swap rates)



Source: Bloomberg, Interest.co.nz, Bank of Canada, Reserve Bank of Australia, Haver Analytics.

Note: Mortgage interest rates are for a standard mortgage with a fixed term of 2-3 years. Deposit interest rates are for a deposit roughly equivalent to NZ$10,000 for 2-3 years. Data definitions vary slightly across countries.

7 Conclusion

The efficiency of the financial system can have an important bearing on a country's economic performance and can be influenced by a broad range of factors, including competition within the financial system. However, financial system efficiency is a complex economic concept and measuring it can be extremely challenging – both quantitative and qualitative analysis is required.

A simple cross-country comparison reveals that, over the past two decades, the New Zealand banking system appears to have achieved high rates of return on equity by international standards, which serves as a useful prompt for questions about the efficiency and competitive structure of the financial system. However, as noted, a fully convincing explanation of this result remains elusive.

Reflecting its legislative mandate, the Bank will continue to research matters relating to both the soundness and efficiency of the financial system and report on them in its regular *Financial Stability Reports* and future *Bulletin* articles.

References

Amel, D *et al* (2004), "Consolidation and efficiency in the financial sector: a review of the international evidence", *Journal of Banking and Finance*, 28, pp. 2493-2519.

Angelini, P *et al* (2011), "BASEL III: Long-term impact on economic performance and fluctuations", *BIS Working Papers* No. 338, February.

Banker, R and D Cummins (2010), "Performance measurement in the financial services sector: Frontier efficiency methodologies and other innovative techniques", *Journal of Banking and Finance*, 34, pp. 1413-1416.

Beck, T (2008), "Bank competition and financial stability: friends or foe?", *World Bank Policy Research Working Paper* 4656, June.

Beck, T and R Levine (2000), "New firm formation and industry growth: does having a market- or bank-based system matter?", *World Bank Policy Research Working Paper* 2383, June.

Beck, T *et al* (2010), *Bailing out the banks: reconciling stability and competition – analysis of state-supported schemes for financial institutions*, (CEPR).

Berger, A, L Klapper and R Turk-Ariss (2008), "Bank competition and financial stability", *World Bank Research Working Paper* 4696, August.

Berger, A and D Humphrey (2000), "Efficiency of financial institutions: international survey and directions for future research", in P Harker and S Zenios (eds), *Performance of financial institutions: efficiency, innovation, regulation* (Cambridge University Press), pp. 32-92.

Cameron, L *et al* (2007), "New Zealand financial markets, savings and investment", *New Zealand Treasury Policy Perspective Paper* 07/01, October.

Chan, D, C Schumacher and D Tripe (2007), "Bank competition in New Zealand and Australia", paper presented at the 12th Finsia-Melbourne Centre for Finance Studies Banking and Finance Conference, 24-25th September.

Claessens, S (2009), "Competition in the financial sector: overview of competition policies", *IMF Working Paper* 09/45.

Claus, I, V Jacobsen and B Jera (2004), "Financial systems and economic growth: an evaluation framework for policy", *New Zealand Treasury Working Paper* 04/17, September.

CMD Taskforce (2009), *Capital markets matter: report of the Capital Market Development Taskforce*, December.

Demirguc-Kunt, A and R Levine (2008), "Finance, financial sector policies and long-run growth", *World Bank Policy Research Working Paper* 4469, January.

Haldane, A (2010), "The $100 billion question", speech at the Institute of Regulation and Risk, Hong Kong, 30 March.

Lerner, J and P Tufano (2011), "Consequences of financial innovation: a counterfactual research agenda", *NBER Working Paper* 16780.

Matthews, C, C Moore and M Wright (2008), "Why not switch? Switching costs and switching likelihood", paper presented at the 13th FINSIA-Melbourne Centre for Financial Studies Banking and Finance Conference, Melbourne 29-30 September.

Merton, R and Z Brodie (1995), "A conceptual framework for analyzing the financial environment", in D Crane (ed) *The global financial system: a functional perspective,* Harvard Business School Press, Boston, pp. 3–12.

Morrell, K (1990), "Banking supervision – an overview", Reserve Bank of New Zealand *Bulletin*, 53(3), pp. 270–276.

NZIER (2002), *Competition and efficiency in banking services: some economic perspectives on New Zealand conditions – report to the RBNZ*, March.

— (2004), *The performance of the New Zealand banking sector: report to the Reserve Bank of New Zealand*, 26th November.

OECD (2006), *Competition and regulation in retail banking*, Policy Roundtables.

Savings Working Group (2011), *Saving New Zealand: Reducing vulnerabilities and barriers to growth and prosperity – final report to the Minister of Finance*, January.

Tripe, D (2007), "The relative efficiency of banks, taking into account a customer satisfaction rating", paper presented at the 20th Australasian Finance and Banking Conference, October.

— (2004), "Efficiency in integrated banking markets – Australia and New Zealand", RBNZ Workshop Financial Stability and Banking, 27 April.

Vittas, D (1991), "Measuring commercial bank efficiency: Use and misuse of bank operating ratios", *World Bank Working Paper* No 806.

Wurgler, J (1998), "Financial markets and the allocation of capital", *Yale ICF Working Paper* No 99.

New Zealand's emergency liquidity measures during the global financial crisis[1]

Enzo Cassino and Aidan Yao

This article discusses the steps taken by the Reserve Bank to alleviate market stress and maintain market functioning during the international financial crisis of 2007–09. Our statistical analysis suggests that the emergency liquidity policies introduced during the crisis period narrowed bank funding spreads in the domestic money market by 5-7 basis points, on average, per announcement. We also find some evidence that these policies helped to reduce the volatility of money market spreads. Collectively, these policies had a material cumulative impact, probably going well beyond the simple announcement effects on money market conditions captured by our formal analysis. This is because some of the policies were taken deliberately in a pre-emptive manner, and more generally they helped to limit broader disruption to the economy's access to credit during the recession.

1 Introduction

Money markets around the world came under gradually increasing stress from August 2007, with stress indicators peaking at unprecedented levels shortly after the collapse of Lehman Brothers in September 2008. Market liquidity dried up and borrowing margins rose sharply.

The New Zealand money market is an important source of short-term funding and pricing of loans and credit for financial institutions and large corporates. It was significantly affected by the offshore developments during the crisis period.

The Reserve Bank of New Zealand acted swiftly to limit the pressures in local markets by introducing a wide range of emergency liquidity facilities between the second half of 2007 and early 2009. This article discusses some of these facilities and the impact they had on market conditions in New Zealand. In attempting to formally measure the effectiveness of these policies, our study focuses on the announcement effect; i.e., the immediate market reaction after the policies were announced. Our results suggest that the actions undertaken by the Reserve Bank helped to significantly reduce both the level and volatility of money market spreads, and, more generally, helped to limit the adverse impact of the offshore financial stresses on domestic monetary and credit conditions.

[1] We thank Michael Reddell, David Drage and Ian Nield for helpful comments and suggestions, and Suzanne Harach for assistance with the data.

2 Background

New Zealand money market before the crisis

The most commonly traded instruments in the New Zealand money market are bank bills, which are short-term securities issued by banks operating in New Zealand. The interest rate on 90-day bank bills – the most frequently traded maturity – is an important reference rate in pricing many corporate credit facilities, especially interest rate swaps. Prior to the crisis, the 90-day bank bill rate was a key benchmark indicator of banks' cost of funds and a major influence on the pricing of, for example, floating rate mortgages. In addition, major corporates issue short-term commercial paper which, at least prior to the crisis, typically traded at yields very close to those on bank bills.

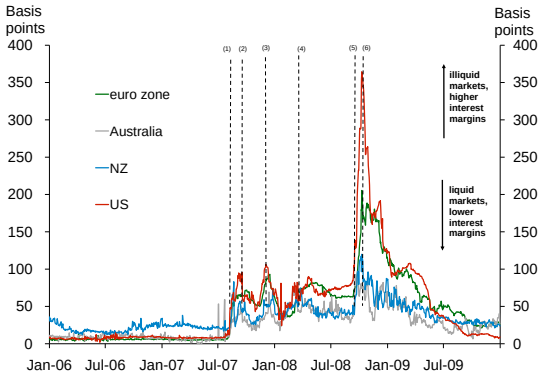
Bank bill rates can be thought of as having two components: a risk-free monetary policy rate component and a bank risk component. The average monetary policy rate (the Official Cash Rate, OCR) expected over the maturity of the bank bill can be proxied by the interest rates on Overnight Indexed Swaps (OIS).[2] The spread between the bank bill and OIS rate – the risk component – represents the credit and liquidity risk associated with lending to banks. Historically, these

[2] An OIS is an interest rate swap where the periodic floating rate of the swap is equal to the geometric average of the OCR (as set by the Reserve Bank, and paid on balances held at the Reserve Bank) over every day of the payment period. In NZ, the OIS pricing is commonly used to extract market expectations for monetary policy in the near term. For a more detailed discussion on OIS and the market, see Choy (2003).

bank bill–OIS (BB-OIS) spreads were broadly stable, tracking around 20-40 basis points in New Zealand before the financial crisis. These spreads were slightly higher than those in offshore markets, probably reflecting a lack of liquidity in smaller New Zealand markets (figure 1).

Figure 1

Short-term money market spreads*



Source: Bloomberg, RBNZ.

* Spread between 3-month interbank rates – LIBOR for the US and euro zone, bank bill rates for New Zealand and Australia – and 3-month OIS rates.

Notes:

1) BNP Paribas suspended redemptions from two of its funds.
2) Problems at Northern Rock emerged.
3) US investment banks started to report write-downs.
4) Bear Stearns sold to JP Morgan.
5) Lehman Brothers filed for bankruptcy.
6) AIG sought help from the government, Washington Mutual collapsed.

Global money market developments during the crisis

Pressure in global money markets increased sharply in August 2007 after BNP Paribas, a major French bank, suspended redemptions from two of its managed funds, which were heavily exposed to the US sub-prime housing market. Money markets in Europe reacted quickly to this event, with funding spreads (LIBOR-OIS) increasing sharply. Those pressures spilled quickly into other international markets, with funding spreads peaking in the wake of the bankruptcy of Lehman Brothers in September 2008 and other associated stresses. Many banks and other financial institutions stopped doing business with each other, fearing the unknown degree of counterparty risk. That in turn resulted in a sudden evaporation of liquidity in funding markets, including key international commercial paper markets that New Zealand and Australian banks relied on.

Central bank responses to the money market crisis

Central banks reacted quickly to the emerging and worsening stresses in financial markets. The European Central Bank (ECB) intervened heavily from the start, and adjusted liquidity conditions actively to steer the key overnight interest rate, the Euro Overnight Interbank Average (EONIA) rate, towards the policy rate. ECB analysis suggests this policy was effective in narrowing the spread between the overnight rate and the policy rate by 23 basis points (Cassola and Huetl 2010). In addition, increased open market operations conducted by the ECB to provide sufficient liquidity to the banking system during the crisis were also found to be effective in lowering the short-term money market interest rates (Euribor rates) by at least 100 basis points (Abbassi and Linzert 2011).

In the US, the Federal Reserve introduced two main policy initiatives targeting the money market: the Term Securities Lending Facility (TSLF) and Term Auction Facility (TAF). The TSLF aimed at increasing the supply of Treasury collateral in order to meet investors' safe-haven demand, dampening pressure on 'repo' interest rates.[3] The TAF, on the other hand, expanded the term of liquidity offered by the Federal Reserve to eligible institutions, and increased the frequency of credit auctions. Federal Reserve research suggests these emergency liquidity facilities provided relief to the money market and helped to reduce funding costs during the market turmoil (Wu 2010, Hrung and Seligman 2011).[4]

[3] A repurchase or 'repo' agreement is one in which one party sells a security at a specified price to another party with an agreement that the security will be repurchased at a fixed price on a specified future date. Many central banks use repo operations to manage liquidity in the economy.

[4] In addition to the policy measures targeting the short-term money market, major central banks, such as the Federal Reserve, ECB and Bank of England (BoE) also introduced large-scale asset purchase (LSAP) programmes. These programs devoted significant resources to buying long-term assets, aimed at providing additional monetary stimulus to the economy after having exhausted all their conventional policy tools, with policy rates close to zero. While there has been considerable controversy about the impact of these measures, research from the Federal Reserve and the BoE suggests the announcement effects of these policies generated desirable financial market reactions. For more detail see Gagnon *et al* (2010), Neely (2010) and Joyce et al. (2010).

Table 1[5]

Estimated impact of selected emergency liquidity measures by major central banks

Central banks	Programmes	Research paper	Key results
ECB	Frontloading policy	Cassola and Huetl (2010)	Policy reduces overnight interest rate (EONIA) by 23 basis points (bps).
	Increase open market operations	Abbassi and Linzert (2011)	Policy reduces Euribor rates by at least 100bps.
Fed	Term Securities Lending Facility (TSLF)	Wu (2010)	Each $1bn increase in TSLF narrows the Fed Funds-Repo spread by 1.2bps.
	Term Auction Facility (TAF)	Hrung and Seligman (2011)	TAF reduces 3-month LIBOR-OIS spreads by 50-55bps.
RBA	Term repurchase	Kearns (2009)	Each $1bn increase in term repo reduces BB-OIS spreads by 1.82bps.
	Liquidity injection		Each $1bn increase in bank balances reduces BB-OIS spreads by 2.5bps.

The Reserve Bank of Australia (RBA) responded to the crisis by expanding the range of securities accepted as collateral in its open market operations, extending the term of repos, and increasing the supply of deposits for banks at the RBA. These policy initiatives helped restore confidence in the money market, and resulted in narrower BB-OIS spreads.

Table 1 provides a summary of some of these facilities and their estimated impact on money market conditions.

New Zealand money market during the crisis period

Pressure in the New Zealand money market also emerged from August 2007.[6] While New Zealand banks had little or no direct exposure to the sorts of 'toxic' assets that caused problems for offshore banks, fears of indirect exposure through counterparties saw local banks become increasingly cautious about who they lent funds to, and preferred to hold on to cash in their accounts at the Reserve Bank. The increased reluctance to hold each other's bills led to a rise in money market interest rates relative to the OCR.

The Reserve Bank's response to the money market crisis

The increase in local money market pressure appeared to result from higher liquidity risk, driven in turn by the overall lack of confidence in the global banking system, rather than specific concerns about the solvency of the Australasian banks. This was reflected, for example, in the relatively small increase in the credit default swap (CDS) spreads on the debt of Australian parents of New Zealand banks, compared to those of international banks (figure 2, overleaf). These increased market stresses threatened to materially tighten monetary and credit conditions in New Zealand, jeopardising banks' confidence in continuing access to credit.

In response, the Reserve Bank increased the amount of cash available in the banking system (figure 3, overleaf).[7] But as the pressure intensified, a suite of additional emergency measures was introduced, aimed at boosting liquidity and

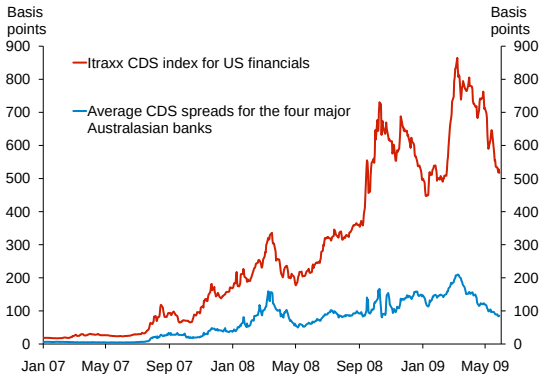
[5] Table 1 captures only the measures with available research. For more comprehensive discussions of policy measures, including analysis of longer-term asset purchase programmes, see Abbassi and Lizert (2011) for the euro zone, Hrung and Seligman (2011) for the US, Fisher (2009) for the UK, and Kearns (2009) for Australia.

[6] In addition to BB-OIS spreads, bank funding premiums through other channels, such as offshore LIBOR markets and foreign exchange swap markets also increased sharply and become more variable during the crisis.

[7] Since adopting a 'cashed-up' liquidity management regime, the Reserve Bank can routinely adjust the level of settlement cash in the system according to changes in market conditions (Nield 2008). Such a system made it easy for the Reserve Bank to respond to the financial crisis by injecting more liquidity into the system when demand for cash was high.

Figure 2

Five-year CDS spreads

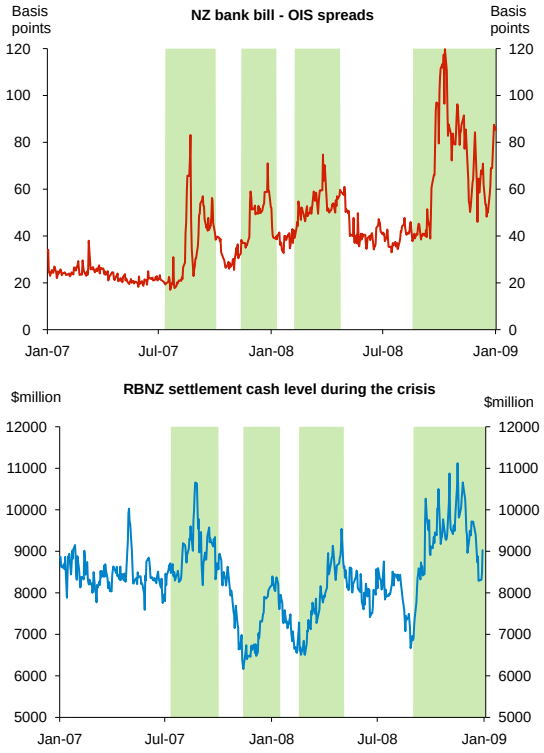


Source: Bloomberg, Reuters.

Figure 3

Indicators of domestic market liquidity

(shaded periods indicate when the RBNZ increased settlement cash level to counteract rising money market pressure)



Source: Bloomberg, RBNZ.

maintaining confidence in the money market. Table 2, opposite, provides a summary of these policies and dates of the announcements.

The first set of discretionary measures, announced in August 2007, was intended to keep short-term wholesale interest rates in line with the intended stance of monetary policy, as reflected by the OCR, and to ensure that the secondary market in 90-day bank bills remained functioning. Bank bill rates, which were typically 20-30 basis points (bps) above OIS rates immediately before the crisis, had risen to more than 80 bps above OIS rates in August 2007, significantly tightening monetary conditions in New Zealand.

As confidence in the bank bill market deteriorated in mid-2007, local banks were increasingly reluctant to hold each others' bills, as they were concerned that they might not be able to sell them if they needed liquidity. The Reserve Bank responded by broadening the range of securities it accepted as collateral in its overnight lending facility to once again include New Zealand bank bills,[8] in addition to New Zealand government Treasury bills and bonds. Local banks took advantage of this expansion, and over 40 percent of the total collateral posted in 2007 was in bank bills (see Figure 4). If only the operations over the period August-December 2007 are considered, the percentage share of bank bills rises to almost 60 percent. The collateral expansion helped to improve confidence in the bank bill market and contributed to a recovery in bill issuance over the second half of 2007.

BB-OIS spreads fell immediately after the August announcement, and continued to trend lower in the following months. However, as an increasing number of US and European financial institutions revealed deeper problems from their sub-prime exposures, money market spreads globally moved higher again around the end of the year, putting renewed upward pressure on New Zealand spreads.

By the second quarter of 2008, the Reserve Bank was focused on the risk that global short-term funding markets the banks relied on might dry up if the international situation deteriorated further. In a suite of precautionary measures announced in May 2008 the Reserve Bank decided to accept AAA-rated Residential Mortgage-Backed Securities (RMBS) created by the banks from their residential mortgage books as collateral in the liquidity operations. The significance of

[8] **Bank bills had not been acceptable collateral in any Reserve Bank operations since the changes to the liquidity management regime described in Nield (2008). Before 2006, the Reserve Bank accepted a limited amount of bank bills as collateral.**

Table 2

Reserve Bank emergency liquidity measures

Announcement date	Announced facilities	Details
(1) 23 August 2007	Bank bills accepted as collateral in overnight repo facility	Aimed at restoring confidence in the bank bill market and relieving pressure on spreads
		Bank bills accepted as collateral for overnight repo at a cost of OCR +100 basis points (margin on government collateral was 50 basis points)
	The Exchange Settlement Account Tiering regime* originally scheduled for introduction in September is brought forward	Tiering regime (limiting the amount of settlement cash on which the full OCR is paid) aims to encourage banks to hold other liquidity instruments, and not just hold cash at the Reserve Bank
(2) 7 May 2008	AAA rated Residential Mortgage-Backed Securities (RMBS) eligible as collateral	A pre-emptive action aimed at improving liquidity in the banking system, as it enables banks to turn a large and illiquid portion of their balance sheets into eligible securities to exchange for cash with the Reserve Bank
	Broaden eligible collateral to all New Zealand registered AAA-rated NZD securities and AA-rated government sector securities	Aimed at restoring confidence in broader capital markets, including corporate and local government bond markets
		All eligible securities discounted at a margin of 50 basis points above the OCR
		A graduated 'haircut' regime** taken for all collateral securities
	Extension of Overnight Reverse Repo Facility from 1 day to a maximum of 30 days	Extension of the Repo term (enabling banks to obtain funds from the Reserve Bank for up to 30 days at a time) designed to further improve market confidence about liquidity and cap rises in short-term market interest rates
(3) 29 May 2008	Further details of 7 May measures announced	
(4) 19 September 2008	Bank bills accepted as collateral in daily Open Market Operations	Aimed at facilitating liquidity injection into the system, helping to take pressure off the FX swap market, which had been the usual channel for the Reserve Bank to inject funds
	Terms of open market operations extended to up to 6 months	Aimed at easing pressure at the short end of the funding market by creating greater access to term funding
	New facility introduced making other asset-backed securities eligible as collateral	Aimed at further broadening the range of assets and institutions that have access to Reserve Bank liquidity
(5) 9 October 2008	Lending on basis of fully-secured RMBS, prior to those securities achieving formal ratings is allowed	Aimed at speeding up the process of liquefying banks' mortgage books and in turn further improving liquidity for the banking system
(6) 7 November 2008	Term Auction Facility (TAF) introduced, offering 3-, 6- and 12-month funding	TAF allows the Reserve Bank to inject cash into the banking system for longer terms on a regular basis
		TAF offers up to $2bn for terms of 3, 6 and 12 months
	Reserve Bank bill tenders to sterilise cash injected with the TAF	Reserve Bank bill tenders restarted to sterilise the liquidity injected via the TAF to maintain settlement cash at a target level while allowing banks to hold secure liquid assets
		The bill tenders typically offer up to $2bn for a term of approximately 3 months
(7) 12 December 2008	Extend the range of eligible securities to NZ government-guaranteed securities, NZ corporate securities rated BBB- or better, and NZD AAA-rated asset-backed securities	Aimed at enhancing system liquidity and easing pressures on corporate sector funding. The inclusion of corporate securities aimed to improve liquidity in the corporate debt market and make it a more attractive investment for banks and portfolio managers at a time when there were fears about business sector access to credit
		A graduated 'haircut' regime applied
		The facility offers up to $250m for terms out of approximately 3 months
(8) 13 January 2009	Tuesday OMO introduced, accepting only Corporate and Asset-Backed eligible securities	Aimed at providing more certainty around the ability to use corporate and asset-backed securities to obtain liquidity, and thereby, support corporate debt markets

* **For more information about the RBNZ's Exchange Settlement Account Tiering regime, see Nield (2008).**

** **In repurchase transactions, additional securities are usually lodged in addition to the amount required to cover the loan. This extra margin is called a 'haircut'.**

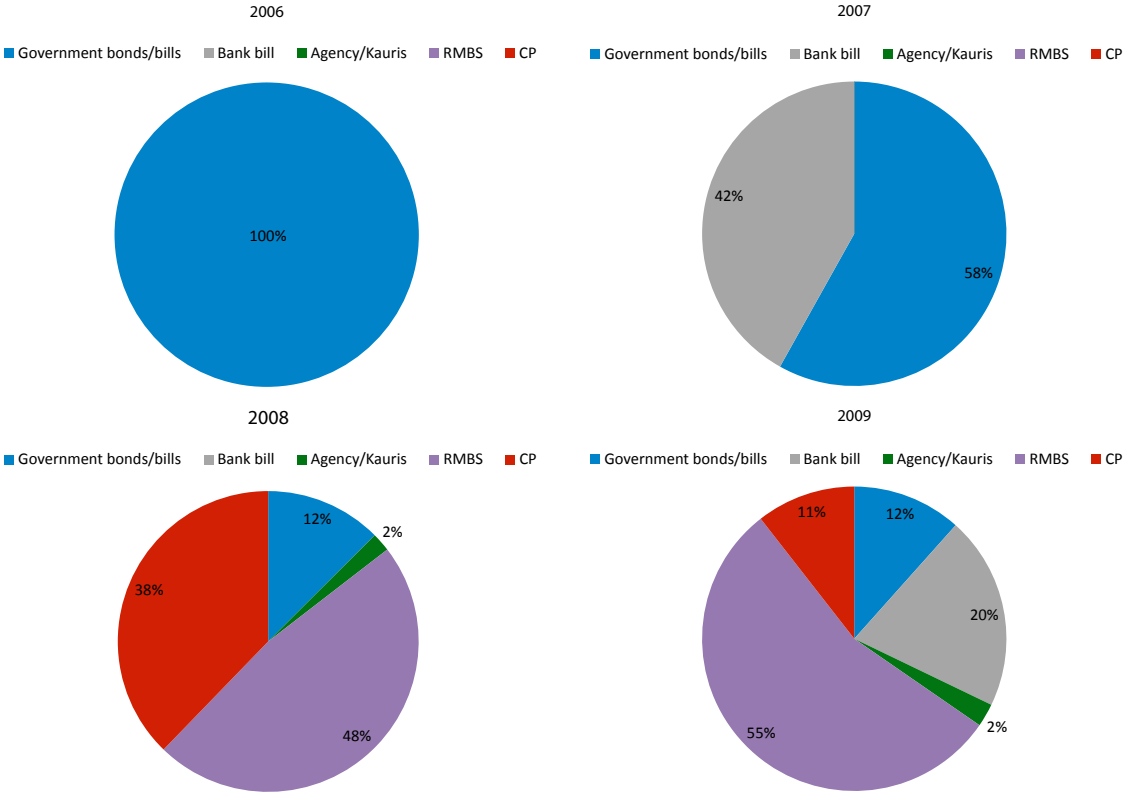
Source: RBNZ.

this unprecedented move was that it enabled local banks to transform a large and illiquid portion of their balance sheets into securities that could, if required in conditions of stress, be exchanged for cash with the Reserve Bank. In addition, access to the Overnight Reverse Repo Facility (ORRF) was extended from an overnight term to a maximum of 30 days. All these moves were explicitly described as "the result of a work programme…to help pre-position for unexpected liquidity pressures".[9]

In addition to providing direct relief to the banking sector, some of the Reserve Bank's emergency policies were also purposely designed to mitigate pressure on the access to credit of non-bank borrowers. The announcements broadening eligible collateral to include less highly-rated securities (May 2008)[10] and asset-backed securities (September 2008) were designed to boost investors' confidence in holding these assets, and assist New Zealand businesses and local governments to maintain access to credit during the market turmoil. Local banks who held these assets could temporarily swap them with the Reserve Bank for cash, effectively further increasing the range of collateral they could provide to the Bank in exchange for liquidity. Commercial Paper (CP) alone accounted for more than one third of collateral accepted in the Reserve Bank's repo and TAF operations in 2008.

After the Lehman failure in September, most international funding markets became frozen. It was very difficult for banks to raise funds longer than overnight, with the fear that access to funding could evaporate completely without notice. That uncertainty threatened to adversely affect banks' confidence in their ongoing ability to make loans to customers, resulting in a heightened risk of a severe credit crunch. In a succession of steps, the Reserve Bank took RMBS as collateral before banks had secured formal credit

Figure 4
Collateral used in Reserve Bank liquidity management operations (percentage shares)



Source: RBNZ.

[9] Reserve Bank media release "Reserve Bank announces new liquidity measures", 7 May 2008.

[10] These included commercial paper, local government securities and corporate bonds.

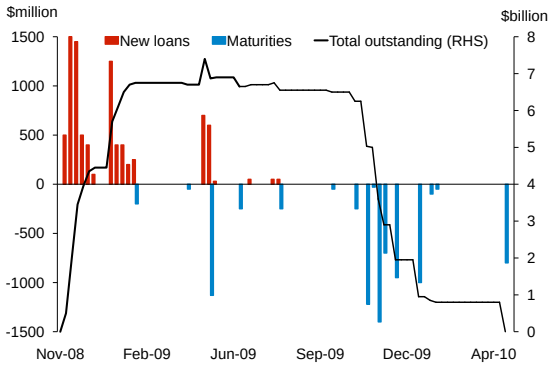
ratings on those securities; introduced a TAF to provide access to term funds at market prices; and then further widened eligible collateral. These measures were introduced quickly over a short period in response to a fast-moving situation. Over the same period, the government was also activating a wholesale funding guarantee scheme to help banks re-enter foreign funding markets.

The TAF allowed banks to borrow funds from the Reserve Bank for terms up to one year using eligible collateral as security. The range of collateral accepted in the TAF was set to be as broad as in the Reserve Bank's regular Open Market Operations (OMOs). As figure 4 shows, these expansions were heavily utilised, resulting in a much more diverse range of collateral accepted in the Reserve Bank's operations in 2008 and 2009. These supportive measures helped local banks to obtain necessary liquidity during a period when wholesale funding markets had become dysfunctional. In the TAF alone, the Reserve Bank lent more than $7 billion in funds to the local banks between October 2008 and April 2009 (figure 5). As the focus of the TAF was to provide secure access to term funding, most of the impact on settlement cash of the term liquidity injection was sterilised by the issuance of short-term Reserve Bank bills.

Term lending through the TAF stopped in April 2009 as demand from banks dissipated. Improved market conditions saw local banks return to offshore markets for funding, and as existing loans matured, the level of TAF loans fell to zero in April last year. The Reserve Bank finally withdrew the TAF and other emergency facilities in late 2010.

Figure 5

Term Auction Facility (TAF)



Source: RBNZ.

3 Impacts of the Reserve Bank's liquidity measures

Impact on funding spreads

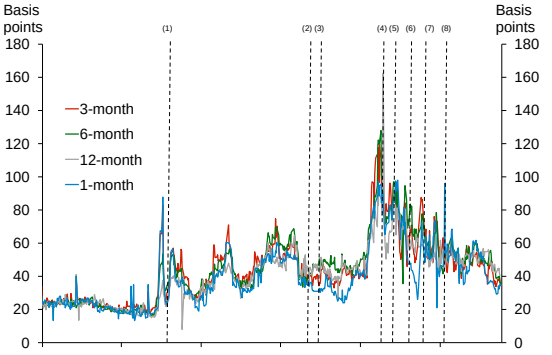
Money market spreads have declined significantly since the Reserve Bank introduced the emergency liquidity measures. Much of this reflects the gradual normalisation of international markets as confidence returned abroad which improved market conditions in New Zealand too. In assessing the impact of New Zealand-specific measures during the crisis, we need to control for the impact of changing global conditions on New Zealand markets.

In box 1, we present the results of some statistical analysis to evaluate how much conditions in the local money market changed in response to the Reserve Bank's emergency facilities introduced during the financial crisis. Our estimates suggest BB-OIS spreads in New Zealand markets narrowed by between 5 and 7 basis points, on average, for each of the policy announcements. The impact appears to be most significant for shorter-term maturities, at 1-3 months, while there is less evidence of a statistically significant effect at longer maturities, at 6-12 months.

Figure 6

New Zealand bank funding spreads

(BB – OIS spreads, dotted lines indicate the RBNZ liquidity announcements as described in table 2)



Source: Bloomberg, RBNZ

In line with our expectations, offshore money market spreads played a significant role in explaining movement in New Zealand spreads, highlighting the importance of global influences on local money market spreads during the crisis period. Interestingly, we find movement in Australian spreads had a slightly larger effect on New Zealand spreads

Box 1

Regression analysis of the Reserve Bank's liquidity policy announcements

We use a regression approach to evaluate how much conditions in the local money market have improved in response to the Reserve Bank's emergency facilities, while controlling for the influence of offshore developments. We use the BB-OIS spreads for 1, 3, 6 and 12 month maturities as measures of money market conditions in New Zealand. To account for international influences, we include the equivalent US and Australian money market spreads.[11] As illustrated before, New Zealand money market spreads were highly correlated with movements in US spreads during the financial crisis. Similarly, movements in the Australian money market can also significantly affect spreads in New Zealand for a variety of reasons, including that Australian banks own the four largest New Zealand banks (ANZ-National, BNZ, ASB and Westpac), which account for over 85 percent of the New Zealand banking sector. Any movements in Australian bank spreads that reflect changing credit risks of these banks could in turn affect the spreads of their New Zealand subsidiaries. The US spreads are lagged by one day in the regression to account for the time difference between New Zealand and the US.

To capture the impact of the Reserve Bank's liquidity policies, we use a dummy variable, which takes the value of 1 on the day when there was a liquidity policy announcement, and zero otherwise. The dummy variable is designed to estimate the "announcement effect" of these policies on money market spreads. This approach has been widely used in the existing literature for measuring the effectiveness of central bank policies introduced during the crisis.[12] The focus on the announcement day reaction is supported by the theory of market efficiency, which suggests that well-functioning and liquid financial markets are capable of incorporating future information into prices of securities immediately an event occurs. In this regard, if the Reserve Bank's liquidity policies did have an impact on

Table 3

Regression Results

Dependent variable: bank bill-OIS spreads

(Sample period: 4/1/2007-9/12/2010)

	1-month	3-month	6-month	12-month
Constant	0.7	1.04	0.28	0.41
	(1.65)	(2.44)	(0.61)	(0.77)
Dependent (t-1)	0.79	0.85	0.62	0.45
	(24.01)	(50.1)	(18.6)	(13.61)
Dependent (t-2)	0.14	0.16	0.22	0.28
	(4.2)	(2.76)	(6.65)	(8.53)
AU spread	0.06	0.07	0.06	
	(3.83)	(5.52)	(5.32)	
US spread (t-1)	0.01	0.03	0.03	0.07
	(2.35)	(4.88)	(4.96)	(8.97)
RBNZ announcements	-5.56	-7.29	-2.15	0.71
	(-3.43)	(-5.0)	(-1.47)	(0.19)
OCR	0.04	0.2	0.3	0.71
	(0.66)	(3.66)	(5.09)	(7.67)
Adjusted R-squared	0.94	0.95	0.95	0.89

[11] Historic data for 12-month Australian bank bill rates has large gaps in the series, and is therefore excluded in our analysis.

[12] Wu (2010) uses a similar regression approach with a dummy variable capturing the introduction of the US TAF. Others, such as Gagnon *et al* (2010) and Neely (2010), estimate the announcement effect of quantitative easing policies (QE) on financial markets.

market conditions, much of the market reaction should be reflected immediately after the announcement, as opposed to when the policies are implemented. We also include the OCR in the equation to see if the aggressive easing in the policy rate over this period had any effect in supporting financial market conditions, in addition to the macroeconomic impact it had.[13] Finally, we include lags of the spreads for up to two days to account for any persistence. Our regression specification can be written as

$$\mathrm{NZ}spread_t = \beta_0 + \beta_1 \mathrm{NZ}spread_{t-1} + \beta_2 \mathrm{NZ}spread_{t-2} + \beta_3 \mathrm{AU}spread_t + \beta_4 \mathrm{US}spread_{t-1} + \beta_5 RBNZ_t + \beta_6 OCR.$$

The regression results are summarised in table 3, opposite.[14] As can be seen, the Reserve Bank dummy variable is significantly negative in the 1- and 3-month equations, suggesting the liquidity policy announcements played a statistically significant role in lowering money market spreads over the sample period.

than those of the US, possibly due to the ownership links of the Australasian banks, and the greater similarities between the New Zealand and Australian financial systems and economies than between those of New Zealand and the US.

The fact that the Reserve Bank's announcements remain significant even after controlling for these global influences suggests the Reserve Bank's liquidity measures had placed additional downward pressure on borrowing costs in New Zealand, over and beyond the influence of narrowing spreads taking place in offshore markets at the time. Finally, our analysis suggests that the level of the OCR mattered for money market conditions. The steep reduction in the OCR during the crisis period had an important effect in easing financial market tensions, in addition to the support it provided to the economy. Overall, our analysis suggests that conventional (reducing the OCR) and unconventional policy measures (emergency liquidity facilities) from the Reserve Bank contributed to stabilising financial market conditions during the crisis.

In addition to testing the combined effect of all the policy measures, we also examine the policy announcements individually to see which announcement had the most impact in alleviating money market stress.[15] Our analysis indicates that the announcements that led to the greatest narrowing in short-term (1-month) spreads were (with the magnitude of spread reduction in brackets): [16]

- Bank bills became acceptable collateral in the Reserve Bank's repo operations – 23 August 2007 (-15 basis points).
- Lower-rated securities and RMBS accepted as collateral – 7 May 2008 (-10 basis points).
- RMBS accepted as collateral before achieving credit ratings – 9 October 2008 (-8 basis points).

Other announcements were relatively less effective in lowering spreads, and a few appeared to be statistically insignificant. The relative impact of these facilities on money market spreads is consistent with the degree to which different facilities were used during the crisis. For example, the announcement that bank bills had become acceptable repo collateral with the Reserve Bank appears to have had the most economic significance in reducing BB-OIS spreads. This is consistent with the fact that over 40 percent of repo collateral in 2007 was accounted for by bank bills (figure 4, p. 44). Between 2008 and 2009, RMBS and commercial paper were the dominant instruments used in the Reserve Bank's repo and TAF operations, accounting for 86 and 66 percent of the collateral respectively. This is also consistent with the large effect of the May 2008 and October 2008

13 It is possible that movements in spreads also impacted on decisions to change the OCR, so the direction of causality flows both ways. However, the results of the impact of the liquidity policy announcements are robust to different equation specifications.

14 All spreads are tested for unit roots using Augmented Dickey Fuller tests. The results suggest all the series are stationary over the sample period. As a robustness check, we also ran the regressions in first-differenced terms, which yielded broadly similar results and conclusions.

15 To do this, we assign a dummy variable to each individual announcement and run separate regressions.

16 The decline in spreads attributed to the policy announcements are the coefficients on the Reserve Bank dummy variables. The actual decline on the day could be higher or lower, depending on movements in international spreads and other influences. The policy impacts on 3-month spreads are broadly similar.

announcements, which together helped to narrow BB-OIS spreads by almost 20 basis points.

In addition to the Reserve Bank's liquidity policy announcements described above, we also examined the impact of the government's announcement of the Retail Deposit Guarantee Schemes on 12 October 2008 and the Reserve Bank's announcement of a USD/NZD swap facility with the Federal Reserve on 29 October 2008. The swap facility announcement did not appear to have a statistically significant impact on funding spreads, but the announcement of the guarantee scheme did help to narrow BB-OIS spreads by around 12 basis points. The Wholesale Guarantee Scheme should also probably have been important, but banks were consulted over this measure over a couple of weeks beforehand, making it harder to detect any specific announcement effect.

It is worth noting that our statistical estimates measure only the announcement effect of the Reserve Bank's emergency policies. While the methodology offers a simple way of measuring policy effectiveness, it is not without its limitations. For example, by focusing only on the initial market reaction on the announcement day, our analysis ignores any subsequent impact. There could have been additional reduction in BB-OIS spreads when these facilities were implemented. Alternatively, some of the announcement effect could have been unwound in subsequent sessions as markets reassessed the significance of the policy measures

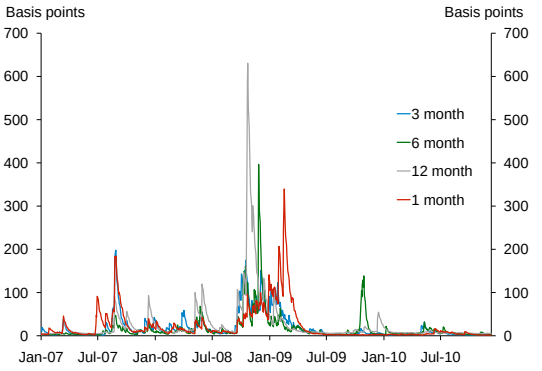
In addition, the Reserve Bank at times acted pre-emptively on many occasions during the crisis. This was particularly so with respect to the May 2008 decision to accept banks' own RMBS as collateral, at a time when global funding markets were still providing tolerably adequate funding for New Zealand banks. It is likely that funding spreads could have risen much more over the following months had the Reserve Bank not undertaken these emergency actions. There is no easy way to measure the effects due to the pre-emptive nature of the actions and so our formal statistical estimates probably underestimate the overall impact of policy measures.

Finally, the price impact of the policy measures in money markets represents only one dimension of the goals the Reserve Bank's policies were designed to achieve. Beyond the immediate aim of calming money market tensions and reducing short-term funding spreads, the supportive actions undertaken by the Reserve Bank were also intended to reduce the impact of financial market stress on the real economy. By providing confidence in access to necessary liquidity during a period when wholesale funding was extraordinarily expensive, or unavailable, these policy measures probably reduced the risk of a very severe domestic credit crunch. That in turn may have limited the depth of the recession, complementing the effects of the very steep reductions in the OCR during this period.

Impact on market volatility

We also examined whether the announcements of the emergency liquidity measures had any effect on the volatility of the spreads. As shown in figure 7, the volatility in money market spreads, measured by the variance of BB-OIS spreads, has varied greatly since the start of the crisis period. There was a moderate increase in volatility over the period September 2007-September 2008, before surging to a record high after the collapse of Lehman Brothers in September 2008. Volatility then subsided rapidly in 2009 as waves of central bank liquidity support and other measures were introduced to help calm markets and allow more normal conditions to resume.

Figure 7
Volatility of New Zealand money market spreads



Source: Bloomberg, RBNZ.

Box 2 presents our analysis of the impact the Reserve Bank's liquidity support had on the volatility of money market spreads. Our results suggest that in addition to narrowing

Box 2

Impact of the Reserve Bank's liquidity policy announcements on market volatility

To examine the impact of the Reserve Bank's liquidity policies on money market volatility, we model the variance of BB-OIS spreads using a Generalised Autoregressive Conditional Heteroskedasticity (GARCH) model.[17] In the model, the variance of BB-OIS spreads ($NZ\sigma^2$) is regressed on to its own lag and on the variance of US ($US\sigma^2$) and Australian spreads ($AU\sigma^2$), to account for the global influence on the New Zealand market. The impact of the Reserve Bank's liquidity announcements is captured by a dummy variable, similar to that in Box 1.

One special consideration in designing the GARCH equation is that we need to lag the announcement dummy to avoid distorting the policy impact on market volatility. This is because the policy measures, as shown by the results discussed above, caused a significant reduction in money market spreads on the day of the announcement, and such a reaction, by construction, would cause an upward spike in the variance of spreads. Without properly accounting for this immediate market reaction, the Reserve Bank announcements would appear to cause more volatility in the money market. To avoid this, we lag the announcement dummy by five days, allowing some time for the initial movement in spreads to dissipate in the variance calculation.[18] The specification of the model is

$$\mathrm{NZ}\sigma_t^2 = \omega + \alpha\varepsilon_{t-1}^2 + \beta\mathrm{NZ}\sigma_{t-1}^2 + \gamma_1\mathrm{AU}\sigma_t^2 + \gamma_2\mathrm{US}\sigma_{t-1}^2 + \gamma_3 RBNZ_{t-5}.$$

The results, not presented here, show that the Reserve Bank policy dummy has a statistically significant negative coefficient in equations for money market spreads at a 1-month maturity, although there is less statistically significant evidence of an impact at longer maturities.

the level of spreads, the liquidity announcements also helped to significantly reduce the volatility of spreads in the short-term money market.

4 Conclusion

Pressure in the New Zealand money market increased significantly during the global financial crisis. Driven by the general deterioration in funding markets globally, borrowing spreads for banks in New Zealand rose to unprecedented levels, and local banks and corporates faced considerably heightened difficulty in accessing market funding. The Reserve Bank responded to this rising pressure by progressively introducing a suite of emergency liquidity measures aimed at maintaining confidence that New Zealand dollar liquidity would be available and easily accessible to banks during the market turmoil.

Our statistical analysis suggests these emergency liquidity policies had a significant announcement effect on funding spreads in the local money market, helping to narrow BB-OIS spreads by 5-7 basis points, on average, per announcement, for up to 3-month maturities. These measures also appear to have helped reduce the volatility of short-term money market spreads. Probably at least as importantly, but not directly measurable, these measures prevented domestic market stresses from worsening further. Overall, our results suggest that the supportive actions undertaken by the Reserve Bank played a significant role in maintaining the functioning of the New Zealand money market and the flow of domestic credit during the global financial crisis.

[17] GARCH models are widely used in the finance literature to model series with volatility that varies over time.

[18] Other lag lengths were also tested, both shorter and longer than five days, with broadly similar results.

References

Abbassi, P and T Linzert (2011), "The effectiveness of monetary policy in steering money market rates during the recent financial crisis", *Working paper series*, No. 1328 – April, ECB.

Cassola, N and M Huetl (2010), "The euro overnight interbank market and ECB's liquidity management policy during tranquil and turbulent times", *Working paper series*, No. 1247 – October, ECB.

Choy, W (2003), "Introducing overnight indexed swaps", Reserve Bank of New Zealand *Bulletin*, 66 (1), March 2003, pp34-39.

Fisher, P (2009), "The Bank of England's balance sheet: monetary policy and liquidity provision during the financial crisis", speech at the Profession Pensions Show, London.

Gagnon, J, M Ruskin, J Remache. and B. Sack (2010), "Large-Scale Asset Purchases by the Federal Reserve: Did they Work?" *Staff Report no. 441*, Federal Reserve Bank of New York.

Hrung, W and J Seligman (2011), "Responses to the financial crisis, Treasury debt, and the impact on short-term money markets" *Staff Report No. 481*, Federal Reserve Bank of New York.

Joyce, M, A Lasaosa, I Stevens, and M Tong (2010),"The financial market impact of quantitative easing", *Working Paper No. 393*, Bank of England.

Kearns, J (2009), `The Australian money market in a global crisis', *Bulletin*, Reserve Bank of Australia, June.

Neely, C (2010), "The large-scale asset purchases had large international effects", *Working Paper 2010-018A*, Federal Reserve Bank of St Louis.

Nield, I (2006), "Review of the Reserve Bank of New Zealand's liquidity management operations", A consultation paper, Reserve Bank of New Zealand, March.

Nield, I (2008), "Evolution of the Reserve Bank's liquidity facilities", Reserve Bank of New Zealand *Bulletin*, Vol 71 No. 4. pp. 5-17

Reserve Bank of New Zealand (2008), "Reserve Bank announces new liquidity measures", media release, 7 May.

Reserve Bank of New Zealand (2008), "Reserve Bank confident in NZ financial system", media release, 19 September.

Wu, T (2010), "The term auction facility's effectiveness in the financial crisis of 2007-09", *Economic Letter* – May, Federal Reserve Bank of Dallas.

DISCUSSION PAPERS

DP 2011/02

Fluctuations in the international prices of oil, dairy products, beef and lamb between 2000 and 2008: A review of market-specific demand and supply factors

Phil Briggs, Carly Harker, Tim Ng and Aidan Yao

This paper looks at the boom period between 2000 and 2008 in the international prices of four internationally-traded commodities: oil, dairy products, beef and lamb. All are important drivers of macroeconomic dynamics in New Zealand. Our aim is to provide overviews of the demand and supply factors specific to each market and product, thus adding colour to more general analyses of the macroeconomic and financial drivers of the cycles in world commodity markets over the period. For each commodity market we examine here, we set out the structures of the markets and the major drivers of world demand and supply, and discuss the apparent relative strength of each of the drivers.

NEWS RELEASES

Sector Risk Assessment released ahead of anti-money laundering requirements

29 March 2011

The Reserve Bank today released its Sector Risk Assessment to help registered banks, non-bank deposit taking institutions and life insurers prepare to meet upcoming requirements under the Anti-Money Laundering and Countering Financing of Terrorism Act 2009.

The Reserve Bank will be responsible for supervising the compliance of these organisations with this new legislation, which is expected to fully come into force in 2013.

An assessment focused on the risk of money laundering that these types of institutions may face has been carried out by the Reserve Bank. There is currently insufficient information about terrorism financing to widen this focus.

This assessment is intended to provide guidance to the institutions the Reserve Bank will supervise as to the money laundering risk in their sector. This in turn will help firms in undertaking their own risk assessments.

The ratings provided by the Reserve Bank in the assessment do not reflect on the financial stability of these sectors or the institutions within them, but merely provide an overview of the relative risk of money laundering.

Measures to counteract money laundering are already in place in banks and some of the other organisations the Reserve Bank will supervise. However, these controls have not been considered for the purpose of the assessment, but will be once the Act comes fully into force.

The Reserve Bank's assessment rates the banking sector as having a relatively high potential money laundering risk. This may mean that money launderers will target the sector for these purposes.

This rating is in line with similar assessments for banks globally and is largely due to factors such as the wide accessibility and availability of banks, the cash intensive nature of their products and services and the volume of transactions they process.

Overall, the non-bank deposit taking sector is described as having a "medium" potential risk rating. This is because their products and services are not generally as cash intensive, but they process a high volume of transactions both in terms of value and volume.

However, within this sector credit unions are rated as "low" potential due to their strong domestic customer focus.

The assessment puts life insurers at a "medium/low" potential risk. Factors such as the large single payments and payouts involved can be attractive to money launderers. However, a large proportion of the transactions in this area are domestic and the sector is not cash-intensive.

The Reserve Bank Sector Risk Assessment can be found on the Bank's website at http://www.rbnz.govt.nz/aml/4345201.pdf. The Securities Commission and the Department of Internal Affairs are also releasing assessments relevant for the organisations they will supervise. These can be found on their respective websites.

New bank registered

31 March 2011

The Reserve Bank of New Zealand today announced that BOI (New Zealand) Limited has been registered as a bank in New Zealand.

BOI (New Zealand) Limited is a fully owned subsidiary of Bank of India. It will change its name to Bank of India (New Zealand) Limited before commencing operation.

There are now 20 registered banks in New Zealand, which are listed on the Reserve Bank website.

Reserve Bank Bulletin Released

31 March 2011

The Reserve Bank today released the March 2011 issue of the Reserve Bank of New Zealand *Bulletin*.

This first issue of the year explores the kind of economic and financial challenges New Zealand has faced in recent years. The lead article outlines a framework for analysing movements in government bond interest rates, concluding with a brief analysis of what those changes could mean for the countries in question, and ultimately for New Zealand.

The second article turns the spotlight on a recent research

conference held at the Reserve Bank with a focus on the transmission of economic and financial shocks from one country to another. This is particularly relevant given the synchronised nature of the recent international recession.

Article three updates the Reserve Bank's work towards improving the range and quality of statistical data on the debt securities market in New Zealand. The recent global economic upheaval highlighted the need for better data on this market, both here and abroad.

The *Bulletin* is rounded off with the Bank's submission to the Government-appointed Savings Working Group and Governor Alan Bollard's January speech to the Canterbury Employers' Chamber of Commerce.

Bank information more accessible

31 March 2011

Revised disclosure requirements for banks coming into effect today will make information more accessible for investors, depositors and analysts, Reserve Bank Deputy Governor Grant Spencer said.

The changes to shorter disclosure statements will also mean a significant reduction in compliance costs.

This marks the completion of a major review of the disclosure regime initiated in October 2009.

The changes follow two new Orders-in-Council setting out the new disclosure requirements, which were published in the *New Zealand Gazette* on 28 February. Banks' next disclosure statements, covering the period up to 31 March 2011, will mostly be on the new basis.

A transitional arrangement allows banks to continue disclosure on the previous basis as at end-March and end-June this year, in case any of them need extra time to make necessary adjustments to their reporting processes. However, the major banks at least will be taking advantage of the new regime immediately.

Further detail on the nature of the changes is in an earlier policy outcome document (PDF 169KB), and also in a Regulatory Impact Statement (PDF 210KB) which is published today. Both can be downloaded from the Reserve Bank's website.

Export prices deliver benefits to economy

12 April 2011

New Zealand's agricultural export prices are likely to remain strong for some time, delivering benefits to the New Zealand economy, Reserve Bank Governor Alan Bollard said in a speech.

Speaking to a farming group, the Grasshoppers, in Ashburton last night, Dr Bollard said the Bank expects the higher terms of trade to continue to be reflected in the exchange rate, as it is currently. The exchange rate would deliver the benefits of the rising terms of trade to the community at large – through higher wealth and cheaper imports.

Global commodity prices have experienced the largest boom in more than 100 years, Dr Bollard said. While hard commodities have seen the biggest surge, agricultural commodity markets have also seen a fundamental change. Another surge in prices has since seen food prices surpass the 2008 record level, boosted by supply disruptions, particularly in grain markets.

Analysis by the Bank indicates New Zealand's agricultural export prices are likely to remain elevated for some time. Although in the near-term, prices could fall slightly as supply becomes less weather-disrupted, demand is underpinned by urban and wealth growth in developing countries, especially China.

Given this outlook, monetary policy will remain focused on any medium-term inflationary pressures that arise, rather than the terms of trade shift in itself.

"If households and firms use the income boost from higher commodity prices and exchange rates to bring forward consumption and investment, or increase borrowing, then pressure on resources in New Zealand would lead to more inflationary pressure. Monetary policy would need to counteract any rise in inflation expectations."

Dr Bollard noted, however: "One thing we do know is that the projection will remain uncertain. History shows it is fiendishly difficult to predict the future path of commodity prices."

RBNZ, People's Bank of China announce currency swap facility

18 April 2011

The People's Bank of China (PBOC) and the Reserve Bank of New Zealand today announced the establishment of a reciprocal currency arrangement (swap line) to support the settlement in Chinese Renminbi (RMB) of trade transactions between New Zealand and Chinese businesses.

The size of the swap facility is RMB 25 billion (NZD 5 billion) and has a three year maturity which may be extended if both parties agree. The facility gives the Reserve Bank the capacity to borrow RMB for use in rare situations where financial market disruption makes it difficult for businesses to access RMB to settle transactions with Chinese businesses.

Reserve Bank Deputy Governor Grant Spencer said the arrangement followed on from recent actions by the PBOC to facilitate the settlement of transactions conducted by firms in RMB. Eight other countries, mainly in Asia, have swap facilities in place with the PBOC.

"While there is no need to use the facility right now, it is useful to have this capacity if markets were ever to become dysfunctional. In addition the signing of this swap line contributes to building the China-NZ relationship," Mr Spencer said.

Discussion document on disclosure requirements for non-bank deposit takers released

21 April 2011

The Reserve Bank, in conjunction with the Ministry of Economic Development, today released a discussion document on proposed disclosure requirements for the non-bank deposit taking (NBDT) sector.

The discussion document's main proposals include requiring NBDTs to disclose a standardised set of prudential information and for these disclosures to be updated six-monthly.

Reserve Bank Deputy Governor Grant Spencer said disclosure of standardised prudential information will provide investors with a framework for analysing an NBDT's risks, and allow investors to compare risks between NBDTs more easily. This will improve market discipline, and confidence in the NBDT sector.

"The six-monthly frequency also aligns prudential disclosures with financial statements during the life of a prospectus," he said.

Other proposals in the Prudential Disclosure Requirements for Non-Bank Deposit Takers discussion document include: disclosures being subject to auditor reviews; and investors being notified when disclosures are updated as a result of material changes in an NBDT's circumstances.

The discussion document and information on existing prudential requirements are available on the Reserve Bank website. The discussion document can also be accessed from the Ministry of Economic Development website.

Submissions close on 19 May 2011.

Background

Prudential regulation of NBDTs is provided for in part 5D of the Reserve Bank of New Zealand Act 1989. The latest of these regulations came into effect in December 2010.

Since then the Reserve Bank and the Ministry of Economic Development have been working together to develop disclosure requirements for the prudential regulations under the Securities Act 1978.

OCR unchanged at 2.5 percent

28 April 2011

The Reserve Bank today left the Official Cash Rate (OCR) unchanged at 2.5 percent.

Reserve Bank Governor Alan Bollard said: "The outlook for the New Zealand economy remains very uncertain following February's Christchurch earthquake.

"As was expected, business confidence, consumer spending and tourism activity all declined sharply following the earthquake. The OCR was cut as insurance to help limit these adverse effects. Confidence and consumer spending have since shown signs of recovery, but many firms and households remain adversely affected in Christchurch. To

date, activity in the rest of the country appears relatively unaffected, with housing market turnover and business investment beginning to increase.

"Trading partner growth remains robust, helping push New Zealand's export commodity prices higher. Along with relatively favourable climatic conditions, the improved price outlook is supporting a pickup in on-farm investment. Higher oil prices and the elevated level of the New Zealand dollar are both unwelcome. They will have some dampening effect on economic activity.

"Headline inflation is currently being boosted by recent increases in indirect taxes. Annual inflation is expected to settle comfortably within the target band once these tax increases drop out of the annual rate.

"Given the outlook for core inflation and continued economic disruption stemming from the earthquakes, the current level of the OCR is likely to remain appropriate for some time."

Economic surveillance after the crisis: reflections from a small full service central bank

05 May 2011

The global financial crisis has changed the economic surveillance required by central banks, placing a greater emphasis upon using monetary policy and financial stability policy in tandem to help keep economies stable.

This is the message of a speech by Reserve Bank Governor Dr Alan Bollard, to be delivered in Singapore tonight by Assistant Governor Dr John McDermott.

Dr Bollard's speech, presented to the Sim Kee Boon Institute Conference on Financial Economics, states that prior to the crisis there was a clear separation between monetary policy formulation and financial stability policy, even in "full service" central banks like the Reserve Bank that perform both functions.

However, the financial crisis challenged traditional economic forecasting models and moved central banks to pay greater attention to financial market information when formulating monetary policy.

"Likewise, more attention is paid to economic imbalances and the financial health of sectors, by looking at household and business balance sheets, when assessing financial sector risks," Dr Bollard says.

"Going forward, the aim is to set monetary and financial policy instruments to take account of the inter-relationship between the financial sector and the real economy. This will require a broader framework for economic surveillance."

Since the crisis, information is being swapped more readily between central banks and regulators globally, and relations with treasuries and Ministers of Finance have become closer.

The Reserve Bank has also strengthened links with regulators in other countries, particularly Australia and Asian central banking partners, to help information sharing.

"Good surveillance usually will not stop nasty surprises, but it may buy some lead time and help policymakers to make better sense of surprises when they happen," Dr Bollard says.

Financial system more resilient but still facing volatility

11 May 2011

New Zealand's financial system is more resilient and positioned to support economic growth, but still faces a volatile and uncertain environment, Reserve Bank Governor Alan Bollard said today, when releasing the Bank's May 2011 *Financial Stability Report*.

"The global economic recovery is now broader, and strong growth in Asia is supporting commodity producers like New Zealand and Australia. However, global wholesale funding markets remain fragile, given stretched fiscal positions and banking sector problems in some European countries," Dr Bollard said.

"Efforts by households and businesses to cut or contain debt are reducing New Zealand's overall external imbalance, but are also weakening domestic demand. Government too is looking to consolidate its financial position, which should help to improve the country's overall external position."

Dr Bollard noted the February earthquake had caused financial stress for households and businesses and created a challenge for the insurance sector in dealing with claim flows. But the banks' readiness to support recovery in Christchurch was encouraging.

"Rebuilding will add momentum to the economy and is likely to require access to credit, despite much of the damage being substantially insured."

Deputy Governor Grant Spencer said the New Zealand banking system has continued to strengthen.

"Bank profits have recovered over the past six months and bad debt charges declined. Bank funding has moved to a more stable footing and capital ratios are relatively high. Non-performing loans are elevated but remain manageable."

Mr Spencer said the Reserve Bank is currently evaluating the new Basel III global regulatory standards for bank capital adequacy and liquidity and expects to consult with banks on this later in the year.

Other matters under way include the restoration of more appropriate risk weights on rural lending from June, and an increase in the required minimum Core Funding Ratio for banks from 65 percent to 70 percent from 1 July. "These moves have been well signaled and largely anticipated by the banks."

The Reserve Bank is also consulting banks about pre-positioning their internal systems to enable Open Bank Resolution. This is a process that would allow a failing bank to be kept open by rapidly allocating losses across shareholders, depositors and other creditors.

"Having this option in the tool kit should reduce the pressure on Government to adopt taxpayer funded solutions when dealing with a distressed bank," he said.

The Reserve Bank recently assumed the role of insurance sector regulator. Following the recent earthquakes, the Government has had to support AMI to ensure an orderly claims process in Christchurch.

"The Bank has accelerated its work programme in light of the earthquakes and is monitoring this sector closely. While there remains considerable uncertainty over the extent of total final claims, we believe the overall industry is sound," Mr Spencer said.

OCR unchanged at 2.5 percent

9 June 2011

The Reserve Bank today left the Official Cash Rate (OCR) unchanged at 2.5 percent.

Reserve Bank Governor Alan Bollard said: "The outlook for the New Zealand economy has improved since the publication of the March *Statement*.

"Economic activity has been significantly disrupted by the Christchurch earthquake. However, while many firms and households – particularly within Canterbury – continue to be adversely affected, it appears the negative confidence effect of the earthquake on economic activity throughout the rest of the country has been limited.

"The early signs of recovery noted in the March *Statement* have continued. Despite some continuing signs of weakness in the world economy, commodity prices remain very strong and firms expect to increase their hiring and capital investment. Reconstruction in Canterbury is projected to add about 2 percentage points to GDP growth over 2012, and boost the level of activity for several years thereafter.

"Despite the strong outlook for export earnings, household expenditure is expected to grow only modestly. Household debt remains very high and is expected to constrain retail spending and the housing market for some time. Continued fiscal consolidation will also act to dampen activity.

"The New Zealand dollar has appreciated substantially over the past two months. This appreciation, supported by high export prices for primary producers, is negatively affecting other parts of the tradable sector, constraining rebalancing of the New Zealand economy.

"Headline inflation is currently being boosted by recent increases in indirect taxes, food and petrol prices, and surveyed expectations of future inflation have edged up. Despite this, indicators of capacity usage and core inflation suggest underlying inflation remains constrained.

"As GDP growth picks up, underlying inflation is expected to rise. A gradual increase in the OCR over the next two years will be required to offset this, such that CPI inflation tracks close to the midpoint of the target band over the latter part of the projection. The pace and timing of increases will be guided by the speed of recovery, but for now the OCR remains on hold."

View the *Monetary Policy Statemen*t page http://www.rbnz.govt.nz/monpol/statements/ for the current policy assessment, *Monetary Policy Statement*, and data file.

PUBLICATIONS

Regular publications

Annual Report	Published in October each year.
Financial Stability Report	Published six-monthly. A statement from the Reserve Bank on the stability of the financial system.
Monetary Policy Statement	Published quarterly. A statement from the Reserve Bank on the conduct of monetary policy.

Reserve Bank of New Zealand Statement of Intent, 2010-2013

Recent Reserve Bank Discussion Papers

2010

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DP2010/03	Multi-period fixed-rate loans, housing and monetary policy in small open economies *Jaromír Beneš and Kirdan Lees*
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DP2010/12	Monetary policy implementation and uncovered interest parity: empirical evidence from Oceania *Alfred Guender and Bevan Cook*
DP2010/13	What drives core inflation? A dynamic factor model analysis of tradable and non-tradable prices *Michael Kirker*
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2011

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DP 2011/02	Fluctuations in the international prices of oil, dairy products, beef and lamb between 2000 and 2008: a review of market-specific demand and supply factors *Phil Briggs, Carly Harker, Tim Ng and Aidan Yao*

A full list of Discussion Papers is available from Administration, Economics Department.

Selected other publications

Testing stabilisation policy limits in a small open economy: proceedings from a macroeconomic policy forum
Finance and Expenditure Select Committee inquiry into the future monetary policy framework: submission by the Reserve Bank of New Zealand

Pamphlets

Explaining Currency
Explaining Monetary Policy
The Reserve Bank and New Zealand's Economic History
This is the Reserve Bank
Your Bank's Disclosure Statement – what's in it for you?
Snakes and Ladders – a guide to risk for savers and investors, by Mary Holm

For further information, go to www.rbnz.govt.nz, or contact:

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Articles in recent issues of the Reserve Bank of New Zealand *Bulletin*

Vol. 73, No. 2, June 2010

The Reserve Bank and macro-financial stability

Financial sector amplification and credit cycles in New Zealand

World trade interdependencies: a New Zealand perspective

The Reserve Bank's new approach to holding and managing its foreign reserves

Vol. 73, No. 3, September 2010

Connecting the dots: a yield curve perspective on New Zealand's interest rates

The New Zealand dollar through the global financial crisis

Anti-money laundering and countering the financing of terrorism - the Reserve Bank's responsibilities and approach

The currency denomination of New Zealand's unhedged foreign reserves

Vol. 73, No. 4, December 2010

Regulating non-bank deposit takers

Bringing financial stability legislation to the insurance industry - the Insurance (Prudential Supervision) Act 2010

Global currency trends through the financial crisis

New Zealand's imbalances in a cross-country contest

Vol. 74, No. 1, March 2011

Making sense of international interest rate movements

We're all in this together: the transmission of international shocks to open economies

Towards better data on New Zealand debt securities markets

Submission to the Savings Working Group

Looking into the crystal ball: a forecast and some risks for the year ahead