
New Zealand's emergency liquidity measures during the global financial crisis¹

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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.

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2 Background

New Zealand money market before the crisis

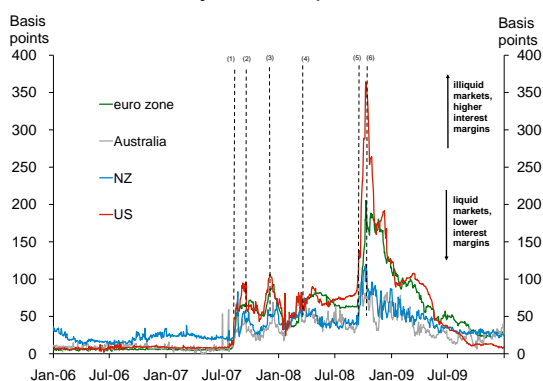
The most commonly traded instruments in the New Zealand money market are bank bills, which are short-term securities issued by banks operating in New Zealand. The interest rate on 90-day bank bills – the most frequently traded maturity – is an important reference rate in pricing many corporate credit 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 1⁵

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.

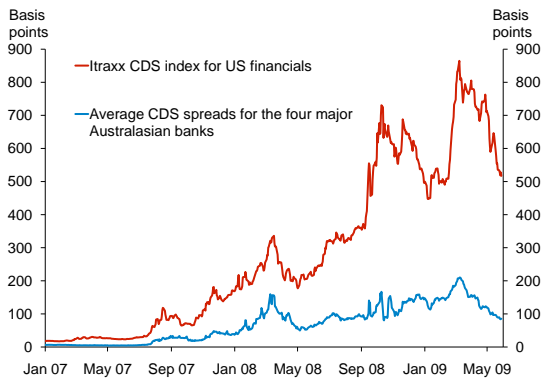
In response, the Reserve Bank increased the amount of cash available in the banking system (figure 3, overleaf).⁷ But as the pressure intensified, a suite of additional emergency measures was introduced, aimed at boosting liquidity and

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.

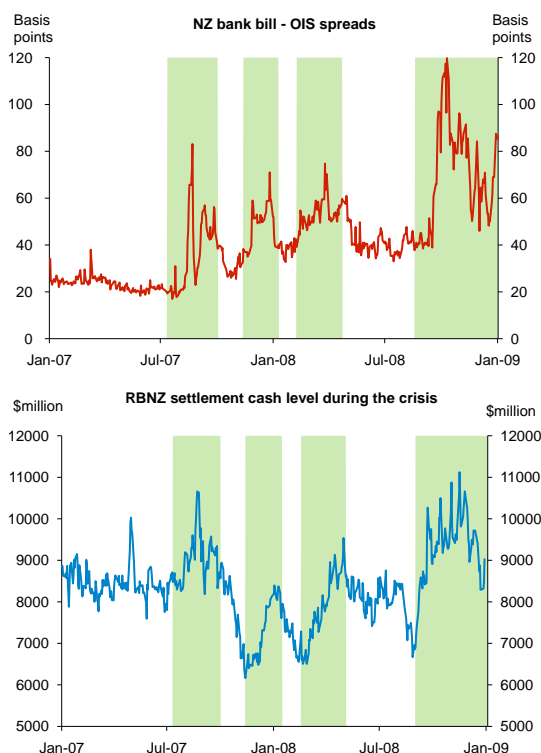
⁷ Since adopting a 'cashed-up' liquidity management regime, the Reserve Bank can routinely adjust the level of settlement cash in the system according to changes in market conditions (Nield 2008). Such a system made it easy for the Reserve Bank to respond to the financial crisis by injecting more liquidity 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 The Exchange Settlement Account Tiering regime* originally scheduled for introduction in September is brought forward	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) 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 Broaden eligible collateral to all New Zealand registered AAA-rated NZD securities and AA-rated government sector securities Extension of Overnight Reverse Repo Facility from 1 day to a maximum of 30 days	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 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 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 Terms of open market operations extended to up to 6 months New facility introduced making other asset-backed securities eligible as collateral	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 Aimed at easing pressure at the short end of the funding market by creating greater access to term funding 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 Reserve Bank bill tenders to sterilise cash injected with the TAF	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 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.

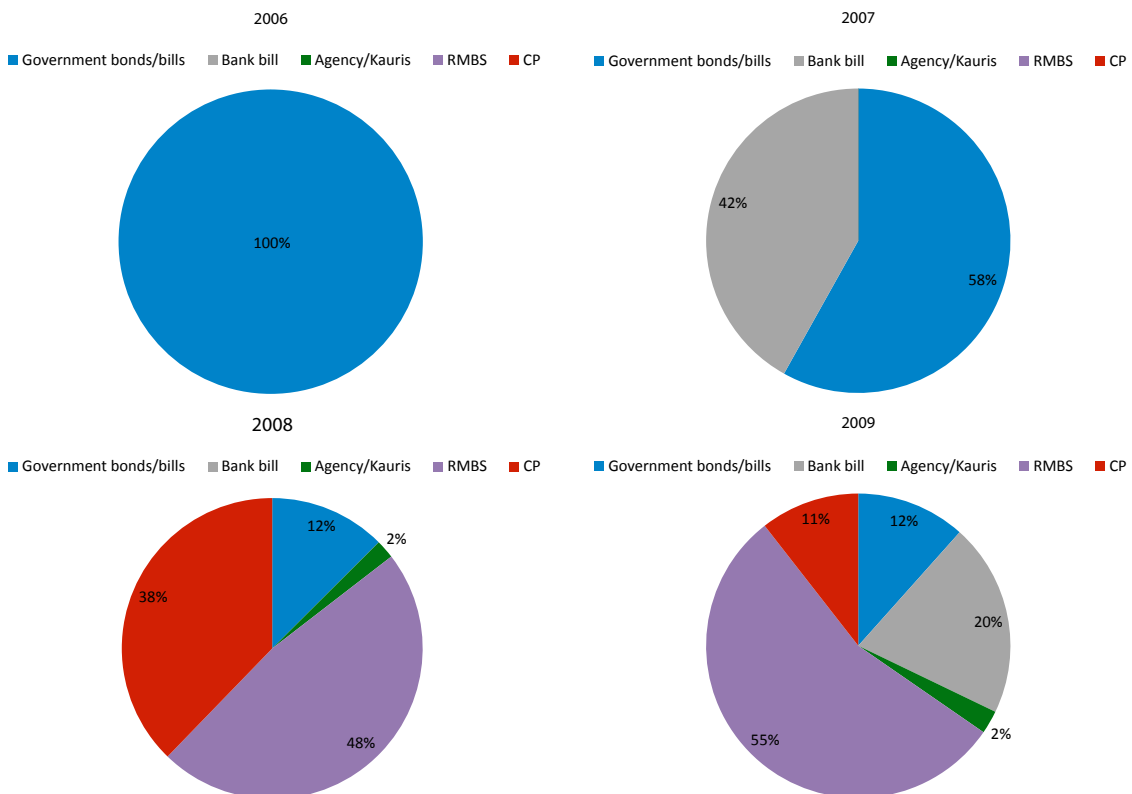
this unprecedented move was that it enabled local banks to transform a large and illiquid portion of their balance sheets into securities that could, if required in conditions of stress, be exchanged for cash with the Reserve Bank. In addition, access to the Overnight Reverse Repo Facility (ORRF) was 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.

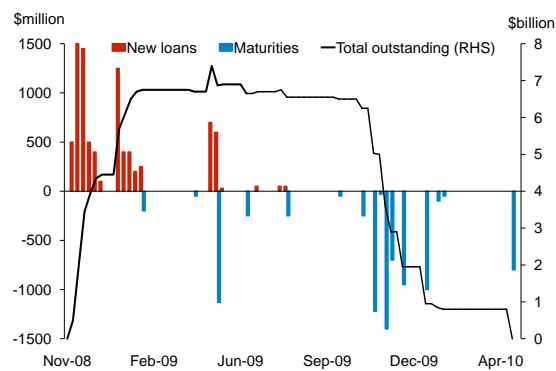
¹⁰ These included commercial paper, local government securities and corporate bonds.

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.

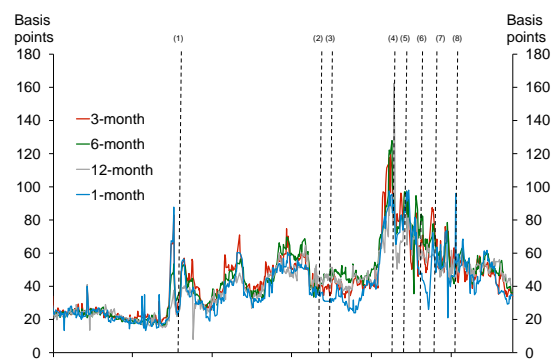
3 Impacts of the Reserve Bank's liquidity measures

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

$$NZspread_t = \beta_0 + \beta_1 NZspread_{t-1} + \beta_2 NZspread_{t-2} + \beta_3 AUSpread_t + \beta_4 USspread_{t-1} + \beta_5 RBNZ_t + \beta_6 OCR.$$

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.

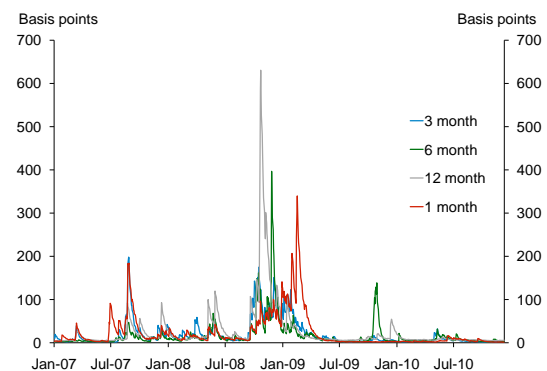
Finally, the price impact of the policy measures in money markets represents only one dimension of the goals the

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

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

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.

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