

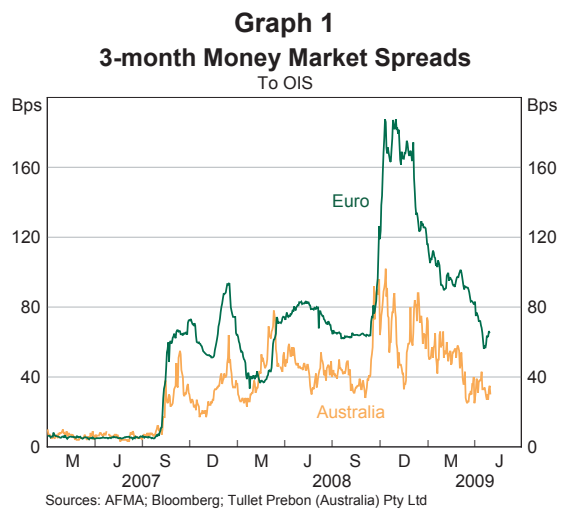
# THE AUSTRALIAN MONEY MARKET IN A GLOBAL CRISIS<sup>1</sup>

## Introduction

Banks, other financial firms and corporates trade billions of dollars every day in the Australian money market, by buying and selling bank bills and other discount securities, and through short-term loans. As is the case in other countries, the Australian money market is typically a deep and liquid market where participants can borrow or invest large sums of money efficiently and cost effectively. However, in August 2007 the confidence underpinning the functioning of money markets declined globally when participants began to question the credit quality of other participants and placed greater value on retaining liquid assets. From this time, money markets have served as a general barometer of the intensity of turmoil in markets, and their recovery remains critical to a restoration of the health of the financial system. This article discusses the co-movement of Australian money market spreads with those internationally and the actions of the Reserve Bank to address the tensions in the Australian money market.

## Pressures in Money Markets

Interest rates in money markets move with expectations of the cash rate (the overnight indexed swap rate, or OIS), but are above that rate by what historically had been a small and steady premium, reflecting the risk of the borrower (credit risk) and the ease of selling a security or borrowing (liquidity risk). However, globally spreads between money rates and OIS rates jumped in early August 2007 after a French bank suspended redemptions from two of its funds because of the difficulty in valuing assets (Graph 1). Since then spreads have displayed a high degree of co-movement across different currencies. The Australian dollar spread has generally moved with the US dollar and euro spreads, but has mostly been well below that of these major currencies. After the initial spike, spreads subsided until



<sup>1</sup> This article was prepared by Jonathan Kearns of Domestic Markets Department, for the 14<sup>th</sup> Melbourne Money and Finance Conference 'Financial Globalization: Implications for Australian Financial Institutions and Markets', 1–2 June 2009. The views expressed are those of the author and should not be attributed to the Reserve Bank of Australia. Thanks to many colleagues for assistance with data and comments.

they again increased with concerns about funding pressures over the 2007 year-end. As year-end passed without major incident, money market spreads again eased until tensions increased peaking with the near collapse of Bear Stearns in March 2008. With the resolution of this, pressures in money markets subsided somewhat but remained at an elevated level until later in 2008. The collapse of Lehman Brothers in September resulted in an extreme amplification of tensions in money markets. Spreads in all major currencies reached new highs, with the 3-month spread in the United States exceeding 400 basis points (hence why it is not shown in Graph 1) and the Australian spread peaking at 100 basis points. Since August 2007, the Australian 3-month spread has averaged 45 basis points, substantially above the 5–8 basis points that prevailed in earlier years.

The elevation and co-movement of spreads in different currencies could result from common trends in either credit risk or liquidity risk, or both. The credit risk premium relates to investors' beliefs about a borrower's ability to repay. Because many institutions are active in different currency money markets, changes in institutions' credit risk could result in the co-movement of spreads. Alternatively, investors' risk aversion may be influenced by developments in other markets, inducing co-movement.

The liquidity risk premium relates to the ease of being able to raise funding in a particular currency. Whether liquidity risk should display co-movement is less clear. One view is that because a liquidity premium relates to a particular currency, these premia should not display correlation across currencies. However, well functioning foreign exchange swap markets allow liquidity in one currency to be readily converted into another. Consequently, internationally active banks may consider liquidity in one currency to be a substitute for liquidity in another currency, and hence their actions can result in correlation of liquidity premia across currencies.

In practice there are many difficulties in decomposing spreads into credit risk and liquidity risk premia, including that greater difficulty in raising funding (i.e. liquidity risk) could increase the credit risk of banks and vice versa. Furthermore, credit default swaps (CDS), which are typically used to identify credit risk, have been a noisy measure of the credit risk of banks because of reduced liquidity in CDS markets and correlation in individual bank CDS across countries induced by trading strategies. In Australia, CDS have at times become dislocated from the spreads on the bank bonds on which they provide insurance, suggesting they are at best a noisy measure of bank credit risk.

Given the difficulties in separating and estimating credit and liquidity risk, an alternative approach to understanding the drivers of Australian money market spreads is to examine whether domestic or international news has had a greater impact on domestic spreads. This can be done relatively easily for Australia because its trading day sits between those of North America and Europe, the epicentres of the crisis. Domestic news – covering announcements by domestic banks which will capture credit risk, and factors affecting Australian dollar liquidity, including actions by the Reserve Bank – arrives in the local trading day and so should move the spread during the local trading hours. Conversely, international developments – which may still have a fundamental influence on domestic banks or funding conditions, say through changes in the quality of their assets or the price of raising debt offshore – should move the spread outside of Australian trading hours.

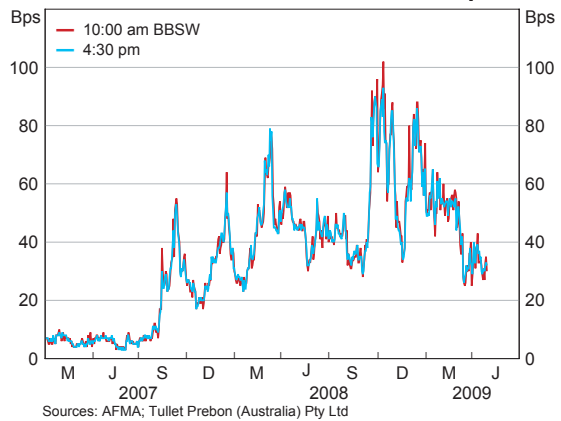
This decomposition of Australian spreads into changes in domestic trading hours and foreign trading hours is possible because there are two rate sets in Australia for bank bills, the main money market instrument. The first occurs at 10.00 am at the beginning of the trading day and the second at 4.30 pm at the end of the trading day. While the former – referred to as the bank bill swap rate, or BBSW – is the benchmark fixing, the latter is conducted using the same methodology.<sup>2</sup> Notably there is no reason why one rate set should be higher than the other. Trading before 10.00 am is likely to reflect predominantly overseas developments as macroeconomic data releases and Reserve Bank announcements occur after this time.<sup>3</sup> The exception is announcements by listed companies, which often occur before trading commences on the stock exchange at 10.00 am.

While the spreads on 3-month bank bills at 10.00 am and 4.30 pm are, not surprisingly, very close, it is notable that during the periods of heightened volatility the spread periodically spiked higher in the morning but retraced some of this during the day (Graph 2). This suggests that the sharp increase in the spread reflected news from offshore, but then developments in the Australian trading day brought the spread lower.

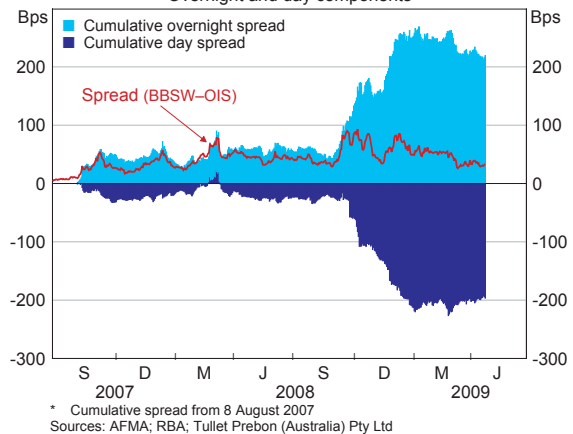
This can be seen in the cumulative change in the spread through the day (from 10.00 am to 4.30 pm) and overnight (from 4.30 pm to 10.00 am) from early August 2007 (Graph 3). Notably, the cumulative overnight change is positive over the entire sample, indicating that the spread has consistently widened outside of Australian trading hours. In contrast, the cumulative day change is negative for most of the sample as the spread often retraced part of its previous overnight increase.

There is one period, in the early months of 2008 coinciding with the near failure of Bear Sterns, when the widening of the Australian dollar

**Graph 2**  
**Australian 3-month Bank Bills to OIS Spreads**



**Graph 3**  
**Australian 3-month Spread\***  
Overnight and day components



2 The rate sets are conducted by the Australian Financial Markets Association from a panel of banks (currently 14, including 9 foreign banks). The rate set is calculated as a trimmed mean of the contributed rates.

3 The Reserve Bank announces its dealing intentions at 9.30 am but these are largely focused on liquidity management; notably they consist of the estimated system cash deficit for the day and the Reserve Bank's preferred dealing terms.

spread also occurred during the Australian day. Unlike the episodes of widening global spreads in late 2007 and late 2008, at this time the Australian dollar spread increased to a similar level as international spreads. During this episode there was no adverse information about the domestic banking system, nor were there any factors which point to an obvious change in liquidity risk (the operations by the Reserve Bank are discussed in more detail in the following section).<sup>4</sup> The most notable development was the increase in domestic interest rate expectations with the expected cash rate increasing by 50 basis points. One possible explanation for the increase in domestic spreads is that credit risk or liquidity risk were seen to be higher with higher money market interest rates.

Following the rescue of Bear Sterns, money market spreads in the US, and Australia, narrowed substantially. From early April 2008, the spread in Australia was relatively stable in a range of 30–50 basis points, with no significant moves in the contributions coming from overnight or day sessions. However, from September spreads globally increased to new highs with the fear that Lehman Brothers could default. Again Australian spreads increased during offshore trading hours, and fell back during domestic trading hours. While these changes were relatively small on any given day, over time they were substantial, with a cumulative 200 basis point increase in spreads during offshore trading hours and a slightly smaller decline in spreads during Australian trading hours. Both the day and night cumulative changes were much greater than during the preceding months. Since early 2009 the Australian spread has gradually eased and this has occurred in offshore trading hours and mimics the decline in spreads globally (Graph 3).

The timing of the change in Australian spreads overnight and during the Australian trading day indicates that much of the movements in spreads can be explained by international developments. While both credit risk and liquidity risk premia can be influenced by offshore developments, given the role of the Reserve Bank in contributing to liquidity in the Australian money market, the greater contribution to widening spreads coming from offshore suggests that credit risk has played a larger role.

## The Policy Response of the Reserve Bank

The Reserve Bank has responded to pressures in the Australian money market by modifying its domestic dealing operations, just as other central banks have responded to pressures in their money markets. Because of the flexibility of the framework for conducting open market operations in Australia, the Bank has been able to respond to market pressures promptly and seamlessly with few changes to the operating framework (see Debelle 2008b for an overview of the mechanics of Reserve Bank market operations and changes to operations, as well as Battellino 2007, Debelle 2007 and 2008a, and Reserve Bank of Australia 2007).

The Bank conducts open market operations daily, ordinarily to offset flows between the private banking system and the government, ensuring that there are adequate funds for the market to operate and the cash rate to remain on target. It does so predominantly by using repurchase agreements (repos) where it purchases a security with an agreement to sell it back at a future date at an agreed price. The Bank has always had the ability to deal at a range of terms

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<sup>4</sup> *There were no significant announcements by Australian banks. CDS premia widened in line with premia internationally, as they have throughout the crisis period, and spreads on domestic bank bonds simply followed the trend increase that started with the onset of the turmoil.*

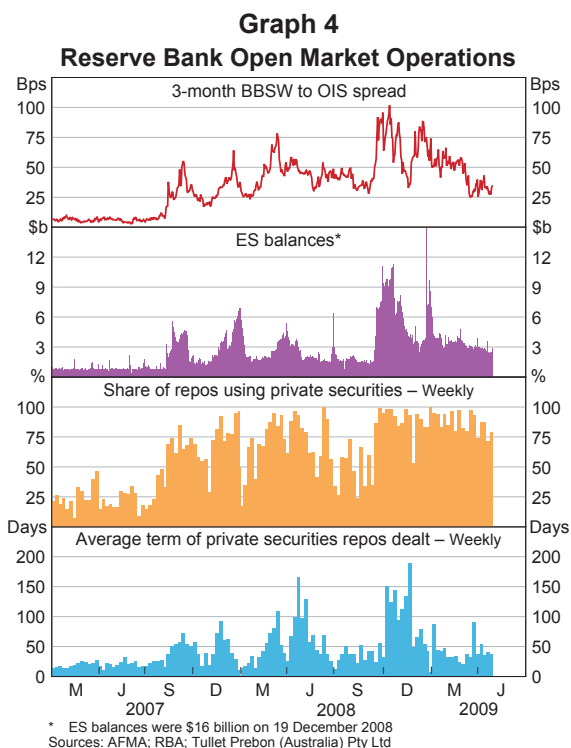
and selectively against different classes of collateral. Within this framework, the Bank has made three major changes to its dealing since August 2007. Specifically, the Bank:

- increased the supply of deposits at the central bank;
- increased its holdings of ‘private securities’ (i.e. non-government securities) under repo;<sup>5</sup> and
- increased the maturity of the repos undertaken.

These initiatives were enacted to enhance the confidence of participants in the money market but also to have a practical impact on the market’s functioning.

Banks, some other authorised deposit-taking institutions (ADIs) and representatives of ADIs have accounts at the Reserve Bank called Exchange Settlement (ES) accounts which are used for the settlement of transactions between themselves and with the Reserve Bank. ES balances are risk free, are highly liquid and pay interest at only 25 basis points below the target cash rate. Because of the increase in risk aversion, and the desire to hold more liquid assets, the onset of the credit crisis increased the demand for ES balances. This was especially so in Australia because, for the first 18 months of the crisis, there were no Treasury notes on issue and the stock of Treasury bonds was being maintained at a minimum level, so there was a very limited supply of other risk-free assets. The Reserve Bank increased ES balances when bank bill spreads increased (Graph 4).<sup>6</sup> The cyclical increases in the level of ES balances have satisfied this higher demand with the cash rate only trading away from the Reserve Bank’s target on less than a dozen days – slightly more frequently than in recent years – and by no more than 2 basis points.

The increase in the Bank’s holdings of private securities held under repo increased the total demand for these securities with the aim of moderating the increase in their yield. The Bank quickly moved from conducting around 20 per cent of its open market operations with private securities to roughly two-thirds, with an offsetting decline in the share of repos done with ‘general

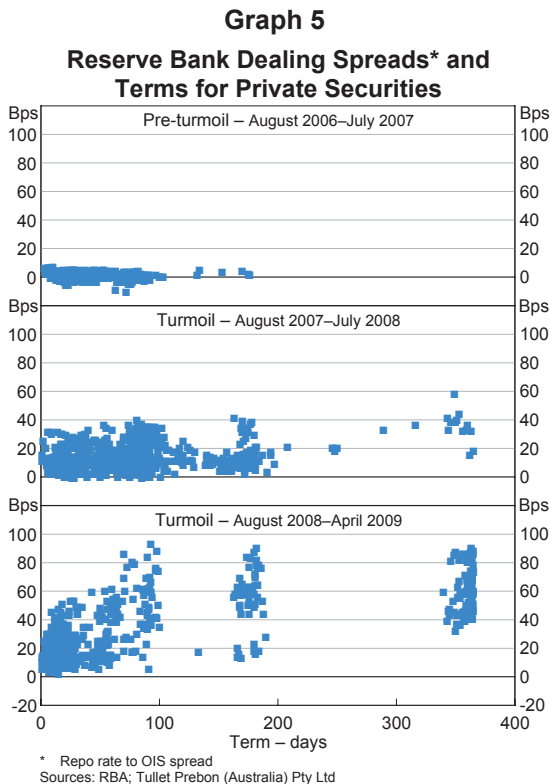


5 In October 2008 the Reserve Bank combined two classes of eligible collateral – authorised deposit-taking institutions (ADI) securities and asset-backed securities (ABS) – into a new class called private securities. For consistency this article combines ADI securities and ABS prior to October 2008 so that the category private securities is used over the full sample.

6 ES balances are also increased temporarily over month-end and quarter-end to accommodate increased demand for cash. This seasonal demand occurred prior to the turmoil but has been stronger over the crisis period.

collateral' (government and government-sponsored securities) (Graph 4). The increase in repos of private securities was also facilitated by reducing its holdings of foreign exchange swaps. In just six weeks, the Bank's holdings of private securities increased by \$26 billion, from \$20 billion, with almost \$17 billion of this coming in the first two weeks.

The third major change in the Reserve Bank's dealing was that repos were conducted for longer terms in an effort to address the greater pressures in the money market at longer horizons (bottom panel of Graph 4). Counterparties have to present collateral to the Bank that has a term at least as great as that of the repo. Longer repos therefore require counterparties to purchase longer-dated securities. The greater pressures were evident in participants in market operations bidding higher rates at longer terms than shorter terms (Graph 5). The top panel shows the Reserve Bank repos in the year prior to the onset of the turmoil, when the spread on repos was invariant to the term of the repo. At this time the Bank predominantly used relatively short terms repos in order to manage aggregate ES balances. Repos rarely had a maturity of more than three months, and the average term was just 45 days. In the first year of the turmoil bids were clearly more aggressive – that is higher – at longer terms, as seen in the middle panel. The Bank substantially increased the share of long-term repos, with some terms out to one year, and the average term increased substantially to 80 days. As tensions in the money market intensified, particularly at longer terms, with the collapse of Lehman Brothers, the spreads on the Bank's repos increased further at longer terms. Consequently the Bank conducted more long-term repos (bottom panel of Graph 5).



It is difficult to assess the efficacy of these changes in dealing arrangements as the counterfactual is not known. Furthermore, the changes in the Bank's dealing occurred in response to episodes of heightened tension in money markets and are therefore endogenous to the change in the spread. However, as shown in Appendix A, to the extent that these factors can adequately be controlled for, regressions of the change in the spread on variables measuring the Bank's dealing indicate that increases in ES balances and increased dealing of repos against private securities, particularly at longer terms, did contribute to small reductions in spreads, at least in the short run.

The Bank complemented these changes within its existing framework for market operations with some

small modifications to the framework. These were made in order to assist the functioning and liquidity of the cash market and various securities markets. In two stages the Bank broadened the range of securities eligible to be used in Reserve Bank repos, thereby improving the liquidity of securities made eligible.

- Early in the crisis, in September/October 2007, the Bank slightly broadened the range of securities issued by ADIs that were eligible, and for the first time accepted high-quality residential-mortgage asset backed securities (ABS). In October 2008 the restriction preventing a counterparty lodging ABS in which a related party was involved in the loan origination or securitisation was removed.
- The eligible collateral was broadened further in November 2008 to include most A1/A1+ and AAA-rated Australian dollar securities (i.e. including commercial bonds, asset backed securities and commercial paper). This expansion was made permanent in March 2009.

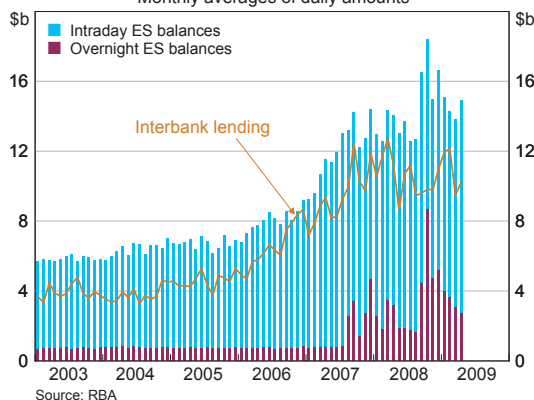
In addition, a term deposit facility was introduced for financial institutions to bid for deposits at the Reserve Bank, typically of 7–14 days. This facility assisted the management of the amount of cash in the interbank market, and enabled the Bank to increase its repos holdings. This facility was used from September 2008 until March 2009.

## Implications of Changed Operations

Since the crisis began, many central banks’ balance sheets have changed, with increased holdings of at-risk assets (mortgage backed securities, bank debt, etc). Like other central banks, the Reserve Bank uses risk management methods to mitigate this additional risk. Specifically, larger haircuts (‘over-collateralisation’) are applied to riskier securities and assets are marked-to-market on a daily, or even intra-day, basis. Overall, these risk management techniques mean that the increase in the risk of the Reserve Bank’s balance sheet has been well controlled.

While the increased supply of interbank funds (ES balances) has the potential to alter private sector behaviour in the interbank market, in Australia there has not been any noticeable change. The increase in overnight ES balances was small relative to the intraday volume of balances (which are used to settle the even larger volume of daily payments) (Graph 6). The volume of interbank lending also appears to have been unaffected by the increase in the supply balances at the Reserve Bank, following a similar trend to intraday balances in recent years. Along with the cash rate almost always trading at target, this suggests the increase in ES balances has been appropriate to account for increased demand for this risk-free, liquid asset.

**Graph 6**  
**Australian Interbank Market**  
Monthly averages of daily amounts



## Conclusion

Since August 2007, Australian money market spreads have tended to widen during US and European trading hours, and contract slightly in Australian trading hours. This indicates that the widening in Australian spreads has resulted from offshore developments. This suggests that credit risk has played a larger role, but liquidity risk may also have played a role.

The Reserve Bank has responded to the pressures in the money market by modifying its domestic dealing operations, largely within the existing framework. The Bank has conducted more of its repos with private securities as collateral, done more of these at longer terms, and also increased the supply of risk-free, highly liquid deposits at the Bank. These actions appear to have contributed to a moderate narrowing of money market spreads. The fact that the Bank's actions have contributed to reductions in spreads suggests liquidity risk has been a factor in elevated spreads.



## APPENDIX A: THE IMPACT OF RESERVE BANK ACTIONS ON MONEY MARKET SPREADS

In this Appendix a simple model of the change in spreads is estimated to examine the impact of the Reserve Bank's domestic market dealing on the 3-month Australian spread.

In order to assess the impact of the Bank's dealing it is necessary to control for the fact that the Bank's actions depended on developments in money markets, as the Bank's actions and money market conditions are endogenous. The endogeneity is controlled for by modelling the change in the spread during the Australian trading day (when US and Europe markets are closed) and conditioning on developments outside Australian trading hours.

The dependent variable in the regressions is the change in the 3-month spread between 10.00 am and 4.30 pm, and the conditioning variables are the overnight change in the Australian 3-month spread and the level of the Australian spread at the beginning of the day (international spreads are not significant and therefore are not used as conditioning variables but the overnight change in the Australian spread will incorporate international information). The endogeneity is also reduced because the Reserve Bank conducts open market operations at around 10.00 am, the beginning of the trading day used in this analysis. Typically new information that may influence spreads through the Australian trading day will not be known by the Reserve Bank when it deals.

As described in the text, the Reserve Bank modified its dealing in three ways: increasing ES balances, conducting more repos against private securities, and conducting more repos at longer maturities.

The impact of the increase in the supply of bank balances at the Reserve Bank is assessed by adding variables measuring the level of bank balance (ES balances) and the projected change in these balances (projected  $\Delta$ ES balances) (models 2 and 3). The projected change in balances is used as it is known to the market through the day while the actual change in balances is not known until the following morning. The coefficient on the level of balances is negative and significant, as is the projected change in balances. However, while on occasions there were large increases in bank balances to address money market stress, balances were also reduced, either in small increments or when market conditions stabilised; in practice only large increases were a 'policy' action. To test whether these had an impact on spreads, the projected change in balances is separated into increases and decreases, and only large (greater than one standard deviation, \$400 million) changes are included (projected large  $\Delta$ ES balances (+) and projected large  $\Delta$ ES balances (-)) (models 4 and 5). The coefficient on large increases is negative and significant, while that on large falls is not statistically significant. The coefficient indicates that an increase in ES balances of \$1 billion would have reduced the spread by a little under 1 basis point. Overall this evidence indicates that large increases in ES balances were effective in slightly reducing spreads, without an offsetting increase in spreads when balances were later reduced.

Two variables are used to capture the increased use of repos against private securities: the total value of these repos (PS repos) and the share of repos done with private securities as collateral (PS repos share). The results are shown in Table 1 (models 6 and 7). The value of PS repos has a negative and statistically significant coefficient, while the share of PS repos has an economically and statistically insignificant coefficient, indicating that it was the total value,

rather than share, of repos against private securities that contributed to a narrowing in the spread. The point estimate indicates that \$1 billion of repos of bank securities reduced the spread by a little under ½ basis point.

The other change in the Reserve Bank's dealing was to lengthen the term of repos. Three variables are used to capture this, the average maturity of repos of private securities and the value of these repos with terms greater than 60 days and 90 days (models 8–10). The point estimate on the average maturity is zero and insignificant, while those on the other two variables are negative and statistically significant. This evidence suggests that doing more repos at longer terms did contribute to a decline in 3-month spreads.

The last specification (model 11) includes the three variables that appear to best capture the changes to Reserve Bank dealing arrangements: the value of repos of private securities, large projected increases in ES balances and the value of repos of bank securities with a term greater than 90 days. The coefficient on the value of PS repos is negative but not significant, while that on PS repos with a term greater than 90 days is significant. Together this indicates that it was repos of private securities with a long term that contributed to reductions in spreads. The coefficient on large projected increases in ES balances is negative and significant, indicating that large increases were indeed able to contribute to a small decline in spreads.

**Table A1: Impact of Reserve Bank Actions on 3-month Spreads**

(continued next page)

Dependent variable:	$\Delta$ BB-OIS day					
	1	2	3	4	5	
Model:	Coeff	t-stat	Coeff	t-stat	Coeff	t-stat
Constant	2.00	4.73***	1.84	4.19***	1.87	4.29***
$\Delta$ BB-OIS night	-0.31	-9.20***	-0.30	-8.58***	-0.30	-8.39***
BB-OIS 10am	-0.05	-5.76***	-0.03	-2.61**	-0.05	-4.97***
ES balance			-0.25	-2.70**		
Projected $\Delta$ ES balance			-0.50	-1.88*		
Projected large $\Delta$ ES balance (+)					-0.92	-2.54**
Projected large $\Delta$ ES balance (-)						
PS repos					0.09	0.20
PS repos share						
PS repos average maturity						
PS repos > 60 days						
PS repos > 90 days						
<i>P</i> -value – joint significance of						
PS repos						
Projected large $\Delta$ ES balance (+)						
PS repos > 90 days	0.23		0.24		0.24	
<i>R</i> -squared	0.23	0.25	0.23	0.24	0.23	0.23
Adjusted <i>R</i> -squared	2.11	1.78	1.78	1.79	1.76	1.76
Durbin Watson						

**Table A1: Impact of Reserve Bank Actions on 3-month Spreads**  
(continued)

Dependent variable:	$\Delta\text{BB-OIS day}$											
	6	7	8	9	10	11						
Model:	Coeff	t-stat	Coeff	t-stat	Coeff	t-stat	Coeff	t-stat	Coeff	t-stat	Coeff	t-stat
Constant	2.05	4.86***	2.16	4.54***	2.08	4.30***	2.06	4.86***	1.92	4.52***	1.79	4.03***
$\Delta\text{BB-OIS night}$	-0.30	-9.03***	-0.31	-9.21***	-0.31	-8.70***	-0.30	-9.11***	-0.30	-8.96***	-0.29	-8.14***
$\text{BB-OIS 10am}$	-0.04	-4.72***	-0.05	-5.00***	-0.05	-5.11***	-0.05	-5.18***	-0.05	-4.97***	-0.04	-4.06***
ES balance												
Projected $\Delta\text{ES balance}$												
Projected large $\Delta\text{ES balance (+)}$											-0.95	-2.53**
Projected large $\Delta\text{ES balance (-)}$												
PS repos	-0.39	-1.99**									-0.03	-0.12
PS repos share			0.00	-0.77								
PS repos average maturity					0.00	-1.07						
PS repos > 60 days							-0.58	-2.20**				
PS repos > 90 days									-0.66	-1.91*	-0.80	-1.82*
<i>P</i> -value – joint significance of PS repos												0.01
Projected large $\Delta\text{ES balance (+)}$												
PS repos > 90 days	0.24		0.23		0.23		0.24		0.24		0.26	
<i>R</i> -squared	0.23		0.23		0.22		0.23		0.23		0.25	
Adjusted <i>R</i> -squared	2.11		2.10		2.19		2.12		2.12		1.80	
Durbin Watson												

Notes: The dependent variable is the change in the 3-month spread ( $\Delta\text{BB-OIS}$ ) during the Australian trading day.  $\Delta\text{BB-OIS}$  night is the change in the spread during the preceding night;  $\text{BB-OIS 10am}$  is the level of the spread at 10.00 am; ES balance is the level of Exchange Settlement balances; projected  $\Delta\text{ES balance}$  is the projected change in ES balances after the Reserve Bank's dealing (i.e. the announced forecast for the system cash deficit for that day plus the Reserve Bank's injection of funds through dealing); PS repos is the value of repos done against private securities; PS repos share is the share of repos done against private securities; PS repos average maturity is the average maturity of all private securities repos dealt; PS repos > 60 days and PS repos > 90 days are the value of private securities repos with terms greater than 60 days and 90 days. All nominal variables are measured in \$ billions. The sample period is from 10 August 2007 to 30 April 2009. \*\*\*, \*\* and \* denote statistical significance at the 1, 5 and 10 per cent levels respectively.

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