What moves benchmark money market rates?

Evidence from the BBSW market

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ABSTRACT

In this study we examine the daily movements of a benchmark interest rate using the bank bill swap rate (BBSW) over the period from 2006 to 2016. By decomposing the BBSW into its credit risk and liquidity risk components we reveal that the relative importance of these priced components are conditional on economic uncertainty. Although the compensation required for credit risk increased markedly during the period 2007-2009, the liquidity risk component exerted a disproportionately stronger effect on short-term BBSW spreads relative to credit risk. Our findings show that using a market-based approach to setting credit-based benchmark interest rates introduces both a liquidity and credit risk premia into benchmark interest rates, and both of these risk premia are affected by market forces.

JEL codes: G01, G12, G32

Keywords: Benchmark interest rates, BBSW, Credit Risk, Liquidity Risk, Risk Premia, Economic Uncertainty, Government Guarantee

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1. INTRODUCTION

The setting of benchmark interest rates has received much attention from policy makers, financial market participants and academics since reports of rate rigging have come to light with regards to the setting of the LIBOR in the UK and BBSW in Australia. The interbank money market serves as an important conduit for banks within a financial system to manage interbank liquidity. These benchmark rates are also extensively applied in pricing financial contracts in the interest rate derivative market, and in the calculation of payments on hundreds of billions of dollars of securities, mortgages and corporate loans as the rates on these are typically priced as a spread relative to the interest rate benchmark. Despite their importance within financial markets, the influence of credit and liquidity risk factors in these uniquely market-determined credit-based benchmark rates over time is not well understood, especially in times of economic uncertainty.

The Bank Bill Swap rates (BBSW) are unique credit-based reference benchmark interest rates in the Australian market. These rates are commonly used by large prime banks as the reference rate to trade wholesale funds on an unsecured basis between themselves on the interbank market via short-term bank bills for various tenors. BBSW rates were compiled by the Australian Financial Markets Association (AFMA) up until January 2017 from approved trading venues every business day at and around 10:00am, and are computed as the midpoint of the nationally observed best bid and best offer (NBBO) for prime bank eligible securities with maturity of between one and six months (primary calculation mechanism). [2] Prime eligible securities comprise bank accepted bills (BABs) and negotiable certificates of deposit (NCDs) issued by Australian prime banks.[3] The daily market-based rate setting mechanism used in the BBSW market in Australia to determine the BBSW rate at which

[2] AFMA eligible prime banks include the following four major Australian banks: Commonwealth Bank of Australia, Westpac, ANZ Banking Group, and National Australia Bank. Prior to 27 September 2013, the BBSW was calculated as the trimmed average of mid-rates observed by 14 survey panelists at 10am each business day before the operational change to using the midpoint of the NBBO rates. The administration of the BBSW market was transferred to the Australian Securities Exchange (ASX) from the beginning of 2017, beyond the end of our sample period.

[3] In normal market conditions eligible prime banks must post bids and offers across all the tenors included in the BBSW benchmark calculation at a maximum spread of 3 basis points for tenors of one, three and six months, and 4 basis points for tenors of two, four and five months.

transactions for prime eligible securities will take place provides an alternative laboratory for studying the sensitivity of these priced components in credit-referenced benchmark interest rates as these interest rate components have previously been identified in the pricing of longer-term corporate bonds (see for example, Shin and Kim, 2015) but are empirically difficult to capture when modelling shorter-term interbank money markets that are thought to be ‘near risk-free’ in stable times.

There is relatively scant empirical evidence on the determinants of banks’ wholesale unsecured funding costs, particularly within a smaller and more domestically orientated and transparent money market like that existing in Australia. As the benchmark interest rates are transaction based and the rate is set at a set time on a daily basis based on the demand and supply forces in the underlying market for unsecured bank borrowing, the market forces are likely to impose even greater disruptions in times of financial market turmoil. It is critical to understand the driving forces in these markets as they serve as barometers on the financial health of any economy and can change abruptly in times of financial crises (Taylor and Williams, 2009; Gefang et al., 2010; Olsen et al., 2012).

In this study, we focus on 3 key research questions: What is the likely impact of credit risk and liquidity premia on the time series variation of BBSW at different tenors? Is the divergence of spreads at longer terms from those at shorter terms suggestive of changing liquidity conditions in the interbank market? What are the determinants of these credit and liquidity risks? To the best of our knowledge we are not aware of any study that has comprehensively investigated the counterparty risk and market and funding liquidity components of such money market benchmark rates at different tenors. This is an issue of particular interest to market participants and regulators alike as these benchmark interest rates are critical to the plumbing of any financial system.

To understand the driving forces of the movement of BBSW, we decompose the risk premia contained in BBSW rates into two key factors, which are counterparty credit risk premium (*CRDRISK*) and liquidity risk premium (*LIQHOARD*). As banks’ funding liquidity (i.e., liquidity premium) cannot be directly observed, following prior studies like McAndrews et al. (2008) and Remolona et al. (2008), we first derive a credit risk premium for the Australian interbank market by using the prices of credit default swaps (CDS spreads) for the four AFMA eligible prime banks and hypothesizing a very conservative recovery rate of 40% given default. We then assume that BBSW rate (in excess of the OIS rate) is comprised of only credit and liquidity components. Hence, the difference between the excess BBSW rate and our estimated credit premium (*CRDRISK*) represents the residual liquidity component (*LIQHOARD*). To further investigate the determinants of the liquidity component, we use a set of proxies, which are derived from trading data and disclosures of the Reserve Bank of Australia (RBA), to measure funding liquidity and market liquidity. We find that funding liquidity plays a more important role than market liquidity in determining liquidity risk component of BBSW rates. For the credit risk component, we not only examine the minimum set of determinants indicated by previous research, which are financial leverage, firm-specific volatility and the slope of the yield curve, we also control for the volatility level of CDS premia and the uncertainty of the market expectations about banks' earnings. Overall, the structural determinants of the credit risk premium are consistent with those identified theoretically (see for example, Heider, Hoerova, and Holthausen, 2015 and references therein). Our results are robust to the inclusion of time fixed effects and the first difference estimation.

In general, we find that both liquidity and credit risk drive movements in the BBSW over time as these are effectively short term interest rates on market- and credit-based instruments. However, the relative importance of these priced components are conditional on economic uncertainty, with the liquidity premium being the main fluctuating economic driver of the BBSW spread and credit risk being a more stable and constant low key driver. Moreover, the compensation required for credit risk significantly increased during the midst of the tumultuous 2007-2009 period but under normal market conditions the liquidity components play a more dominant role in driving short-term BBSW movements. This is an important result which delineates from the extant literature that has focused on other international reference benchmark rates or interest rate spreads in the absence of either implicit or explicit government protection on banks operating in these interbank markets. In Australia, in the height of the 2008 Global Financial Crisis (GFC), the Australian government introduced a guarantee on large deposits and wholesale debt that was utilized by the domestic prime banks that also operated in the BBSW market (see Luong et al., 2017 and references therein for further details). Our empirical evidence, consistent with Bollen et al.'s (2015) study on Australian bank risk through the GFC indicates that market perceptions of bank risks changed when the government explicitly provided guarantees on banks' public debt and we find as a result of this counterparty risk became relatively less of a concern in the interbank market during 2008. Our empirical results imply that using a market transaction approach to setting credit-based benchmark interest rates introduces both a liquidity and credit risk premia into benchmark rates and both are subject to changing market forces and fluctuate over time especially in response to economic uncertainty.

A better understanding of the economic factors that influence the behavior of BBSW is important for several reasons. First, since these benchmark rates are used at different maturities as default reference rates, an increase in the BBSW term premia would not only affect the liquidity of many classes of fixed income and derivative contracts but also reduce real-sector investments. Second, there has been a decline over recent years in the turnover of prime bank paper used to calculate BBSW as banks have gradually pulled back from interbank transactions fearing possible allegations of rate rigging. The decreasing turnover in the interbank market raises concerns that BBSW might become a less widely used benchmark rate in the future. Thus, understanding the economic forces behind BBSW changes would strengthen market confidence in the robustness of the BBSW to changing interbank market conditions, and mitigate the risk that a sudden rate shift might be misinterpreted as evidence of market manipulation. Third, the regulator has recently proposed to compute BBSW as the volume-weighted average price (VWAP) of market transactions during the rate set window. It is therefore important to investigate whether the interbank market liquidity mitigates or amplifies shocks to the BBSW rate setting process.

The remainder of this paper proceeds as follows: Section 2 surveys the related literature. Section 3 details the data sources. Section 4 discusses our empirical strategy and Section 5 reports summary statistics and our main findings. Finally, Section 6 concludes.

2. *RELATED LITERATURE*

The interbank market is of great interest and debate among financial market participants and academic researchers, especially during the post Global Financial Crisis period.

There are two key strands of literature related to our research. First, the relationship between credit risk of individual banks and interbank rates. Consistent with other global unsecured short-term money market benchmark rates such as LIBOR and EURIBOR, the BBSW rate is based on the borrowing costs of major banks, with bank credit risk embodied in the rate. It follows that a rise in unsecured BBSW rates at different maturities could reflect increased compensation demanded by risk-averse lenders against *counterparty risk*. Several theoretical models relate the increase in interbank rates to the worsening of the credit risk of individual banks in the presence of asymmetric information (see e.g., Flannery (1996), Freixas and Jorge (2008), and Heider, Hoerova, and Holthausen (2015)). The main assumption of these models is that adverse selection originating from credit-risk uncertainty would lead lenders to "hike" interbank benchmark rates hence contributing to a market-wide drying up of liquidity. Furthermore, the model proposed by Heider, Hoerova and Holthausen (2015) has important implications. The theory shows that there is an opportunity cost of holding liquid assets due to the endogeneity of liquidity in the banking industry. In addition, Heider, Hoerova and Holthausen argue that the interaction of asymmetric information and the endogenous liquidity can cause a novel form of market break-down in which no interest rate is compatible with trade in the interbank market. Empirically, using interbank loan-level data in Germany, Bräuning and Fecht (2016) provide evidence of the role that asymmetric information played in impacting interbank rates. Specifically, they find that, opaque borrowers obtain lower rates from their relationship lenders, compared to other lenders, implying that relationship lenders may have more inside information and hence are able to provide lower rates to the opaque borrowers. Similar results can also be found in Cocco, Gomes and Martins (2009). Maggio, Kermani and Song (2016) shows that the impact of relationship on the ability to access liquidity is especially strong during periods of market turmoil, implying that lenders concern more about counterparty risks during turmoil and hence are reluctant to lend to needy institutions except the lenders' closest ties. Furfine (2001) demonstrates that interest rates negotiated in the interbank market reflect borrowing banks' credit risk. Not only does this piece of evidence indicate that banks could be effective monitors of other banks, but it also verifies the critical role of counterparty risk in determining interbank rates. Ejsing et al. (2012) disentangle credit and liquidity premia in French and German sovereign bond markets and find that dramatic decrease in expected future monetary rates and the strong downward pressure on the core-country yields disguised the increase in sovereign credit premia during the global financial crisis. Similarly, Poskitt and Waller (2011) also find that liquidity and credit risk effects vary in influencing the on- and off-shore interest rate differential for New Zealand. The interplay between liquidity and credit risk effects are pervasive around the world and the unique rate-setting mechanism in Australia affords an appropriate laboratory to disentangle these two forces over time and under varying market conditions. In this context, the time series variation in unsecured BBSW benchmark rates are capturing the inherent credit risk of individual banks operating in the Australian financial system at any point in time as well as market concerns regarding fluctuations in funding liquidity conditions.

Second, other studies attribute the level of and variation in interbank benchmark rates to lending disruptions due to *liquidity hoarding*. This phenomenon refers to an increase in interbank rates for term borrowings – or reduction in the average maturity of term interbank lending – by the lender to stack up precautionary liquidity reserves even when borrowers have high credit quality. Liquidity hoarding played a major role in the determination of interbank rates in the US and European markets during the financial crisis while the credit factor appeared to account for only a small percentage of these rates. One of the reasons for this was that banks granted credit lines or a "liquidity backstop" to off-balance-sheet structured investment vehicles and conduits used by sponsoring banks to raise funds (see Brunnermeier, 2009). The increased uncertainty about if and when these lines could be withdrawn made banks reluctant to lend beyond very short maturities in the interbank markets causing interbank rates to rise. Acharya and Skeie (2011) develop a model of liquidity hoarding where even strong banks with low credit risk are unable to access liquidity in the interbank market if lenders face significant short-term rollover risk. In their model, the inability of a lending bank to roll over its own debt increases its precautionary demand for liquidity hence sending shock waves through the interbank market. Diamond and Rajan (2011) propose a model where more liquid financial institutions could depress lending by demanding elevated required rates of return to banks facing a potential risk of forced fire sales. Brunnermeier and Pedersen (2008) develop a model where higher asset price volatility causes traders' margins or haircuts to increase, and worsens funding liquidity risk. Allen, Carletti, and Gale (2009) argue that an increase in asset price volatility pushes banks to elevate precautionary liquidity reserves. The consequence of liquidity hoarding is severe because it is costly for needy banks to create liquidity (Heider, Hoerava and Holthausen, 2008). Banks with liquidity shortages have to sell assets to obtain liquidity. According to Acharya, Gromb and Yorulmazer (2012), however, when assets are bank-specific and surplus banks have powerful bargaining position, needy banks cannot sell their assets efficiently. This inefficiency is more acute in financial crises where the outside market is weaker, and can only be mitigated by the intervention of Central Banks, who act as the lender-of-last-resort (LOLR) facilities. Using a novel data set on euro area overnight unsecured interbank transactions, Garcia-de-Andoain, Heider, Hoerava and Manganelli (2016) show that the central bank liquidity provision replaced the interbank market and enhanced the supply of liquidity during the sovereign crisis but the impact of central bank liquidity provision is highly heterogeneous. In addition, the fear of contagion effect may cause banks to reduce lending and hoard liquidity even further (see e.g., Allen and Gale, 2000; Iyer and Peydro, 2011). By examining German banks' behaviour in ECB's repo auctions, Fecht, Nyborg and Rocholl (2011) show that, not only a bank's own liquidity, but also other banks' liquidity, determine the rate a bank pays for liquidity.

3. DATA

Our daily data on BBSW rates over 3 and 6 months is from the Australian Financial Market Association (AFMA). We collect from the RBA the daily volume of first-leg securities including authorized deposit-taking institutions (ADI) securities, residential mortgage-backed securities, asset-backed commercial papers traded by RBA under repurchase agreement (repo) contracts in OMO, daily exchange settlement (ES) balances in the interbank market, and the lowest rate and number of days of repo contracts dealt by RBA. The data on the Overnight Index Swap (OIS) and yield curve is obtained from Bloomberg. The data on the 5 year credit default swap (CDS) spreads for the four AFMA eligible prime banks is sourced from MARKIT. Last, the data on prime banks' leverage and idiosyncratic risk is obtained from Datastream. Our sample covers the sample period from 2006 to 2016, and contains a total of 2,515 observations.

Figure 1 illustrates the swap spread for 3-month (*SPREAD3M*) and 6-month tenor (*SPREAD6M*). The variable *SPREAD3M* (*SPREAD6M*) is computed as the difference between the BBSW 3-month (6-month) tenor and the overnight index swap (*OIS*).[4] The observation period starts in October 2013 following the adoption by AFMA of a new automated process to extract BBSW rates. In the absence of any frictions, *SPREAD3M* would reflect the daily compensation required by interbank lenders against bank default risk and/or any premium to induce investors to transact in or to hold comparatively illiquid assets. The figure shows the existence of significant daily variation in the primary measure of interbank stress (*SPREAD*), ranging between 0 and 50 basis points. This variation explains in excess of 30% of the daily variations in the BBSW.

[Insert Figure 1 about here]

4. METHODOLOGY AND RESEARCH DESIGN

We model the structural forces that move the BBSW by decomposing the risk premia contained in the BBSW benchmark rates into two key factors reflecting compensation for counterparty risk in the interbank market (*CRDRISK*) and any premium associated with liquidity demand of borrowing banks (*LIQHOARD*). Disentangling credit from liquidity factors in the BBSW term premia is difficult as we are not able to observe banks' funding liquidity. As such, we follow the approach proposed by

[4] The overnight index swap (OIS) measures market forecasts of the RBA cash rate. The OIS does not reflect interbank credit risk because it does not involve any exchange of principal (credit risk is also mitigated by collateral and netting arrangements). Similarly, it does not contain liquidity premia as there is no exchange of cash at inception of the swap agreement hence it cannot be used for funding purposes.

McAndrews et al. (2008) and use the prices of credit default swaps (CDS) for the four AFMA eligible prime banks to derive a proxy of credit risk premium for interbank loans, *CRDRISK*. Specifically, we first derive the risk-neutral default probabilities of the CDS reference entity assuming a very conservative recovery rate of 40% given default.[5] This probability is then used to infer the "fair" credit spread in excess of the OIS rate for obtaining 12-month funds in the interbank market. The final step is to compute the median of these estimated credit spread, *CRDRISK*, across the four AFMA eligible prime banks.

Next, we assume that any difference between BBSW rates and the proxy for *CRDRISK* reflects the residual liquidity component of the interbank rate (see Bank of England, 2007):

$$SPREAD3M_t = CRDRISK_t + LIQHOARD_t \quad (1)$$

where *SPREAD3M* is the difference between the BBSW with 3-month tenor and the 3-month OIS rate.[6] A caveat of this decomposition is that it implicitly assumes that liquidity premium and credit risk components are uncorrelated. However, if the two components are interrelated and compound each other, the CDS spread also captures the premium related to endogenous default driven by interbank liquidity. In this case, the liquidity measure *LIQHOARD* would underestimate the total liquidity component of the benchmark rate. To the extent that we are not overestimating this liquidity component, we would err on the side of conservative estimates. To identify the drivers of the spread between BBSW and OIS rates, we further decompose *CRDRISK* and *LIQHOARD* into several factors reflecting the characteristics of the banks operating in the interbank market as well as market-wide conditions.

[5] Although average recovery rate of unsecured corporate debt under each CDS contract are known to be around 40%, there is no publicly available data on recovery rates of interbank loans. Since the interbank loans are claims senior to the unsecured corporate debt, it is reasonable to assume that they should have a higher recovery rate than unsecured corporate debt. Kuritzkes, Schuermann and Weiner (2005) provide evidence that recovery rates of interbank loans could be as high as 90%.

[6] Our main variable of interest is the *BBSW3M* as this rate is the most liquid benchmark rate on approved trading venues, although bank papers are also issued regularly for 6-month tenor. For robustness, we will repeat the BBSW decomposition analysis using benchmark rates with 6-month tenors (*BBSW6M*).

Our first multivariate regression entails the decomposition of interbank liquidity, *LIQHOARD*, into funding liquidity risk and market liquidity risk (see Brunnermeier, 2009). Although we cannot observe directly the funding needs of the prime banks in the interbank market we use several measures provided by the RBA to quantify the degree of funding liquidity needs in the interbank market. Specifically, the RBA publishes daily aggregated information of the volume, maturity, cutoff rates of repo transactions as part of its Open Market Operations (OMO). In addition, the RBA also discloses daily measures of direct liquidity injections in the interbank market in response to daily liquidity needs of eligible banks.[7] It follows that our decomposition of the liquidity premium in the interbank market can be expressed as follows:

$$LIQHOARD_t = a + [b.RPMATURITY_t + c.(RPRATE\text{-}OIS)_t + d.FLY2QUAL_t + e.FLIQDEM_{1,t} + f.FLIQDEM_{2,t}] + [g.MKTLIQ_t] + \varepsilon_t \quad (2)$$

where *LIQHOARD* is the non-default or liquidity component of the BBSW-OIS spread on day t. We use several proxies that quantify directly the extent of funding liquidity needs in the interbank market: (i) the *RPRATE-OIS* is the repo spread computed as the difference between the repo rate and the OIS rate, where the repo rate is the daily lowest repo rate dealt by the RBA through OMO for each term dealt. The loading of *RPRATE-OIS* is expected to be positive as worsening of funding liquidity will create tensions on the (reverse) repo rates; (ii) the variable *RPMATURITY* which is the number of days of repo contracts. We expect the sign of *RPMATURITY* to be negative as longer repo terms are likely to lower the uncertainty of funding for counterparties and encourage greater liquidity in the underlying market for bank paper (see Debelle, 2008). Next, we include the variable (iii) *FLY2QUAL* which is defined as the spread between the repo rate on highly-liquid collateralized (quasi-)

[7] Banks maintain with the RBA an aggregate balance of funds in their Exchange Settlement (ES) accounts which represent their primary source of liquidity to clear transactions amongst themselves without affecting (but simply redistributing) the aggregate balance. Whenever banks transact with the RBA to demand liquidity (ES deficit), they cause ES unbalances which could lower the cash rate below the target within the corridor of ±25bps. To neutralize the effect of ES unbalances on the target cash rate, the RBA intervenes with OMO by injecting (if ES deficit) or withdrawing (if ES surplus) liquidity in the repo market. The size of any deviations from the target rate measures the effectiveness of RBA's daily interventions in the interbank market. During the financial turmoil of 2007-2008, for instance, ES aggregate balance peaked at $16 billion from its long-term average of $750 million, reflecting the dramatic liquidity injection of the RBA in the ES system aimed at containing any deviations of the cash rate from the target (in total, there were 6 deviations of -1bps and 1 deviation of -2bps).

Commonwealth Government securities (CGS) and the repo rate on less-liquid collateralized securities (e.g., Authorised Deposit-taking Institutions issued securities (ADI), Residential Mortgage Backed Securities (RMBS), and Asset Backed Commercial Paper (ABCP)). This spread would become increasingly negative during periods of heightened illiquidity in the interbank market as dealers' demand "flies" to high quality risk-free assets such as CGS (either GC1 or GC2) and away from collateralized ADI securities hence causing CGS repo rates to trade persistently below those of ADI securities.[8] Hence, *FLY2QUAL* is expected to be negatively related to liquidity premium; (iv) $FLIQDEM_1$ which represents the daily volume of first-leg securities (ADI-issued securities (ADI), residential mortgage-backed securities (RMBS), and asset-backed commercial papers (ABCP)) bought (if positive) or sold (if negative) by the Reserve Bank of Australia under repo contracts dealt in OMO. An increase in the daily amount of repo contracts bought (sold) by the RBA captures the extent of funding liquidity demanded (supplied) by banks in the interbank market. As such, we expect $FLIQDEM_1$ to be positively associated with the liquidity premium *LIQHOARD*; (v) $FLIQDEM_2$ which is computed as the logarithm of the daily exchange settlement (ES) balances in the interbank market. An increase (decrease) in the aggregate balance of ES accounts reflects banks' need for RBA's injection (withdrawal) of funding liquidity through the repo market. We then expect $FLIQDEM_2$ to be positively correlated with *LIQHOARD*. Last, despite the difficulty to separate market liquidity from funding liquidity due to "liquidity spirals" (see Brunnermeier and Pedersen, 2008), we measure the effect of interbank market liquidity in Equation (1) using the proxy *MKTLIQ* which is computed as the 30-day total volatility of the BBSW National Best Bid and Offer (NBBO) quotes. Amiram, Cserna, and Levy (2016) show that higher total volatility is associated with higher illiquidity due to its jump component. This market liquidity proxy is expected to be positively associated with the liquidity premium. We also construct an alternative proxy of interbank market liquidity, *MKTLIQ*, using historical data on aggregate daily volumes in prime bank paper executed

[8] The RBA intervenes in the interbank markets by conducting OMO as repos collateralised by Government securities (CGS), ADI, RMBS, and ABCP. Repos involve two legs. First the RBA buys (sells) a security from (to) a bank through a reverse repo contracting (repo contracting), hence injecting (withdrawing) liquidity ($FLIQDEM_1$). Second, at the agreed maturity of the repo contract (*RPMATURITY*), the initial purchase (sale) is reversed by the RBA and the liquidity injection (withdrawal) is unwound. During the financial crisis the share of collateralised ADI, RMBS and ABCP securities exceeded 70% of all the repo OMO conducted by the RBA (with the remaining 30% represented by CGS repo transactions).

through approved venues. This time series is obtained from the Australian Securities Exchange (ASX) and is only available from 27 September 2013.

Next, we follow the structural model of Merton (1974) and Longstaff and Schwartz (1995) to examine the second determinant of the interbank spread, namely the *CRDRISK* component. The structural model assumes an explicit link between firm's default risk and economic fundamentals that are central to the Merton (1974) approach. These economic fundamentals in our context include: (i) the degree of leverage of the major banks (*BLEV*), (ii) the volatility of firm's underlying assets as proxied by either the prime bank's idiosyncratic volatility (*BIVOL*) or the uncertainty in market expectations about prime banks' earnings (*UNCERTAINTY*); (iii) the past 12-month time series cross sectional dispersion in daily CDS spreads of the four major prime banks (*CDSVOL*) as in the presence of higher CDS dispersion safe borrowers would abandon the interbank market due to elevated adverse selection costs (see Heider et al., 2015); and (iv) the slope of the yield curve which impacts on the value of the option on firm value (*EXYCURVE*). All of the variables are expected to be positively correlated with credit premium. The regression suggested by previous theory consists therefore of regressing the CDS premia, denoted by *CRDRISK* on the following independent variables:

$$CRDRISK_t = a + b.CDSVOL_t + c.BLEV_t + d.BIVOL_t + e.UNCERTAINTY_t + f.EXYCURVE_t + \varepsilon_t \quad (3)$$

We implement a series of time-series regressions emphasizing time-series dependences of *LIQHOARD* and *CRDRISK* on theoretical fundamental variables. We also estimate Equation (3) using time-series cross-sectional regressions with time fixed effects to add the cross sectional dimension to the overall estimation procedure.

5. SUMMARY STATISTICS

Descriptive statistics of all variables used in this study are provided in Table 1. It is well worth noting that the average *LIQHOARD* (19.41 bps for 3 months and 22.85 bps for 6 months) is significantly higher than the average *CRDRISK* (3.98 bps for 3 months and 8.04 for 6 months). Statistically, both *T-test* and Wilcoxon test reject the null of equal values of these two components. The higher liquidity premium in the Australian interbank market confirms the expectation that liquidity constitutes an issue of greater concerns to interbank market participants than counterparty risk (Taylor and Williams, 2009). In detail, the liquidity component varied significantly over our sample period, ranging between 5 bps and 47 bps. By contrast, *CRDRISK* moved within a much narrower range, with a maximum of 9 bps and a minimum of 0.3 bps. The distribution of *CRDRISK* is almost symmetric while that of *LIQHOARD* is slightly skewed to the right, indicating that during some periods (e.g., times of stress) *LIQHOARD* may be extremely high.

Interestingly, repo maturities (*RPMATURITY*) have averaged at around 42 days over the sample period considered, with a maximum repo term of 103 days. This reflects the change in the RBA policy at times when term markets for bank funding was particularly under stress. Specifically, during the 2008 financial crisis the Bank signaled that it was willing to deal repo contracts for longer terms so as to provide greater liquidity in the underlying market for bank paper. This coincided with an increase in the supply of ES balances (*ESVOLUME*) by the Bank, from the level of $750 million –which had prevailed for a number of years prior to the crisis – to more than $5 billion (our 95th percentile value of $3.6 billion reflects spikes in the RBA interventions in 2008). Finally, the average spread between the repo rate on highly-liquid collateralized CGS and that on less-liquid collateralized securities (*FLY2QUAL*) is -0.4%, with the 5th percentile of this variable averaging as low as -3.35%. Negative spreads below -3% were reached during the 2008 financial crisis when many security providers retreated precipitously from the lending market to reduce their exposure to any counterparty risk. This caused repo rates on many CGS to trade below rates on less-liquid collateralized securities for a longer time (see also RBA Bulletin, December 2010).

[Insert Table 1 about here]

Table 2 decomposes the three main variables of interest, namely BBSW spread, *LIQHOARD* and *CRDRISK*, into different subsamples over the full sample period from 2005 and 2016. The BBSW spread prior to the GFC (2005-2006) had been around 10 bps as compared to its average of 23 bps over the entire sample period. Sub-period 2 in Table 2 considers instead the period of intense turmoil in interbank markets sparked by the collapse of Lehman Brothers in the US. The failure of Lehman Brothers is regarded as a seminal event because it shattered the belief about the resilience of the interbank market to major liquidity and credit risk event. The resulting turmoil prompted a coordinated intervention by governments and central banks to restore promptly investor confidence in the financial system and forestall the implosion of the money market.

During this period of heightened market stress, the 3-month BBSW spread peaked at about 143 bps, with most (94%) of this variation being explained by the sudden increase in the (estimated) liquidity premium (135 bps). This emphasizes that the functioning of the interbank markets around the world had become severely impaired as the financial crisis deepened during this subperiod. The liquidity dry-up that followed reflects the preference of banks to hoard cash rather than lend it out in the money market even at short maturities. Similar conclusions yield when we turn to Subperiod 3 which reflects the build-up of tensions in the European interbank markets in 2011. This second major turbulence in the global financial markets contributed to maintaining an elevated liquidity risk premium in the Australian interbank market of about 75 bps, which accounted for 90% of the BBSW spread. After these two subperiods of significant market stress, the BBSW spread mean reverted towards its long-term sample average of about 21 bps. In the whole, the difference in the descriptive statistics of *LIQHOARD* and *CRDRISK* documented in Table 2 highlights the importance of separating these two components of liquidity risk and credit risk to understand their dynamic contribution to the time series variation of the BBSW spread.

[Insert Table 2 about here]

Table 3 reports the pair-wise correlation matrix comprising most of the explanatory variables considered in this study. Unsurprisingly, the positive correlation coefficient of about 0.40 between *CRDRISK* and *LIQHOARD* reflects the interdependence of interbank liquidity risk and credit risk on each other. This positive correlation is also supported by the model proposed by Heider, Hoerova and Holthausen (2015), in which the authors demonstrate that counterparty risk and liquidity hoarding are intrinsically correlated. As expected, market liquidity (*MKTLIQ*), which is proxied by the bid-ask spread, is positively correlated with funding liquidity (*LIQHOARD*). In addition, as expected, *CRDRISK* is positively associated with all the four economic fundamentals that are central to the Merton (1974) model, which are *CDSVOL*, *BLEV*, *BIVOL*, and *EXYCURVE*. The high correlation between these proxies for credit risk suggest than no more than one of these proxies should be included as an explanatory variable in the same regression model to interpret properly their effect on *CRDRISK*.

[Insert Table 3 about here]

Before turning to our multivariate analysis of the determinants of funding liquidity and credit risk in Section 6, we first evaluate whether and, if so to what extent our variables are affected by a unit root problem. McAndrews et al. (2008) highlights the importance of testing for unit root before estimating multivariate regressions based on daily spreads. To this end, we run an Augmented Dickey-Fuller test of unit root for both the daily levels and daily changes of all the variables used in this study. The findings of this test are illustrated in Table 4.

Overall, the test statistics there show that the null hypothesis of a unit root can be rejected for both the level and variation of all the determinants of funding liquidity discussed in Section 4. By contrast, we do not reach the same conclusion when we consider the *level* of the economic determinants of *CRDRISK*. Indeed, the unit root test suggests clearly that a better estimation of the determinants of *CRDRISK* should rely on regression models based on first-differences.

[Insert Table 4 about here]

6. *MAIN RESULTS*

6.1 The determinants of the liquidity premium

After confirming that our daily data does not suffer from the serious unit-root problems, we proceed with our estimation of the determinants of the level of the daily interbank liquidity premium by estimating the model in Equation (1). Table 5 reports the findings of this estimation. The market liquidity proxy (*MKTLIQ*) is associated positively to the degree of liquidity in the interbank market. For instance, the coefficient (4.65) of the market liquidity proxy *MKTLIQ* in column (i) implies that a one standard deviation increase (0.9261) in this variable is associated with an increase in the *LIQHOARD* of about 4.3 bps. This economic magnitude tends to weaken somewhat after accounting for the effect of several proxies of interbank funding needs on the liquidity risk premium in the regression specifications of models (iii) to (v) of Table 5.

The loading of the BBSW spread on the fly-to-quality proxy of *FLY2QUAL* in model (ii) suggests the existence of a negative relationship between this variable and the extent of illiquidity in the interbank market. Specifically, the lower the spread *FLY2QUAL* between the repo rate on highly-liquid collateralized (quasi-) Government securities (CGS) and the repo rate on less-liquid collateralized securities (e.g., ADI, RMBS, and ABCP), the higher the interbank liquidity premium. To give an idea of the economic magnitude of such relationship, a one standard deviation increase in the variable *FLY2QUAL* is associated with a economically meaningful reduction in the liquidity premium of about 8 bps, on average. Furthermore, an increase (decrease) in the aggregate balance of exchange settlement accounts ($FLIQDEM_2$) should reflect prime banks' need for an RBA's injection (withdrawal) of funding liquidity through the repo market. This conjecture is confirmed by the loading of the BBSW spread on this interbank liquidity proxy of *FLIQDEM*: a one standard deviation increase in the variable $FLIQDEM_2$ is associated with an increase in the liquidity premium of about 2 bps.

We also quantify the effect of the RBA intervention on the repo market by including the variable $FLIQDEM_1$. The positive and significant coefficient (2.22) of this variable in model (ii) suggests that an increase in the daily volume of first-leg securities bought or sold by the RBA under the repo contract dealt in OMO is associated with a significant increase in the interbank liquidity premium. This confirms that in periods of heightened funding illiquidity, prime banks are more active sellers of first-leg securities under the repo contract in the OMO, and more willing to accept a significant higher rate on repo contracts (*RPRATE-OIS*) to access greater funding liquidity. This is also confirmed by the positive loading of the dependent variable, *LIQHOARD*, on the spread on term repo rates measured by *RPRATE-OIS*. Further, consistent with our summary statistics, the liquidity premium increased by an average of about 9 bps during the crisis period as quantified by the coefficient attached to the dummy variable $SHOCK_{2007\text{-}2008}$. These results are robust to the use of time fixed effects.

In models (vi) and (xii) of Table 5, we repeat the analysis of models (iv) and (x) of Table 5 using the aggregate daily volumes in prime bank paper executed through approved venues as an alternative proxy of interbank market liquidity, *MKTLIQ*. As expected, the estimated coefficients of the independent variable, *MKTLIQ*, in models (vi) and (xii) suggest that the liquidity premiums are negatively correlated with the underlying trading interest embodied in the executable bids and offers used in the determination of the BBSW rates. Although the time series on aggregate daily volumes is only available from 27 September 2013, the estimated coefficients on all the funding liquidity proxies in models (vi) and (xii) remain qualitatively unchanged over the much shorter sample period.

[Insert Table 5 about here]

6.2 A structural model of the determinants of the credit risk premium in the interbank market

In this section, we examine the determinants of the daily credit risk premium in the Australian interbank market *CRDRISK*. For this purpose, we first estimate the credit risk component of the

BBSW spread under risk neutral probabilities, assuming a recovery rate of 40% (see McAndrews et al., 2008). We then use the structural model of default to help identify variables that can explain the (minor) changes in the variable *CRDRISK*. This approach has been used extensively in the literature to examine the theoretical determinants of corporate bond spreads (see Collin-Dufresne et al., 2001) and the CDS premia (Ericcson et al., 2009). The findings of this literature indicate that the minimal set of determinants includes the financial leverage (*BLEV*), firm-specific idiosyncratic volatility (*BIVOL*), and the slope of the yield curve (*EXYCURVE*). We also control for the volatility level of the CDS premia (*CDSVOL*) and the degree of uncertainty in market expectations about prime banks' earnings (*UNCERTAINTY*). These variables were described previously in Section 4.

The evidence in Table 3 of a high correlation between the structural determinants of credit risk motivated our decision to begin our regression analysis by first estimating simple bivariate versions of equation (2). The findings of those estimations show that the loadings of our dependent variable *CRDRISK* on its structural determinants in the Australian interbank market are consistent with those identified in the previous literature. Specifically, an increase in prime banks' financial leverage should be associated with a greater probability of default, on average (see e.g., Merton, 1994). This is congruent with the estimated loading (6.50) in model (ii) of our dependent variable *CRDRISK* on the structural explanatory variable *BLEV*. To put this estimated coefficient into perspective, a one standard deviation (0.65) increase in the average financial leverage of prime banks' value is associated with a sizeable increase (4.22 bps) in the credit risk component of the BBSW spread. Importantly, the two structural variables of the level of financial leverage and volatility of the CDS explain almost 35% of the time series variation in the credit risk premium.

Our third structural model variable is the slope of the excess yield curve (*EXYCURVE*). After controlling for market expectations of short term rates (i.e., OIS rate), which affect the default probabilities negatively (see Longstaff and Schwartz, 1995), the yield on 10-year treasury bonds increases the drift rate of the risk neutral process for firm value, which in turns makes the risk neutral probability of default lower. Unsurprisingly, greater market uncertainty surrounding the profitability of the Australian prime banks (*UNCERTAINTY*) is associated with higher default probability across most of our model specifications. The magnitude of this structural factor is however not meaningful economically as a one standard deviation (0.05) increase in *UNCERTAINTY* seems to amount to less than a basis point increase in the associated level of the credit premium, equal conditions.

The decomposition of the BBSW spread into credit risk and liquidity hoarding components ignores the possibility that default and non-default factors are positively correlated as also indicated by the correlation matrix in Table 3. For this reason, we decided to control for the (excess) interbank repo rate, *RPRATE-OIS*, in model (vi) of Table 6 to quantify the effect of liquidity risk on credit risk premia.[9] The coefficient there suggests that the effect of the aggregate balance of exchange settlement accounts feeds into the credit risk component which confirm the existence of a lead-lag effect between funding liquidity and credit risk premium. Thus, there appears to be some evidence that the level of interbank liquidity is factored in the credit risk premium, possibly due to the greater default risk of prime banks during periods of severe funding illiquidity in the interbank market. Nonetheless, the effect of interbank liquidity on credit premium disappears both economically and statistically after including the lagged value of *CRDRISK* in model (vii) to account for any serial correlation in the dependent variable.[10]

[Insert Table 6 about here]

Next, we also expanded our structural model in Equation (3) to include the dummy variable *GOVGUARANTEE* which is equal to 1 in the days between 12 October 2008 (announcement date) and 31 March 2010 (final date) when the Australian Government implemented the Guarantee Scheme for large deposits and wholesale debt funding.[11] We also interacted this variable with each of the

[9] We obtained qualitatively similar results when other liquidity factors were considered in the regression models illustrated in Table 6.
[10] An analysis of the sources of this time series correlation between funding liquidity and credit risk would require a Granger causality test which is beyond the scope of this study.
[11] During the period 12 October 2008 and 31 March 2010, the Australian Government implemented the Guarantee Scheme for Large Deposits and Wholesale Funding to offer increased depositor protection and

structural-model determinants of the credit risk premium. The loadings of the 3-month credit risk premium, *CRDRISK3M*, on these additional variables are reported in column (viii). We repeat this analysis using as our dependent variable the 6-month credit risk premium (*CRDRISK6M*) in column (xvi). Overall, the Government Guarantee Scheme lowered significantly the 3-month credit risk premium by almost 10 bps. Importantly, the presence of this guarantee reduced the loading of the credit risk premium on its structural-model factors, as indicated by the coefficients attached to the interaction variables between *GOVGUARANTEE* and each of these factors. Our results corroborate with Bollen et al.'s (2015) previous finding that the introduction of the Government Guarantee reduced Australian banks' systematic as well as systemic risk. However, we also add new evidence on the impact that Government Guarantees have in affecting benchmark interest rates and particularly banks' credit risk premium embedded in those rates.

6.3 An analysis of the changes in funding liquidity hoarding and credit risk premia

The coefficients reported in Table 5 and Table 6 are estimated at the level of the variables. However, the statistics of the Augmented Dickey-Fuller test presented in Table 4 suggest that some of these variables suffer from a unit root problem. Although this econometric issue is unlikely to affect our conclusions, we decided to re-estimate the regression models of equations (2) and (3) in first differences. Our objective is to provide a more reliable estimation of the economic drivers of the components of the BBSW spread. An analysis of the determinants of changes in funding liquidity and credit risk would also highlight the efficacy of the RBA liquidity provision to contain the liquidity risk and credit risk premia during the turbulence(s) experienced by the interbank liquidity market.

The results of the determinants of the change in the BBSW components are presented in Table 7.

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guarantee arrangements for financial institutions' wholesale debt. Under this scheme, eligible ADIs were able to offer government-guaranteed deposits greater than $1 million, and government-guaranteed wholesale funding with maturity out to five years in exchange for a risk-based fee. The Financial Stability Department of the Reserve Bank of Australia argues that this guarantee contributed positively to strengthening the overall stability of the Australian financial system by ensuring that financial institutions continued to have access to capital markets during the most intense phase of the crisis. Importantly, it also suggests that the guarantee scheme helped mitigate the large increase in the cost of issuing debt by reducing the banks' senior 5-year CDS premiums over the implementation period of this scheme. Please refer to https://www.rba.gov.au/publications/bulletin/2016/mar/pdf/bu-0316-5.pdf.

Panel A of Table 7 shows the results when the dependent variable is the change in the funding liquidity premium, while the dependent variable in Panel B is the change in the credit risk premium. Overall, the findings of Panel A of Table 7 are qualitatively similar to those illustrated in columns (iv) and (ix) of Table 5. Notable exceptions are the now insignificant coefficients of the daily volume of first-leg securities bought or sold by the Reserve Bank of Australia under repo contracts dealt in open market operations ($FLIQDEM_1$), and that of the spread between the repo rate on highly-liquid collateralized CGS and the repo rate on less-liquid collateralized securities (*FLY2QUAL*). Given their high correlation with the other independent variables, this might not be that surprising. We interpret this finding as evidence that the effect of $FLIQDEM_1$ and *FLY2QUAL* on the liquidity hoarding premium is likely to be subsumed by the impact of the changes in the repo contract rates (*RPRATE-OIS*) and RBA liquidity injections of funding liquidity through the repo market ($FLIQDEM_2$).

Panel B of Table 7 provides empirical evidence on the structural determinants of the *change* in the daily interbank credit premium. The findings there are comparable to those estimated in column (vi) and column (xii) of Table 6, in terms of both economic magnitude and statistical significance. Only bank's idiosyncratic volatility (*BIVOL*), which is a proxy of the volatility of underlying assets of Australian prime banks, becomes now insignificant. In the whole, the results of Panel B of Table 7 confirm the validity of the theoretical predictions of the structural model in Equation (2).

[Insert Table 7 about here]

6.4. BBSW-OIS Spread: Full Model with both Liquidity Risk and Credit Risk Factors

In the last part of our empirical investigation, we combine the determinants of both liquidity risk and credit risk into a regression model in differences to capture the time series variation of the BBSW-OIS spreads at 3-month and 6-month maturities over the sample period from 2006 to 2016. Table 8 illustrates the findings of the full model estimation. Remarkably, after controlling for liquidity premium, none of the proxies for credit premium significantly contributes to the daily change of BBSW-OIS spread. This empirical evidence confirms the notion that funding liquidity premium plays an important role in the time series variation of the benchmark rates in the interbank market and corroborates with Gefang et al.'s (2010) finding regarding the dominance of liquidity risk in driving movements in the Libor-OIS spreads during the 2008 Global Financial Crisis. This is an important result which delineates from the extant literature that has focused on other international reference benchmark rates or interest rate spreads in the absence of either implicit or explicit government protection on banks operating in these interbank markets. In Australia, in the height of the Global Financial Crisis the Australian government introduced a wholesale debt guarantee that was utilized by the domestic prime banks that also operated in the BBSW market (see Luong et al., 2017 and references therein for further details). Our empirical evidence suggests that this explicit protection offered to banks' large depositors and wholesale creditors significantly changed market perceptions and counterparty risk became less of a concern during 2008 when the government explicitly provided guarantees on banks' liabilities.

Among the liquidity factors, funding liquidity (Δ*(RPRATE-OIS)*, Δ$FLIQDEM_2$ and Δ*RPMATURITY*) has greater economic impact than market liquidity (Δ*MKTLIQ*) on the daily movements of the BBSW spread. Again, this is in line with our findings presented in Table 5 which demonstrated that funding liquidity is more important than market liquidity in determining the liquidity risk premium. Our findings remain qualitatively unchanged when we control in an unreported test for the dummy variable *GOVGUARANTEE*.[12]

[Insert Table 8 about here]

7. CONCLUSION

In this paper, we investigate the drivers of daily benchmark interest rates that are explicitly set by banks in the interbank money market as proxied by the BBSW. We do so by decomposing the BBSW movements into its core funding and market liquidity risks and credit risk components. To the best of our knowledge, this paper represents the first study of the determinants of the time series variations in

[12] We omit these results for brevity but these are available from the authors upon request.

such credit-based reference benchmark rates at different tenors using daily data over a long time period from 2006 to 2016.

Our findings show that both liquidity risk and credit risk components drive the time series variation of the BBSW spreads as these benchmark rates are effectively short term interest rates on market-traded credit-based instruments. Our empirical evidence highlights that both liquidity and credit risks are priced and the relative importance of these priced components in a market-based rate-set mechanism is conditional on the extent of economic uncertainty. The compensation required for credit risk significantly increased in the midst of the 2007-2009 GFC period but compensation for illiquidity remained a key concern. Our empirical evidence also suggests that counterparty risk became relatively less of a concern during 2008 when the government explicitly provided guarantees on banks' liabilities and changed market perceptions on bank risk. Outside this period of significant stress in the interbank market, the liquidity and credit risk components have both played an important role in driving short-term BBSW movements.

An interesting question concerns the commonalities in the movements of credit risk and liquidity risk components over time but limited data availability of bank-specific financial market data restricts the system-wide tests that we can reliably undertake. We leave this issue for future research on market transacted and credit-based benchmark interest rates as data becomes more readily available for a larger number of financial institutions quoting in the BBSW market.

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Figure 1
Time Series Variation of the BBSW – OIS Spread

This figure illustrates the movements in the BBSW-OIS spread over time from 2013 to 2016. The figure illustrates the swap spread for 3-month tenor (*SPREAD3M*) and 6-month tenor (*SPREAD6M*). The variable *SPREAD3M* (*SPREAD6M*) is computed as the difference between the BBSW 3-month (6-month) tenor and the overnight index swap (*OIS*), with same maturity. The observation period of this illustration starts in October 2013 following the adoption by the Australian Financial Markets Association (AFMA) of a new automated process to obtain the BBSW benchmark quotes.

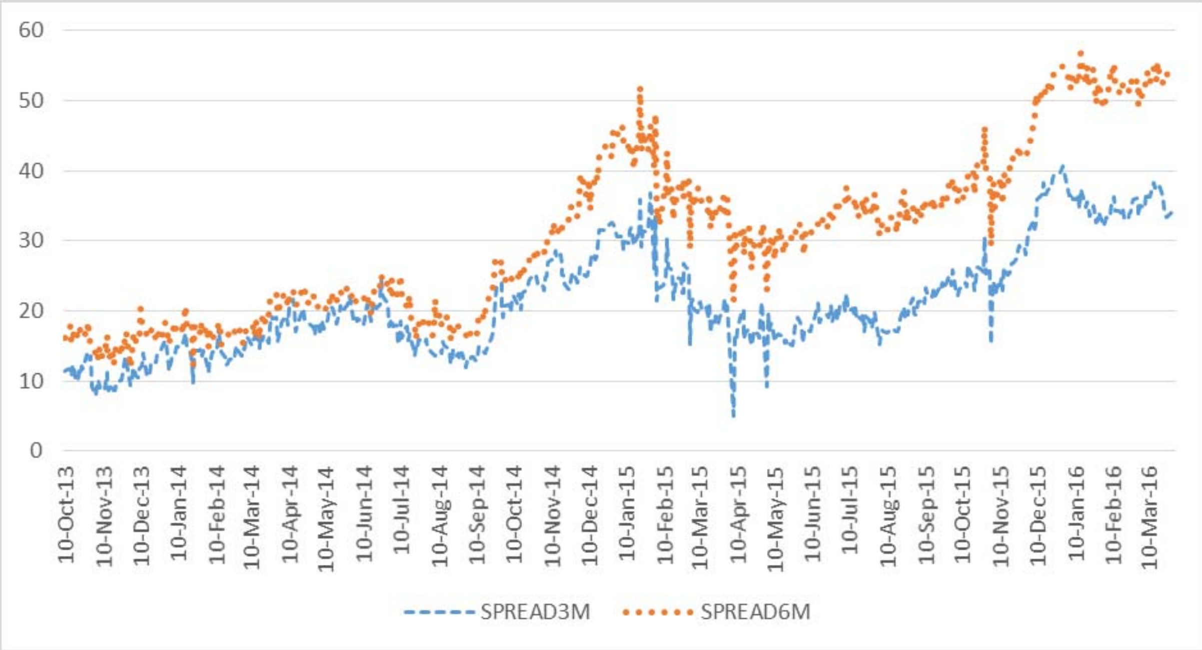

Table 1
Sample Statistics

This table reports the summary statistics of the variables used in this study after the decomposition of the BBSW spreads at different tenors (3 and 6 months) into a liquidity risk (*LIQHOARD*) and a credit risk (*CRDRISK*) component. The table illustrates the descriptive statistics of the following variables: the interbank market liquidity factor (*MKTLIQ*) as proxied by the 30-day total volatility of the BBSW NBBO quotes; the *RPMATURITY* which is the number of days of repo contracts; the variable *RPRATE-OIS* computed as the difference between the repo rate and the OIS rate, where the repo rate is the daily lowest repo rate dealt by the RBA through OMO for each term dealt; *FLY2QUAL*, which is defined as the spread between the repo rate on highly-liquid collateralized (quasi-) Commonwealth Government securities (CGS) and the repo rate on less-liquid collateralized securities (e.g., ADI, RMBS, and ABCP); the volume of the repo contracts (*REPOVOLUME*); the aggregate volume of the exchange settlement accounts (*ESVOLUME*); the past 12-month time series cross sectional dispersion in daily CDS spreads of the four major prime banks (*CDSVOL*); the degree of leverage of the prime banks (*BLEV*); the idiosyncratic volatility of underlying assets of prime banks (*BIVOL*); the uncertainty surrounding the market expectations about prime banks' earnings (*UNCERTAINTY*); and the slope of the yield curve which impacts on the value of the option on firm value (*YCURVE*).

	Nobs	Mean	StdDev	p5	p25	p50	p75	p95
LIQHOARD3M	2515	19.41	14.21	4.84	9.58	15.49	25.83	46.48
CRDRISK3M	2515	3.98	2.58	0.33	2.18	4.04	5.53	8.66
LIQHOARD6M	2515	22.85	14.64	6.12	10.56	20.12	31.23	49.88
CRDRISK6M	2515	8.04	5.20	0.67	4.43	8.13	11.17	17.46
MKTLIQ	2515	0.08	0.09	0.01	0.02	0.05	0.08	0.24
RPMATURITY	2515	42.31	36.85	9.00	22.00	33.94	49.10	103.22
RPRATE - OIS	2515	0.16	0.26	-0.06	0.02	0.09	0.19	0.72
FLY2QUAL	2515	-0.40	1.37	-3.35	-0.10	-0.05	0.00	0.01
REPOVOLUME	2515	802.1	775.4	68.0	215.0	500.0	1193.0	2400.0
ESVOLUME	2515	1585.0	1235.7	716.0	953.0	1237.0	1740.0	3668.0
CDSVOL	2515	22.17	20.03	0.00	5.92	16.88	32.66	66.15
BLEV	2515	2.83	0.65	2.23	2.41	2.61	3.06	4.08
BIVOL	2515	1.03	0.55	0.60	0.76	0.82	0.95	2.59
YCURVE	2515	4.58	1.18	2.64	3.48	5.01	5.60	6.17
UNCERTAINTY	2515	0.12	0.04	0.07	0.09	0.11	0.13	0.22

Table 2

Daily Statistics of the Liquidity and Credit Risk Premia: 2005 – 2016

This table decomposes the three main variables of interest, namely BBSW spread, *LIQHOARD* and *CRDRISK* for contracts over a 3-month tenor into different subsamples over the full sample period from 2005 and 2016.

	Nobs	Mean	StdDev	Min	p5	p25	p50	p75	p95	Max
Full period: 2005 - 2016										
BBSW3M - OIS3M	2503	23.39	15.45	-2.25	6.92	12.57	19.83	30.97	52.12	142.50
LIQHOARD3M	2503	19.41	14.24	0.00	4.84	9.56	15.49	25.84	46.48	135.23
CRDRISK3M	2503	3.99	2.58	0.22	0.33	2.06	4.05	5.53	8.66	12.42
Sub-period 1: 2005 - 2006										
BBSW3M - OIS3M	406	10.48	2.76	3.00	6.67	8.40	10.08	12.53	15.10	20.75
LIQHOARD3M	406	10.01	2.71	2.58	6.28	7.96	9.60	12.02	14.60	20.18
CRDRISK3M	406	0.47	0.08	0.31	0.34	0.42	0.46	0.49	0.66	0.73
Sub-period 2: 2007 - 2008										
BBSW3M - OIS3M	451	34.40	24.58	-2.25	3.35	8.77	34.00	48.42	81.50	142.50
LIQHOARD3M	451	31.64	22.55	0.00	3.11	8.39	30.97	43.61	74.49	135.23
CRDRISK3M	451	2.79	2.34	0.22	0.24	0.33	2.23	4.62	7.27	8.64
Sub-period 3: 2009 - 2011										
BBSW3M - OIS3M	637	27.60	13.07	5.35	12.00	18.67	24.00	33.58	54.00	81.83
LIQHOARD3M	637	21.70	11.98	1.27	6.91	13.38	18.77	27.35	45.77	74.59
CRDRISK3M	637	5.90	1.96	3.13	3.38	4.60	5.38	6.78	9.76	12.42
Sub-period 4: 2012 - 2016										
BBSW3M - OIS3M	1009	21.00	8.59	0.75	9.50	14.68	19.35	26.15	36.55	47.20
LIQHOARD3M	1009	16.29	8.21	0.00	4.21	10.41	15.43	21.51	30.79	39.12
CRDRISK3M	1009	4.73	1.79	2.29	2.63	3.18	4.32	5.77	8.20	9.98

Table 3
Time Series Correlation Matrix

This table reports the pair-wise correlations between each pair of variables used in our analysis. All the variables considered in the correlation matrix were described previously in Table 1.

		[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]	[11]	[12]
[1]	LIQHOARD	1											
[2]	CRDRISK	0.39	1										
[3]	MKTLIQ	0.48	0.35	1									
[4]	RPMATURITY	0.27	0.02	0.27	1								
[5]	FLY2QUAL	-0.47	-0.11	-0.31	-0.1867	1							
[6]	$FLIQDEM_1$	0.20	-0.16	-0.18	0.08	-0.08	1						
[7]	$FLIQDEM_2$	0.75	0.40	0.46	0.26	-0.43	0.21	1					
[8]	CDSVOL	0.45	0.59	0.53	0.24	-0.30	-0.19	0.53	1				
[9]	BLEV	0.65	0.64	0.57	0.23	-0.39	-0.13	0.57	0.64	1			
[10]	BIVOL	0.47	0.31	0.50	0.25	-0.38	-0.07	0.54	0.81	0.67	1		
[11]	EXYCURVE	0.05	-0.39	0.23	0.18	-0.22	-0.30	-0.04	0.04	0.12	0.27	1	
[12]	UNCERTAINTY	0.51	0.29	0.52	0.20	-0.31	0.04	0.55	0.60	0.62	0.82	0.11	1

Table 4

Random Walk Test of the Time Series Variables: Level and Change

This table reports the Augmented Dickey-Fuller unit root tests for all the variables used in our analyses. All the variables considered in this table were described previously in Table 1.

Panel A: Augmented Dickey-Fuller Test of Unit Root (Max 4 lags): Daily level of the variables

	LIQHOARD3M	CRDRISK3M	LIQHOARD6M	CRDRISK6M	MKTLIQ	RPMATURITY	RPRATE - OIS	CDSVOL	BLEV	BIVOL	UNCERTAINTY	EXYCURVE
Lag 4	-5.176	-2.993	-4.392	-2.889	-6.497	-11.670	-6.781	-1.699	-1.982	-0.592	-2.934	-1.813
	I(0)	I(0)	I(0)	I(0)	I(0)	I(0)	I(0)	I(1)	I(1)	I(1)	I(0)	I(1)
Lag 3	-5.196	-2.953	-4.739	-2.848	-6.496	-14.000	-7.523	-1.414	-2.054	-0.538	-2.93	-1.844
	I(0)	I(0)	I(0)	I(0)	I(0)	I(0)	I(0)	I(1)	I(1)	I(1)	I(0)	I(1)
Lag 2	-5.618	-2.824	-5.084	-2.820	-6.632	-16.983	-9.294	-1.115	-2.092	-0.464	-2.925	-1.867
	I(0)	I(1)	I(0)	I(1)	I(0)	I(0)	I(0)	I(1)	I(1)	I(1)	I(0)	I(1)
Lag 1	-6.294	-2.827	-6.499	-2.825	-6.114	-21.493	-10.924	-0.674	-2.13	-0.39	-2.921	-1.917
	I(0)	I(1)	I(0)	I(1)	I(0)	I(0)	I(0)	I(1)	I(1)	I(1)	I(0)	I(1)
Opt Lag (Ng-Perron seq t)	3	3	4	3	4	4	4	4	4	4	0	1
Nobs	2,834	2,834	2,834	2,834	2,498	2,498	2,498	2,498	2,498	2,498	2,498	2,498

Panel B: Augmented Dickey-Fuller Test of Unit Root (Max 4 lags): Day-to-day change in the variables

	Δ(LIQHOARD3M)	Δ(CRDRISK3M)	Δ(LIQHOARD6M)	Δ(CRDRISK6M)	Δ(MKTLIQ)	Δ(RPMATURITY)	Δ(RPRATE - OIS)	Δ(CDSVOL)	Δ(BLEV)	Δ(BIVOL)	Δ(UNC.TY)	Δ(EXYCU
Lag 4	-24.337	-23.932	-31.236	-23.944	-15.482	-29.082	-35.226	-7.573	-22.731	-14.098	-22.325	-21.55
	I(0)	I(0)	I(0)	I(0)	I(0)	I(0)	I(0)	I(0)	I(0)	I(0)	I(0)	I(0)
Lag 3	-27.364	-26.622	-34.336	-26.634	-16.196	-35.713	-37.062	-8.56	-26.018	-17.106	-24.965	-24.49
	I(0)	I(0)	I(0)	I(0)	I(0)	I(0)	I(0)	I(0)	I(0)	I(0)	I(0)	I(0)
Lag 2	-34.720	-31.611	-40.826	-31.648	-17.206	-42.672	-44.301	-10.413	-29.289	-20.193	-28.833	-28.75
	I(0)	I(0)	I(0)	I(0)	I(0)	I(0)	I(0)	I(0)	I(0)	I(0)	I(0)	I(0)
Lag 1	-44.662	-33.800	-56.106	-33.835	-18.49	-54.144	-50.459	-13.443	-35.44	-26.046	-35.32	-36.32
	I(0)	I(0)	I(0)	I(0)	I(0)	I(0)	I(0)	I(0)	I(0)	I(0)	I(0)	I(0)
Opt Lag (Ng-Perron seq t)	3	2	4	2	4	3	4	4	0	4	0	0
Nobs	2,833	2,833	2,833	2,833	2,497	2,497	2,497	2,497	2,497	2,497	2,497	2,497

Table 5

Determinants of the Level of the Daily Interbank Liquidity Premium

This table illustrates the determinants of the daily liquidity premium in the interbank market. The dependent variable is the daily level of the liquidity hoarding factor (*LIQHOARD*) of the BBSW-OIS spread for contracts with 3- and 6-month tenors. Main independent variables include the interbank market liquidity factor (*MKTLIQ*) as proxied by the logarithm of the 30-day total volatility of the BBSW NBBO quotes; the *RPMATURITY* which is the number of days of repo contracts; the variable *RPRATE-OIS* computed as the difference between the repo rate and the OIS rate, where the repo rate is the daily lowest repo rate dealt by the RBA through OMO for each term dealt; *FLY2QUAL*, which is defined as the spread between the repo rate on highly-liquid collateralized (quasi-) Commonwealth Government securities (CGS) and the repo rate on less-liquid collateralized securities (e.g., ADI, RMBS, and ABCP); $FLIQDEM_1$ is the daily volume of first-leg securities (ADI-issued securities (ADI), residential mortgage-backed securities (RMBS), and asset-backed commercial papers (ABCP)) bought (if positive) or sold (if negative) by the Reserve Bank of Australia under repo contracts dealt in OMO; $FLIQDEM_2$ is computed as the logarithm of the daily exchange settlement (ES) balances in the interbank market. The variable $SHOCK_{2007\text{-}2008}$ is a dichotomous realization that is equal to 1 during the subperiod 2007-2008, and 0 otherwise. In models (vi) and (xii) we proxy for interbank market liquidity (*MKTLIQ*) using the aggregate daily volume in prime bank paper executed through approved revenue (this data item is obtained from the Australian Securities Exchange) We also include the lagged realization of the dependent variable *LIQHOARD* in models (iv), (vi), (x), and (xii). Robust *t*-statistics are reported in parentheses. One, two, and three asterisks denote statistical significance at the 10%, 5%, and 1% levels, respectively.

	LIQHOARD3M							LIQHOARD6M				
	(i)	(ii)	(iii)	(iv)	(v)	(vi)	(vii)	(viii)	(ix)	(x)	(xi)	(xii)
MKTLIQ	4.646***		3.104***	0.266*	2.154***	-0.195**	3.909***		3.207***	0.341**	2.202***	-0.731***
	(13.880)		(11.202)	(1.947)	(8.400)	(-1.977)	(11.637)		(10.747)	(2.158)	(7.473)	(-4.038)
RPMATURITY		-0.006	-0.018**	-0.009**	-0.027***	-0.008**		-0.023**	-0.035***	-0.013***	-0.043***	-0.002**
		(-0.505)	(-2.121)	(-2.090)	(-3.454)	(-2.220)		(-2.209)	(-4.487)	(-2.630)	(-5.914)	(-2.136)
RPRATE - OIS		27.622***	18.459***	2.994***	17.384***	10.904***		33.057***	22.062***	3.647***	20.198***	48.749***
		(14.942)	(10.680)	(3.662)	(10.220)	(3.358)		(19.430)	(13.489)	(3.979)	(12.590)	(10.623)
FLY2QUAL		-2.916***	-1.979***	-0.198	-1.241***	-0.313***						
		(-13.146)	(-9.252)	(-1.489)	(-5.432)	(-3.620)						
$FLIQDEM_1$		2.222***	2.638***	0.407***	2.454***	2.112**		2.625***	3.233***	0.498***	2.962***	0.713*
		(11.798)	(14.075)	(5.107)	(14.003)	(2.446)		(12.480)	(15.681)	(4.632)	(14.894)	(1.717)
$FLIQDEM_2$		2.444**	1.568*	1.280***	1.759**	1.141**		2.162**	1.085	1.404***	1.292	0.577
		(2.483)	(1.842)	(3.402)	(2.230)	(2.290)		(2.060)	(1.133)	(3.397)	(1.427)	(0.647)
LIQHOARD				0.869***		0.890***				0.861***		1.197***
				(43.230)		(37.154)				(43.422)		(32.690)
$SHOCK_{2007\_2008}$					8.980***						8.485***	
					(10.401)						(10.999)	
R-sq	38.7%	46.5%	55.1%	90.6%	58.5%	92.1%	29.7%	35.4%	45.1%	87.1%	48.3%	88.4%
N	2,515	2,513	2,513	2,513	2,513	470	2,515	2,513	2,513	2,513	2,513	470

Table 6

Determinants of the Level of the Daily Credit Risk Premium

This table illustrates the determinants of the daily credit risk premium in the interbank market. The dependent variable is the daily level of the credit risk premium factor of the BBSW-OIS spread for contracts with 3- and 6-month tenors. Main independent variables of interest include the following structural-model factors: the past 12-month time series cross sectional dispersion in daily CDS spreads of the four major prime banks (*CDSVOL*); the degree of leverage of the prime banks (*BLEV*); the idiosyncratic volatility of underlying assets of prime banks (*BIVOL*); the uncertainty surrounding the market expectations about prime banks' earnings (*UNCERTAINTY*); and the slope of the yield curve which impacts on the value of the option on firm value (*EXYCURVE*). We include the change in the logarithm of the daily exchange settlement (ES) balances in the interbank market, Δ*FLIQDEM*. Robust *t*-statistics are reported in parentheses. We also control for the dummy variable *GOVGUARANTEE* which is equal to 1 during the period 12 October 2008 and 31 March 2010, and 0 otherwise. During this period, the Australian Government implemented the Guarantee Scheme to offer increased large depositor protection and guarantee arrangements for financial institutions' wholesale debt. We also interacted the dummy variable *GOVGUARANTEE* with each structural-model factors to quantify any change in the sensitivity of credit risk premiums during the period of the Guarantee Scheme. One, two, and three asterisks denote statistical significance at the 10%, 5%, and 1% levels, respectively.

	CRDRISK3M								CRDRISK6M							
	(i)	(ii)	(iii)	(iv)	(v)	(vi)	(vii)	(viii)	(ix)	(x)	(xi)	(xii)	(xiii)	(xiv)	(xv)	(xvi)
CDSVOL	0.076***					0.080***	0.001	0.094***	0.153***					0.161***	0.001**	0.188***
	(29.858)					(37.909)	(1.472)	(38.624)	(29.911)					(38.000)	(2.485)	(38.519)
BLEV		6.495***				4.485***	1.997***	11.198***		11.028***				10.724***	1.799***	22.652***
		(16.115)				(6.458)	(3.886)	(34.644)		(18.565)				(19.833)	(6.460)	(34.690)
BIVOL			1.477***		1.167***	-2.571***	-0.064***	-3.394***			2.984***		2.369***	-5.225***	-0.130***	-6.766***
			(21.618)		(9.387)	(-26.461)	(-3.288)	(-23.263)			(21.724)		(9.458)	(-26.653)	(-3.302)	(-23.008)
UNCERTAINTY				2.260***	0.739***	0.432***	0.008	1.118***				4.554***	1.469***	0.758***	0.015	2.235***
				(15.840)	(3.070)	(3.838)	(0.574)	(10.588)				(15.856)	(3.025)	(3.950)	(0.572)	(10.489)
EXYCURVE						0.726***	0.013**	1.704***						1.442***	0.076**	3.426***
						(34.406)	(2.510)	(50.085)						(33.840)	(2.465)	(49.899)
RPRATE - OIS						0.591***	0.035							1.192***	0.070	
						(3.647)	(1.064)							(3.643)	(1.049)	
CRDRISK							0.980***	0.970***							0.980***	0.970***
							(247.187)	(187.934)							(246.881)	(186.589)
CDSVOL * GOVGUARANTEE								-0.052***								-0.105***
								(-4.836)								(-4.873)
BLEV * GOVGUARANTEE								-2.526***								-5.235***
								(-3.963)								(-4.083)

BIVOL * GOVGUARANTEE								3.354***								6.677***
								(14.647)								(14.492)
UNCERTAINTY * GOVGUARANTEE								-4.467***								-8.990***
								(-7.011)								(-7.026)
EXYCURVE * GOVGUARANTEE								-1.533***								-3.092***
								(-13.885)								(-13.942)
GOVGUARANTEE								-9.954***								-19.746***
								(-5.160)								(-5.096)
R-sq	34.6%	35.2%	9.8%	7.4%	10.1%	74.9%	99.3%	83.6%	34.7%	35.5%	9.8%	7.3%	10.2%	74.8%	99.3%	83.6%
N	2,515	2,515	2,515	2,515	2,515	2,515	2,515	2,515	2,515	2,515	2,515	2,515	2,515	2,515	2,515	2,515

Table 7

Determinants of the Daily Change in Liquidity Risk and Credit Risk Components

This table illustrates the determinants of the change in daily liquidity risk and credit risk premia in the interbank market. The dependent variable is the daily change in the liquidity risk factors of the BBSW-OIS spread variable (Δ*LIQHOARD*) at different tenors. The main independent variables include the daily changes of the funding liquidity factors described previously in Table 5. In Panel B, we illustrate the determinants of the daily credit risk premia in the interbank market. The dependent variable is the daily change in the credit risk factors of the BBSW-OIS spread (Δ*CRDRISK*) at different tenures. Main independent variables of interest include the structural-model factors described in Table 6. Robust *t*-statistics are reported in parentheses. One, two, and three asterisks denote statistical significance at the 10%, 5%, and 1% levels, respectively.

Panel A: An analysis of the determinants of changes in liquidity hoarding risk

	Δ(LIQHOARD3M)				Δ(LIQHOARD6M)			
	(i)	(ii)	(iii)	(iv)	(v)	(vi)	(vii)	(viii)
Δ(MKTLIQ)	1.666**			1.777**	2.567**			2.533**
	(2.574)			(2.464)	(2.283)			(2.315)
Δ(RPMATURITY)		-0.018***	-0.017***	-0.017***		-0.018***	-0.018***	-0.018***
		(-3.954)	(-3.935)	(-3.935)		(-3.523)	(-3.503)	(-3.503)
Δ(RPRATE - OIS)		4.624***	4.558***	4.558***		4.861***	4.799***	4.799***
		(4.448)	(4.376)	(4.376)		(3.851)	(3.782)	(3.782)
Δ(FLY2QUAL)		0.049	0.051	0.051		-0.029	-0.028	-0.028
		(0.477)	(0.494)	(0.494)		(-0.266)	(-0.256)	(-0.256)
Δ($FLIQDEM_1$)			0.146*	0.146*			0.137	0.137
			(1.659)	(1.659)			(1.291)	(1.291)
Δ($FLIQDEM_2$)			1.156***	1.156***			1.381***	1.381***
			(2.952)	(2.952)			(3.273)	(3.273)
R-sq	2.0%	5.6%	5.9%	5.9%	1.5%	4.3%	4.7%	4.7%
N	2,514	2,514	2,512	2,512	2,514	2,514	2,512	2,512

Panel B: An analysis of the determinants of changes in credit risk premia

	Δ(CRDRISK3M)						Δ(CRDRISK6M)					
	(i)	(ii)	(iii)	(iv)	(v)	(vi)	(vii)	(viii)	(ix)	(x)	(xi)	(xii)
Δ(CDSVOL)	0.054**				0.052**	0.083**	0.109*				0.106**	0.167**
	(1.962)				(2.276)	(2.070)	(1.953)				(2.269)	(2.064)
Δ(BLEV)		0.951***			1.189***	1.390***		2.122***			2.403***	2.810***
		(5.811)			(5.106)	(8.044)		(5.679)			(5.095)	(8.033)
Δ(BIVOL)			-2.069	-2.119	-1.556	-3.336**			-4.227	-4.329	-3.191	-6.809**
			(-1.063)	(-1.089)	(-1.413)	(-2.523)			(-1.069)	(-1.094)	(-1.422)	(-2.532)
Δ(UNCERTAINTY)				1.861***	0.516	0.328***				3.752***	1.036	0.668***
				(2.621)	(0.783)	(3.138)				(2.620)	(0.779)	(3.178)
Δ(EXYCURVE)					0.574***	0.228					1.155***	0.461
					(5.016)	(0.352)					(5.004)	(0.352)
Δ(RPRATE - OIS)					0.074**	-0.006					0.114**	-0.013
					(3.641)	(-0.279)					(3.799)	(-0.296)
Δ(CDSVOL) * GOVGUARANTEE						-0.057						-0.115
						(-1.334)						(-1.333)
Δ(BLEV) * GOVGUARANTEE						-0.419						-0.855
						(-1.312)						(-1.326)
Δ(BIVOL) * GOVGUARANTEE						3.885**						7.896**
						(2.353)						(2.357)
Δ(UNCERTAINTY) * GOVGUARANTEE						0.278						0.558
						(0.691)						(0.688)
Δ(EXYCURVE) * GOVGUARANTEE						2.700						5.423
						(1.047)						(1.043)
GOVGUARANTEE						-0.004						-0.009
						(-0.239)						(-0.241)
R-sq	0.6%	17.8%	0.6%	0.7%	23.1%	22.8%	0.6%	17.8%	0.6%	0.8%	23.1%	22.8%
N	2,502	2,502	2,502	2,502	2,502	2,502	2,502	2,502	2,502	2,502	2,502	2,502

Table 8

BBSW-OIS Spread: Full Model with Liquidity and Credit Risk Drivers

This table illustrates the full model of the determinants of the time series variation in the BBSW-OIS spread at different tenures. The dependent variable is the daily changes in the BBSW-OIS spreads (Δ*SPREAD*) for 3-month and 6-month tenors. Independent variables include the daily changes in the funding liquidity and credit risk proxies described previously in Table 5 and Table 6. Robust *t*-statistics are reported in parentheses. One, two, and three asterisks denote statistical significance at the 10%, 5%, and 1% levels, respectively.

	ΔSPREAD3M						ΔSPREAD6M					
	(i)	(ii)	(iii)	(iv)	(v)	(vi)	(vii)	(viii)	(ix)	(x)	(xi)	(xii)
Δ(MKTLIQ)	1.553**	1.574**	1.584**	1.561**	1.545**	1.575**	1.312**	1.032**	1.023**	1.026**	1.006**	1.008**
	(2.143)	(2.140)	(2.142)	(2.143)	(2.140)	(2.138)	(2.158)	(2.157)	(2.157)	(2.158)	(2.156)	(2.151)
Δ(RPMATURITY)	-0.018***	-0.018***	-0.018***	-0.018***	-0.018***	-0.018***	-0.019***	-0.019***	-0.019***	-0.019***	-0.019***	-0.019***
	(-3.953)	(-3.959)	(-3.952)	(-3.952)	(-3.952)	(-3.950)	(-3.515)	(-3.516)	(-3.513)	(-3.514)	(-3.513)	(-3.510)
Δ(RPRATE - OIS)	4.617***	4.617***	4.619***	4.618***	4.616***	4.617***	4.912***	4.911***	4.914***	4.912***	4.911***	4.911***
	(4.419)	(4.414)	(4.420)	(4.420)	(4.412)	(4.411)	(3.847)	(3.843)	(3.847)	(3.848)	(3.843)	(3.837)
Δ(FLY2QUAL)	0.047	0.047	0.047	0.047	0.048	0.048	-0.033	-0.033	-0.033	-0.033	-0.033	-0.033
	(0.460)	(0.461)	(0.460)	(0.460)	(0.462)	(0.462)	(-0.302)	(-0.301)	(-0.302)	(-0.303)	(-0.300)	(-0.300)
Δ($FLIQDEM_1$)	0.143	0.142	0.143	0.143	0.143	0.143	0.123	0.122	0.123	0.123	0.123	0.123
	(1.610)	(1.610)	(1.611)	(1.610)	(1.610)	(1.611)	(1.145)	(1.142)	(1.144)	(1.145)	(1.144)	(1.143)
Δ($FLIQDEM_2$)	1.234***	1.232***	1.234***	1.234***	1.230***	1.229***	1.485***	1.482***	1.484***	1.485***	1.482***	1.481***
	(3.140)	(3.140)	(3.140)	(3.140)	(3.131)	(3.130)	(3.553)	(3.546)	(3.550)	(3.553)	(3.541)	(3.538)
Δ(CDSVOL)		-0.003				-0.001		-0.004				-0.002
		(-0.533)				(-0.099)		(-0.496)				(-0.123)
Δ(BLEV)			-0.072			-0.054			-0.081			-0.042
			(-0.295)			(-0.187)			(-0.276)			(-0.118)
Δ(SLOPE)				0.029		0.049				0.042		0.049
				(0.472)		(0.594)				(0.534)		(0.407)
Δ(UNCERTAINTY)					2.058	2.653					1.353	1.796
					(0.559)	(0.721)					(0.297)	(0.333)
Δ(BIVOL)					-0.215	-0.208					-0.164	-0.130
					(-0.764)	(-0.431)					(-0.463)	(-0.179)
R-sq	6.9%	6.9%	6.9%	6.9%	6.9%	6.9%	5.8%	5.8%	5.8%	5.8%	5.8%	5.8%
N	2,512	2,512	2,512	2,512	2,512	2,512	2,512	2,512	2,512	2,512	2,512	2,512

Appendix Table 1.
List of Variables Used

Variable	Definition	Data Source
SPREAD3M	3-month swap spread (difference between the BBSW 3-month tenor and the overnight index swap, OIS).	AFMA and Bloomberg
SPREAD6M	6-month swap spread (difference between the BBSW 6-month tenor and the overnight index swap, OIS).	AFMA and Bloomberg
OIS	Overnight index swap, which measures market forecasts of the RBA cash rate. We use the 3-month or 6-month OIS rate.	Bloomberg
CRDRISK	Compensation for counterparty risk in the interbank market (default component of BBSW-OIS spread), derived from the prices of credit default swaps (CDS) for the four AFMA-eligible prime banks.	AFMA, Markit and authors' own calculations
LIQHOARD	Premium associated with liquidity demand of borrowing banks (liquidity component of BBSW-OIS spread), estimated by the difference between BBSW rates and the proxy for *CRDRISK*.	AFMA and authors own calculations
BBSW3M	BBSW with 3-month tenor.	AFMA
$FLIQDEM_1$	The daily volume of first-leg securities including ADI-issued securities (ADI), residential mortgage-backed securities (RMBS), and asset-backed commercial papers (ABCP) bought or sold by the RBA under repo contracts in open market operations (OMO).	RBA
$FLIQDEM_2$	The logarithm of the daily exchange settlement (ES) balances in the interbank market.	RBA
RPRATE-OIS	Difference between the repo rate and the OIS rate, where the repo rate is the daily lowest repo rate dealt by the RBA through OMO for each term dealt.	RBA
RPMATURITY	The number of days for repo contracts in OMO.	RBA
FLY2QUAL	The spread between the repo rate on highly-liquid collateralized (quasi-) Government securities (CGS) and the repo rate on less-liquid collateralized securities.	RBA

MKTLIQ	The main proxy is the 30-day total volatility of the BBSW National Best Bid and Offer (NBBO) quotes. In some model specifications, we also use as an alternative proxy the aggregate daily interbank market volumes of the BBSW at different tenors.	AFMA and ASX
BLEV	The degree of leverage of the major banks computed as the ratio between the accounting value of debt and the market value of equity.	Datastream
BIVOL	Prime bank's idiosyncratic volatility, which is a proxy for the volatility of firm's underlying assets.	Datastream
UNCERTAINTY	We use the dispersion in analyst forecasts to proxy the uncertainty in market expectations about prime banks' earnings.	I/B/E/S
CDSVOL	The cross sectional dispersion in CDS spreads in the related industry of the four major prime banks.	Markit
EXYCURVE	The excess slope of the yield curve (relative to the OIS rate).	Bloomberg
GOVGUARANTEE	A dummy variable which is equal to 1 during the Australian Government Guarantee Scheme for Large Deposits and Wholesale Funding period from 12 October 2008 (announcement date) to 31 March 2010 (final date)	Australian Government; RBA