This is the authors’ final peer reviewed (post print) version of the item published as:


Available from Deakin Research Online:

http://hdl.handle.net/10536/DRO/DU:30042567

Reproduced with the kind permission of the copyright owner.

Copyright: 2012, Emerald Group Publishing.
Business Cycles and the Impact of Macroeconomic Surprises on Interest Rate Swap Spreads: Australian Evidence

Victor Fang, A.S.M. Sohel Azad, Jonathan A. Batten, Chien-Ting Lin

ABSTRACT
This study examines the response of Australian interest rate swap spreads to the arrival of macroeconomic news information during the economic expansion and contraction periods. We find that the impact of news announcements on swap spread change differs and largely depends on the state of the economy. The unexpected inflation rate is the only news released that has significant impact on swap spreads across all maturities during contractions and remains the important news announcement throughout the business cycles, while the unanticipated unemployment rate tends to be more relevant to 10-year swap and the unanticipated change in money supply tends to be more relevant to 4- and 7-year swaps during expansions. We also find shocks from these news surprises appear to have significant impact on the conditional volatility of the swap spread change during both economic phases. The macroeconomic shocks in general are negatively related to the conditional volatility of the swap spread change, suggesting that the newsworthy announcements tend to reduce uncertainty on the news announcement days in the swap market during expansion and contraction periods.

Keywords: Interest rate swap spreads; macroeconomic news; business cycles; probability of default

INTRODUCTION
Macroeconomic news plays an essential role in financial markets by revealing new information about the fundamentals of the economy. Periodic news announcements such as unemployment rate and consumer price index (CPI) are, therefore, closely watched by market participants who respond quickly and accordingly to unexpected element of the news. These news surprises, therefore, form an important part of the price discovery process in financial assets. More importantly, the concept of market efficiency is closely related to the reaction of asset returns to news announcements. Analyzing the effects of news shocks on asset returns might shed some light on market efficiency.


In addition, a number of empirical studies find that macroeconomic fundamentals play an important role in determining credit spread dynamics. For examples, Jaffee (1975) and Fama and French (1989) show that credit spreads (the difference between corporate bond yield and Treasury bond yield with an equivalent maturity) are significantly related to macroeconomic conditions and widen during recession periods. Ewing (2003) shows that the default risk premium is relatively higher during recessionary conditions. Wilson (1997a, 1997b), Ramchander, Simpson, and Webb (2003), Ramchander, Simpson, and Chaudhry (2005), and Duffie, Saita, and Wang (2007) show that macroeconomic fundamentals have an impact on default rates or yield spread changes. A recent study by Azad, Fang, and Wickramanayake (2011) shows that macroeconomic surprises and volatility of yen interest rate swap are closely related, albeit volatility of swap leads the relationship on Granger causal sense. However, Azad et al. (2011) have not examined whether yen swap spread is influenced by macroeconomic news surprises. In terms of methodology and empirical approach, this study is similar to that of Fang, Lin, and Parbhoo (2008), who examine the influence of macroeconomic news announcements on Australian financial markets (excluding interest rate swaps) under different economic conditions.

Thus, little empirical work has been done to examine the impact of macroeconomic variables on swap spreads outside the United States. In this study, we examine the effects of macroeconomic fundamentals on swap spreads under different state of economy. Specifically, our study addresses the following sets of questions. First, how do unanticipated macroeconomic news announcements impact the Australian dollar interest rate swap spreads? Second, do these unanticipated macroeconomic announcements affect swap spreads?
differently across different state of the economy? Third, are these influences consistent with existing theories on interest rate determination?

The swap spread is the difference between the fixed rate of a plain-vanilla swap and the yield of a government bond of similar maturity. Since an interest rate swap is an OTC derivative and is not exchange traded, it does not enjoy a payment guarantee by a clearing organization or exchange. Consequently, the pricing of swaps and the corresponding swap spreads reflect credit risk across different maturities. Changes in the swap spreads due to news surprises, the unexpected component of the news announcements, should therefore contain new information about default risk and the overall credit worthiness of the Australian corporate sector in addition to interest rate risk.

A broad consensus has been reached that only a small number of macroeconomic factors have a significant impact on pricing and return. For interest rate swaps in particular, Fornari (2004) finds that only six macroeconomic variables are influential on US implied volatilities that are extracted from swaption - prices namely US non-farm payrolls, the US Institute for Supply Management (ISM) index, jobless claims, the Chicago Purchasing Managers (CPM) index, durable goods orders and retail sales announcements. Because some of the news announcements are not available in Australia and they tend to provide similar information on the economy, hence, we restrict our analysis to the most closely watched economic indicators. Specifically, we focus on the news of money supply growth, unemployment rate, and CPI. We choose these macroeconomic announcements because they are well known to offer insight into the intrinsic health of the economy, the future direction of interest rates, and the performance of financial markets.

Besides being the first study outside United States, to our knowledge this is the first study in which we introduce a state contingent framework to examine whether these news announcements carry the same influence in both periods of economic expansion and contraction. A rise in inflation rate during expansion, for example, may carry more weight than an increase in money supply growth because Central Bank may need to respond to the rising inflation by raising interest rate whereas the same rise of inflation rate may have less effect on interest rate during contractions. One of the aims in this study is therefore to extend the existing literature by examining which news announcements play a dominant role in providing information during each phase of the business cycles.

The state contingent framework also allows us to investigate the interaction of the risk factors where they may vary across different phase of the business cycles. As evidenced by Boyd, Hu, and Jagannathan (2005) that information provided by the news arrivals may be interpreted differently depending on the state of the economy.: They find that stock market is more responsive to rising unemployment news during expansions but not during contractions. For example, a negative macroeconomic surprise related to an unexpected rise in unemployment rate during an expansion may lower market expectations on future economic activities that lead to a rise in the probability of default on private sector debt. At the same time, the expected decline in the economic activities may push interest rate lower, thereby producing a counter effect. Determining which macroeconomic variable is the dominant effect could depend on the state of the economy.

In addition, using an exponential generalized autoregressive conditional heteroskedasticity (EGARCH) specification in our analysis, we address whether the macroeconomic surprises (positive and negative shocks) have an asymmetric effect on the conditional volatility of the swap spreads within each state of the economy and the macroeconomic shocks remain persistent during both economic growth and slowdowns. Finally, unlike earlier studies that only identify surprise arrivals, our study takes into account both the direction and size of the unexpected component of a news announcement, an improvement that we believe will better capture the impact of news surprises.

We find that over the full sample period, news surprise from CPI is the only significant news announcement affecting the interest rate swap spread change across all maturities. That is, a lower (higher) than expected inflation is related to an increase (decrease) in the swap spreads. However, when we decompose the full sample period into periods of expansion and contraction, unanticipated news on money supply (on 4- and 7-year swap spreads) and unemployment rate (on 10-year swap spread) are more important during expansions while unexpected inflation rate news is the only factor that has an impact on swap spreads across all maturities during contractions.

Within each phase of the business cycles, we further find that the EGARCH modeling has clearly captured the characteristics of swap spreads volatility. The conditional volatility of swap spreads exhibits volatility clustering behavior (measured by $a_{1}$) across all maturities. The asymmetric effect (measured by $b_{1}$) is not statistically significant for all sample periods. Looking at the effects of macroeconomic announcements on the conditional volatility of swap spreads, it appears that shocks from CPI are the only shocks that are persistent during both expansions and contractions. However, these shocks are found to reduce conditional volatility
The rest of the paper is structured as follows. Section 2 describes and provides summary statistics of the swap spread, macroeconomic news announcements, and business cycles. Section 3 discusses the methodologies used to examine the impact of the macroeconomic news announcements. Section 4 reports the results of our empirical tests. Section 5 concludes the paper.

DATA AND SUMMARY STATISTICS
For the 2, 3, 4, 5, 7, and 10-year interest swap rates, we use the daily closing mid-rates from DataStream over the period from January 3, 1995 to January 31, 2007. The Treasury bond yields of corresponding maturities are obtained from the Reserve bank of Australia (RBA). Swap spreads for the 6 maturities are then calculated by subtracting the swap rates from the Treasury bond yields of the same maturity. Table 1 provides some descriptive statistics for the swap spreads. It shows that the average swap spread rises as the maturity of the swap increases, capturing the risk premium embedded in the swap rates. The volatility of the swap spread however appears to be fairly constant across all maturities.

<table>
<thead>
<tr>
<th>Table 1. Descriptive Statistics of the Interest Rate Swap Spreads.</th>
</tr>
</thead>
<tbody>
<tr>
<td>2-Year Swap Spreads</td>
</tr>
<tr>
<td>Mean              0.2405</td>
</tr>
<tr>
<td>Median            0.2350</td>
</tr>
<tr>
<td>Standard deviation 0.1375</td>
</tr>
<tr>
<td>Minimum           -0.1350</td>
</tr>
<tr>
<td>Maximum           0.6100</td>
</tr>
<tr>
<td>Skewness          0.1280</td>
</tr>
<tr>
<td>Kurtosis          2.2820</td>
</tr>
<tr>
<td>Observations      2533</td>
</tr>
</tbody>
</table>

Notes: This table reports the summary statistics of the daily interest rate swap spreads from January 1995 to January 2007. The critical value for t-ratio at 1% and 5% significant level significant are -3.43 and -2.87 m, respectively.

Across all maturities, the skewness and the kurtosis of the swap spread show non-normality with some skewness and thin tails. Each of the swap spreads also exhibits non-stationarity based on the Augmented Dickey-Fuller (ADF) test.

We also collect 3 different scheduled macroeconomic announcements over the same 12-year period as the swap spreads. Monthly unemployment rate is compiled by the Australian Bureau of Statistics and released at 11:30 am on the second Thursday of the month. Information on money supply growth is announced at 11:30 am on the first Friday of the month by the Reserve Bank of Australia. Finally, quarterly CPI is made public at 11:30 am on the last Wednesday of the month following every quarter (e.g., March quarter CPI is released on the last Wednesday of April). In order to examine the extent to which these economic fundamentals affect the swap market, it is important to understand and properly model the news information arrivals. Releases of macroeconomic announcements are partly anticipated by the market. At the point of announcement release, the market only reacts to the unexpected component of the news, that is, to the news information that deviates from market expectations. While the announcement of expected component of news information has little influence since it has largely been absorbed in the current price by the market prior to the release.2

To measure the news surprises in terms of both direction and magnitude, we subtract the expected values of the macroeconomic news from the actual data of the news releases. Since consensus estimates on the news announcements is not available in Australia where they are collected by Money Market Services (MMS) in the United States, we follow Connolly and Wang (2003) and build an ARIMA model for each actual news announcement series and use residuals from the model to estimate the unexpected value of each of the macroeconomic information.3

Table 2 reports some summary statistic of the macroeconomic announcements and their news surprises. The change in unemployment rate over the sample period averaged -0.031% and ranged from -0.41% to 0.38%. This period is often characterized by high growth especially in the last several years where the unemployment rate stays at a low of 5–6%. Money supply also grew at an average rate of 0.66% per month although with high variability. The kurtosis of 53.1 reveals heavy tails in the distribution of money supply growth and suggests that it is highly responsive to changes in economic activities. The Australian economy also experienced low inflation.
environment over the same period in which quarterly inflation rate averaged 0.65% or 2.8% annually. Along with low unemployment rate, inflation rate has also been low and kept within 3% target band established by the Reserve Bank. We also find that during this period of largely good economic fundamentals, the announcement surprises from the three news announcements are on average negative, suggesting that the actual data are better than their respective forecasts.

**Table 2.** Descriptive Statistics of the Australian Macroeconomic Announcements and Macroeconomic Surprises.

<table>
<thead>
<tr>
<th></th>
<th>Change in Unemployment Rate (%)</th>
<th>Change in Money Supply Growth (%)</th>
<th>Change in Consumer Price Index (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Actual</td>
<td>Surprise</td>
<td>Actual</td>
</tr>
<tr>
<td>Mean</td>
<td>-0.0305**</td>
<td>-0.0025</td>
<td>0.6586**</td>
</tr>
<tr>
<td>Median</td>
<td>-0.0331</td>
<td>0.0103</td>
<td>0.6927</td>
</tr>
<tr>
<td>Standard deviation</td>
<td>0.1602</td>
<td>0.1629</td>
<td>1.6129</td>
</tr>
<tr>
<td>Minimum</td>
<td>-0.4084</td>
<td>0.4174</td>
<td>-13.7018</td>
</tr>
<tr>
<td>Maximum</td>
<td>0.3784</td>
<td>0.4134</td>
<td>3.7094</td>
</tr>
<tr>
<td>Skewness</td>
<td>0.1025</td>
<td>-0.0163</td>
<td>-5.8987</td>
</tr>
<tr>
<td>Kurtosis</td>
<td>0.0129</td>
<td>-0.2937</td>
<td>53.0662</td>
</tr>
<tr>
<td>Observations</td>
<td>120</td>
<td>120</td>
<td>120</td>
</tr>
</tbody>
</table>

Notes: The table reports summary statistics for the monthly and quarterly percentage changes in news release from January 1995 to January 2007. The announcement surprises are the differences between actual macroeconomic value and the forecasted value based on the ARIMA model. *, ** denote statistical significance at the 1%, 5% levels, respectively.

Since economic activities tend to vary widely over business cycles, one primary question of interest in this study is whether the response of swap spreads to changes in macroeconomic fundamentals varies systematically over time. In other words, could the same information be interpreted differently depending on the state of the economy as the news arrives? To test this hypothesis, we first need to classify the level of economic activities into two different states—expansions and contractions over the business cycles.4 Burns and Mitchell (1946) define business cycles as “a type of fluctuation found in the aggregate economic activity of nations that organise their work mainly in business enterprises: a cycle consists of expansions occurring at the same time in many economic activities followed by similar general recessions, contractions and revivals which merge in the expansion phase of the next cycle; this sequence of changes is recurrent but not periodic.”

Following the description of business cycles, we measure expansions and contractions using the local maxima and minima of the sample path of Gross Domestic Product (GDP), the natural measurement of the level of economic activities.5 With the business cycle reference dates of the Australian Bureau of Statistics (1992), we are able to identify peaks and troughs in Australia’s business cycle from 1990 to 2007. We denote the period from trough to peak as expansions and from peak to trough as contractions. Table 3 shows the dates of turning points in the Australian business cycles together with the duration of each phase of cycle. As expected, we find that there are more expansions (116 months) than contractions (90 months). The Australian economy had particularly been doing well from 1997 to 2004 during which expansions took place for most of the sample period.

**Table 3.** Australian Business Cycle.

<table>
<thead>
<tr>
<th>Turning Point</th>
<th>Duration in Months</th>
</tr>
</thead>
<tbody>
<tr>
<td>Peak</td>
<td>Trough</td>
</tr>
<tr>
<td>1989.12</td>
<td>1993.02</td>
</tr>
<tr>
<td>1995.04</td>
<td>1997.02</td>
</tr>
<tr>
<td>2001.06</td>
<td>2001.02</td>
</tr>
<tr>
<td>2004.05</td>
<td>2006.02</td>
</tr>
<tr>
<td>2007.01</td>
<td></td>
</tr>
</tbody>
</table>

Note: This table reports the Australian business cycle from December 1989 to January 2007. There are 116 expansion and 90 contraction months.
EMPIRICAL MODELS

In this study, we use a univariate exponential GARCH (EGRACH) that proposed by Nelson (1991) to estimate the return volatility for several reasons. Unlike GARCH, the EGARCH variant imposes no positive constraints on the estimated parameters and explicitly accounts for asymmetry common in asset return volatility, thereby avoiding possible misspecification in the volatility process (Glosten, Jagannathan, & Runkle, 1993). In addition, EGARCH allows for a general probability density function (i.e., GED), which nests the normal distribution along with several other possible densities.

In order to capture this effect, we include the news variables in both the mean return and the conditional volatility. In our analysis, we first examine the surprise effects of the news arrivals (i.e., MS, UE, and CPI) on each swap spread change and its conditional volatility over the full sample period, and then investigate the news surprise effects in each state of economy. To remove any serial correlations and sign bias of zi, t in the estimate, we include an MA(q) process for the mean equation and specify the conditional variance as an EGARCH(1, 1) model for the full sample analysis as follows:

\[
\Delta \text{Swapspread}_{i,t} = z_{i,t} + \sum_{k=1}^{q} \alpha_{i,k}z_{i,t-k} + \sum_{N=1}^{4} \mu_{i,N}\text{News}_{N,t} + \varepsilon_{i,t} \quad (1)
\]

\[
\ln(h_{i,t}) = \beta_{i,0} + \beta_{i,1}\ln(h_{i,t-1}) + \beta_{i,2}z_{i,t-1} + \beta_{i,3}(|z_{i,t-1}| - E(|z_{i,t-1}|)) + \sum_{N=1}^{4} \gamma_{i,N}\text{News}_{N,t} \quad (2)
\]

where \( \varepsilon_{i,t} \sim N(0,1) \)

Where \( \Delta \text{Swapspread}_{i,t} \) is the swap spread change for maturity \( i \) (i.e., 1, 2, 3, 4, 5, and 10-year swaps respectively); \( h_{i,t} \) is the error term assumed \( \sim N(0, h_{i,t}) \); \( h_{i,t} \) is conditional return volatility for asset \( i \); and \( \text{News}_{N,t} \) is the unexpected component of each macroeconomic announcement (N=1, 2, and 3 for MS, UE, and CPI respectively) as measured by the difference between the announced figures and the expected value forecasted by an ARIMA model. These monthly and quarterly surprise variables are assigned a value of zero for days without the particular macroeconomic announcement and the magnitude of the surprises for days with announcements.

The coefficient \( \beta_{i,1} \) represents the impact of the unexpected component of news on the swap spread \( i \). The coefficient \( \beta_{i,2} \) measures the persistence of the conditional variance. The coefficients \( \beta_{i,3} \) and \( \beta_{i,4} \) represent the impact of the lagged errors on the current conditional variance. A negative \( \beta_{i,3} \) indicates that the negative shocks have a larger effect on the conditional variance, that is, the asymmetric variance effect. Meanwhile, a significant \( \gamma_{i,3} \) suggests that the unexpected news (NEWSi) has a direct impact on the conditional variance on the announcement dates.

To test whether the state of economy changes the news announcement effects, we modify the above equations by multiplying the unexpected news \( \text{News}_{N,t} \) with a dummy variable \( D_{e} \) which denotes the state of the economy. Therefore, the model becomes,

\[
\Delta \text{Swapspread}_{i,t} = z_{i,t} + \sum_{k=1}^{q} \alpha_{i,k}z_{i,t-k} + \sum_{N=1}^{4} \delta_{i,N}(D_{e} \times \text{News}_{N,t}) + \varepsilon_{i,t} \quad (3)
\]

\[
\ln(h_{i,t}) = \beta_{i,0} + \beta_{i,1}\ln(h_{i,t-1}) + \beta_{i,2}z_{i,t-1} + \beta_{i,3}(|z_{i,t-1}| - E(|z_{i,t-1}|)) + \sum_{N=1}^{4} \rho_{i,N}(D_{e} \times \text{News}_{N,t}) \quad (4)
\]

where \( \varepsilon_{i,t} \sim N(0,1) \)

The variable \( (D_{e} \times \text{News}_{N,t}) \) denotes the unexpected news under the contraction or expansion state of the economy. The coefficient \( \delta_{i} \) measures the impact of unexpected news on the swap spread \( \delta_{i} \) under the
contraction state or expansion state of economy. While the coefficient $\rho^i$ measures the impact of unexpected news on the conditional variance under different state of economy. Other variables are as defined in previous Equations. We estimate the parameters of the above equations for each return asset using the quasi maximum likelihood (QML) procedure described in Bollerslev and Wooldridge (1992). Hence the estimate results are consistent and asymptotically normal and efficient.

**EMPIRICAL RESULTS**

Table 4 reports the full sample results of the effects of news surprises on swap spread changes. Among the three news announcements, we find that only unexpected inflation rate is significant in explaining the swap spread changes across all maturities except 7-year swap. The inverse relationship between inflation surprises and changes in the swap spread indicates that a higher (lower) than expected inflation rate contributes to a reduction (widening) in the swap spreads. The changes of the swap spread however could come from changes in Treasury yield or changes in swap rate. In other words, a reduction of the swap spread may indicate that the swap rate and Treasury yield move in opposite directions, or in the same direction but different magnitudes. Hence, while a higher than expected inflation rate (indicates a strong economic growth) increases inflation premium on interest rate, it also reduces the default risk premium of the swap rate. The decrease in swap spreads during a higher inflation can be explained by using the option pricing model that proposed by Sørensen and Bollier (1994). If the actual inflation rate is higher than the expected inflation rate (indicates future interest rates are expected to rise), then the option to receive fixed is worth less than the option to pay fixed. In this situation, the expected losses from default on a par swap are not symmetric due to the higher default risk exposure in paying fixed and the lower default risk exposure in receiving fixed. The presence of this default risk implies that the payer of fixed may not receive the later (increasing) floating payments. Upon default, these higher floating rates will not be paid, thus leaving the payer of fixed in a more disadvantaged situation. A lower fixed rate coupon will compensate for this risk, causing the swap spread to decrease. On the other hand, if the actual inflation rate is lower than expected (indicates future interest rates are expected to fall), the value of the option to receive fixed will be higher than the value of the option to pay fixed. To compensate the potential default risk from the pay-fixed party, the receive-fixed party will require a higher fixed coupon, hence causing the swap spread to increase (see Fang & Muljono, 2003).

Consistent with previous studies (see Ederington & Lee, 1993; Roley, 1983; Urich & Wachtel, 1981), the 4- and 7-year swap spread change respond negatively to unexpected change in money supply (with coefficient $\beta^\text{hms}_i$) values of -0.0046 and -0.0053 respectively. In their study, Urich and Wachtel (1981) find that interest rate levels have a positive relationship with the unexpected change in money supply. They interpret this as an inflationary effect. That is unexpected change in money supply may exert an upward pressure on interest rate as the central bank may engage in an open market operation that tightens the supply of reserves to offset the unexpected change. Hence, causing the swap spread change to decrease (as interest rates are expected to rise). The 10-year swap spread change is the only swap that responds negatively and significantly to unanticipated unemployment rate change (with a coefficient (mUE) value of -0.0306). This suggests that the arrivals of unemployment news have the greatest effect on the long-term interest rate swap spread in both economic and statistical sense.

![Table 4](image)

Notes: This table reports quasi-maximum likelihood (QML) estimate results (models are estimated using Bollerslev–Wooldridge Heteroskedasticity consistent covariance, and the Marquardt optimization algorithm) for the EGARCH (1,1) model of Eq. (1):
\[\Delta \text{Swapspr}_t = \alpha_{t,c} + \sum_{k=1}^{q} \gamma_{t,k} e_{t-l-k} + \sum_{N=1}^{4} \mu_{t,N} \text{News}_{N,t} + \varepsilon_{t,t}\]

\[
\ln(h_{t,t}) = \beta_{t,0} + \beta_{t,1} \ln(h_{t,t-1}) + \beta_{t,2} z_{t,t-1} + \beta_{t,3} \{\ln(z_{t,t-1}) - \mu(\ln(z_{t,t-1}))\} + \sum_{N=1}^{4} \gamma_{t,N} \text{News}_{N,t}
\]

where \(\Delta \text{Swapspr}_{t,t}\) is the change in swap spreads, \(\text{News}_{N,t}\) denotes the surprises of news announcements (\(N\)) which are transformed into daily variables by assigning zero for days without the particular news announcement and the values of the surprises for announcement days. \(q\) is the number of MA lags required to remove serial correlations. \(\varepsilon_{t,t}\) denotes the error term which is assumed to be \(\sim (0, h_t)\). \(\sqrt{h_t}\) is the conditional volatility of \(\Delta \text{Swapspr}_{t,t}\).

The sample period is from January 1995 to January 2007. *, ** and *** indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

On the conditional volatility of the swap spread changes, the estimates of the lagged volatility coefficient \(b_1\) are highly statistically significant and fall within the range 0.8270–0.9792. This implies that the swap spread volatilities are highly persistent across all maturities. The asymmetric impact (as measured by \(b_2\)) is not significant across all swap maturities which means that negative shocks have greater impact on swap market than the positive shocks is not evident. Finally, the coefficients (\(b_3\)) of lagged innovations are positive and statistically significant. In relation to the unanticipated macroeconomic announcements on the conditional volatility of swap spread change, the unanticipated news on inflation rate are found to have negative effects on the conditional volatility of 2-, 3-, 5-, and 10-year swap spread change and the unexpected component of the change in money supply also has a significantly negative effect on the 5- and 10-year conditional volatility of swap spread change. Overall, the results seem to be consistent with Ederington and Lee (1996) and Brenner et al. (2009). Ederington and Lee (1996) show that implied volatility tends to rise in the days before news announcement release. They also find that there is a sharp fall in implied volatilities just after announcements. They argue that the announcement itself helps market to resolve uncertainty. Similarly, Brenner et al. (2009) find that the conditional return volatility rises before a news announcement and then declines on the day of news release. They attribute this volatility behavior to mean reversion in short-term interest rates that may have caused the impact of announcement shock to decrease for long-term bonds.

Further into our analysis, we examine swap spread responses to macroeconomic announcement surprises under different state of economy. Recent studies (see Anderson, Bollerslev, Diebold, & Vega, 2007; Boyd et al., 2005) suggest that the impact of some macroeconomic variables tends to dominate in periods of economic growth while other variables may be more influential in periods of economic slowdowns. Tables 5 and 6 report the impact of macroeconomic surprises on swap spreads during expansions and contractions, respectively.

It is interesting to note that in the economic expansion periods (see Table 5), swap market participants seem to ignore the inflation rate surprises as none of the coefficients of inflation rate surprises (measured by \(\delta_{\text{CPI}}\) in the mean equation is statistically significant. Other macroeconomic variable like money supply (\(\delta_{\text{MS}}\)) has the same significant effects on swap spread change as discussed in the full sample periods. However, we expect the unemployment shocks have a negative and significant effect on the swap spreads of longer term maturities. This is because market participants are more concern with macroeconomic variables (in this instance the unanticipated unemployment figure) that may signal the end of the expansion period and the arrival of the contraction period. As a result, the growth prospect of the private sector may remain stagnant or decline, hence the possibility of the central bank cut interest rate is highly likely which in turn may affect the swap spreads. Looking at the coefficients of unemployment surprises (measured by \(\delta_{\text{UI}}\)), they are negative but not statistically significant except the 10-year swap spread. These results are consistent with those in Table 4. This suggests that the unemployment surprises have the greatest impact on the long-term swap spreads during the expansion periods.

In contrast to the findings during economic expansions, inflation rate surprises appear to be the most influential news information during contractions. Table 6 shows that swap spread change across all maturity is highly responsive to the CPI surprises. The coefficient \(\delta_{\text{CPI}}\) for inflation rate surprises is negatively significant at the 5% level for all swap spread change. One explanation for the significant relationship during contractions
is that swap market participants pay more attention to inflation figure because an increase in inflation (indicates future interest rates are expected to increase) is associated with an improving business condition, which in turn improves credit quality and subsequently causes the swap spread to decline. Unlike during expansions however, news surprises on inflation rate are not important on the swap spread changes. Other macroeconomic surprises have no significant impact on swap spread change except the unexpected money supply has a significant effect on 4-year swap spread change.

Finally, results in Panel B of Tables 5 and 6 show that the macroeconomic shocks in general are negatively related to changes in conditional volatility of the swap spreads, suggesting that these newsworthy announcements tend to reduce uncertainty on the announcement days in the swap market during expansion and contraction periods. While there are some variations on the effects of the news surprises in different phase of the business cycles, the impacts appear to be quite consistent. For example, shocks generated from inflation rate announcements are generally negatively significant at the 1% level across all maturities in both states of economy. They also tend to dominate other news announcements in the swap market. The shocks from the inflation rate appear to dampen the conditional volatility of the swap spread. On the other hand, the shocks from money supply changes are restricted to the conditional volatility of 10-year swap spread during both expansions and contractions. The effect from the money supply shocks tends to calm down the conditional volatility of the swap spread.

**Table 5.** The Impact of macroeconomic News Surprises on Australian Interest Rate Swap Spreads: Expansion Periods.

<table>
<thead>
<tr>
<th></th>
<th>2-Year Swap Spread</th>
<th>3-Year Swap Spread</th>
<th>4-Year Swap Spread</th>
<th>5-Year Swap Spread</th>
<th>7-Year Swap Spread</th>
<th>10-Year Swap Spread</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Panel A: Conditional mean</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>( \hat{\beta}_0 )</td>
<td>-0.0002</td>
<td>0.0003</td>
<td>-0.0002</td>
<td>0.0003</td>
<td>-0.0002</td>
<td>0.0003</td>
</tr>
<tr>
<td>( \hat{\beta}_1 )</td>
<td>-0.0022</td>
<td>0.0028</td>
<td>-0.0039</td>
<td>0.0041</td>
<td>-0.0041</td>
<td>0.0039</td>
</tr>
<tr>
<td>( \hat{\beta}_2 )</td>
<td>-0.0252</td>
<td>0.0302</td>
<td>-0.0547</td>
<td>0.0624</td>
<td>-0.0526</td>
<td>0.0516</td>
</tr>
<tr>
<td><strong>Panel B: Conditional variance</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>( \hat{\beta}_3 )</td>
<td>-0.3287*</td>
<td>0.0975</td>
<td>-0.3282</td>
<td>0.1962</td>
<td>-0.4735**</td>
<td>0.1148</td>
</tr>
<tr>
<td>( \hat{\beta}_4 )</td>
<td>-0.7177*</td>
<td>0.0811</td>
<td>-0.9685*</td>
<td>0.6287</td>
<td>-0.5401**</td>
<td>0.1142</td>
</tr>
<tr>
<td>( \hat{\beta}_5 )</td>
<td>-0.00151</td>
<td>0.0244</td>
<td>-0.00891</td>
<td>0.0613</td>
<td>-0.01891</td>
<td>0.0271</td>
</tr>
<tr>
<td>( \hat{\beta}_6 )</td>
<td>-0.2077*</td>
<td>0.0329</td>
<td>-0.1566**</td>
<td>0.0875</td>
<td>-0.2464**</td>
<td>0.0646</td>
</tr>
<tr>
<td>( \hat{\rho}_{\text{cmin}} )</td>
<td>-0.0131</td>
<td>0.0259</td>
<td>0.0537</td>
<td>0.0868</td>
<td>-0.0052</td>
<td>0.0722</td>
</tr>
<tr>
<td>( \hat{\rho}_{\text{cmax}} )</td>
<td>0.1673</td>
<td>0.7277</td>
<td>0.141</td>
<td>2.0753</td>
<td>0.6140</td>
<td>0.5352</td>
</tr>
<tr>
<td>( \hat{\rho}_{\text{cCD}} )</td>
<td>-1.1584*</td>
<td>0.3769</td>
<td>-1.3464*</td>
<td>0.5231</td>
<td>-0.4372</td>
<td>0.507</td>
</tr>
</tbody>
</table>

Notes: This table reports quasi-maximum likelihood (QML) estimate results (models are estimated using Bollerslev–Wooldridge Heteroskedasticity consistent covariance, and the Marquardt optimization algorithm) for the EGARCH (1,1) model of Eq. (2):

\[
\Delta \text{Swapspr}_{t,t+1} = \Delta \epsilon_{t,t+1} + \sum_{k=1}^{q} \rho_{k} \delta_{t,k} + \sum_{k=1}^{q} \delta_{t,k} N(D_{t} + \text{Newswt}_{t}) + \eta_{t,t+1} \\
\ln(h_{t,t+1}) = \beta_{0} + \beta_{1} \ln(h_{t}) + \beta_{2} \ln(\text{Newswt}_{t}) + \beta_{3} \ln(\text{Newswt}_{t}) - E(\ln(\text{Newswt}_{t})) + \sum_{N=1}^{q} \rho_{N} N(D_{t} + \text{Newswt}_{t, N}) + \Delta \text{Swapspr}_{t,t+1}
\]

where \( \Delta \text{Swapspr}_{t,t+1} \) is the change in swap spreads. \( \Delta \epsilon_{t,t+1} \) is dummy variable takes on a value of 1 during expansions and zero otherwise. \( \text{Newswt}_{t} \) denotes the surprises of news announcements \( N \) which are transformed into daily variables by assigning zero for days without the particular news announcement and the values of the surprises for announcement days. \( q \) is the number of MA lags required to remove serial correlations. \( \epsilon_{t,t} \) denotes the error term which is assumed to be \( \sim(0, \text{ht}) \). \( \sqrt{h_{t}} \) is the conditional volatility of \( \Delta \text{Swapspr}_{t,t+1} \).

The sample period is from January 1995 to January 2007.

* * * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.
Table 6. The Impact of Macroeconomic News Surprises on Australian Interest Rate Swap Spreads: Contraction Periods.

<table>
<thead>
<tr>
<th></th>
<th>2-Year Swap Spread</th>
<th>3-Year Swap Spread</th>
<th>4-Year Swap Spread</th>
<th>5-Year Swap Spread</th>
<th>7-Year Swap Spread</th>
<th>10-Year Swap Spread</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Coefficient</td>
<td>Standard error</td>
<td>Coefficient</td>
<td>Standard error</td>
<td>Coefficient</td>
<td>Standard error</td>
</tr>
<tr>
<td>(\alpha_t)</td>
<td>0.0003</td>
<td>0.0003</td>
<td>0.0003</td>
<td>0.0003</td>
<td>0.0002</td>
<td>0.0004</td>
</tr>
<tr>
<td>(\beta_{\alpha})</td>
<td>-0.0016</td>
<td>0.0007</td>
<td>0.0014</td>
<td>0.0101**</td>
<td>0.0021</td>
<td>0.0008</td>
</tr>
<tr>
<td>(\delta_{\alpha})</td>
<td>0.0281</td>
<td>0.0316</td>
<td>0.0234</td>
<td>0.0021</td>
<td>0.0092</td>
<td>0.0007</td>
</tr>
<tr>
<td>(\delta_{\alpha}^2)</td>
<td>-0.0005**</td>
<td>0.0012</td>
<td>-0.0002**</td>
<td>-0.0001**</td>
<td>0.0007</td>
<td>0.0000</td>
</tr>
</tbody>
</table>

Panel B: Conditional variance

<table>
<thead>
<tr>
<th></th>
<th>Coefficient</th>
<th>Standard error</th>
<th>Coefficient</th>
<th>Standard error</th>
<th>Coefficient</th>
<th>Standard error</th>
</tr>
</thead>
<tbody>
<tr>
<td>(\delta_{\alpha}^2)</td>
<td>0.2814</td>
<td>0.1000</td>
<td>0.2643</td>
<td>0.2118**</td>
<td>0.2118</td>
<td>0.2118**</td>
</tr>
<tr>
<td>(\delta_{\alpha}^2)</td>
<td>0.0046</td>
<td>0.0047</td>
<td>0.0145</td>
<td>0.0164</td>
<td>0.0145</td>
<td>0.0164</td>
</tr>
<tr>
<td>(\delta_{\alpha}^2)</td>
<td>0.2959**</td>
<td>0.0347</td>
<td>0.1168</td>
<td>0.2044</td>
<td>0.6541</td>
<td>0.4941</td>
</tr>
<tr>
<td>(\delta_{\alpha}^2)</td>
<td>0.0254</td>
<td>0.0166</td>
<td>0.0365</td>
<td>0.2154</td>
<td>0.6541</td>
<td>0.4941</td>
</tr>
<tr>
<td>(\delta_{\alpha}^2)</td>
<td>0.02758</td>
<td>0.0040</td>
<td>0.0375</td>
<td>0.2154</td>
<td>0.6541</td>
<td>0.4941</td>
</tr>
<tr>
<td>(\delta_{\alpha}^2)</td>
<td>0.2511</td>
<td>0.2551</td>
<td>0.1871</td>
<td>0.2035</td>
<td>0.0293</td>
<td>0.1825</td>
</tr>
</tbody>
</table>

where \(\Delta \text{Swapspr}_{it}\) is the change in swap spreads. \(D_{kt}\) is a dummy variable takes on a value of 1 during contractions and zero otherwise. \(\text{Newsm}_{it}\) denotes the surprises of news announcements \(N\) which are transformed into daily variables by assigning zero for days without the particular news announcement and the values of the surprises for announcement days. \(q\) is the number of MA lags required to remove serial correlations. \(\hat{e}_{it}\) denotes the error term which is assumed to be \(\sim(0, \text{ht})\). \(\sqrt{h_t}\) is the conditional volatility of \(\Delta \text{Swapspr}_{it}\).

The sample period is from January 1995 to January 2007.

*, **, and *** indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

CONCLUSIONS

This study investigates which macroeconomic news announcements are more influential on the behavior of Australian interest rate swap spreads and to the extent that they affect the changes in the swap spread during economic expansions and contractions. Using news releases from money supply growth, unemployment rate, and inflation rate, we find that news information provided by inflation rate announcements is the only important news throughout the business cycles but most dominant during economic contractions. Whilst the unanticipated unemployment rate tends to be more relevant to 10-year swap and the unanticipated change in money supply tends to be more relevant to 4- and 7-year swaps during expansions. Our findings suggest that market participants pay attention to different macroeconomic news announcements depending on the state of the economy. Information revealed by these news releases therefore may vary in their relevance in each phase of the business cycles.

We also find shocks from these news surprises appear to have significant impact on the conditional volatility of the swap spreads during both economic phases. The macroeconomic shocks in general are negatively related to changes in conditional volatility of the swap spreads, suggesting that these newsworthy announcements tend to reduce uncertainty on the news announcement days in the swap market during expansion and contraction periods. While there are some variations on the effects of the news surprises in different phase of the business cycles, the impacts appear to be quite consistent.

NOTES

1. Boyd et al. (2005) examine only the unemployment rate news announcements compared with three news announcements in this study.
2. Fama (1971) first formalized the relationship between information arrival and the price formation process by making use of the efficient market hypothesis to assert that asset prices immediately reach an equilibrium state reflecting the arrival of new information in the marketplace.
3. Previous related studies that also used ARIMA model are Urich and Watchel (1981), Wasserfallen (1988), and Singh (1993).

4. A business cycle is a graphic representation of the fluctuations in the level of economic activity. The curves of the cycle extend over a number of years, fluctuating through periods of expansions and contractions. These fluctuations are the result of changes in the levels of production, spending, and employment. Expansions and contractions were defined as periods of rising and falling levels of economic activity, respectively.

5. The chain volume measure of GDP is used.

6. We define separate state of economy dummy variables for contraction and expansion which each takes on a value of unity on the state of economy to which they are assigned and zero otherwise.

REFERENCES


