Monetary surprises and financial market reactions: The effect of Australian cash rate target announcements

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ABSTRACT

The paper investigates the impact of unexpected monetary policy on three classes of Australian financial futures assets—ASX stock price index futures, AUD/USD exchange futures and 3- and 10-year Treasury bond futures contracts. This study contributes to the literature by using 30-day and 90-day bank accepted bill (BAB) rates to gauge the unanticipated component of cash rate target changes in the Australian money market, and by simultaneously modelling effects of the cash rate target surprises and other key macroeconomic announcements. Empirical results indicate that the Reserve Bank's cash rate announcements have a strong contemporaneous impact on all futures markets when expected monetary policy changes are measured by using 30-day BAB rate. The degree of significance for these monetary announcement effects depends largely on how we measure the monetary surprises. The 30-day BAB rate is the best proxy of the expected monetary policy changes. The effect of monetary surprises on volatility of all futures instruments, except the stock index futures, is still significant and complete when other key macroeconomic announcements are considered simultaneously.

JEL classifications: C22; E44; G12; G14

Keywords: Monetary policy surprises, asset return volatility, financial market reaction to monetary news

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1. Introduction

Overnight cash interest rate target is the core of monetary policy in Australia and many other countries, such as in the U.S., Germany, the United Kingdom and New Zealand. This paper investigates how monetary policy in general and the cash rate target in particular, impact on Australian financial futures markets. The paper examines the unexpected announcement effects of the cash rate movements or the real "news" effect of the monetary announcements on the All Ordinary Index futures contracts, the AUD/USD foreign exchange futures contracts and 3- and 10-year bond interest rate futures markets. The main objectives of this paper are two-fold: 1) the impacts of expected and unexpected monetary policy announcements, 2) the integrated effects of monetary "news", together with effects of major macroeconomic announcements.

The reactions of financial markets to the central bank's monetary policy stance and open market operations (OMOs) are essential for central banks and financial market participants. The topic confronted here is important to central banks because central banks need to know how monetary policies are transmitted to financial markets and how efficient the transmission process would be, since the efficiency of monetary policy is dependent on effective communications between central banks and financial markets. For financial markets, how asset prices react to the monetary shocks is an essential part of price discovery process. Unfortunately, this is also one of the least understood issues amongst academics, policy makers and market practitioners.

This paper investigates the effect of unexpected monetary policy effect on Australian interest rate futures, foreign exchange rate futures markets and the Australian stock index futures contract, for the period from January 1996 to June 2005. Two distinctive approaches are employed to measure the expected changes in Australian cash rate target – the 90-day bank bill rate and 30-day bank bill rate from Australian money market. We then examine the effect of the central bank's monetary surprises on financial futures markets with an extended threshold GARCH (T-GARCH) model. The asymmetric threshold GARCH-class model enables us to test the impact of monetary surprises and the key macroeconomic announcements on the Australian financial asset returns and return volatility.

The plan for the remainder of this paper is as follows. Section 2 reviews the previous research related to this topic. Section 3 briefly describes the role of Australian cash rate target, and presents a descriptive statistics for the cash rate target movements and the ways by which we measure the cash rate surprises. Section 4 provides preliminary analysis on our financial market data and Section 5 specifies the empirical modelling framework. Section 6 presents the major empirical results from the application of the TGARCH model. Section 7 concludes the paper.

2. Literature review

Li and Engle (1998) examine the reaction of the treasury futures market to the scheduled announcements of prominent U.S. macroeconomic data by using open-close returns and volume data. Their study reveals heterogeneous persistence from scheduled and non-scheduled announcements. However, they do not find statistically significant increase in expected open-close returns, *i.e.* macroeconomic risk premium on the announcements days. Li and Engle (1998) show that announcement-day volatility plays a substantial role in short-term volatility forecasts, which is contrary to Jones, Lamont and Lumsdaine (1998)'s findings that the announcement-day shocks do not have subsequent impact on daily volatility. Evidence from Li and Engle (1998) suggests strong asymmetric effect of scheduled announcements--positive shocks depress volatility on consecutive days, while negative shocks increase volatility. Evidence on conditional volatility and volume shows that the market process the information from scheduled news more quickly than non-scheduled news, which supports the asymmetric information trading hypothesis. Information asymmetry is decreased after news disclosure, however, convergence in beliefs does not happen instantaneously. One of their key findings is that the strong asymmetric effects in the T-bond futures market where negative shocks increase conditional volatility on consecutive days. Also, their study shows that bad news from scheduled announcements brings stronger asymmetric effects than that from unscheduled news announcements.

Roley and Sellon (1998a) examine how treasury security yields, stock prices and federal funds futures rates respond on Federal Open Market Committee (FOMC) meeting dates when expected policy actions do not occur. Their empirical results suggest a small but statistically significant reversal rates when an expected federal funds rate target change does not occur. The existence of significant non-announcement effects suggests that information is conveyed to financial markets even when no policy action takes place. The size of effect is consistent with the view that the information causes financial markets to temporarily postpone, but not eliminate the possibility of a future policy action, which means that the information content provided by the no-change policy stance appears limited to the timing of the policy actions and not the basic assessment about the long run stance of monetary policies. In contrast, for nonzero target interest rate changes, Cook and Hahn (1989) and Roley and Sellon (1998a) find statistically significant responses of long-term interest rates in different time period, suggesting that nonzero and zero target interest rates changes (or non-announcement) apparently provide different information for financial markets.

Roley and Sellon (1998b) also tested wether the market reaction to policy non-announcements is larger after February 1994 when the fed began making all of its nonzero changes in the federal funds rate target at FOMC meetings. They find that the response to non-announcements is only larger for a near-term federal fund futures rate, but not for the treasury security yields under investigation, suggesting only minor differences in the information content of non-announcements after the FOMC began announcing target changes after meetings. These results, all together, suggest that monetary policy decisions can be informative to financial markets even these decisions do not involve any actual policy action, this, inturn, support the notion that market expectations of future policy actions are important determinant of the market interest rate behaviour.

Bonser-Neal et al. (2000) presents a rational expectation based model of the exchange rate response to U.S. monetary policy actions. They assume that the US economy is subjected to economic shocks and the Federal Reserve may choose to offset these shocks by changing its federal fund rate target, and foreign central banks alter their policies in response to either common global economic shock or to the Fed action itself. Under those assumptions, they show that the response pattern of spot and expected future exchange rates depends on the both the predictability of Federal Reserve actions and the extent to which foreign central banks react to the Fed's monetary policy changes. Bonser-Neal et al. show that the dollar can appreciate for a number of future periods in response to a contractionary US policy action, with the greatest value occurring in some future period. And, this exchange rate response pattern is more likely as the predictability of the Federal Reserve policy actions declines. Their results suggest that the responses of spot and future expected exchange rates in anticipation of a policy action could be larger than the responses to the policy action itself. They also find that the spot and future values of the dollar can appreciate in anticipation of a Federal Reserve tightening policy, but then depreciate once the action is taken.

Kuttner (2001) examines the impact of monetary policy actions on the bill, note, and bond yields, using U.S. Fed funds futures rates as a measure of expected component of policy changes to separate expected and unexpected components changes in the target funds. Kuttner finds that interest rate market's response to the anticipated part of monetary policy changes is small while its reaction to the unanticipated *surprises* is large and highly significant. He contends that the failure of previous studies in documenting the close link between monetary policy actions and market reactions is due to the inability to disentangle the anticipated component of the policy change from the unanticipated component.

Demiralp and Jorda (2004) examine how the Fed's target rate announcement affected the term structure of nominally risk-free Treasury securities since the Fed began publicly announcing its target in February 1994. They argue that the practice of publicly disclosing changes in the target level federal funds rate affects the monetary transmission mechanism either by increasing the effectiveness with which the Fed manages federal funds trading around the target or by regimenting the formation of expectations and the price discovery process of Treasury securities. Their results suggest that term rates react strongly when the Fed initiates a policy stance reversal, which is consistent with the rational expectation hypothesis and with the market's better anticipation on the timing and the nature of future policy moves.

With regarding to Australian context, it is still rare to find studies addressing the interest rate markets, especially the Treasury bond market's responses to the Reserve Bank's policy announcements[1]. This paper contributes to the literature by focusing on the effect Australian cash rate target announcement on Treasury bond markets, ASX stock index futures (ASX-SPI) as well as AUD/USD exchange futures markets. The paper also adds to the literature by examining the effect of monetary policy on financial markets in a context in which other key macroeconomic factors are also incorporated.

3. The cash rate and Australian monetary policy

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[1] Kearns and Manners (2005) have recently examined the impact of monetary policy on exchange rate markets in four countries including Australia, by using an event study model with intraday data. Their results indicate that monetary policy changes account for only a small part of the observed variability of exchange rates in countries covered. They suggest the differences monetary effect on exchange rate depend on how the central banks manipulate expectations regarding future policy moves.

3.1 The cash rate and its influence on financial markets

Before examine the impact of the monetary policy on Australian interest rate, foreign exchange rate and stock index futures markets, we need to briefly describe the role of cash rate target in Australian monetary system and present a descriptive statistics for the cash rate target movements and the ways by which the cash rate has been announced to the financial markets in the last decade or so.

The single main instrument of monetary policy in Australia is the short-term interest rate, often referred as the cash rate, which is the market interest rate on overnight funds. The cash rate target, functioning as the policy instrument for the Reserve Bank under the current Australian monetary regime, is periodically adjusted by decisions of the Reserve Bank board and is publicly announced to financial markets along with explanations by the Bank for the change. The cash rate has a very strong influence on other interest rates, and therefore helps to set the level of short-term interest rates in the wider economy. This is true both for money market rates and for key market rates of commercial banks. Financial intermediary rates tend to move in line with movements in the cash rate, which in turn, gives monetary policy a powerful influence over the broader financial market and aggregate economy.

Current Australian monetary policy operates through a single main instrument, which is sharply different from what it was before financial deregulation taking place over the decade to the mid-1980s. In the pre-deregulation period, monetary policy operated through a mixture of financial-market operations and direct controls on markets and financial institutions. These included controls on bank interest rates, reserve requirements and various other balance-sheet restrictions. A change in monetary policy under this system could be achieved through a range of different mechanisms or through some combination of them. This conventional monetary policy system gradually became ineffective as markets developed corresponding ways of avoiding regulations through growth of the unregulated parts of the financial sector. With the current deregulated financial market system, Australian monetary policy becomes more transparent and consistent as it works directly through the single short-term interest rate--the overnight cash interest rate for inter-bank exchange settlement funds.

The monetary policy in Australia is hence implemented by influencing the exchange settlement position with the banking system. By controlling the tightness or looseness of the money market conditions the monetary authority influences overnight interest rates directly and other interest rate indirectly. In turn, this provides a mechanism by which the central bank attempts to achieve its policy objectives, including its control of monetary aggregates, the stability of Australian currency, full employment objective and the growth and prosperity of the economy.

Australian monetary policy can be divided into three periods by the way the cash rate target is release into financial markets. These three periods broadly correspond to three different stages of monetary policy communication arrangements at the RBA. The first period is from July 1985 to January 1990, which corresponds to the time period before a cash rate target was announced. During this period, the policy stance of the central bank was regarded as highly secret for the financial market. The second period is transitional period from January 1990 to November 1997 during which the first articulation of inflation target and other important policy initiatives were established. The third period extends from December 1998 until March 2005, during which the statement on the conduct of monetary policy was regularly released and the inflation-targeting framework of monetary policy was formalised. The accountability and transparency of the Australian monetary policy have been in place since then. Table 1 below presents some descriptive statistics of moves in the target cash rate.

Table 1 Descriptive statistics of monetary policy announcements in Australia

	Pre-announcement period (Jul 1985 - Jan 1990) [(a)]	Announcement period (Jan 1990 - Nov 1998)	Regular announcement period (Dec 1998 - Mar 2005)
No. of cash moves	20	23	17
Proportion of scheduled moves (%)	11	37	100
Mean Absolute cash rate changes	129	87	35
Average no. of trading days between rate moves	59	86	91

Notes: (a) During this period where there was no official target cash rate, policy changes were identified as the midpoint of the informal band used by the RBA's domestic trading desk.
Source: The cash rate movements data for Pre-announcement period was extracted from Dungey and Hayward (2000). Data for the period after 1990 is from the RBA.

Three points we can distil from Table 1. *First*, the average size of cash rate target moves has been significantly reduced. In the first period from 1985 to 1990, the average absolute movement is 129 basis points. However, since December 1998, the mean absolute cash rate movement has been reduced to 35 basis points. *Second*, the average number of trading days between cash rate target moves is also increased significantly since 1990. The smaller scale and longer time span of cash rate adjustments reflect the underlining fact of a healthier Australian financial system: an increased transparency in monetary policy conducted under a more stable macroeconomic condition. *Finally*, the proportion of cash rate target changes occurring on the scheduled day has increased from 11% in the first period to 100% in the third period since December 1998, reflecting the growing tendency to announce the cash rate target in a set time on the day following the Board meetings.

3.2 Measurements of the cash rate surprises

As the sole monetary policy instrument, the cash rate target changes affect asset prices to the extent that such changes convey new information regarding either short- or long-term monetary policy objectives. An implication of efficient market and rational expectation hypotheses is that, since markets are efficient, asset prices should react immediately and unbiasedly to the unexpected component of information contained in monetary policy—the "news" effect of the Bank's policy stance and market operations.

The key issue here is how we measure and separate the two parts of the information regarding cash rate target announcements: the expected and unexpected component of monetary news. Previous research on effect of monetary policy on interest rate and exchange rate markets uses the entire news item (e.g., Jones et al., 1998), market survey data (e.g., Lobo, 2002), and available monetary policy target futures rates (Kuttner, 2001). In this paper, we use three alternatives methods to isolate the element of surprise in monetary announcement. Our alternative techniques for measuring the expected and unexpected components of cash rate target allow us to explicitly evaluate and separate the unanticipated element of cash rate target from the anticipated changes.

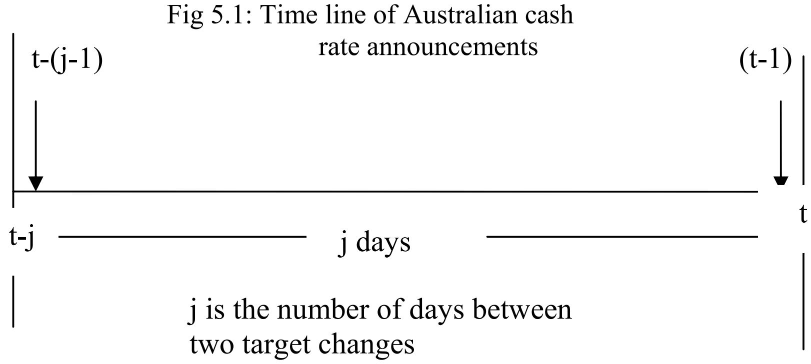
The first approach used to distil the unanticipated component of target changes utilizes information contained in the Australian 90-day bank accepted bill (BAB) rates to gauge the market's expectations of the likely changes in the Reserve Bank's cash rate target. This approach is based on previous findings that the 90-day bank bill (or 3 month Treasury bill in the U.S. market) yield fully reflects the changes in central bank's policy target rate (Kuttner, 2001; Cook and Hahn, 1989). The expected component of the cash target movement is then calculated by using the following formula:

$$\Delta R^{e}_{crt,\,t} = R_{90\,d,\,t-1} - R_{90\,d,\,t-(j-1)} \qquad (1)$$

where $R_{90\,d,\,t-1}$ is 90-day BAB yield on the day before a target change, $R_{90\,d,\,t-(j-1)}$ is 90-day BAB yield on the day immediately after the previous target change made on day t-j. The monetary surprises, $\Delta R^{u}_{crt,\,t}$, are then calculated as the difference between the actual target changes and anticipated target changes, $\Delta R^{e}_{crt,,t}$, as shown in equation (2):

$$\Delta R^{u}_{crt,\,t} = \Delta R_{crt,\,t} - \Delta R^{e}_{crt,\,t} \qquad (2)$$

Fig 5.1: Time line of Australian cash rate announcements



The second alternative approach we used as a proxy for expected component of the cash rate target in this study is the short-end interest rate quoted in Australian money market—the 30-day bank bill (BAB) rate. The rationale behind the technique is that the 30-day BAB rate is the most flexible short-end interest rate. The daily movements of the 30-day rate may possibly reflect the influence of available information content that also motivates the changes of the Reserve Bank's cash interest rate target. We calculate the expected component of the cash target movement by using 30-day BAB rate as in equation (1):

$$\Delta R^{e}_{crt,\, t,} = R_{30\, d,\, t-1} - R_{30\, d,\, t-j+1} \qquad (3)$$

where $R_{30\, d,\, t-1}$ is 30-day BAB yield on the day before a target change, $R_{30\, d,\, t-j+1}$ is 30-day BAB yield on the day after the previous target change made on day (t-j). The monetary surprises are then calculated as the difference between the actual and expected target changes by using formula (2). The third approach is to take the entire cash target change in estimation, which is used for comparison purpose.

Appendix 1 presents the dates and movements of the Reserve Bank's cash rate target for the period from October 1990 to March 2005. The unexpected component of monetary policy changes is shown in columns (5) and (6), calculated by using 30-day and 90-day bank accepted bill rates, respectively.

4. Financial market data

The objective of this study is to analyse the Australian financial market reaction to the release of the Reserve Bank's cash rate target. The basic dataset we use in this study consists of daily continuously compounded returns on three assets classes--

AUD /USD dollar exchange rate futures, 3- and 10- year Treasury bond futures and ASX stock index futures contracts. Daily AUD/USD exchange rate futures prices, 3-year and 10-year Australian Treasury bond futures prices and data for ASX stock index futures contracts are obtained from the Sydney Futures Exchange (SFE). The most frequently traded futures contracts are selected in all three futures markets data. Daily percentage changes are used as returns for each security. The dataset covers the period from January 1996 to June 2005.

Table 2 summarizes statistics on daily returns from four series. Daily mean returns for all four markets are positive. The variances range from 0.0724 for the 3-year T-bond futures market to 1.553 for the ASX stock price index series. The sign of skewness for the ASX stock price index is positive, indicating that distribution of the series has a long right tail, while the other series with negative skewness have long left tails. The distributions of all those series are thus not symmetric. Kurtosis of all four series exceeds 3 and the distribution for the four series is leptokurtic and more peaked than normal distribution. The reported probability for the Jarque-Bera test is zero for all series, suggesting (at 1% significance level) that all series are not normally distributed. The Augmented Dickey-Fuller (ADF) Test t-statistics is also reported for the raw data series. The ADF test critical value at the 1% level is –3.4362, the calculated t-statistics of all the variables for ADF tests are less than the test critical values at the 1% significance level. Hence, the null hypothesis that any one series in this group has a unit root is rejected. Thus all daily return series (daily percentage changes) are of I (0), and they are stationary. The means and autocovariances of all the series do not depend on time. The summary statistics suggest that a GARCH –class of model would be appropriate, along with an error distribution that allows for greater kurtosis than normal distribution.

Table 2 Summary statistics on daily returns of ASX stock index futures (ASX-SPI), AUD/USD exchange futures and 3- and 10-year T-Bond futures markets

The table below reports descriptive summary statistics for four futures markets—ASX stock index futures (ASX-SPI), AUD/USD exchange futures (AUDF), 3- and 10-year Treasury bond futures (TBF3y, TBF10y). μ is the mean and σ is the standard deviation. Skew is the coefficient of skewness, Kurt is kurtosis. ADF is t-statistics value for Augmented Dickey-Fuller test of unit root for all series. LB (10) is the value of Ljung-Box test of randomness for the 1^{st} through 10^{th} order autocorrelation, asymptotically distributed as χ^2 [10] under the null hypothesis that the series is white-noise process in which all autocorrelations be zero. Note that rejecting the null H_0 means accepting an alternative H_1 that at least one autocorrelation is not zero. The signs of "***", "**", "*" indicate significance at the 1-, 5- and 10- percent level, respectively.

	ASX-SPI	AUDF	TBF3Y	TBF10Y
μ	0.0539	0.0173	0.0012	0.0015
σ	1.5533	0.7457	0.0724	0.0719
Skew	10.1627	-0.2380	-0.0659	-0.1925
Kurt	319.4359	4.1041	4.5007	4.1050
ADF-t	-46.46376	-37.3336	-36.2809	-37.293
LB(10)	22.139***	18.366***	15.260***	12.017

5. The model

The GARCH (1, 1) model proposed by Bollerslev (1986) is widely used for modelling the financial asset return volatility and has served as a benchmark model now for studies dealing with financial market volatility. However, according to

Andersen and Bollerslev (1997), and Li and Engle (1998), the standard GARCH (1,1) models imply a geometric decay in the volatility autocorrelation structure, which makes the model hard to accommodate strong regular cyclical patterns often found in modelling the day-of-the-week effect and the announcement effect around "news" disclosure days.[2] A key point is that volatility on announcement days may have both transitory component and non-transitory component due to either a shift of beliefs caused by the disclosure or due to gradual convergence of beliefs. It will be impossible to identify any volatility persistence with the standard GARCH (1, 1) model if the transitory component dominates the process. Another drawback of the standard GARCH model is that it cannot accommodate the potential asymmetric leverage effect of negative shocks from various news announcements.

In order to deal with the leverage effect of market volatility from negative shocks, and better accommodate the regular cyclical patterns as well as the potential transitory component of return volatility on announcement day, we employ a threshold GARCH (or TGARCH) model (Zakoian, 1994). Following Ederington and Lee (2001) and Li and Engle (1998), we consider the Reserve Bank's monetary policy surprises and market operations, together with all other information flows, in a single T-GARCH model, as in equations (4) and (5) so as to accommodate the cyclical patterns of the monetary policy shocks and announcements, and also to address the potential asymmetric leverage effect of negative shocks from various news announcements. The extended T-GARCH model adopted for this paper can be specified as follows:

[2] Also as pointed out by Ederington and Lee (2001), the coefficients of past shocks estimated by the GARCH (1,1) model with high frequency data tend to underestimate the influence of the most recent and more distant return innovations and tend to overestimate the influence of the shocks at the intermediate lags.

$$R_{i,t} = b_{i,0} + b_{i,1} R_{i,t-1} + b_2 M_t + \varepsilon_t \quad (4)$$

where $\varepsilon_t \mid \Phi_{t-1} \sim N(0, h_t)$, *and*

$$h_{t,1} = \omega + \alpha\, \varepsilon_{t-1}^{2} + \beta\, h_{t-1} + \gamma\, I^{-}_{t-1}\, \varepsilon_{t-1}^{2} + \sum_{i=0}^{3} \theta_i M_{t-i} \quad (5)$$

In equation (4), $R_{i,t}$ is the daily returns from market i, (i is one of the four markets considered in this study) from day t-1 to day t. M_t is the unanticipated cash rate target changes. We first use the 90-day bank accepted bill rate to gauge the market expectation of the likely changes in the Reserve Bank's cash rate target. The second alternative approach we utilize as a proxy for expected component of the cash rate target is the short-end bank bill rate quoted in the Australian money market—the 30-day bank bill rate. Equation (5) specifies our benchmark TGARCH (1, 1) for conditional variance. Φ_{t-1} represents the information set available at the end of day t-1. In equation (5), I^{-}_{t-1} is dummy variable, $I^{-}_{t-1} = 1$ if $\varepsilon_t < 0$, $I^{-}_{t-1} = 0$ otherwise. Parameter α captures the ARCH effect while β captures the persistence in volatility. Parameter γ is used to catch the asymmetric effect of return volatility. A significant γ means that the negative innovation has a greater effect than the positive shocks. Equations (4) and (5) will serve as our benchmark model for this study.

We also test the speed with which returns and volatility of financial markets incorporate the news contents of the cash rate target changes by assessing the lagged effects of the cash rate target movements on stock index futures contracts, interest rate and foreign exchange rate futures markets. Three-day lags are chosen because we test whether the lagged effect of the cash rate target movements on the selected financial markets dies out within a three-day period. The contemporaneous and lagged effects are captured by parameter θ_i, where i = (0, 1, 2, 3).

This study also examines the combined effect of monetary policy releases and key macroeconomic news announcements, on the Australian stock index futures market, foreign exchange rates and interest rate futures markets. We are particularly interested in the relative importance of each information flow, and the interdependence and interaction of four streams of information inflows in determining daily return volatility: (a) information flows of past volatility, (b) information flows of monthly monetary policy review and release of the Reserve Bank's policy stance, (c) information flows of key macroeconomic announcements, which include employment reports (EMP) by Australian Bureau of Statistics (ABS), the consumer price index (CPI), growth rate of Gross Domestic Product (GDP) announcements by the ABS, and (d) information announcements on the U.S. monetary policy changes—the Federal Reserve Banks' announcement on Fed Fund Target changes. The extended variance equation is then expressed as follows:

$$h_t = \omega + \alpha\, \varepsilon_{t-1}^{2} + \beta h_{t-1} + \gamma\, I^{-}_{t-1}\, \varepsilon_{t-1}^{2} + \sum_{i=0}^{3} \theta_i\, MD_{t-i} + \sum_{j=1}^{4} \varphi_j A_j \quad (6)$$

where A_{it} is for scheduled macroeconomic announcement dummy, representing the Consumer Price Index (CPI), employment reports (EMP), and the growth rate of GDP. A_{it} =1 if announcement j is released on day t, and A_{it} = 0 otherwise. MD_t is dummy variable for the monthly monetary policy release of the Reserve Bank's policy stance. MD_t =1 for the first Wednesday of each calendar month on which the Reserve Bank announces its monetary policy, and MD_t = 0 otherwise.

6. Empirical results

6.1 The Impact of the cash rate target announcements

Table 3 presents the empirical results of the impact of monetary surprises on the volatility of Australian stock index futures market. Columns 1 and 2 contain estimate results of the impact of cash rate target surprises, based on the separation of unexpected and expected target movements using 30-day bank bill yields as the proxy of the anticipated target changes. The contemporaneous impacts of monetary policy surprises on the volatility of the stock futures index, captured by parameter θ_0, is positive and statistically significant at the 5 % level, while the lagged effects of cash rate surprises on volatility, captured by θ_1, θ_2 and θ_3 , respectively, are all statistically insignificant. These results suggest that the monetary surprises from the official cash rate target announcements increase share market volatility on the monetary policy announcement days, and volatility then reverts to pre-surprise levels on the days after the announcement. This finding is consistent with the idea that the cash target interest rate surprises initially increase stock market volatility, and that the volatility dies out quickly as soon as the market assimilates the new information contained in such announcement. The impact of cash rate surprises on the mean of price movements, captured by b_2, is not found for the Australian stock index futures market.

Columns 3 and 4 of Table 3 contain estimates of the impact of cash rate target surprises, based on the separation of unexpected and expected target movements using 90-day bank bill yields as the proxy of the anticipated target changes. The estimated contemporaneous impact of monetary policy surprises on stock index futures contract is no longer significant when daily 90-day BAB futures rate is used. The lagged effect of cash target surprises, captured by θ_{1}, θ_2, θ_3, respectively, is insignificant, suggesting that the reaction of stock price index futures to monetary shocks is completed on the target announcement day. This result provides new evidence that new information contained in cash target announcements is quickly assimilated into the stock prices in Australian share market. For comparison purposes, we also report the estimation results with the Model 3 in columns 5 and 6, by using unseparated total cash rate target changes as in Bonser-Neal et al. (1998, 2000) and Thornton (1998). The effect of monetary policy surprise on the stock market, as expected, is not significant. This is supportive of the notion that in an efficient market, share prices react primarily to the unexpected component of information flows, or news. The impact of cash rate surprises on the mean price of the futures contract, captured by b_2, is insignificant again in the model either with the 90-day BAB futures rate or with the actual target rate.

Table 4 presents maximum likelihood estimation results of the T-GARCH model for AUD/USD futures markets. Parameter γ is positive and significant at the 5% level in all three models, suggesting that the impact of past innovations on current volatility is asymmetric in the AUD/USD exchange futures market. Columns 1 and 2 present the estimation results with Model 1, using the 30-day bank bill rate as the anticipated component of cash rate changes. The contemporaneous impact of cash rate target announcements on volatility of the currency futures market, captured by parameter θ_0, is negative and significant at the 5 % level, indicating that the Reserve Bank's monetary policy stance plays a key role in smoothing the currency market and thus reducing return volatility on the policy announcement days. The policy announcement effect on market volatility is incomplete, as the lagged effect on day 3 after the announcement day t, captured by θ_3, is significant. Columns 3 and 4 show estimate results with Model 2, using the 90-day bank bill futures price as the proxy of the anticipated target changes. The estimated impact of monetary policy surprises is insignificant when the daily 90-day BAB futures rate is used as the proxy of expected cash rate target changes. The impact of cash rate target surprises on the mean of the currency futures contract, captured by b_2, is significant in Models 2 and 3, indicating that monetary surprises also affect the mean returns from the AUD/USD exchange futures market when 90-day BAB rate or the actual target rate changes are used as the proxy of the anticipated target changes.

Table 5 reports maximum likelihood estimation results of the T-GARCH model for 3-year bond futures markets. Parameter θ_0, is negative and significant at the 5 % level for Model 1 in columns 2 and 3, indicating that the Bank's monetary announcement plays a key role in smoothing the T-bill futures market and thus reducing return volatility by influencing market participant's beliefs and/or by reducing the information processing period needed for the gradual convergence of market expectations among participants. The impact of monetary policy is insignificant when the 90-day BAB rate is used as the proxy of expected cash rate target changes in Model 2 and when the entire cash target changes are used in Model 3. The effect of monetary surprises on volatility of the 3-year bond futures market is also complete, since all lagged effects are statistically insignificant. The impact of cash rate target surprises on the mean of the 3-year bond futures market, captured by b_2, is statistically significant in Model 1 with the movement of the 30-

day BAB rate as monetary surprises, suggesting that monetary surprises affect the mean returns of the long-term interest rate futures market.

Table 6 presents similar results for 10-year bond futures markets. The effect of monetary surprises, with 30-day bank bill futures yield as the proxy of the anticipated target changes, is negative and statistically significant at the 5% level in Model 1 and significantly negative at the 10% level in Model 3. The effect of cash rate target announcements is complete on the announcement day in Models 1 and 2, as lagged effects are all statistically insignificant in these models. Coefficient b_2 is statistically insignificant in all three models, suggesting that monetary surprises do not impact on the mean returns of the 10-year bond long-term interest rate futures market.

6.2 The cash rate target and other key macroeconomic announcements

This study examines the combined effect of monetary policy releases and key macroeconomic news announcements on the Australian stock index futures market and foreign exchange rate and interest rate futures markets by simultaneously incorporating three information flows of key macroeconomic announcements, as well as overseas monetary policy shocks, into one single equation for volatility estimation. The key macroeconomic indicators considered here include labor market condition or employment reports (EMP) by the Australian Bureau of Statistics, the consumer price index (CPI), GDP announcements, and information flows on the US monetary policy changes—the Fed's announcement on Fed Fund Target changes. The effects of monetary policy releases and key macroeconomic news announcements on mean returns and volatility of Australian financial futures markets are then tested simultaneously by using equations (4) and (6).

Table 7 presents empirical results for the impact of cash rate target announcements, together with the other three Australia macroeconomic announcements and the U.S. Fed's announcement on Fed Fund Target changes, on four Australian financial futures markets. Parameter θ_0, is negative and significant at the 5 % level for AUD/USD futures and 3- and 10-year bond futures markets, indicating that the Reserve Bank's unexpected cash rate target announcement still plays a key role in smoothing the volatility of the currency futures and T-bill futures markets while other key macroeconomic announcements are considered. Monetary policy surprises are transmitted into these three futures markets completely since all parameters for the lagged effect of monetary policy announcements are insignificant in this case. The monetary policy effect on volatility of stock index futures is, however, insignificant when effects of other key macroeconomic announcements are considered simultaneously in the ASX-SPI futures market. The lagged impact of monetary policy surprises on the volatility of stock index futures shows that the stock market reaction to monetary policy changes is quite sluggish when other key macroeconomic announcements are considered. CPI announcements affect volatility of the 3-year T-bond futures market, while employment reports reduce the volatility of the stock index futures market. News announcements on the GDP growth rate have a strong impact on the volatility of the ASX-SPI futures and the 3-year T-bond futures markets, while news on the Federal Fund target rate, a key indicator of US monetary policy stance, only affects the volatility of the stock futures market.

7. Summary and concluding remarks

The existing literature on the impact of monetary policy has documented the relationship between macroeconomic announcements, monetary policy and asset returns around those announcements. The literature has typically focused on a single assets or asset class, in isolation of other markets, and does not separate the unexpected component of the announcement from the entire policy target rate movements.

This study contributes to the literature by using 30-day and 90-day bank bill rates to gauge the unanticipated component of cash rate target changes in the Australian money market. This method enables us to separate the surprises of monetary policy announcements from the entire policy target rate movements and better model the impact of monetary policy changes on three classes of Australian financial futures markets—ASX stock price index futures, AUD/USD exchange futures and 3- and 10-year Treasury bond futures contracts. We find that the daily yield movement of the 30-day BAB rate outperforms the 90-day BAB rate in measuring the expected monetary policy changes.

Empirical results show that the Reserve Bank's cash rate announcements have a strong impact on the ASX-SPI stock index futures market and AUD/USD exchange rate futures contracts. We have also documented strong announcement effects of unexpected monetary policy changes on 3- and 10- year T-bond futures markets, by using the 30-day BAB rate in measuring the expected monetary policy changes. The degree of significance for these announcement effects depends largely on how we measure the unanticipated component of regular and irregular monetary policy announcements. We find that the 30-day BAB rate is the best proxy of the expected monetary policy changes.

The paper also examines the speed with which returns and volatility of financial futures markets incorporate the news content of monetary announcements by assessing the lagged effects of the Reserve Bank's cash rate target movements. The empirical results indicate that the cash rate announcement effect is complete on the announcement day for ASX-SPI futures and 3- and 10-year bond futures markets, but not for the AUD/USD futures market, where market reaction to monetary policy changes appears sluggish.

The effects of monetary surprises on the volatility of AUD/USD futures contracts and 3- and 10-year bond futures markets are significant and complete when other key domestic macroeconomic announcements and the U.S. Federal fund target announcements are incorporated into a single equation. The result suggests that the Reserve Bank's cash rate target announcements play a superior role in determining the prices and volatility of these financial futures assets. The lagged impact of monetary policy surprises on the volatility of stock index futures shows that the stock market reactions to monetary policy changes are quite sluggish when other key macroeconomic announcements are considered.

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Table 5.3 Impact of cash rate target changes on ASX-SPI futures market

$$R_{i,t} = b_0 + b_1 R_{i,t-1} + b_2 M_t + \varepsilon_t \qquad (5.4)$$

where $\varepsilon_t \,|\Phi_{t-1} \sim N(0, h_t)$, and

$$h_t = \omega + \alpha\varepsilon_{t-1}^{\ 2} + \beta h_{t-1} + \gamma I^-_{t-1} \varepsilon_{t-1}^{\ 2} + \sum_{j=0}^{3} \theta_j M_{t-j} \qquad (5.5)$$

where R_t is the daily return of ASX-SPI Futures contract from day t-1 to day t. M_t is cash rate changes. Parameter θ_0 captures the contemporaneous effect of cash target surprises. α captures the ARCH effect, β captures the persistence in volatility. The presence of leverage effect is tested by the hypothesis that the parameter $\gamma < 0$. The impact of past innovations on current volatility is asymmetric if $\gamma \neq 0$. In Model 1, monetary surprises are calculated using 30-day BAB yield changes as anticipated component of cash rate movements. In Model 2, monetary surprises are calculated using 90-day BAB yield changes as anticipated component of cash rate changes. Model 3 utilizes actual cash rate target changes.

Panel A. Maximum likelihood parameter estimates for ASX-SPI futures market

	Model 1 with 30-day BAB		Model 1 with 90-day BAB futures		Model 3 actual target changes	
	(1)	(2)	(3)	(4)	(5)	(6)
	Coeff	S. E.	Coeff	S. E.	Coeff	S. E.
b_0	0.0747	0.0513	0.0595	0.0343*	0.0587	0.0328*
b_1	0.0189	0.0372	0.0233	0.0261	0.0244	0.0252
b_2	0.8965	1.4399	0.5894	1.3638	0.5169	0.9748
ω	2.0393	1.4838	1.9539	1.8269	1.1535	0.4278**
α	0.0041	0.0072	-0.0011	0.0013	-0.0010	0.0061
γ	-0.0269	0.0016	0.0044	0.0154	0.0154	0.0135
β	0.4829	0.3774**	0.1560	0.7891	0.4555	0.2019**
θ_0	6.5596	3.0345**	2.0302	5.0066	0.7476	3.2714
θ_1	4.3806	2.9515	3.8670	2.0638	-1.0451	3.8615
θ_2	3.5991	2.9104	3.2452	3.7370	1.7382	4.2332
θ_3	3.7540	2.8258	3.8527	3.2209	2.6801	2.2578

Panel B. Model diagnostics for standardized residuals

	Model 1	Mode 2	Model 3
Mean	-0.0104	-0.0041	-0.0046
S. D.	0.7982	1.0228	1.0648
Skew	9.5586	10.119	10.237
Kurt	295.863	317.344	322.191
LB(10) for $Z_{i,t}$	10.674 (0.384)	11.236(0.339)	11.359(0.330)
LB(10) for $Z^2_{i,t}$	0.0326(0.039)	0.0295 (0.017)	0.037 (0.067)

Note: *denotes significance at 10%, **denotes significance at 5%

Table 5.4
Impact of cash rate target changes on AUD/USD futures market

$R_{i,t} = b_0 + b_1 R_{i,t-1} + b_2 M_t + \varepsilon_t$ (5.4)

where $\varepsilon_t | \Phi_{t-1} \sim N(0, h_t)$, and

$$h_t = \omega + \alpha\, \varepsilon_{t-1}^{\ 2} + \beta\, h_{t-1} + \gamma\, I^-_{t-1}\, \varepsilon_{t-1}^{\ 2} + \sum_{j=0}^{3} \theta_j M_{t-j} \qquad (5.5)$$

where R_t is the daily return AUD/USD futures contract from day $t-1$ to day t. M_t is unexpected cash interest rate changes. Parameter θ_0 captures the contemporaneous effect of cash rate target surprises. α captures the ARCH effect, β captures the persistence in volatility. The presence of leverage effect is tested by the hypothesis that the parameter $\gamma < 0$. The impact of past innovations on current volatility is asymmetric if $\gamma \neq 0$. In Model 1, monetary policy surprises are calculated using 30-day BAB yield changes as the anticipated component of cash rate movements. In Model 2, monetary policy surprises are calculated using 90-day BAB yield changes. Model 3 utilizes actual cash rate target changes.

Panel A. Maximum likelihood parameter estimates for AUD/USD futures market.

	Model 1 with 30-day BAB		Model 2 with 90-day BAB futures		Model 3 actual target changes	
	(1)	(2)	(3)	(4)	(5)	(6)
	Coeff	S. E.	Coeff	S. E.	Coeff	S. E.
b_0	0.0289	0.0194	0.0308	0.0195	0.0360	0.0187*
b_1	-0.0496	0.0261*	-0.0372	0.0276	-0.0397	0.0280
b_2	0.5253	0.5133	-1.4359	0.5007**	0.7777	0.1426**
ω	0.3238	0.0957**	0.3279	0.0989**	0.0148	0.0069**
α	-0.0463	0.0165**	-0.0413	0.0227*	0.0061	0.0152
γ	0.1392	0.0483**	0.1445	0.0525**	0.0412	0.0204**
β	0.3808	0.1836**	0.3705	0.1863**	0.9448	0.0200**
θ_0	-3.5189	0.3119**	2.0732	2.1601	-1.2033	0.4502**
θ_1	3.0273	4.1639	0.7798	1.7935	0.2498	0.5651
θ_2	-1.8156	2.0259	-1.1599	1.0138	0.2413	0.6511
θ_3	-2.0777	0.9923**	-1.3963	0.5138**	0.2885	0.5271

Panel B. Model diagnostics for standardized residuals

	Model 1	Model 2	Model 3
Mean	-0.0144	-0.0171	-0.0198
S. D.	1.0107	1.0052	1.0070
Skew	-0.2236	-0.2270	-0.2480
Kurt	4.0836	4.0895	4.1217
LB(10) for $Z_{i,t}$	7.3902(0.688)	6.880(0.737)	4.776(0.906)
LB(10) for $Z^2_{i,t}$	24.006(0.008)	22.631(0.012)	2.923(0.983)

Note: *denotes significance at 10%, **denotes significance at 5%

Table 5.5
Impact of cash rate target changes on 3-year T-bond futures market

$$R_{i,t} = b_0 + b_1 R_{i,t-1} + b_2 M_t + \varepsilon_t \qquad (5.4)$$

where $\varepsilon_t \mid \Phi_{t-1} \sim N(0, h_t)$, and

$$h_t = \omega + \alpha\, \varepsilon_{t-1}^{2} + \beta\, h_{t-1} + \gamma\, I^{-}_{t-1}\, \varepsilon_{t-1}^{2} + \sum_{j=0}^{3} \theta_j M_{t-j} \qquad (5.5)$$

where R_t is the daily return 3-year T-bond futures contract from day $t\text{-}1$ to day t. M_t is cash interest rate changes. Parameter θ_0 captures the contemporaneous effect of cash target surprises. α captures the ARCH effect, while β captures the persistence in volatility. The presence of leverage effect is tested by the hypothesis that the parameter $\gamma < 0$. The impact of past innovations on current volatility is asymmetric if $\gamma \neq 0$. In Model 1, monetary policy surprises are calculated using 30-day BAB yield changes as anticipated component of cash rate movements. In Model 2, monetary policy surprises are calculated using 90-day BAB yield changes as anticipated component of cash rate changes. Model 3 utilizes actual cash rate target changes.

Panel A. Maximum likelihood parameter estimates for 3-year T-bond futures market

	Model 1 with 30-day BAB		Model 2 with 90-day BAB futures		Model 3 actual target changes	
	(1)	(2)	(3)	(4)	(5)	(6)
	Coeff	S. E.	Coeff	S. E.	Coeff	S. E.
b_0	0.0017	0.0018	0.0012	0.0024	0.0014	0.0017
b_1	-0.0046	0.0287	0.0029	0.0283	-0.0096	0.0273
b_2	-0.4911	0.1085**	-0.0659	0.0848	0.0095	0.0488
ω	9.52E-05	5.01E-05*	0.0039	0.0023*	-1.47E-06	3.57E-06
α	0.0493	0.019**	0.0242	0.0466	0.0030	0.0045
γ	-0.0096	0.0201	-0.0977	0.0473**	-0.0081	0.0019**
β	0.9380	0.0209**	0.4778	0.3145	1.0008	0.0048**
θ_0	-0.0284	0.0101**	-0.0207	0.0164	-0.0066	0.0066
θ_1	0.0060	0.0230	-0.0144	0.0100	-0.0026	0.0107
θ_2	-0.0038	0.0282	0.0026	0.0419	0.0038	0.0087
θ_3	0.0118	0.0190	-0.0004	0.0237	0.0018	0.0010

Panel B. Model diagnostics for standardized residuals

	Model 1	Model 2	Model 3
Mean	-0.0142	-0.0005	0.0066
S. D.	0.9947	0.8611	0.9959
Skew	-0.0581	-0.1139	0.0121
Kurt	4.1979	4.5243	3.7760
LB(10) for $Z_{i,t}$	6.351 (0.786)	6.425(0.778)	6.002 (0.815)
LB(10) for $Z^2_{i,t}$	12.934(0.227)	60.385(0.000)	13.309(0.207)

Note: *denotes significance at 10%, **denotes significance at 5%.

Table 5.6
Impact of cash rate target changes on 10-year T-bond futures market

$R_{i,t} = b_0 + b_1 R_{i,t-1} + b_2 M_t + \varepsilon_t$ (5.4)
where $\varepsilon_t \,|\Phi_{t-1} \sim N(0, h_t)$, and

$$h_t = \omega + \alpha\, \varepsilon_{t-1}^2 + \beta\, h_{t-1} + \gamma\, I^-_{t-1}\, \varepsilon_{t-1}^2 + \sum_{j=0}^{3} \theta_j M_{t-j} \quad (5.5)$$

where $R_{i,t}$ is the daily return 10-year T-bond futures contract from day $t-1$ to day t. M_t is cash rate changes. θ_0 captures the contemporaneous effect of cash target surprises. β captures the persistence in volatility, while α captures the ARCH effect. The presence of leverage effect is tested by the hypothesis that the parameter $\gamma < 0$. The impact of past innovations on current volatility is asymmetric if $\gamma \neq 0$. In Model 1, monetary policy surprises are calculated using 30-day BAB yield changes as anticipated component of cash rate movements. In Model 2, monetary policy surprises are calculated using 90-day BAB yield changes as anticipated component of cash rate changes. Model 3 utilizes actual cash rate target changes.

Panel A. Maximum likelihood parameter estimates for 10-year T-bond futures market

	Model 1 with 30-day BAB		Model 2 with 90-day BAB futures		Model 3 actual target changes	
	(1)	(2)	(3)	(4)	(5)	(6)
	Coeff	S. E.	Coeff	S. E.	Coeff	S. E.
b_0	0.0020	0.0019	0.0017	0.0021	0.0022	0.0019
b_1	-0.0279	0.0231	-0.0271	0.0281	-0.0340	0.0255
b_2	0.1406	0.1475	0.0487	0.2599	-0.0180	0.0574
ω	0.0045	0.0041	0.0039	0.0014**	0.0048	0.0042
α	-0.0459	0.0144	0.0168	0.0728	-0.0463	0.0083
γ	0.0555	0.0341**	-0.0906	0.0705	0.0511	0.0332
β	0.1500	0.7903	0.4820	0.1907**	0.1019	0.7985
θ_0	-0.0345	0.0029**	-0.0213	0.0190	-0.0127	0.0071*
θ_1	-0.0157	0.0346	-0.0141	0.0132	-0.0014	0.0119
θ_2	-0.0231	0.0241	-0.0078	0.0199	-0.0132	0.0051*
θ_3	0.0092	0.0309	0.0050	0.0213	0.0016	0.0117

Panel B. Model diagnostics for standardized residuals

	Model 1	Model 2	Model 3
Mean	-0.0093	-0.0017	-0.0102
S. D.	1.0007	0.8539	0.9966
Skew	-0.1786	-0.2214	-0.1758
Kurt	4.0472	4.1884	4.0469
LB(10) for $Z_{i,t}$	11.51 (0.319)	12.356 (0.262)	11.026 (0.355)
LB(10) for $Z^2_{i,t}$	12.386(0.260)	34.201 (0.000)	12.504 (0.253)

Note: *denotes significance at 10%, **denotes significance at 5%

Table 5.7
The impact of cash rate target changes and macroeconomic news on Australian financial futures markets

$$R_{i,t} = b_0 + b_1 R_{i,t-1} + b_2 M_t + \varepsilon_t \qquad (5.4)$$

$$h_t = \omega + \alpha\, \varepsilon_{t-1}^{\;2} + \beta h_{t-1} + \gamma\, I^-_{t-1}\, \varepsilon_{t-1}^{\;2} + \sum_{i=0}^{2} \theta_i\, MD_{t-i} + \sum_{j=1}^{4} \varphi_j A_j \qquad (5.6)$$

where $R_{i,t}$ is the daily percentage changes of returns from the four futures markets from day $t-1$ to day t. M_t is unexpected monetary policy surprises measured by using 30-day bank bill rate. A_{it} stands for scheduled macroeconomic announcement dummies, representing Consumer Price Index (CPI), employment (EMP), growth rate of Gross Domestic Product (GDP) and the US Federal Reserve Bank's announcement on Fed Fund Target changes. A_{it} =1 if announcement j is released in day t, and A_{it} = 0 otherwise. MD_t is dummy variables for monthly monetary policy release of the Reserve Bank's policy stance. MD_t =1 for the first Wednesday of each calendar month on which the Reserve Bank of Australia reviews its monetary policy, and MD_t = 0 otherwise.

Panel A. Maximum likelihood parameter estimates for the four futures markets

	ASX-SPI futures		AUD/USD futures		3-year bond futures		10-year bond futures	
	Coeff	S. E.	Coeff	S. E.	Coeff	S. E.	Coeff	S. E.
b_0	0.037	0.053	0.029	0.019	0.002	0.002	0.002	0.002
b_1	0.024	0.036	-0.051	0.027*	-0.010	0.029	-0.033	0.026
b_2	1.396	3.927	0.467	0.577	-0.492	0.082**	0.138	0.029**
ω	2.560	0.287**	0.291	0.088**	0.001	0.0003**	0.003	0.001**
α	-0.002	0.000**	-0.047	0.013**	0.056	0.031*	-0.051	0.007**
γ	0.033	0.038	0.151	0.049**	0.017	0.039	0.077	0.034**
β	0.151	0.075**	0.420	0.169**	0.797	0.062**	0.410	0.256
θ_0	-3.393	13.65	-3.495	0.370**	-0.028	0.008**	-0.032	0.004**
θ_1	1.974	9.648	3.200	4.136	0.003	0.026	-0.015	0.016
θ_2	5.534	1.460**	-2.045	2.011	-0.001	0.022	-0.006	0.026
φ_1	-0.391	0.552	-0.030	0.163	0.003	0.001**	0.004	0.004
φ_2	-1.242	0.491**	0.419	0.325	0.000	0.001	0.000	0.003
φ_3	-1.596	0.337**	0.049	0.113	0.002	0.001**	0.002	0.001*
φ_4	6.727	0.338**	0.049	0.080	0.001	0.001	0.000	0.001

Panel B. Model diagnostics for standardized residuals

	ASX-SPI	AUD/USD	3-year bond	10-year bond
Mean	-0.0035	-0.0132	-0.0060	-0.0102
S. D.	0.8972	1.0095	1.0023	0.9990
Skew	2.4439	-0.2228	-0.1061	-0.2134
Kurt	61.122	4.0833	4.1526	4.0046
LB(10) for $Z_{i,t}$	26.368	16.870	13.589	17.955
	(0.034)	(0.327)	(0.557)	(0.265)
LB(10) for $Z^2_{i,t}$	9.7658	33.253	21.188	26.058
	(0.834)	(0.004)	(0.131)	(0.037)

Note: *denotes significance at 10%, **denotes significance at 5%

Appendix 5.1 Dates and movements of the RBA's cash rate target (CRT) Oct 1990—March 2005

Date of Changes	Level in CRT(%) (1)	Change of CRT(%) (2)	Change in BAB yield 30-day BAB (3)	90-day BAB (4)	Unexpected CRT (%) from (3) (5)	from (4) (6)
15/10/90	13.00	-1.00				
18/12/90	12.00	-1.00	-0.41	-0.48	-0.59	-0.52
04/04/91	11.50	-0.50	-0.19	-0.45	-0.31	-0.05
16/05/91	10.50	-1.00	-0.40	-0.54	-0.60	-0.46
03/09/91	9.50	-1.00	-0.12	-0.27	-0.88	-0.73
06/11/91	8.50	-1.00	-1.02	-1.17	0.02	0.17
08/01/92	7.50	-1.00	-0.95	-0.98	-0.05	-0.02
06/05/92	6.50	-1.00	-0.80	-0.62	-0.20	-0.38
08/07/92	5.75	-0.75	-0.83	-0.89	0.08	0.14
23/03/93	5.25	-0.50	-0.45	-0.44	-0.05	-0.06
30/07/93	4.75	-0.50	-0.19	-0.30	-0.31	-0.20
17/08/94	5.50	+0.75	0.55	0.86	0.25	-0.11
24/10/94	6.50	+1.00	0.59	0.77	0.41	0.23
14/12/94	7.50	+1.00	0.23	0.93	0.77	0.07
31/07/96	7.00	-0.50	-0.10	-0.51	-0.40	0.01
06/11/96	6.50	-0.50	-0.46	-0.51	-0.04	0.01
11/12/96	6.00	-0.50	0.01	-0.04	-0.51	-0.46
23/05/97	5.50	-0.50	0.03	0.00	-0.47	-0.50
30/07/97	5.00	-0.50	-0.26	-0.42	-0.24	-0.08
02/12/98	4.75	-0.25	0.00	-0.07	-0.25	-0.18
03/11/99	5.00	+0.25	0.43	0.65	-0.18	-0.40
02/02/00	5.50	+0.50	0.36	0.34	0.14	0.18
05/04/00	5.75	+0.25	0.18	0.19	0.07	0.06
03/05/00	6.00	+0.25	0.32	0.25	-0.07	0.00
02/08/00	6.25	+0.25	0.11	0.06	0.14	0.19
07/02/01	5.75	-0.50	-0.51	-0.80	0.01	0.30
07/03/01	5.50	-0.25	-0.18	-0.28	-0.07	0.03
04/04/01	5.00	-0.50	-0.34	-0.24	-0.16	-0.26
05/09/01	4.75	-0.25	-0.17	-0.12	-0.08	-0.13
03/10/01	4.50	-0.25	-0.39	-0.50	0.14	0.25
05/12/01	4.25	-0.25	-0.23	-0.18	-0.02	-0.07
08/05/02	4.50	+0.25	0.22	0.44	0.03	-0.19
05/06/02	4.75	+0.25	0.29	0.30	-0.04	-0.05
05/11/03	5.00	+0.25	0.11	0.00	0.14	0.00
03/12/03	5.25	+0.25	0.25	0.16	0.00	0.09
02/03/05	5.50	+0.25	0.27	0.31	-0.02	-0.06

Note: (5) = (2)-(3); (6) = (2)-(4).

Note that in the above table, CRT is RBA's cash rate target. Column 1 is the level of CRT, Column 2 is changes in CRT, Columns 3 and 4 are changes in bank bill rates from the day after previous target change to the day before a target change, using equation (1): $\Delta R^{e}_{crt,\,t} = R_{30\,d,\,t-1} - R_{30\,d,\,t-j+1}$ (1) where $R_{30\,d,\,t-1}$ is 30-day (90-day) BAB yield on the day before a target change, $R_{30\,d,\,t-j+1}$ is 30-day (90-day) BAB yield on the day after the previous target change made on day (t-j). The monetary surprises in columns 5 and 6 are then calculated as the difference between the actual and anticipated target changes using equation (2) below

$$\Delta R^{u}_{crt,\,t} = \Delta R_{crt,\,t} - \Delta R^{e}_{crt,\,t}, \qquad (2)$$