The Impact of Macroeconomic Announcements on the Australian Fixed Income Market

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Abstract

New information has an important role in asset price movement. This paper investigates the role of scheduled domestic news releases on the Australian government bond market. Specifically, it examines the impact of pre-announced macroeconomic news release on bond futures markets and associated market volatility. Furthermore, an EGARCH-in-mean model is used to determine the asymmetric response of the conditional volatility to either news release or unexpected changes of some news content. The results indicate that excess return of bond futures in the research period was leptokurtic (fat-tailed) with time-varying conditional heteroscedasticity. Day of the week volatility was also present but with a declining pace. It's generally attributed to the release dates of announcements and information flow from offshore markets. Although announcement effects to the bond futures market were significant, they depended on the type of maturity. Finally, results from EGARCH indicate that fundamental lagging indicators such as CPI and GDP are always important in explaining the impact of news release on market volatility, whereas the unemployment rate has a reasonable role in announcement surprises. The data suggest the following conclusion: investors are seriously concerned with news releases on macroeconomic variables they can feasibly forecast because they are always fundamental and provide a partial indication of the future economy. Surprises from news content are also critical to investors because some important variables can only be forecasted with limited accuracy. Therefore, deviation from anticipated outcomes in the actual content also causes significant market movement.

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1 Introduction

1.1 Problem

Information flow is one of the key components in any market. It brings together participants from both the supply and demand sides to interact and create a market-acceptable price. That price adjustment process happens more frequently in the financial market than in any other market because financial assets are more readily tradable and standardised and, with the aid of the Internet, financial markets are almost always open without any geographical boundary. Therefore, it is important to understand the flow of information, its content, and the way those factors affect the market.

Every day, a new set of information events affects investor expectations. They can be local and/or international, and in most cases, they have significant weighting in the decision making process of any investor. However, it is ambiguous to try to forecast the market linkage between countries, given the amount of financial integration in recent years. So generally, investors focus more on local market releases, particularly on periodic macroeconomic news releases with pre-announced dates from domestic government authorities. In reaction to those releases, investors change their expectations, which causes a certain degree of market equilibrium adjustment, and that in turn causes volatility in the markets. It is well known by financial economists that in an arbitrage-free environment, price volatility is directly related to the rate of information flow.

A classic example is to consider the expected value of a game that has a fifty-fifty chance of paying nothing or $1 million one year from now. Suppose that one year from now, you have to flip a fair coin to determine whether the game will pay you $1 million or nothing, assuming the result of the coin flip is unconditional to any other events in the world. The current value of this game is simply half the discounted value of $ 1million. Would the answer be different if, instead of having to wait one year for the news, it was announced that the coin would be flipped tomorrow?

Academically, there are two schools of thought concerning such timing effects. The first one argues that the early resolution of uncertainty through the announcement event helps investors to plan. As a result, asset price movement and its volatility are conditional to the timing of information. The second school, the well-known “Efficient Market Hypothesis – EMH” argues that in an efficient market, the early release of information cannot influence value when it changes no real cash flow. This is true regardless of whether the news releases have information or not. According to the EMH, in an information efficient environment, the collective belief of all investors will determine the new equilibrium price. If information has no value, investors will not take any action and as result price should not move.

The objective of this paper is to conduct an extensive examination of the impact of domestically announced economics news on the mean and volatility of excess returns in the Australian bond futures market. Not only will the impact of the news arrival itself be considered, but also the role of expectations and the asymmetric response of conditional volatility to news surprises will be examined. Specifically, the investigation focuses on non-clustered and pre-announced news release on a weekly basis for the last 10 years.

1.2 Australian bond market

The so-called CGS — Commonwealth Government Securities — were originally issued by the Australian Office of Financial Management (AOFM) to finance government expenditures. However, twenty years ago, the Australian government bond market was a "buy and hold" market because the financial system was heavily regulated, with fixed exchange rates, restricted lending practices in the banking sector, an underdeveloped secondary bond market, and no derivative available. Thus, the Australian government bond market was mainly domestic investor–based, and there was no clear distinction between monetary policy and debt management by the authorities.

Deregulation in the early 1980s removed a lot of hurdles and also initiated some operational reforms for the development of the Australian government bond market. Major reforms, such as separation of responsibilities between the Reserve Bank of Australia (RBA) and AOFM[1], introduction of market-based issuance mechanisms, permission for short selling of government bonds, introduction of market makers, setup of clearing and settlement systems and derivative markets, etc., have increased the growth of the Australian government bond market until now it is one of the biggest and most efficient bond market in the Asia-Pacific region.

Fortuitously, as a result of these changes, government bonds are now significantly used by RBA as part of the open market operation to influence the domestic interest rate. The consolidation of government bonds into benchmark lines has further improved the structure of the official reference rates for the issuance of corporate debts, i.e., corporate issuers can now use a rather stable government yield curve to benchmark their issue.

Historically, businesses in Australia have relied heavily on direct lending from financial intermediaries rather than issuing debt in their own name (non-intermediated debt). But the trend has changed during the past 10 years, in particular demand for conventional non-government non-intermediated debt. The share of non-government debt, including credit wrapped vehicles and hybrid securities, has more than doubled in recent years. One major reason is the increasing budget surplus of the coalition government, which reduced issuance of government bonds. Given that the annual growth rate of the superannuation industry is around 9% and on average, approximately 23% of that is allocated into the fixed income sector, it is necessary to look for alternatives, such as non-government bonds. Furthermore, following the broadening of the major domestic bond index to include relatively low investment grade securities such as constituents, there is an increasing demand for non-government debts.

[1] "The separation of debt management and monetary policy" — Reserve Bank of Australia Bulletin, November 1993.

1.3 Results and implications for the market

One of the most important results of this paper is that, judging from the norms of macroeconomics, fundamental measurements such as CPI and GDP are always critical for market participants because they are fundamentally observable through an aggregate view of other supporting indicators, having a longer history and feasible to forecast. As result, investors can always take a pre-emptive action in order to anticipate the news releases. That means these variables are almost always responsible for the volatility in the bond futures market in both 3 year and 10 year contracts. Therefore, the correct view should be that the act of releasing information causes the market to react rather than the news content itself. So, keeping track of scheduled pre-announced news releases matters to market participants on a day-to-day basis. On the other hand, news content or announcement surprises from other non-fundamental variables are also important in terms of the mean and conditional volatility of bond futures. Retail sales and unemployment are simple but are impossible to forecast with a reasonable accuracy. Unemployment surprises normally affect the mean return of futures contracts and unanticipated retail sales figures could be attributed to interest rate volatility. Overall, the role of expectation from these unanticipated components can ultimately encourage market adjustment, which causes price movement on or before the release day.

These results have several important implications. Firstly, they raise the question why the announcement of fundamental “ex-ante” variables, such as CPI and GDP, is important to participants in the interest rate market, rather than the news content or announcement surprise. Since “ex-ante” variables in here are referring to variables that are possible to forecast with reasonable accuracy. So, the focus here is on key national indicators[2] that have a long-term stable history, are feasible to forecast with reasonable accuracy (based upon fundamental economic theories) before the release of actual results, and are popular with market participants such as traders and fund managers.

CPI and GDP are the most well-known economic terms on the globe because they are fundamental economic measures, which can indirectly explain the growth of an economy and also address the issue of whether domestic monetary policy is effective enough to allow the current stage of economy to achieve the highest unemployment, growth stability and fair value of exchange rate. All of all, both variables are highly linked and complicated, there are different ways to measure them and they can be decomposes into different components. So, whether he is a year ten high school student learning basic economics or an experienced bond dealer. They all use these variables to formulate expectations and justify their current view of the economic growth of a country; however, individuals carry many expectations about these variables that may not be quantitatively justifiable. That does not matter because these variables are so popular, have a long-term history, and can be forecast by players anytime. It would be relatively easy to derive an estimate similar to the market consensus. In short, market participants are knowledgeable about these variables based on their knowledge of other partial indicators, correlated

[2] Australian Bureau of Statistics — Key National Indicators: http://www.abs.gov.au/.

components and historical experience. As such, they have more confidence with these estimates than with any others.

Another question is why participants are concerned about surprises from retail sales and unemployment figures. The detailed answer of this question is beyond the scope of this paper, but some possible explanations can be suggested. The so-called "ex-post" economic measurements, such as retail sales and unemployment figures, are simple and real, i.e., the number of unemployed persons divided by the labour force. They are absolute real figures because, without the actual surveyed results (ex-post), it's impossible to come up with the latest figures. That means market participants cannot really forecast them. Also, structurally, these indicators have less stable history than CPI and GDP because of the difficulty of defining the labour force, accounting for part-time positions, etc. As a result, market participants have less confidence in their own estimates of these variables, so they must always rely upon the actual outcomes to formulate the latest view of these numbers and their impact on the interest rate market.

1.4 Outline of this paper

This paper is organised into chapters. The second chapter surveys the literature on event studies — announcement effects and their impact on financial markets. It examines the origins and types of events in the bond market, highlighting the role of expectation and comparing that with news releases, analysing the effect of information flow on market volatility. It also outlines in considerable detail the types of news that can cause movement among the foreign exchange, fixed income, and equity markets, both local and overseas.

The third chapter outlines the methodology used. It introduces the variables used as inputs and outputs in each of the various models in this paper, explaining their specifications and justifying their inclusion in each of the two data sets — news release and content surprises — used here. In particular, it outlines the specification of the lagging variable, whose exclusion in a model of news release is a clear departure from the model of content surprises and most of the literature summarised in chapter 2. The methodology chapter also outlines the way in which the results of the paper should be interpreted.

The fourth chapter contains descriptive statistics for the variables used in this paper. It discusses them briefly in the context of their impact on the results and their cross-sectional relationship.

The fifth chapter discusses the results of the paper and their implications. It describes the models applied in this research to examine news release and announcement with surprises. It compares the results and explains the relationship between the data sets and the drivers behind return volatility.

The sixth chapter places the results in the context of the Australian bond market, identifies further avenues of research and concludes the thesis.

2 Literature Review

2.1 Introduction

This paper concerns the impact of scheduled domestic events to the bond futures market using a well-known and tested technique — EGARCH-in-mean — whose history in this area is relatively limited domestically. Underlying this approach is the difference between the two types of data set used in this research: news release and content surprises. These data require modification of the model. Therefore, it seems appropriate to divide the literature relevant to this paper into three categories — papers that concern the role of expectation and the actual news release, papers that involve measuring the impact of announcements to various financial markets (overseas, domestic, and their linkage), and papers that discuss the news effect in the bond market with varied scope ranging from impact based on monetary policy to the actual movement of the benchmark yield curve.

Scheduled news releases, such as CPI and GDP figures, are domestic macroeconomic events have a significant weighting in the decision making process of a trader, fund manager or any market participant. Therefore, an "event study" is a good starting point, since it is an analysis of whether there was a statistically significant reaction in financial markets to past occurrences of a given type of event that is hypothesized to affect the value of a marketable and tradable instrument.

2.2 Event studies

Under the efficient market hypothesis, there are three forms of efficiency: strong, semi-strong and weak. Event studies are the principal research tool used to examine a semi-strong market. They are a measure of the speed with which security prices adjust to new information.

A traditional event study focuses on corporate events and their impact on a firms' value or stock price. Events such as buy-back, split, right issue, merger & acquisition, spin-off and leverage buyout, etc. have been studied in academia since 1969 [3]. A simple event study would normally involve the following steps:

1. Identifying the event of interest and defining an event window
2. Selecting a set of cases to include in the analysis
3. Predicting a "normal" outcome during the event window in the absence of the event
4. Estimating the cumulative abnormal outcome, defined as the *difference between the actual and predicted returns during the event window*
5. Testing whether the cumulative abnormal return is statistically different from zero.

[3] The first event study was undertaken by Fama, Fisher, Jensen and Roll.

In this paper, the sequence of steps for the research is very similar to a traditional event study. However, here the focus is on abnormal return, which is generally defined as the difference between predicted and actual return, given a proxy market movement from an acceptable benchmark. Fundamentally, predicted return in an event study can be obtained from the well-known Capital Asset Pricing Model (CAPM)[4], which allows the researcher to assume a linear relationship between the return of a security and the market portfolio. Therefore, it is possible to predict the return of a stock based on the movement of its market. That means the market portfolio is critical for the process of generating predicted returns.

A simple comparison between stocks and bonds would show that most of the stock indexes are more popular and transparent than the bond indexes. Bond indexes are generally a smaller subset of the investable universe, and the overall liquidity in the bond market is relatively limited. As a result, there isn't any straightforward relationship between the return of a bond and the so-called "market portfolio". Overall, it is easier to find an acceptable market portfolio in stock and to explain an abnormal return. So, it is obvious that event studies are ultimately related to stocks rather than bonds.

For every event study, it is necessary to identify the events of interest and the event window (as per the steps above). So, a single event study typically analyses the average cumulative performance of stocks in response to a particular event over time, i.e., from a

[4] Capital asset prices: A theory of market equilibrium under conditions of risk, Sharpe, William F. (1964). *Journal of Finance*, 19 (3), 425–442.

specified number of periods before an event to a specified number of periods after. A multi-event study would be very similar, except that it looks at how a security price reacts to instances of more than one type of event. Here, the purpose is to examine a number of domestic announcement effects on the bond markets; therefore, it is similar to a traditional multi-event study.

2.2.1 Types of event

The logical starting-point for this research is the definition of event. As per the normal steps of an event study, the scope of events or interests that need to be accounted for should be defined explicitly at the start so that other non-related impact can be minimised. Theoretically, any type of news event that can convey information on the future path of monetary policy can affect interest rate expectations. For example, in relation to this research, a release of strong retail figures relative to both previous periods and the market consensus would indirectly force the participants to expect a rate hike in a foreseeable future.

Consequently, market participants will take positions in the future market to adjust their current exposure and rebalance their previous view in the spot market. The net effect is a new equilibrium price in the market to anticipate the future rate movement. Again, it demonstrates that macroeconomic events are important.

Generally, four types of event are considered important in the interest rate market:

1. Domestic macroeconomic news
2. Overseas macroeconomic news
3. Monetary policy news
4. Central banks communications.

In normal circumstances, this news is scheduled and released by government officials. But, occasionally there are some unscheduled releases, which could be critical to the market and potentially create adverse movement. It is quite clear that the above is different from traditional event studies in which events are infrequent and unscheduled company news.

2.3 News release and its components

2.3.1 Announcements and expectations

In the past, a large body of literature has argued that scheduled economic announcements are among the most important events in the interest rate market, such as the results from Fleming and Remolona (1997). They suggest that bond prices react largely to the arrival of public information about the economy. Additionally, Connolly and Kohler (2004) also point out that bond futures responded to both macroeconomic and policy news, but response to macroeconomic news was larger, especially once the analysis included foreign news release. These findings are fundamentally valid, since the arrival of domestic news release will force the market participants to react, and international news release will further affect the decision making process and the view of future interest rate movement. The net effect is a new discount rate for interest rate instruments that will be used in any valuation process as a result of changing the price of a fixed income security.

As we all know, bond price is a function of risk free rate, term to maturity, credit risk premium and liquidity premium of the issuer. In the case of government bonds, which is almost default free and has a continuous supply from the government. Interest rate is the only driver of price movement, and therefore it is not unreasonable to infer that macroeconomic announcements (interest rate related) are the main driver of price movement. Obviously, it stands to reason that these announcements should also affect the price of other instruments such as derivative of government bonds, i.e. bond futures.

However, the real question is, to what extent is movement in the bond market to be attributed to the act of news release? And, if other components amplify the movement, what are they? In the case of the stock market, Cutler, Poterba, and Summers (1989) pointed out that it is difficult to identify consequential information to account for most of the market's major price movement. Fleming and Remolona's (1999) research on the U.S. Treasury market actually concluded that bond price response to economic announcements seemed to reflect both differences among the various announcements as well as differences of information content within a given announcement type. Alternatively, a study by Kim, McKenzie and Faff (2003) indicated that it is not the act of releasing macroeconomic announcements that the market considers important, but rather the 'news' component of each release, i.e., the difference between the actual figure and the prevailing market consensus. In the same research, they also found that news related to the internal economy was important in the bond market. Thus, it may not be unrealistic to say that the act of releasing information to the market is not unimportant. But the role of expectation is even more important because there is a magnitude of surprise between the actual announcement and the expectation, which in turn determines the response of the market to the new information. Therefore, announcement impact can be broken down into the following components: the type of news release, unexpected or surprise information (market consensus vs. actual release figure), and the direction of the surprise (positive or negative).

Historically, most of the research has been concentrated on announcements such as GDP, CPI, PPI, unemployment rate, balance of payment, and retail sales. Most of the research investigated the surprise component, and most of it was interested in the foreign exchange market. A few studies conducted by Singh (1993, 1995), Kim (1998, 1999), and Bulduzzi, Elton and Green (1997) considered the impact of the unexpected component of scheduled news released on individual markets.

2.3.2 Volatility and information flow

Volatility can be defined technically as the standard deviation of daily change in price:

$$Volatility = std\left(\log\left(\frac{Q_t}{Q_{t-1}}\right)\right)$$ **Equation 1-1**

Where Q_t is the price of an asset at period t, and Q_{t-1} is the price of the same asset for the previous period. Log(a/b) is the continuous compounded return of the two prices, and std is the standard deviation of the returns. As explained previously, volatility is a by-product of information flow, where information events affect investors' expectations, which in turn, affect trading, which then causes volatility. So for simplicity, volatility is just the relative rate at which the price of a security moves up and down. But based on the above equation, we can relate the price movement of a security to only the information events that occurred in the corresponding period. It is rather difficult to dissect the total volatility of a security during a specific period into various components or effects.

P.K. Clark was the first to initiate research about the relationship between volatility and information flow. In his (1973) paper, he found that daily information flow is the underlying and non-observable variable that supports daily price changes and trading volume. That means price changes and volume are jointly subordinated to a prime set of information. Other, more recent, studies such as Lamoureux and Landstrapes (1994) and Andersen (1996) have adopted an autoregressive process to model the daily information events to look for serial independency. All and all, it is fair to say that volatility is related to a superior set of information that potentially consists of current information flow, historical information flow and, potentially, cross-country information flow.

Nowadays, given the amount of economic convergence between countries and the degree of financial integration such as capital mobility, daily information flows can be domestic, international or a mixture of both. Therefore, volatility can be caused by linkage between countries and markets. Authors such as Fleming, Kirby and Ostdiek (1998) developed a model of speculative trading that formalises the relationship between information and volatility. According to this model, volatility linkage arises from two sources: common information and information spillovers. Common information simultaneously affects more than one market. Information spillovers occur when information flow in one market causes activity in other markets through cross-hedging or re-balancing of portfolios, etc. Thus, information flow can be dissected into the following components:

1. Common information
    a. Domestic
    b. International
    c. Historical
2. Information spillovers.

However, due to the complexity of international news and its resultant activities, this research will focus on domestic news.

2.4 Impact of announcements on financial markets

2.4.1 Foreign exchange markets

Most of the earliest research on announcement effects in foreign-exchange markets focuses on current account news, i.e., Goodhart and Smith (1985). They report the impact of UK trade balance announcements on UK pound exchange rates. Though none of the coefficients in their report were significant, they seem to suggest that the pound appreciates as a result of larger-than-expected trade-deficit news. Hardouvelis (1988) found a different result for the U.S.; he found that an unanticipated increase in trade deficit depreciated the US dollar in most cases. Similar research conducted by Deravi, Gregorowicz and Hegji (1988) found that prior to 1985, there was little evidence of significant foreign exchange market response to trade balance announcements. However, the sample period after 1985 showed strong evidence of market response, i.e., the US dollar depreciated in response to unanticipated large deficit news. An Australian version was conducted by Karfakis and Kim (1995), and their result was consistent with the view that a larger than expected current account deficit led market participants to depreciate the Australian dollar, primarily to anticipate market intervention by the RBA. Hypothetically, that explains the structural changes in the financial market over time, in particular the general view of a link between exchange rates, interest rates and domestic monetary policy. It would not be unfair to say that participants were so focused on the impact of the deviation of the actual outcome from the market consensus and the corresponding action potentially taken by central banks to implement their monetary policy to control the exchange rate. A partial argument of the above flow-on effect is that the floating exchange rate mechanism was not widely adopted in the early 1980s, capital control was more restrictive among countries, markets were less integrated and monetary policy tools were less efficient and effective at fighting inflation than they are now. The resultant effect is the dominant role of macroeconomics news before the 1990s, and the focus of most market participants to try to forecast these indicators. Another interesting fact of the macro news found by Karfakis and Kim (1995) was structural breaks: the analysis showed that after January 1990, current account news affected neither exchange rate nor interest rates.

Another type of research on the effects of macroeconomic announcement news on exchange rates analysed the news' effects on the conditional mean and variance of the changes. Kim (1999) did such research in Australia and found that a current account deficit, CPI and unemployment news announcements significantly raised the conditional volatility of changes in the AUD on announcement days.

2.4.2 Bond market

The above clearly indicates that news has a tremendous impact on the foreign exchange market. At the same time, it is also possible to view the effect in the interest rate market, such as the impact on physical government bonds or more liquid derivative instruments such as treasury bills and bond futures.

The earlier theme also centred on the effects of the release of current account news, such as the above mentioned paper by Goodhart and Smith (1985). More recent papers focus on all types of announcements and the post announcement effects on volatility and the price response of the instrument. Kim and Sheen (1999) concluded that the price of 10-year Australian bond futures fell in response to higher than expected current account deficits, inflation, GDP and retail sales announcements, whereas an unexpected rise in unemployment raised it. In addition to the price response, there was strong evidence of an increase in the volatility of price movements following all five types of announcements. More importantly, both price and volatility adjustment to new information were completed during the first minute following each news announcement. Ederington and Lee (1993) also found that the bulk of price adjustment occurs within the first minute after major releases, with volatility substantially higher than normal for approximately fifteen minutes and elevated slightly for several hours. Crain and Lee (1995) found that most of the price adjustment occurs within the first hour, with some evidence that volatility remains higher than normal for several hours. A similar study conducted by Frino and Hill (2000) suggested that the majority of adjustment to new information occurs rapidly, within 240 seconds of the scheduled time for major announcements, with some evidence of abnormal activity prior to announcements. Alternatively, Leng (1996) found that the impact of major announcements lasted for at least an hour, whereas the impact of minor announcements was relatively short lived.

2.4.3 Stock market

In the stock market, research on news impact focused on the implied volatility, which is a typical indicator used by traders and market makers to determine the direction of the market or a specific stock. "As Robert Merton, distinguished professor of financial theory at Harvard Business School stated, implied volatility can be interpreted as a market's expectation of the average stock's return volatility over the remaining life of the option contract".

Given the integration of world equity markets, the majority of studies focus on the transmission effect across borders, such as the ones conducted by Niarchos, Tse Wu and Young (1999) and Kanas (2000). Another type of study focuses more on companies, i.e., the study by Donders and Vorst (1996) that emphasised the effect of earnings announcements on option volatility to detect the increase in implied volatility before a news release.

Finally, a more popular type of study focuses on the behaviour of implied volatility on, before or around the announcement period. Research by Nikkinen and Sahlstrom (2001) found that implied volatility increases prior to a macroeconomic news release (employment, CPI and PPI figures) and drops after the announcement in both U.S. and Finnish equity markets. In this case, uncertainty associated with the U.S. economy was reflected in the Finnish stock exchange. By the same token, they also found that employment figures posted the largest impact on volatility. A reasonable explanation for this finding was that the U.S. economy was still the biggest trading partner to most of the countries, and as a result, changing economic conditions in the U.S. would have tremendous impact on the amount exported to these countries. Companies that have exposure to the U.S. would like to prepare for any potential downturn and adjust their corresponding production.

2.5 News effects and other bond market related studies

2.5.1 Announcement shocks and asymmetric volatility

The effects of macroeconomic news are typically more pronounced on government-backed securities than on equity (McQueen en Roley, 1993). This type of news is the key driver of interest rate expectations; however, firm-specific news is the main source of information to shareholders and, as a result, affects the equity market the most.

The asymmetric volatility effect, first noted by Black (1976), refers to the tendency that good and bad news in returns have different impacts on conditional volatility. One handy tool to analyse this effect is news impact curves. They show the impact of unexpected returns on future volatility, such as asymmetric volatility in the treasury bond market found by DeGoeij and Marquering (2001).

But, unfortunately, most of the research separates the announcement effect and asymmetric volatility. DeGoeij and Marquering (2002) found that macroeconomic announcement shocks appear not to have a significant impact on stock market volatility, but they do have a strong impact on bond market volatility. Furthermore, they provided evidence that after correcting for announcement shocks, none of the asymmetric volatility parameter estimates is individually significant anymore. That suggested that asymmetric volatility in the treasury bond market is largely caused by overreactions to macroeconomic news. This type of research is not exceptionally popular around the globe and is even less popular in Australia.

2.5.2 Monetary policy news and central bank transparency

Central banks around the world have become considerably more transparent over the past decade, particularly in terms of communication techniques. The use of technique has been a concern, as the effectiveness of any interest rate policy will also depend on the incentive of the officials to communicate with the market. There is a substantial body of academic work on the theoretical and empirical aspects of monetary policy transparency, such as a study by Coppel and Connolly (2003). They found that the predictability of monetary policy was very similar across a panel of central banks in developed economies, potentially reflecting similarities in central bank communication strategies. Coppel and Kohler (2004) did a similar study but with a focus on four types of news: domestic macroeconomic news, foreign news, monetary policy surprises, and central bank communication. They found that interest rate expectations reacted to domestic and overseas macroeconomic news and policy news, although the response to macroeconomic news was more significant when foreign news was included. They also found that the impact of RBA's communication policy is in line with other major central banks and significantly affects market expectations about future monetary policy.

2.5.3 Economic news and yield curve movement

Much effort has been devoted to the impact of news release on the pricing of the interest rate instrument. However, few studies examine the impact to the yield curve. Bulduzzi, Elton and Green (1997) found that economic news and surprises have a significant impact on the price of 2-, 10- and 30-year bonds. The price of 2-year bonds reacts to 15 announcements, whereas 10-year bonds react to 16 announcements and 30-year bonds react to just 10 announcements. The shortest instrument, the T-bill, reacts to the fewest number of announcements, only three. This is consistent with the market view that the short end of the yield curve is tight to changes of monetary policy, but the long end of the curve is determined by expectations for future interest rate movement. Therefore, long-term rates are more sensitive to news releases and surprises. Bulduzzi, Elton and Green (1997) also realised that payroll number is the most influential variable; the volatility of T-bills and 10-year bond prices is significantly higher after that announcement.

2.5.4 Intra-day response of announcement effects

Compared with the general theme of studying the impact of news release on the pricing and implied volatility of assets, market efficiency is a perspective that attracts more attention. However, geographically, only the U.S. has more studies in that area; other countries have relatively fewer. That may be due to the infrastructure of the local market, such as the availability of a complete history of tick data for most of the tradable instruments. In some places, there aren't any tradable instruments that can reasonably represent the local market. Ederington and Lee (1993, 1995) utilised tick data from Eurodollar futures to study market efficiency. They found that the price impact of macroeconomics news release normally concluded in the first minute of the announcement.

Becker, Finnerty and Kopecky (1996) revised the approach taken by Ederington and Lee and commented that their approach was inadequate to evaluate whether market efficiency was affected by news release because they did not take into account the news deviation from market expectation. Instead, Becker, Finnerty and Kopecky found that the significant news effect occurred in the first 15–30 minutes in both the U.S. and U.K. futures markets. They specifically used CPI inflation, non-farm payrolls and merchandise trade balance to test the efficiency. Kim (1999) did a similar study using 10-year futures with CPI inflation, current account deficit, retail trades and GDP data in Australia and found that volatility increased as a result of price movements following the news releases; however, the overall adjustments process was completed in the first minute.

2.5.5 Impact of macroeconomic news on the conditional variances, covariance and correlation of bond returns

Christiansen (1999) did the first methodical study to examine the effects of macroeconomic announcements in a multivariate environment. Christiansen found that the conditional variances, covariances, and correlations of bond excess returns are significantly larger on macroeconomic announcement days. Furthermore, the news shock does not cause the high persistency of shocks observed in the bond market; in fact, the persistency is actually smaller on the day of announcement than on other days.

2.5.6 Link between U.S. and Australian bond markets

Fleischer (2003) extended the analysis of Fleming, Kirby and Ostdiek, which focused on the equity, money and bond markets in the U.S., and extended it to the three markets in Australia. According to the model developed by Fleming, Kirby and Ostdiek, volatility linkage arises from two sources: common information and information that affects more than one market simultaneously.

Fleischer found that cross-market linkages are much stronger than those found using traditional proxies for volatility. Furthermore, cross-country volatility linkages are very similar irrespective of whether contemporaneous or lagged data are used. Another interesting study conducted by Kim and Sheen (1998) locally found that the Australian interest rate moved significantly in response to the previous day's U.S. interest rate shocks. The conditional volatility of Australian interest rate changes was also significantly influenced by lagged U.S. interest rate shocks, as well as by surprises in U.S. macroeconomics announcements.

Overall, there was a remarkable and complex array of linkages between the two countries. Again, qualitatively U.S.-specific news has tremendous spill-over effects in other countries. In most cases, the impact went in a single direction, and the majority of them originated from the U.S.

3 Data and methodology

3.1 Methodology

This paper uses a modified version of GARCH, the EGARCH-in-mean model, to determine the asymmetric response of conditional volatility to either news release or unexpected changes in the news content of some announcements. Other fundamental statistical approaches are also used to examine the pre- and post-announcement effect, day of the week effect, etc.

The EGARCH-in-mean approach is based on the original GARCH model introduced by Bollerslev (1986). GARCH (generalised autoregressive conditional heteroscedasticity) is a natural generalisation of the ARCH (autoregressive conditional heteroscedasticity) process. The following is a brief review of the GARCH and EGARCH processes.

GARCH is a general class of processes that allow for a flexible lag structure.

$$h_t = a_0 + \sum_{k=1}^{p} \gamma_k h_{t-k} + \sum_{j=1}^{q} \alpha_j \varepsilon_{t-j}^2$$

$$\varepsilon_t | \psi_{t-1} \approx N(0, h_t)$$

$p \geq 0$, $q < 0$

$$a_0 > 0, \gamma_k \geq 0, k = 1.......p,$$

$\alpha_j \geq 0,\ j = 1.......q,$

Whereas EGARCH-in-mean is the exponential generalised autoregressive conditional heteroscedasticity model with the involvement of the mean equation.

Here is a typical EGARCH-M model.

$$\Delta R_t = a_0 + a_1 h_{t-1} + bR_{t-1} + \varepsilon_t$$

$$\log h_t = a_0^2 + \sum_{k=1}^{p} \gamma_k \varepsilon_{t-k} h_{t-k}^{-\frac{1}{2}} + \sum_{j=1}^{q} \alpha_j \log h_{t-j} + \alpha \left[|\, \varepsilon_{t-1} \,|\, h_{t-1}^{-\frac{1}{2}} - \left(\frac{2}{\pi}\right)^{\frac{1}{2}} \right]$$

The first equation above is the mean equation of the model. It consists of a coefficient b, which is a first order autocorrelation of the endogenous variable, and h is the conditional variance of the previous period.

The second equation above is the conditional variance equation. Note that the left hand side is the log of the conditional variance; this implies that the leverage effect is exponential, rather than quadratic, and that forecasts of the conditional variance are guaranteed to be non-negative.

There are two EGARCH models applied in this research to examine the announcement impact. Both models have similar mechanics and rationale; even the variables used in the process are the same. The only difference is that one of the models caters only for news release, and the other one is used for announcement surprise. In each model, the variables chosen reflect aspects of the economic environment and how these variables relate to the interest rate market. The outputs of these models also reflect the outcomes sought from the process and consider how bond price movement is related.

So, to successfully evaluate announcement impact using the above models, it is important that the input variables be representative of the domestic markets, be generally accepted by market participants and have a reasonable history and minimum structural issues, such as rebasing an economic indicator or redefining a survey component, etc. The input variables used in this research are bond price, cash rate, CPI, GDP, retail sales, unemployment rate, Westpac Melbourne Institute consumer sentiment and NAB business survey.

The above variables can be further classified into different categories. They are either market data or official data. Market data is raw data provided directly by a vendor from an exchange or derived from some sort of privately conducted survey, i.e., a bond price provided by SFE and the NAB business survey provided by NAB. Their data are fully automated with minimal quality assurance; therefore, data integrity is always an issue. On the other hand, official statistics or data are provided by government organisations such as the Australian Bureau of Statistics, which has a mission to assist and encourage informed decision making and research within the government and community. So researchers should have more confidence in the quality of data provided by ABS than in that from other data vendors.

3.2 Variables

3.2.1 Spot versus future prices

The spot price or spot rate of a commodity, security or currency is the price quoted for immediate (spot) settlement (payment and delivery). Spot settlement is normally one or two business days from the trade date. This is in contrast with the forward price established in a forward contract or futures contract, where contract terms (price) are set now, but delivery and payment will occur at a future date. Spot rates are estimated via the bootstrapping method, which uses the prices of securities currently trading in the market, that is, from the cash or coupon curve. The result is the spot curve, which exists for each of the various classes of securities. In this research, the future price of government bonds was used instead of the spot price. A simple explanation is that because the focus is on the impact of macroeconomic news around the announcement period, an instrument with reasonable popularity and accessibility should act as a proxy.

Both 3- and 10-year futures are commonly used by fund managers, hedge funds and central banks to manage their positions. Fund managers will use these futures systematically to hedge their risks, such as short selling futures to reduce the duration of a bond portfolio to protect against interest rate movement. Hedge funds will take position to bet against interest rate movement and in order to make profit, central banks around the globe try to use these futures to diversify their asset holdings of trade balance reserve. It is also apparent that participants can exchange their futures contract for physical bonds when the opportunity arises. This is a well-known fact; both the efficiency and liquidity of the Australian secondary bond market provide a lot of support to the spot market, and therefore, it is appropriate to use futures prices rather than spot prices. Australian 10-year futures are recognised as one of the most popular interest rate futures in the ex-Japan Asian region. Therefore, the movement of Australian bond futures should somehow depict how the market reacts to news.

An alternate argument is that, based on the unbiased expectation hypothesis (one of the simplest theories of the term structure of interest rates), the forward rate equals the market consensus expectation of the future interest rate. This means that market participants should be able to use the forward rate derived from the current yield curve to infer market expectations for future interest rates. This is the same as using the implied interest rate from the current future price to infer the market expectation of the future interest rate.

Finally, it is fundamentally sound to use long term interest rate futures to explain how interest rates will potentially move and react because the slope of the yield curve has been used by market participants as one indicator of economic growth. So it will not be unreasonable to assume that long-term interest rates are a function of the economic growth of a country, which can further include consumer price movement, inflation, trade balance and unemployment. Also, there is an extensive backing for the use of the futures price in economics and interest rate related research. So, the futures price is one of the most relevant and suitable variables for this research.

3.2.2 Daily excess return over cash rate

It is generally accepted in most of the research that asset returns being calculated should be coupon and dividend naked in order to observe the drivers of the capital gain. This is also the reason why bond futures are used in this research instead of physical bonds. Since contributions from coupon income accumulate daily, it is necessary to strip out the coupon component before calculating the return. As stated previously, the objective of this paper is to understand the changing yield or price movement within the period. Therefore, capturing the price movement is an alternate way of analysing information flow. By calculating the excess return from the bond futures over the cash rate, it is possible to understand some of the market sentiment during the announcement period. In this case, to calculate the bond futures return for both 3 and 10 years, the percentage of the price change is used, which is based on the duration of the bond futures multiplied by the changing yield. Therefore, it is necessary to capture the correct prices at the beginning and end of each period and convert the implied yield from the prices.

y is the implied yield of a bond future

y = 100 – bond future price

y_i where i = 0……n; period from 0 to n

MD = Modified Duration of the bond future

$$\%\Delta price = -MD \times (y_1 - y_0)$$

Example: Bond future price at period 0 = 95.50, and at period 1 = 95.40

Assume that the MD of a 10-year future is 7.1

So, the implied yield at period 0 = >100–95.50=4.50, at period 1 = >100–95.40=4.60

%Δprice = –7.1x(4.60–4.50) = –7.1x0.1 = –0.71%

Therefore, the percentage price change of the 10-year bond future over the period from 0 to 1 is equal to–0.71%, that is the return of the bond future during this period. The negative sign with MD reflects the inverse relationship between price and yield. In this example, because the yield actually went up by 10 bp (basis point), the price will go down instead of up.

One extra point that needs to be emphasised is MD, the modified duration of a bond. It is normally dynamic rather than static. The MD of a physical bond will decay gradually over time as the bond approaches maturity. For bond futures, because the contract itself is a replica of a theoretical government bond using a basket of on-the-run government securities, the basket of stocks for 10-year bond futures from the March 2007 contracts are set out below:

6.25%	April	2015
6.00%	February	2017
5.25%	March	2019

It is obvious that the MD of individual bonds in the basket will decay over time, as will the combined MD for the bond future if the MD is derived from the three physical bonds.

Overall, the gradual decline of MD will impact the percentage price change regardless of the changing yield. Therefore, for the purpose of this research, it is necessary to minimise the non-news impact to the price in order to examine the overall effect of information flow; thus, a static MD was chosen and applied to the calculation of percentage price change.

Given the above, it is possible to calculate the return of bond futures. But for the excess return to be calculated correctly, it would depend on the risk-free rate in the corresponding period. So, it is necessary to obtain the official risk-free rate from the central bank, which in this case is the "RBA Cash Rate". The daily cash rate is approximately equal to Cash rate/360 days, i.e., the cash rate in mid 2003 was 4.75%, so the daily cash rate is around 4.75%/360 = 0.013%.

So daily excess return over cash rate is the following:

$$= \%\Delta price - Daily\_Cash\_Rate = -MD \times (y_1 - y_0) - \frac{Cash\_Rate}{360}$$

Using the previous example, the daily return of the bond future is –0.71%, and the daily cash return in mid-2003 was 0.013%. Therefore, the daily excess return over cash rate is –0.71%–0.013% = –0.723%.

3.2.3 Absolute and squared excess returns

These variables are very straightforward and self explanatory. They are the modification of the daily excess return over the cash rate with respect to different types of measures. But overall, these measures are trying to examine a similar component in the daily return of the bond future: volatility.

So, the absolute value of daily excess return over cash rate is the following:

$$= \left|\%\Delta price - Daily\_Cash\_Rate\right| = \left| - MD \times (y_1 - y_0) - \frac{Cash\_Rate}{360} \right|$$

Whereas the squared daily excess return over cash rate is the following:

$$= \left(\%\Delta price - Daily\_Cash\_Rate\right)^2 = \left(= -MD \times (y_1 - y_0) - \frac{Cash\_Rate}{360} \right)^2$$

For example, the absolute value of daily excess return over cash rate in mid-2003 should be $\left|-0.723\%\right| = 0.723\%$. Similarly, using the same sort of information, the squared excess return over cash rate should be $\left(-0.723\%\right)^2 = 0.00523\%$

Clearly, both types of measure have stripped out the negative impact and have tried to understand the excess return series from a slightly different perspective, like the absolute value of daily excess return over the cash rate. It examines the “absolute” news impact to the bond future but ignores the asymmetric components. So looking at the entire series, it is possible to interpret the news impact over time and determine how volatile the series is. Fundamentally, it is the magnitude of the impact on a day-to-day basis rather than the net news impact being targeted by this measure. On the other hand, the squared excess return over cash rate basically smoothes out the asymmetric effect and produces a better interpretation of the return volatility and its correlation over time.

Both measures are included in this paper because they are both easy to interpret, widely accepted by researchers and simple to apply to research that involves a long history of daily calculations.

3.2.4 CPI — consumer price index

In economics, a consumer price index is a statistical time-series measure of a weighted average of prices of a specified set of goods and services purchased by consumers. It is a price index that tracks the prices of a specified basket of consumer goods and services, providing a measure of inflation. The CPI is a fixed quantity price index and considered a cost-of-living index, and it is a lagging indicator. In the U.K., it is also known as the retail price index.

The CPI can be used to track changes in the prices of goods and services purchased for consumption by households, i.e., of the consumer basket. User fees (such as water and sewer service) and sales and excise taxes paid by consumers are also included. Income taxes and investment items (such as stocks, bonds, life insurance, and homes) are not included.

In Australia, the Australian Bureau of Statistics releases the CPI 4 times a year by on the last Wednesday of January, April, July and October at 11:30 AM Canberra time. The CPI is specifically designed to provide a general measure of price inflation for the household sector as a whole. Technically, it measures quarterly changes in the price of a basket of goods and services that account for a high proportion of expenditure by the CPI population group (i.e., metropolitan households). This basket covers a wide range of goods and services, arranged in the following eleven groups:

food
alcohol and tobacco
clothing and footwear
housing
household contents and services
health
transportation
communication
recreation
education
financial and insurance services.

The reason to include this macroeconomic variable in this research and model is that it is the fundamental building block of the nominal interest rate. This is based on Fisher's hypothesis: the proposition by Irving Fisher that the real interest rate is independent of monetary measures, especially the nominal interest rate. The Fisher equation is:

$$i_n = i_r + e(\text{inf})$$

i_n is the nominal interest rate

i_r is the real interest rate

e(inf) is the expected inflation rate.

Therefore, in a stable economic environment, where i_r is constant, an increase in inflation expectation will soon increase the nominal interest rate. The nominal interest rate is used to price most interest rate instruments, such as bonds and interest rate swaps. So intuitively, the CPI should have a reasonable relationship with the nominal interest rate:

the higher the CPI, the higher the nominal interest rate.

3.2.5 GDP — gross domestic product

A country's gross domestic product (GDP) is one of several measures of the size of an economy. The GDP of a country is defined as the market value of all final goods and services produced within a country in a given period of time. Until the 1980s, the term GNP or gross national product was used. The two terms, GDP and GNP, are almost identical.

To understand GDP, it is necessary to provide a brief overview of how it is derived using different methods. According to the Australian Bureau of Statistics, GDP can be derived by three broad approaches: the income approach (I), the expenditure approach (E) and the production approach (P). Although each measure should conceptually deliver the same estimate of GDP, if the three measures are compiled independently using different data sources, then different estimates of GDP result. However, the Australian national account estimates have been integrated with annual balanced supply and use tables. These tables have been compiled from 1994–95 up to the year preceding the latest complete financial year. As integration with balanced supply and use tables ensures that the same estimate of GDP is obtained from the three approaches, annual estimates using the I, E and P approaches are identical for the years for which these tables are available.

Prior to 1994–95, and for quarterly estimates for all years, the estimates using each approach are based on independent sources, and there are usually differences among the three estimates. Nevertheless, for these periods, a single estimate of GDP has been compiled. In chain volume terms, GDP is derived by averaging the chain volume estimates obtained from each of the three independent approaches. The current price estimate of GDP is obtained by reflating the average chain volume estimate by the implicit price deflator derived from the expenditure-based estimates.

As a result of the above methods, there is no statistical discrepancy for annual estimates from 1994–95 up to the year prior to the latest complete financial year, in either current price or volume terms. However, for years prior to 1994–95, and for all quarters, statistical discrepancies exist between estimates based on the I, E and P approaches and the single estimate of GDP, in both current prices and volume terms. These discrepancies are shown in the relevant tables.

Income approach, (I) — Using this approach, GDP is derived as the sum of factor incomes, consumption of fixed capital (depreciation) and taxes less subsidies on production and imports. Volume estimates are derived by deflating current price estimates by the implicit price deflator from the expenditure approach.

Expenditure approach, (E) — Using this approach, GDP is derived as the sum of all final expenditures, changes in inventories and exports of goods and services less imports of goods and services. Volume estimates are derived for each of the components as well as for their sum.

Production approach, (P) — Using this approach, GDP is derived as the sum of gross value added for each industry, at basic prices, plus taxes less subsidies on products. Basic values represent the amounts received by producers, including the value of any subsidies on products, but before any taxes on products. The difference between the sum over all industries of gross value added at basic prices, and GDP at market (or purchasers) prices, is the value of taxes less subsidies on products.

The most common approach to measuring and understanding GDP is the expenditure method:

GDP = consumption + investment + government spending + (exports − imports)

"Gross" means depreciation of capital stock is not included. With depreciation, with net investment instead of gross investment, it is the Net domestic product. Consumption and investment in this equation are the expenditure on final goods and services. The exports minus imports part of the equation (often called cumulative exports) then adjusts this by subtracting the part of this expenditure not produced domestically (the imports), and adding back in domestic production not consumed at home (the exports).

Given the above, GDP is a critical measure of a country’s economic activity, and therefore, it is reasonable to try to understand the relationship between GDP and interest rates. Interest rates are the natural ingredient in the economy and financial system that can facilitate the turnover of monetary assets from lenders to borrowers. As a result, it affects economic activities.

3.2.6 UE — unemployment rate

In economics, a person willing to work at a prevailing wage rate who is unable to find a paying job is considered to be unemployed. The unemployment rate is the number of unemployed workers divided by the total civilian labour force, which includes both the unemployed and those with jobs (all those willing and able to work for pay). In practice, measuring the number of unemployed workers actually seeking work is notoriously difficult, particularly those whose unemployment benefits expired before they found work. There are several different methods for measuring the number of unemployed workers, each with its own biases, which makes comparisons between methods difficult.

In Australia, unemployment is defined as a state of being without work during a specific reference period while actively seeking and currently being available to work. The long-term unemployed are those who fulfil the criteria for unemployment noted above and have been out of work for more than six months. High unemployment rates mean that there are few jobs for those who wish to work. According to the ABS (2001), a high rate of unemployment indicates limited employment opportunities in a labour market that is in a situation of oversupply. A low rate of unemployment indicates a tight labour market, potential scarcity of skilled labour, and future cost pressures from wage demands from workers. The trend over time in the overall unemployment rate serves as a current economic indicator of the performance of the economy at large, and the unemployment rate for different groups of people (e.g., younger people, older people, females) identifies areas of social concern when rates for some groups are much higher than for others.

The fundamental reason for including unemployment rate in this research is that it is another major lagging economic indicator, just like GDP, which reflects how benign the current economy has been in the recent period. Therefore, it is necessary to include it.

3.2.7 RET — retail sales

Retail trade is a key and timely indicator measuring changes in the Australian economy. The series, which includes selected hospitality and service industries, accounts for approximately 40% of final household consumption expenditure in the National Accounts. The retail trade publication presents monthly estimates of business turnover in the retail and selected hospitality and services industries, classified by industry and state/territory.

Retailers, industry associations, economists, governments and media use these statistics to analyse current consumer spending behaviour and, in conjunction with other economic indicators, to help assess current Australian economic performance. Retail sales are in some ways a good indication of how sensitively the household sector reacts to government policies or how private consumption changes in different conditions.

3.2.8 NAB — NAB business survey

The NAB business survey started in 1989 with qualitative comments and questionnaires from a sample of 900, for companies with 40 or more employees. Historically, it is a quarterly survey, but a monthly survey is now also available. Economic-wise, it is a forward-looking indicator because the actual survey consists of comprehensive details on conditions by industry sector as well as by state for the next 12 months. Furthermore, it also comprises macroeconomic components such as labour market conditions, a view of the GDP growth, prices, capital expenditures (capex), etc. These are all blended into a composite index to reflect a consensus view about-near future economic conditions. The reason for including here is that forward indicators are normally constructed via survey data or using more innovative econometric modelling to try to forecast the future. This survey is well known in the market and has a reasonable history. Therefore it is not unreasonable to include a forward indicator to see whether it can provide any explanation about interest rates and their movement historically and in advance.

3.2.9 WEST — Westpac Melbourne Institute consumer sentiment

The Consumer Sentiment Index for Australia is an average of five indexes reflecting respondents' evaluations of their family finances over the past and coming year, expectations about one-year and five-year economic conditions and views about current buying conditions for major household items. Assessments of future unemployment are also recorded each month.

Each quarter, consumers are also surveyed on their views about buying conditions for cars and dwellings and economic news recall. The latter specifically refers to politics, budget, taxation, inflation, employment, interest rates, the Australian dollar, economic conditions and international conditions. This index is forward looking and similar to the NAB business surveys. But it is more related to private-sector fundamentals with a focus on consumer behaviour and their potential changes in the future. The reason to include this indicator is similar to that for the NAB business survey except that it is provided by a different institute, and it is more specific in terms of "sentiment".

3.2.10 Announcement and non-announcement days

Announcement can be defined as a formal notice or short message released by a primary party to one or a group of secondary parties. The notice can be about a general matter or contain critical facts about a mutual target. In this case, the notice is a predetermined macroeconomic indicator or figure.

The selected announcements for this research are not autocorrelated, so analysis for different types of news is necessary and can be conducted for the day of the release and compared with other normal days (non-announcement days) to explain some of the return volatility and effects of the news.

3.2.11 Pre- and post-announcement days

Any days other than the announcement or event day can be defined as the pre- or post-announcement days. Normally, academia defines a window of "n" days for the pre or post announcement period for an event study. However, there isn't a generally accepted number to define a window for this type of research. Although, arguably post-announcement period for an announcement may have impact to another pre-announcement period, and there is a general view that market participants such as fund managers will take action within a small timeframe before or after a specific announcement that they would focuses on. In here, pre and post announcement day is defined as a single trading day before or after the actual announcement day of an economic variable. So, if the actual release day of GDP is the 24^{th} June, then the pre-announcement day is the 23^{rd} June and the post-announcement day is the 25^{th} June.

Defined announcement variables for this study:

Pre-announcement day = day -1

Event / announcement day = day 0

Post-announcement day = day +1

3.3 Modelling the impact of announcements

3.3.1 Introduction

One of the main goals in this paper is to study how public information about macroeconomic news moves bond future prices. It is well known that volatility in markets is correlated over time, and volatility itself is equivalent to information flow in a broader class of model; therefore, a possible explanation is that public news arrives in clusters. However, publicly observable events do not occur independently over time. As a result, volatility is correlated to itself and is closely associated with the number of news releases or announcements in a particular time.

3.3.2 Australian announcements

News and information relating to the Australian macroeconomic variables is released to the market by the Australian Bureau of Statistics. ABS is the only commonwealth government statistical provider that assists and encourages informed decision making within the government and the community by providing objective and responsive national statistics.

In this study, market announcements are considered for four Australian macroeconomic variables and two privately derived but well-known domestic leading indicators. These variables have been found to be important (Chris and Troy, 2003; Kim, McKenzie and Faff, 2003), and details about them are presented in Table 1. The six macroeconomic announcements are:

1. Gross Domestic Product (GDP)
2. Unemployment Rate (UE)
3. Retail Sales Growth (RET)
4. Consumer Price Index (CPI)
5. NAB Business Survey (NAB)
6. Westpac Melbourne Institute Consumer Sentiment (WEST)

GDP, CPI and NAB are made every quarter at 11:30 am, and the rest are monthly at the same time. All the variables are backward looking except NAB and WEST, which are forward looking. GDP is the only economic indicator that relies upon different types of partial indicators to provide an overall picture of the economy as it approaches its final release date.

Summary of Australian economic announcement data **Table 1:**

Announcement — (June 1993 to June 2003)	**Gross Domestic Product (GDP)**	**Unemployment Rate (UE)**	**Retail Sales Growth (RET)**	**Consumer Price Index (CPI)**	**NAB Business Survey (NAB)**	**Westpac Melbourne Institute Consumer Sentiment (WEST)**
Type of indicator	**Lagging**	**Lagging**	**Lagging**	**Lagging**	**Leading**	**Leading**
Official release channel	**ABS**	**ABS**	**ABS**	**ABS**	**NAB Bank**	**Westpac Bank**
Official release time	**11:30 AM**	**11:30 AM**	**11:30 AM**	**11:30 AM**	**11:30 AM**	**11:30 AM**
Frequency of announcement	Quarterly	Monthly	Monthly	Quarterly	Quarterly	Monthly
Unit of measurement	% change in GDP from previous period	Unemployment rate (%)	% change in Retail Sales from previous period	% change in CPI from previous period	% change in NAB composite indicator from previous period	% change in sentiment index from previous period
Total announcements	**40**	**118**	**120**	**40**	**38**	**120**
Announcements made on						
Monday			20			
Tuesday	2	1	33	4	38	
Wednesday	35	1	23	32		120
Thursday	1	116	21	2		
Friday	2		23	2		
News surprise (March 1998 to June 2003)	Available	Available	Available	Available	N/A	N/A
	(Bloomberg market consensus survey)					
Total announcements	21	63	63	21		
Positive surprises	12	20	25	10		
Negative surprises	7	33	30	10		
No surprises	2	10	8	1		

3.3.3 Announcement effect and volatility

In light of the above, it is now appropriate to introduce the range of models examined in this paper. The first part of this study examines whether shocks to bond volatility on macroeconomic announcement days are as persistent as shocks on non-announcement days. If announcement shocks do not persist, it would suggest that market prices quickly incorporate public information and that reaction by market participants does not inherently generate persistent volatility in response to news releases. On the other hand, strong persistence of announcement shocks would suggest an alternative interpretation: some part of the information gathering process and/or price adjustment by participants caused volatility to be autocorrelated, regardless of the nature of the news.

In this section, the basic building block is daily excess return. I examined daily excess returns on 3-, and 10-year bond futures to understand their behaviour and the potential impact of announcements in different periods. I chose these two instruments because of the inherent relationship between economic news, interest rates and bonds. Australian bond futures intrinsically represent government bonds but without the concern of coupon income deteriorating the analysis of excess return. I calculated excess returns on bond futures over the cash rate of the corresponding period from 1993 to 2003, using percentage of price change, which is the duration of the bond future multiplied by the changing yield. Then, I deducted the daily cash return from the bond future return to generate the daily excess return over the cash rate. Absolute and squared excess return were also derived from the daily excess return over the cash rate because they can provide a better picture of the magnitude of news impact and its effect on price movement in bond futures over time.

The sample was run from June 17, 1993 to June 13, 2003. I chose to start my sample from 1993 for two primary reasons: a) Fundamentally, RBA changed its approach to manage monetary policy over the period and introduced the inflation target zone. b) The microeconomic structure of the country has also changed, and market participants are more concerned about private consumption and its flow-on effect than they were 10 years ago, so some of the major economic indicators are less relevant now than they were historically.

After initial calculations and the generation of basic statistics for the return series, I turned to simple OLS (ordinary least squares) regression to explore the relationship of the day-of-the-week effect and announcement dates to both risk and return. Absolute and squared excess returns of the 3-, and 10-year bond futures over the cash rate were used as dependent variables. The timing of macroeconomics news release is exogenous to the financial markets. I used a dummy variable equal to 1 to test the announcement day and day-of-the-week effects. So, pre-, post- and actual announcement days and individual days of the week were included as independent variables for the OLS to examine their relationships. There are four different types of relationship that I need to examine for both 3- and 10-year bond futures:

1. Absolute excess return over the cash rate with day of the week effect

$$AbsoluteExcess\,\mathrm{Re}\,turn = \alpha + \sum_{i=0}^{n} weekdays + \varepsilon$$

Where α = Monday and i = Tuesday……Friday.

2. Absolute excess return over the cash rate with announcement effect

$$AbsoluteExcess\,\mathrm{Re}\,turn = \alpha + \sum_{i=0}^{n} day + \varepsilon$$

Where i = pre-, post- and actual announcement day.

3. Squared excess return over the cash rate with day of the week effect

$$SquaredExcess\,\mathrm{Re}\,turn = \alpha + \sum_{i=0}^{n} weekdays + \varepsilon$$

Where α = Monday and i = Tuesday……Friday.

4. Squared excess return over the cash rate with announcement effect

$$SquaredExcess\,\mathrm{Re}\,turn = \alpha + \sum_{i=0}^{n} day + \varepsilon$$

Where i = pre-, post- and actual announcement day.

3.3.4 Risk premium of bond futures on announcement days

Whereas the previous section focused on announcement effects and volatility, in the current section I will examine the risk premium generated by the announcement. The fundamental is very much the same, but risk premium will be a critical factor to determine the risk appetite of the general market when macroeconomic variables are rather difficult to forecast.

The approach I used here to analyze risk premiums is very similar to the analysis of volatility. Again, I used excess return, but I needed no further modification, such as absolute and squared excess return because I am more interested in the net effect of announcement release on bond futures returns. The following model explains the relationships:

Daily excess return over the cash rate with day of the week effect

$$DailyExcess\,\mathrm{Re}\,turn = \alpha + \sum_{i=0}^{n} weekdays + \varepsilon$$

Where α = Monday and i = Tuesday……Friday.

Daily excess return over the cash rate with announcement effect

$$DailyExcess\,\mathrm{Re}\,turn = \alpha + \sum_{i=0}^{n} day + \varepsilon$$

Where i = pre-, post- and actual announcement day.

3.4 Modelling the news releases

3.4.1 Model selection and other issues

Historically, researchers have used a wide variety of models of conditional volatility to examine market behaviour: ARCH, GARCH, EGARCH, etc. But generally, researchers such as Kim (1999) and Lee, Silvapulle and Pereira (1997) agree that EGARCH-M is an appropriate model to explain the time-varying volatility of interest rates because it is useful in addressing the leptokurtosis, time-varying heteroscedasticity and asymmetric response of conditional volatility to unexpected changes. Therefore, I have adopted the basic structure of EGARCH-M with announcement type variables for this research to examine the contribution of some of the announcements and the news impact to the volatility of excess return on bond futures.

The following model will be applied to excess return of both 3-, and 10-year bond futures over the cash rate.

Mean equation:

$$\Delta R_t = a_0 + a_1 h_{t-1} + bR_{t-1} + \sum_{j=1}^{6} a_j News_{jt} + \varepsilon_t$$

Variance equation:

$$\log h_t = a_0^2 + \sum_{k=1}^{p} \gamma_k \varepsilon_{t-k} h_{t-k}^{-\frac{1}{2}} + \sum_{j=1}^{q} \alpha_j \log h_{t-j} + \alpha \left[| \varepsilon_{t-1} | h_{t-1}^{-\frac{1}{2}} - (\frac{2}{\pi})^{\frac{1}{2}} \right] + \sum_{j=1}^{6} a_j News_{jt}$$

— Model (1)

Where:

ΔR_t=Excess return over cash rate

ΔR_{t-1}=Previous period excess return over cash rate

j=1…6, which 1= CPI, 2=GDP, 3=UE, 4=RET, 5=NAB, 6=WEST

$News_{jt}$ is the news release or announcement on day "t". If there is an announcement, the variable is equal to 1, else equal to 0.

Generally, there is no major issue with modelling announcement effect using EGARCH-M. The model itself has been tested thoroughly by many researchers, and it is robust enough to explain asymmetric effect and conditional volatility.

3.5 Modelling news content and surprises

3.5.1 Model selection and other issues

As explained by most of the previous research, the news content of announcements causes the market to react. So, focus of this section is to examine the surprise component of different macroeconomic announcements and whether various surprises have various degrees of impact on the market and time-varying volatility.

Again, as with the impact of scheduled but non-clustered macroeconomic news by ABS, modelling surprises is similar to modelling news effects using the daily price changes of bond futures over the cash rate as the dependent variable. The daily price changes or excess returns are found to be leptokurtic and exhibit time-varying heteroscedasticity and asymmetric response to unexpected changes similar to the test conducted by Kim (1999) and Karfakis and Kim (1995). Therefore, the EGARCH-M modelling approach is also useful in addressing these issues.

Surprises are news contained in a given announcement that deviates from the observed value of some sort of macroeconomic fundamental to its counterpart market consensus value. Although a unique measure is not well defined in the academic world, I have chosen a generally accepted method defined as the percentage deviation of actual (released) figures from a market consensus estimate provided by Bloomberg.

Here, news surprise is calculated as news = (Actual release/Bloomberg Market Consensus Survey) x 100. None of the announcements are qualitative; therefore, surprise can be classified as either a positively signed news event or a negatively signed news event, depending on the actual value relative to the market consensus value. For example, a positive GDP news event occurs where actual GDP > market consensus based on the Bloomberg survey from a predetermined period prior to the actual news release.

For the final part of this study, I have included the four lagging indicators as variables in the model; 1) CPI 2) GDP 3) UE 4) RET, and the sampling period is from March 1998 to June 2003. The objective is to understand not just the news effect, but also the information content or surprise from news release to the market during the recent period such that implementation of the latest monetary policy by the RBA and current trends for how market participants made decisions in the market are incorporated into the model.

The actual EGARCH-M model to test news surprise is the following, which applied to the excess returns of both 3-, and 10-year bond futures over the cash rate.

Mean equation:

$$\Delta R_t = a_0 + a_1 h_{t-1} + bR_{t-1} + \sum_{j=1}^{6} a_j News_{jt} + \varepsilon_t$$

Variance equation:

$$\log h_t = a_0^2 + \sum_{k=1}^{p} \gamma_k \varepsilon_{t-k} h_{t-k}^{-\frac{1}{2}} + \sum_{j=1}^{q} \alpha_j \log h_{t-j} + \alpha \left[|\varepsilon_{t-1}| h_{t-1}^{-\frac{1}{2}} - (\frac{2}{\pi})^{\frac{1}{2}} \right] + \sum_{j=1}^{6} a_j News_{jt}$$

— Model (2)

Where:

ΔR_t=Excess return over cash rate

ΔR_{t-1}=Previous period excess return over cash rate

j=1…4, which 1= CPI, 2=GDP, 3=UE, 4=RET, 5=NAB, 6=WEST

$News_{jt}$ is the news or surprise on day “t” (current period). Lagging indicators are normally estimated by the market. As a result, the percentage of deviation can be introduced into the model. Therefore, the variable will be equal to 1 or 0 to represent the date of release.

$News_{j(t-1)}$ is the news or surprise on day “t–1” (previous period). It is a lagging variable to allow the model to capture the effect from news released in the previous period and also market sentiment about certain news content before the actual release date, i.e., tomorrow. This additional variable was not included in the news impact model in 3.4.1 because it reflects the news content and surprises against the market consensus. Therefore, it is not used to forecast the news impact on market participants but instead to estimate the impact of the news content and participants’ surprise about the release to predict certain price movement.

3.6 Comparing news releases and surprises

Previously, much of the work in this type of research has considered the announcement event only, without involving the actual information revealed to the market by that announcement. But announcement events are getting more attention from market participants than they used to and increasing the computational capabilities of financial institutions to forecast economic growth. It is now common practice to continuously monitor various economic variables or indicators and to try to act ahead of the crowd using proprietary models to estimate and interpret economic figures.

News elements contained in announcements have continuously gained importance in financial markets. Since the theoretical market efficiency argument applies to event studies that inquire whether financial markets are informationally efficient, only the unanticipated component of the announcement should significantly affect financial prices. That means, participants formulate expectations regarding the upcoming scheduled information release, and they take positions based on their own models of expectations. Therefore, a certain portion of the announcement has an effect on the markets if the market expectations are not the final outcome or if the actual result differs significantly from the anticipated news content. Furthermore, the pace of price adjustment should be fast enough to discourage arbitrage in the short term.

Clearly, the difference between news releases and surprises depend on the current practice of the market, the possibility of forecast and how difficult it is to estimate such economic indicators over time. All in all, if a variable is difficult to forecast in the long term, market participants may be less willing to estimate, and as a result, it is difficult to obtain market consensus figures. That means decision makers will put less focus on the content and will consider only the news release.

4 Descriptive statistics — initial testing

The data for this paper are divided into two sets — the basic news release and the news surprise. Descriptive statistics for the entire sample, with and without announcement dates and the testing of risk premium and bond volatility, are summarised in tables 4.1 to 4.4 below:

Descriptive Statistics — Full Sample **Table 4.1:**

Full sample		3-yr future			10-yr future	
	ExcessRtn	ExcessRtn^2	|ExcessRtn|	ExcessRtn	ExcessRtn^2	|ExcessRtn|
Mean	–0.0081	0.0700	0.1937	–0.0017	0.3410	0.4407
Median	–0.0132	0.0201	0.1418	0.0147	0.1356	0.3682
Maximum	1.2502	2.5415	1.5942	2.7127	12.0016	3.4643
Minimum	–1.5942	0.0001	0.0102	–3.4643	0.0001	0.0118
Std. Dev.	0.2645	0.1597	0.1803	0.5841	0.7268	0.3833
Skewness	–0.2626	6.7052	2.2251	–0.3126	6.8988	2.0792
Kurtosis	6.1742	67.7386	10.9696	5.5359	73.3866	10.6266
L-B Q(20):						
$X^2(20)$	16.7550			21.2070		
	{0.6690}			{0.3850}		
ARCH(20):						
$X^2(20)$	127.4659			133.2484		
	{0.0000}			{0.0000}		
Number in {}s are p values						
Observations	2496	2496	2496	2496	2496	2496

As the table above indicates, average daily excess returns are –0.01% to 0% for both 3- and 10-year bond futures on a per trading day basis over the entire period. Using 252 trading days, the annualised return would be around –2.49% to 0% for both 3- and 10-year futures, respectively. The magnitude of daily return can be quite high on some occasions, such as 2.71% for the 10s and 1.25% for the 3s. However, they can be as low as –3.46% for the 10s and –1.59% for the 3s. Both excess return distributions are negatively skewed and fat-tailed. None of the maximum or minimum excess returns for either 3-year or 10-year futures are on an announcement day.

For the second part of the table above, I conducted tests of linear independence of excess returns. They are the Ljung-Box Q test for the null of white noise with size = 20, which is equivalent to a normal trading month, and the ARCH test. Linear dependence is generally weak for both contracts (without even a need to check the confidence level, i.e., 1%, 5% and 10% level). Therefore, time-varying conditional heteroscedasticity exists in both excess return series, and that is formally confirmed by ARCH(20) statistics.

Descriptive Statistics — Announcement & Non Announcement Da　　　Table 4.2:

Sample — announcement days

	3-yr future			10-yr future		
	ExcessRtn	**ExcessRtn^2**	**|ExcessRtn|**	**ExcessRtn**	**ExcessRtn^2**	**|ExcessRtn|**
Mean	–0.0052	0.0838	0.2156	0.4521	0.3393	0.0161
Median	–0.0125	0.0285	0.1689	0.3773	0.1424	–0.0132
Maximum	1.1896	1.4150	1.1896	2.5692	6.6008	2.2226
Minimum	–1.0362	0.0001	0.0102	0.0132	0.0002	–2.5692
Std. Dev.	0.2897	0.1659	0.1934	0.3677	0.6200	0.5829
Skewness	0.3231	4.4392	1.8306	1.6685	5.2261	–0.0830
Kurtosis	4.9347	27.2857	7.5525	7.7994	40.5546	4.3423
Observations	466	466	466	466	466	466

Sample — non-announcement days

	3-yr future			10-yr future		
	ExcessRtn	**ExcessRtn^2**	**|ExcessRtn|**	**ExcessRtn**	**ExcessRtn^2**	**|ExcessRtn|**
Mean	–0.0087	0.0668	0.1887	–0.0057	0.3414	0.4380
Median	–0.0139	0.0200	0.1414	0.0154	0.1166	0.3415
Maximum	1.2502	2.5415	1.5942	2.7127	12.0016	3.4643
Minimum	–1.5942	0.0001	0.0102	–3.4643	0.0001	0.0118
Std. Dev.	0.2585	0.1581	0.1768	0.5844	0.7493	0.3868
Skewness	–0.4523	7.3157	2.3353	–0.3647	7.0634	2.1613
Kurtosis	6.5383	79.2903	12.0739	5.7996	75.5268	11.1591
Observations	2030	2030	2030	2030	2030	2030

The above shows that excess returns are much higher on announcement dates, averaging 0.45% for 10-year bond futures. In fact, most of the excess returns were generated by the 6 types of announcements, which is equivalent to 18% of trading days. However, 82% of trading days are non-announcement days, which generated much smaller excess returns, i.e., only –0.01% for 10-year bond futures. It is worth noting that the ex-ante excess return on government bonds is not necessarily positive. Campbell (1995) found that using monthly data, 10-year treasury bonds earned negative excess returns over the period 1952–1991.

From the mean excess return of different contracts on announcement days, I can deduce that the annualised excess returns on announcement days range from –1.3% to 211.65%. In comparison, results from non-announcement days are much lower. The annualised excess returns on non-announcement days are –2.17% to –1.43% for 3- and 10-year bond futures, respectively.

Event Type	**Contract**	**Excess Return**	**Annualised Excess Return**
Announcement day	3-yr future	–0.005%	–1.30%
Announcement day	10-yr future	0.452%	211.65%
Non-announcement day	3-yr future	–0.009%	–2.17%
Non-announcement day	10-yr future	–0.006%	–1.43%

Bond Volatility (Absolute and Squared Excess Returns) Table 4.3:

Day of the week & announcement effects

Variable	Coefficient	Std. Error	t-Statistic	Prob.
			3-yr future	
1 -Dependent Variable: ABSRTN_3				
C = MON	0.2184	0.0083	26.4079	0.0000
TUE	–0.0486	0.0115	–4.2275	0.0000
WED	–0.0128	0.0115	–1.1133	0.2657
THU	–0.0196	0.0115	–1.7056	0.0882
FRI	–0.0412	0.0115	–3.5776	0.0004
2 -Dependent Variable: ABSRTN_3				
C = Non Announcement Day	0.1925	0.0047	40.7443	0.0000
PRE	–0.0034	0.0094	–0.3649	0.7152
ANN	0.0280	0.0093	3.0168	0.0026
POST	–0.0180	0.0094	–1.9179	0.0552
3 -Dependent Variable: SQDRTN_3				
C = MON	0.0910	0.0073	12.3935	0.0000
TUE	–0.0338	0.0102	–3.3160	0.0009
WED	–0.0151	0.0102	–1.4821	0.1384
THU	–0.0235	0.0102	–2.3051	0.0212
FRI	–0.0312	0.0102	–3.0521	0.0023
4 -Dependent Variable: SQDRTN_3				
C = Non Announcement Day	0.0713	0.0042	17.0174	0.0000
PRE	–0.0109	0.0083	–1.3169	0.1880
ANN	0.0183	0.0082	2.2229	0.0263
POST	–0.0141	0.0083	–1.6958	0.0900

Day of the week & announcement effects

Variable	Coefficient	Std. Error	t-Statistic	Prob.
			10-yr future	
1 -Dependent Variable: ABSRTN_10				
C = MON	0.5109	0.0176	29.0573	0.0000
TUE	–0.1227	0.0244	–5.0232	0.0000
WED	–0.0614	0.0244	–2.5171	0.0119
THU	–0.0799	0.0244	–3.2747	0.0011
FRI	–0.0824	0.0245	–3.3663	0.0008
2 –Dependent Variable: ABSRTN_10				
C = Non Announcement Day	0.4429	0.0101	44.0313	0.0000
PRE	0.0126	0.0200	0.6294	0.5291
ANN	0.0156	0.0197	0.7891	0.4301
POST	–0.0402	0.0200	–2.0155	0.0440

3 –Dependent Variable: SQDRTN_10				
C = MON	0.4797	0.0334	14.3820	0.0000
TUE	–0.2168	0.0463	–4.6788	0.0000
WED	–0.1424	0.0463	–3.0796	0.0021
THU	–0.1678	0.0463	–3.6244	0.0003
FRI	–0.1565	0.0465	–3.3685	0.0008
4 -Dependent Variable: SQDRTN_10				
C = Non Announcement Day	0.3591	0.0191	18.8240	0.0000
PRE	–0.0177	0.0379	–0.4670	0.6405
ANN	0.0032	0.0374	0.0842	0.9329
POST	–0.0821	0.0379	–2.1681	0.0302

The above tables are simple OLS regressions that explore the relationship of the announcement days to both risk and return and the day of the week effect. I measured volatility in two ways, absolute values of excess return (ABSRTN) and squared excess return (SQDRTN).

Results indicate that there are day-of-the-week effects for return volatility: generally the return volatility is substantially higher on Monday, but fell back to a lower level on Wednesday. In terms of trends, the series exhibits a declining volatility over the week, which is somewhat similar to the stock market, in which return variances decline over the course of the week. A simple explanation is that domestic news releases are scheduled throughout a normal trading week, but overseas news releases are generally concentrated at the end of the week. Therefore causing market volatility to increase on Monday, then dropped significantly on Tuesday and returned with an upward bias towards the end of a week.

As the analysis of announcement effects shows, announcement days have significantly higher volatility than average days, as measured by both absolute value and squared excess return. Announcement effects are therefore statistically significant.

On the other hand, a "calm before the storm" exists in most cases. For example, the squared return is lower than average on days preceding macroeconomic announcements for both futures contracts, except that when I measure absolute returns on the pre-announcement day, 10-year futures have a return similar to that on announcement day. Return volatility after announcement day is generally lower than average for both contracts using two different measurements, and those effects are also statistically significant. Therefore, the analysis clearly shows no evidence that the trading process generates autocorrelated volatility in response to a one-time piece of news.

Bond Risk Premium **Table 4.4:**

Day of the week & announcement effects

	3-yr future					10-yr future			
Variable	**Coeff**	**Std. Error**	**t-Stat**	**Prob.**	**Variable**	**Coeff**	**Std. Error**	**t-Stat**	**Prob.**
C = MON	0.0106	0.0122	0.8721	0.3833	**C = MON**	0.0169	0.0269	0.6276	0.5304
TUE	–0.0457	0.0169	–2.7033	0.0069	**TUE**	–0.0709	0.0374	–1.8975	0.0579
WED	–0.0036	0.0169	–0.2128	0.8315	**WED**	0.0279	0.0373	0.7472	0.4550
THU	–0.0297	0.0169	–1.7583	0.0788	**THU**	–0.0276	0.0373	–0.7401	0.4593
FRI	–0.0132	0.0170	–0.7762	0.4377	**FRI**	–0.0211	0.0375	–0.5632	0.5734
C= Non Announcement Day	–0.0103	0.0069	–1.4885	0.1368	**C**	–0.0120	0.0153	–0.7851	0.4325
PRE	0.0103	0.0138	0.7459	0.4558	**PRE**	0.0386	0.0304	1.2691	0.2045
ANN	0.0030	0.0136	0.2223	0.8241	**ANN**	0.0200	0.0301	0.6647	0.5063
POST	–0.0012	0.0138	–0.0858	0.9316	**POST**	–0.0030	0.0304	–0.0997	0.9206

Excess returns are consistently positive on Monday, which corresponds to the day-of-the-week effect. Also, excess returns on announcement days are positive for both contracts, but their magnitude is less than on preannouncement days, which suggests that the market generally has its own view about those announcements and their content. Therefore, participants are anticipating certain outcomes and taking a pre-emptive action to try to reduce loss.

5 Empirical results

5.1 Introduction

From the initial analysis of the excess return distribution in the previous section, I have adopted various techniques to examine the behaviour of bond price movement and news release. Using simple statistics to analyse excess return series and OLS regression to examine announcement effects, day of the week effect and risk premium of bond price and volatility, I have been able to understand more about the effect of information flow and how the market generally reacts to it. This also provides a strong foundation for various volatility models applied in this paper because modelling news release and surprise are completely different.

The evaluation of news release and surprise through the models described in section 3 has further provided insight about the components of news release and its corresponding volatility. Here, I will first interpret the results from the announcement effects and then use the news release model to explain the impact of different events. Next, I will use the surprise model as a proxy to compare not just the event itself but also the news content and other exogenous factors, such as overseas announcement effects, etc., which have not been included in the current models.

5.2 Summary of initial results

Table 4.1 gives a summary of daily excess returns and compares non-announcement and announcement days. As can be seen in the first row of table 4.1, excess returns are –0.01%–0% per trading day in this period, or about –2.49%–0% per year for both 3- and 10-year bond futures. The magnitude of daily excess returns is sometime quite large, with returns for the 10-year futures as high as 2.71% (on June 5, 1995) and as low as –3.46% (on March 11, 1996). Neither of these two dates is an announcement date. Similarly, the highest return for 3-year bond futures was 1.25% (on July 7, 1995) and the lowest was –1.58% (on June 27, 1994). In addition, significant negative skewness and kurtosis are present for both excess return series. These are due to the higher peaks and fat tails of the distributions compared with the corresponding normal distributions. The second section of table 4-1 reports the test of linear dependence of the returns. It is the Ljung-Box Q test for the null of white noise (with lag length equal to 20 days, which is approximately a normal trading month) for the squared changes. Although there is a highly significant serial dependence for the squared changes, linear dependence is generally weak and observable for both contracts at all levels. That suggests the presence of a time-varying conditional heteroscedasticity in both excess return series, and it is formally confirmed by the highly significant ARCH(20) test statistics in both cases. In sum, both excess return series show leptokurtosis, time-varying conditional heteroscedasticity and potentially asymmetric volatility response to unanticipated changes, so the modelling of the excess return should properly address these properties.

Table 4.2 shows that excess returns over the period are much higher on announcement dates, averaging 0.45% for the 10-year bond futures. In fact, most of the excess returns were generated by the 18% of trading days with the 6 types of announcements. It is worth noting that both return series for announcement dates have significant positive skewness and kurtosis, whereas on non-announcement dates, the other 82% of the sample earned close to no excess return over the same period.

To put the numbers in perspective, the mean excess returns for the 10-year contract on announcement days imply annualised excess returns of more than 211% per year, but for a 3-year contract, it is only –1.3%. This is different from the non-announcement days because annualised excess returns range only from –2.17% to –1.43% for both 3- and 10-year contracts. Therefore, it depends on the type of interest rate future, the exposure to macroeconomic risk can earn a high risk premium during an announcement period.

Tables 4.3 and 4.4 show the results of the OLS regressions, which examine bond volatility and day-of-the-week effects and also explore the relationship of the announcement dates to both risk and return. Table 3 documents the volatility of daily excess returns using day-of-the-week and announcement indicator variables. Again, I measured volatility in two ways, the squared (SQDRTN_3, SQDRTN_10) and absolute value of excess returns (ABSRTN_3, ABSRTN_10).

The results indicate that there are day-of the-week effects for return volatility. Generally, volatility is highest on Monday and returned to a lower level but with an upward bias towards the end of the week. It somehow resemble a declining trend of volatility over the week, which somewhat similar to the stock market, in which return variances decline over the course of the week (e.g., French, 1980). Note that since I did not use an additional variable to examine the volatility on Friday i.e. variable with local announcement on Friday. I can not separate the Friday and announcement effects. But, referring to Table 3.1, only 6% of local announcements happen on Fridays. So, the local announcement impact on Friday is minimal. However, we have to keep in mind that foreign announcements on Friday will contribute a significant impact to the return on the following Monday.

As can be seen from table 4.3 sections 2 and 4, announcement days have significantly higher volatility than average days, as measured by both absolute value and squared excess return. The announcement effect is therefore highly statistically significant. In detail, the estimated announcement day effect (with standard error) for 3- and 10-year futures contracts, respectively, is 0.028 (0.0093) and 0.0156 (0.0197) for absolute returns and 0.0183 (0.0082) and 0.0032 (0.0374) for squared returns.

Financial headlines always claim that the markets will enter a quiet period a few days prior to announcements. For example, a typical market update from brokers (i.e., ANZ) says “Expect little market action today with figures in Australia due for release later this week." (29/03/2000) and a headline in the *Wall Street Journal* reads "Treasurys Decline in Light Trading as Market Awaits Today's Report on Employment in July" (08/05/1984). This so-called 'calm before the storm' effect does exist, and it is so popular that empirical studies can confirm it, such as Entorf and Steiner (2006). It is not confined to a specific market or region.

I did an investigation similar to that of other event studies by including a lead of the announcement dummy in the regression, and I found that the 'calm before the storm' exists in most cases. Generally, for both of the contracts, absolute returns are lower than average on days preceding macroeconomic announcements. For example, 10-year bond absolute returns on the day before an announcement are 0.012 percentage points below the average volatility. This is a significant drop from the full sample average volatility of 0.44%. However, the effect is statistically significant only for the 3-year contract and not for the 10-year contract. This is rather difficult to interpret and is different from some of the studies conducted previously. A reasonable explanation is that the long term contract (10-year) is becoming more popular than it was 15 years ago, and more participants, such as CTA, hedge funds, etc., take various views about the central bank's decision and economic growth. Also, such investors intrinsically use 10-year contracts for purposes that can be completely unrelated to the basic economic fundamental. For example, they might use Australian bond futures as part of a global fixed income arbitrage strategy. As a result, price movement would be less related to traditional news effects than expected. A counterargument for the 3-year contract is that, because it is less sensitive than the 10-year contract to major economic news and is less popular than the 10-year contract in terms of trading strategies, most users will still be traditional market participants, such as fund managers and treasury officers.

The second part of table 4.3 examines the sample with a one-day-lag-of-announcement-day dummy. I looked to see whether shocks to volatility on announcement days generated persistent volatility, since it would not be unreasonable to expect the day after an announcement day to have higher than average volatility. Table 4.3 show that, volatility on the day after an announcement is higher than average for 10-year contracts, but lower than average for 3-year contracts. Both findings are statistically significant. Thus, my analysis provides some evidence that the trading process itself generates autocorrelated volatility in response to a one-time piece of news.

Table 4.4 examines the risk premiums earned by bond futures on announcement days. A striking result was found: excess returns are consistently positive on Mondays. However, in table 4.3, I also found that Mondays are high-volatility days. I found no obvious relationship between volatility and mean excess returns across days of the week. Also, in the second part of table 4, I examined the effect of including the announcement day dummy. I found that excess returns for both contracts are positive, but the magnitude is less than on preannouncement days, and the effects are not statistically significant. Therefore, the estimation has limited power.

5.3 Importance of news releases

Table 5.1 reports the estimation of Model (1) for 3-year bond futures contracts. The model was described in section 3.4.1, using the EGARCH-M model. Panel A provides the estimated results for the mean equation of the 3-year contract with the six predetermined announcements over the period of 10 years. Of the individual news announcements, only unemployment (at the 10% level), retail sales (at the 5% level) and the NAB business survey (at the 5% level) remain significant for 3-year bond futures contracts. For unemployment and the NAB business survey, both coefficients were negative, which reflects that these specific news releases cause lower than average returns for futures contracts. On the other hand, effects from retail sales announcements were positive and therefore cause above-average returns. These results suggest that only some individual macroeconomic announcements are significant and important. In the variance equation (Panel B), with regard to the 3-year contract, CPI (at the 1% level), GDP (at the 1% level), and retail sales (at the 2.5% level) announcements were all important because these dummy variables attract estimated coefficients that are significant and positive. Kim, McKenzie and Faff (2003) report a similar result with U.S. 10-year bonds, except for CPI release. According to their research, none of the results from the variance equation were significant. But in my analysis, retail sales stand out. It appears as a positive and significant announcement effect on the 3-year bond futures market. The section after Table 5.1 also reports diagnostics of the estimation; they are the statistical properties of the estimated standardised residuals. Both skewness and kurtosis are significantly reduced in size compared with the results reported in Table 4.1, which indicates that the adoption of the standardised t-distribution for the residuals is an improvement over the normal distribution. The ARCH test demonstrates that ARCH effects are not present in the standardised residuals. In sum, as initially expected, the EGARCH-M model addresses most of the statistical properties of the daily excess return of 3-year bond futures over the cash rate very well.

Testing news release — 3-Year **Table 5.1:**

The impact of individual scheduled macroeconomic announcements on 3-year bond futures contracts

		3-yr future		
Panel A: mean equation	**Coeff**	**Std. Error**	**t-Stat**	**Prob.**
a_0 = Excess rtn (1 day lag)	–0.0104	0.0214	–0.4876	0.6259
a_1 = CPI	0.0286	0.0399	0.7168	0.4735
a_2 = GDP	0.0035	0.0417	0.0838	0.9332
a_3 = UE	–0.0237	0.0177	–1.3339	0.1822
a_4 = RET	0.0357	0.0212	1.6823	0.0925
a_5 = NAB	–0.0801	0.0422	–1.8978	0.0577
a_6 = WEST	0.0314	0.0269	1.1673	0.2431
ε	0.0143	0.0251	0.5677	0.5702
Panel B: variance equation	**Coeff**	**Std. Error**	**t-Stat**	**Prob.**
α	–0.0353	0.0255	–1.3886	0.1650
Γ	0.9861	0.0038	256.4174	0.0000
a_0 = Excess rtn (1 day lag)	0.0239	0.1036	0.2309	0.8174
a_1 = CPI	0.4508	0.1206	3.7365	0.0002
a_2 = GDP	0.5504	0.0881	6.2480	0.0000
a_3 = UE	–0.1042	0.0823	–1.2653	0.2057
a_4 = RET	0.1446	0.0727	1.9888	0.0467
a_5 = NAB	–0.0115	0.1225	–0.0942	0.9250
a_6 = WEST	0.0442	0.0810	0.5459	0.5851

ARCH Test:

F-statistic	1.132557	Probability	0.307337
Obs*R-squared	22.63602	Probability	0.307018

Test Equation:

Dependent Variable: STD_RESID^2

Method: Least Squares

Date: 11/15/05   Time: 00:10

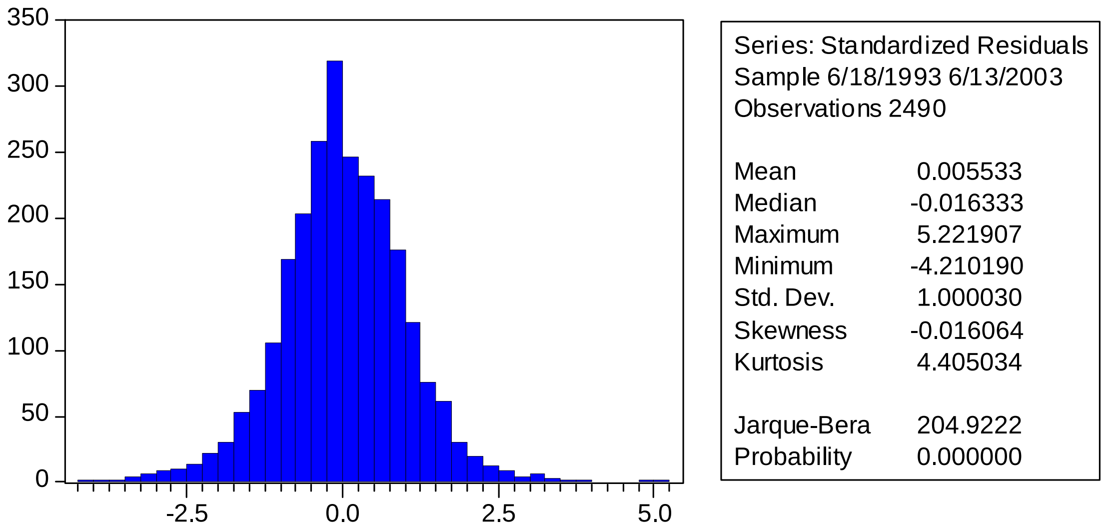
Sample (adjusted): 7/16/1993 6/13/2003

Included observations: 2470 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.976525	0.093709	10.42085	0.0000
STD_RESID^2(-1)	0.009481	0.020203	0.469276	0.6389
STD_RESID^2(-2)	0.025506	0.020201	1.262604	0.2069
STD_RESID^2(-3)	0.030040	0.020208	1.486534	0.1373
STD_RESID^2(-4)	0.002058	0.020216	0.101808	0.9189
STD_RESID^2(-5)	0.024445	0.020207	1.209755	0.2265
STD_RESID^2(-6)	–0.002166	0.020221	–0.107119	0.9147
STD_RESID^2(-7)	–0.011089	0.020221	–0.548368	0.5835
STD_RESID^2(-8)	–0.009951	0.020219	–0.492187	0.6226
STD_RESID^2(-9)	–0.035308	0.020198	–1.748084	0.0806
STD_RESID^2(-10)	0.041515	0.020207	2.054451	0.0400
STD_RESID^2(-11)	–0.017828	0.020207	–0.882228	0.3777
STD_RESID^2(-12)	–0.026690	0.020188	–1.322059	0.1863
STD_RESID^2(-13)	0.016789	0.020194	0.831391	0.4058

STD_RESID^2(-14)	–0.007560	0.020194	–0.374383	0.7082
STD_RESID^2(-15)	0.024703	0.020194	1.223271	0.2213
STD_RESID^2(-16)	–0.032067	0.020193	–1.588012	0.1124
STD_RESID^2(-17)	–0.005482	0.020199	–0.271375	0.7861
STD_RESID^2(-18)	0.005829	0.020186	0.288770	0.7728
STD_RESID^2(-19)	0.012981	0.020181	0.643209	0.5201
STD_RESID^2(-20)	–0.022244	0.020182	–1.102155	0.2705

R-squared	0.009164	Mean dependent var	0.999452
Adjusted R-squared	0.001073	S.D. dependent var	1.848183
S.E. of regression	1.847192	Akaike info criterion	4.073676
Sum squared resid	8356.277	Schwarz criterion	4.123089
Log likelihood	–5009.990	F-statistic	1.132557
Durbin-Watson stat	2.000657	Prob(F-statistic)	0.307337



Similarly, Table 5.2 below provides the estimated results of Model (1) for the 10-year bond futures contract. Panel A shows that four of the coefficients are statistically significant in the mean equation. Of the individual news announcement, retail sales (at the 5% level) and the NAB business survey (at the 5% level) again demonstrate their importance in the model. Coincidentally they behaved the same as for the 3-year contracts with similar effects, but they are statistically even stronger than the effect found for 3-year contracts, i.e., retail sales is 0.098 (2.008) and the NAB business survey is –0.183 (–2.068). Besides the news variable, the lagged excess return (at the 10% level) and error term (at the 5% level) are also significant.

Panel B demonstrates the variance equation. With regard to 10-year contracts, the CPI (at the 1% level), GDP (at the 1% level) and WEST (at the 1% level) announcements are found to be important. Both CPI and GDP attract estimated coefficients that are significant and positive, and WEST was negative. Clearly, CPI and GDP were positive and significant in both futures contracts, which explains that they are not just theoretically important; both fundamental macroeconomic variables practically affect the volatility of the bond futures market.

Again, both skewness and kurtosis are significantly reduced in size compared with the ones reported in Table 4.1, which indicates that the adoption of the standardised t-distribution for the residuals is an improvement over the normal distribution. The ARCH test also demonstrates that ARCH effects are not present in the standardised residuals. In sum, as initially expected, the EGARCH-M model addresses most of the statistical properties of the daily excess return of 10-year bond futures over the cash rate very well.

Testing news release — 10-Year

Table 5.2:

The impact of individual scheduled macroeconomic announcements on 10-year bond futures contracts

	10-yr future			
Panel A: mean equation	**Coeff**	**Std. Error**	**t-Stat**	**Prob.**
a_0 = Excess rtn (1 day lag)	–0.0269	0.0210	–1.2814	0.2001
a_1 = CPI	0.0506	0.0860	0.5881	0.5565
a_2 = GDP	0.1029	0.0884	1.1633	0.2447
a_3 = UE	0.0006	0.0440	0.0132	0.9895
a_4 = RET	0.0981	0.0488	2.0085	0.0446
a_5 = NAB	–0.1827	0.0884	–2.0681	0.0386
a_6 = WEST	0.0495	0.0525	0.9432	0.3456
ε	0.1047	0.0623	1.6791	0.0931
Panel B: variance equation	**Coeff**	**Std. Error**	**t-Stat**	**Prob.**
A	–0.024392	0.035437	–0.688311	0.4913
Γ	0.983074	0.005849	168.0627	0.0000
a_0 = Excess rtn (1 day lag)	–0.000724	0.065913	–0.010984	0.9912
a_1= CPI	0.304948	0.118374	2.576148	0.0100
a_2 = GDP	0.301459	0.094081	3.204255	0.0014
a_3 = UE	0.087516	0.086678	1.009668	0.3127
a_4 = RET	–0.008227	0.074443	–0.110519	0.9120
a_5 = NAB	–0.132538	0.114142	–1.161170	0.2456
a_6 = WEST	–0.218460	0.090248	–2.420662	0.0155

ARCH Test:

F-statistic	0.658357	Probability	0.869524
Obs*R-squared	13.20904	Probability	0.868236

Test Equation:

Dependent Variable: STD_RESID^2

Method: Least Squares

Date: 11/15/05   Time: 00:22

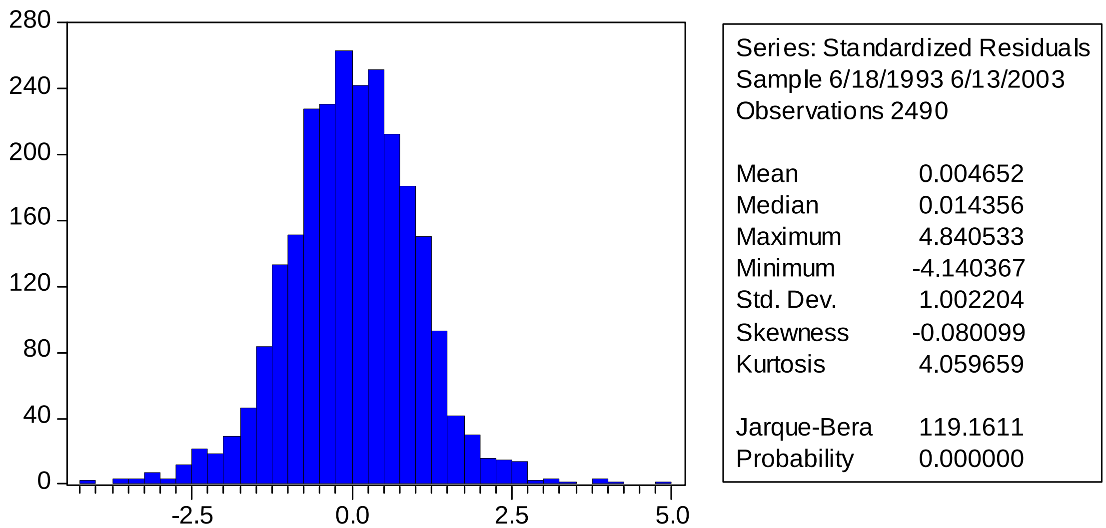
Sample (adjusted): 7/16/1993 6/13/2003

Included observations: 2470 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.960236	0.093323	10.28940	0.0000
STD_RESID^2(-1)	0.001326	0.020208	0.065611	0.9477
STD_RESID^2(-2)	0.017415	0.020206	0.861905	0.3888
STD_RESID^2(-3)	0.005818	0.020208	0.287924	0.7734
STD_RESID^2(-4)	0.031472	0.020204	1.557687	0.1194
STD_RESID^2(-5)	0.015023	0.020215	0.743161	0.4575
STD_RESID^2(-6)	–0.002935	0.020214	–0.145211	0.8846
STD_RESID^2(-7)	–0.001973	0.020214	–0.097598	0.9223
STD_RESID^2(-8)	–0.013817	0.020209	–0.683708	0.4942
STD_RESID^2(-9)	–0.012646	0.020195	–0.626178	0.5313
STD_RESID^2(-10)	0.038522	0.020189	1.908120	0.0565
STD_RESID^2(-11)	–0.025922	0.020191	–1.283847	0.1993
STD_RESID^2(-12)	–0.014221	0.019823	–0.717396	0.4732
STD_RESID^2(-13)	0.011645	0.019823	0.587474	0.5569
STD_RESID^2(-14)	0.010109	0.019823	0.509939	0.6101
STD_RESID^2(-15)	–0.016301	0.019824	–0.822281	0.4110
STD_RESID^2(-16)	–0.005832	0.019822	–0.294197	0.7686
STD_RESID^2(-17)	–0.017277	0.019816	–0.871845	0.3834
STD_RESID^2(-18)	0.013278	0.019818	0.669984	0.5029

STD_RESID^2(-19)	0.001842	0.019818	0.092956	0.9259
STD_RESID^2(-20)	0.004059	0.019850	0.204487	0.8380

R-squared	0.005348	Mean dependent var	0.999711
Adjusted R-squared	–0.002775	S.D. dependent var	1.728564
S.E. of regression	1.730961	Akaike info criterion	3.943696
Sum squared resid	7337.755	Schwarz criterion	3.993109
Log likelihood	–4849.464	F-statistic	0.658357
Durbin-Watson stat	1.999791	Prob(F-statistic)	0.869524



5.4 Effect of announcement surprises

The results below are based on Model (2), which is similar to most of the previous literature, such as Kim, McKenzie and Faff (2003), Lee (1993, 1995), Kim (1998, 1999) and Lee, Hu (1998). It incorporates information about expectations into the estimation procedure. The mean equation results indicate that during the 5-year period and using the Bloomberg consensus survey as a median market expectation, both CPI (at the 5% level) and unemployment (at the 1% level) were statistically significant for 3-year bond futures contracts. News surprise about CPI has a slightly negative impact, –0.02. This resembles outcomes from previous studies, which show that bond market mean returns exhibit a negative and significant response to a positive CPI. Further evidence from my summary analysis of CPI releases and surprise in the same period (Table 5.3) also demonstrate that there is only a 50:50 chance that a news release is going to be a positive or negative surprise. When surprises occur, they average approximately 6.74% over or 7.55% below the median consensus of the market. The result may suggest that news surprise from CPI is highly probable, but the chance of a market consensus significantly different from the actual outcome is quite low. Investors and market participants have a certain degree of understanding of some of the key macroeconomic variables, so it is feasible for them to forecast results with reasonable accuracy; plus there are partial indicators such as private dwellings, gross national expenditure, imports and exports of goods and services, and producer price index, which can explain the general movement of these variables. Therefore, the degree of impact on the mean equation is small.

Survey: CPI		**Table 5.3:**
Actual Release	Surprise	% Deviation
Positive Surprise	10	6.74%
Negative Surprise	10	–7.55%
No Surprise	1	
Total	21	

Secondly, unemployment rate is in the mean equation where its effects are positive at 0.03 and highly significant. This outcome partially reflects what Kim (1999) generated from his study, where an unexpected rise in unemployment rate was found to raise bond prices; in this case, it increases the excess return. But the summary in Table 5.4 of unemployment figures released between March 1998 and June 2003 clearly show that there were more negative surprises than positive ones. However, the percentage of deviations from the Bloomberg median figures is not that substantial, i.e., only 0.65% for positive surprises and –1.15% for negative surprises.

So, the positive impact from the mean equation may not be entirely attributable to positive surprise from the news content of the unemployment figure. One explanation is that forecasting the unemployment figure is very difficult because there are only two components: the total number of unemployed workers and the total civilian labour force. Both components are collected from survey data, and there is always a significant sampling error from data collection. Therefore, the data reaffirm my initial argument about macroeconomic variables that are more difficult to forecast: any deviation or unanticipated changes from consensus will require immediate market adjustment. As a result, the unemployment news release is critical because market participants are unable to correctly forecast it and need to revise their initial action to minimise risk generated from this variable. (Table 5.1 shows that unemployment news release was also significant at 10%, and the impact to the mean equation was –0.02.)

Survey: Unemployment		**Table 5.4:**
Actual Release	Surprise	% Deviation
Positive Surprise	20	0.61%
Negative Surprise	33	–1.15%
No Surprise	10	
Total	63	

Panel B also shows that the lagged excess return (at the 5% level), CPI (at the 10% level) and the NAB business survey (at the 5% level) were statistically significant in the variance equation. Again, just as in the modelling of news release in Table 5.1, CPI was present in the variance equation and with a positive coefficient of 0.03. Perhaps it is recognised by the mutual understanding of both Models (1) and (2) that CPI is important in modelling the volatility of 3-year bond futures, regardless of whether it is news release or news content.

Similarly, the diagnostic tests demonstrated that both skewness and kurtosis are relatively normal. The ARCH test also shows that ARCH effects are not present. In sum, as initially expected, the EGARCH-M model addresses most of the statistical properties of the daily excess return of 3-year bond futures over the cash rate, which is similar to the news impact model regardless of news content.

Testing news surprise — 3-Year Table 5.5:

The impact of announcement surprise on 3-year bond futures contracts
Using Bloomberg consensus surveys

		3-yr future		
Panel A: mean equation	**Coeff**	**Std. Error**	**t-Stat**	**Prob.**
a_0 = Excess rtn (1 day lag)	0.0253	0.0280	0.9033	0.3663
a_1 = CPI	–0.0175	0.0104	–1.6876	0.0915
a_2 = GDP	0.0004	0.0010	0.4377	0.6616
a_3 = UE	0.0327	0.0091	3.5792	0.0003
a_4 = RET	0.0000	0.0002	0.0655	0.9477
a_5 = NAB	–0.0264	0.0463	–0.5694	0.5691
a_6 = WEST	0.0198	0.0300	0.6612	0.5085
ε	–0.0142	0.0470	–0.3022	0.7625

Panel B: variance equation	**Coeff**	**Std. Error**	**t-Stat**	**Prob.**
A	–0.2619	0.1151	–2.2751	0.0229
Γ	0.9432	0.0334	28.2068	0.0000
a_0 = Excess rtn (1 day lag)	0.9368	0.4833	1.9384	0.0526
a_1 = CPI	0.0304	0.0236	1.2865	0.1983
a_2 = GDP	0.0018	0.0038	0.4881	0.6255
a_3 = UE	0.0010	0.0311	0.0319	0.9746
a_4 = RET	–0.0005	0.0004	–1.1370	0.2555
a_5 = NAB	–0.2830	0.1459	–1.9390	0.0525
a_6 = WEST	–0.0149	0.0934	–0.1592	0.8735

ARCH Test:

F-statistic	0.518230	Probability	0.960414
Obs*R-squared	10.45144	Probability	0.959228

Test Equation:

Dependent Variable: STD_RESID^2

Method: Least Squares

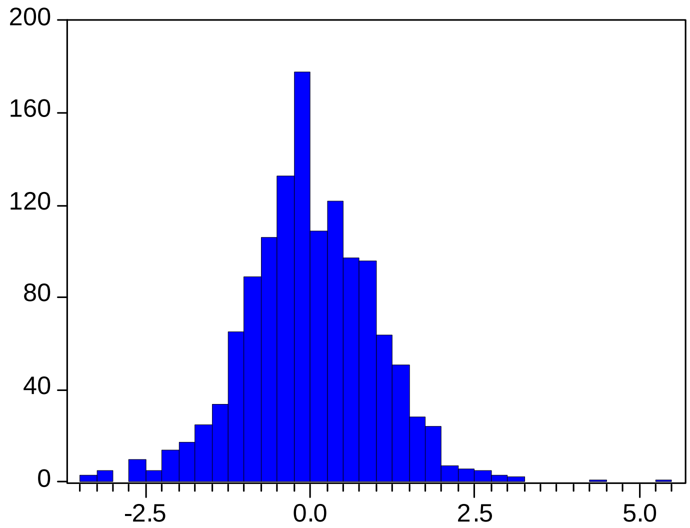
Date: 11/15/05 Time: 00:12

Sample (adjusted): 5/01/1998 6/13/2003

Included observations: 1280 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.028163	0.133064	7.726811	0.0000
STD_RESID^2(-1)	0.042290	0.028183	1.500567	0.1337
STD_RESID^2(-2)	0.021460	0.028209	0.760766	0.4469
STD_RESID^2(-3)	–0.000427	0.028208	–0.015147	0.9879
STD_RESID^2(-4)	–0.003473	0.028199	–0.123161	0.9020
STD_RESID^2(-5)	0.033357	0.028198	1.182953	0.2371
STD_RESID^2(-6)	–0.020131	0.028327	–0.710652	0.4774
STD_RESID^2(-7)	–0.014704	0.028329	–0.519054	0.6038
STD_RESID^2(-8)	–0.008766	0.028323	–0.309506	0.7570
STD_RESID^2(-9)	–0.032980	0.028320	–1.164548	0.2444
STD_RESID^2(-10)	0.007187	0.028328	0.253703	0.7998
STD_RESID^2(-11)	–0.017294	0.028329	–0.610461	0.5417
STD_RESID^2(-12)	0.011042	0.028318	0.389936	0.6966
STD_RESID^2(-13)	–0.021459	0.028319	–0.757785	0.4487
STD_RESID^2(-14)	–0.016794	0.028320	–0.593019	0.5533
STD_RESID^2(-15)	0.020716	0.028321	0.731464	0.4646
STD_RESID^2(-16)	–0.020295	0.028301	–0.717111	0.4734
STD_RESID^2(-17)	–0.026432	0.028305	–0.933845	0.3506
STD_RESID^2(-18)	0.009433	0.028315	0.333131	0.7391
STD_RESID^2(-19)	0.013420	0.028311	0.474014	0.6356
STD_RESID^2(-20)	–0.003808	0.028291	–0.134611	0.8929
R-squared	0.008165	Mean dependent var		1.000719

Adjusted R-squared	–0.007591	S.D. dependent var	1.779364
S.E. of regression	1.786104	Akaike info criterion	4.014221
Sum squared resid	4016.423	Schwarz criterion	4.098789
Log likelihood	–2548.102	F-statistic	0.518230
Durbin-Watson stat	1.999592	Prob(F-statistic)	0.960414



Series: Standardized Residuals	
Sample 4/01/1998 6/13/2003	
Observations 1300	
Mean	0.002500
Median	-0.028119
Maximum	5.256937
Minimum	-3.463009
Std. Dev.	0.999407
Skewness	0.021137
Kurtosis	4.137550
Jarque-Bera	70.18955
Probability	0.000000

News surprise for 10-year bond futures was tested using Model (2), in a fashion similar to that used for 3-year bond futures. I found three statistically significant coefficients: lagged excess return (at the 10% level), NAB business survey (at the 10% level) and error term (at the 5% level). Only NAB is a news variable as well as a leading indicator. However, it has a negative coefficient with an impact of 0.168 to the mean equation. That means general market participants cannot forecast this indicator correctly, or potentially there are drivers behind the scene affect bond futures. It is uncommon to estimate a leading indicator, such as NAB or WEST, because fundamental leading indicators can only provide certain views of the economy in the future, and they contain no intrinsic value for the current environment. Furthermore, it is relatively difficult to estimate leading indicators because most of them are constructed by individual research houses or banks. Therefore, the significance of NAB does not really explain the full story of the news surprise. Other factors can affect the mean equation and 10-year bond futures, and that's why the error term has a statistically significant and positive coefficient. This forms an interesting contrast to Kim, McKenzie and Faff (2003), who find that bond futures in response to higher than expected CPI, GDP and retail sales, whereas an unexpected rise in unemployment raise them.

Panel B also shows the variance equation of Model (2) for 10-year bond futures. Again, none of the fundamental macroeconomic dummy variables were significant except NAB, a leading indicator that has no news surprise that can be derived from market consensus. It has a negative coefficient and is statistically significant at the 5% level.

The diagnostic tests also demonstrated that both skewness and kurtosis are relatively normal. The ARCH test shows that ARCH effects are not present. In sum, the EGARCH-M model addresses most of the statistical properties of the daily excess return of 10-year bond futures over the cash rate, which is similar to the news impact model regardless of news content.

Testing news surprise — 10-Year Table 5.6:

The impact of announcement surprise on 10-year bond futures contracts
Using Bloomberg consensus surveys

	10-yr future			
Panel A: mean equation	**Coeff**	**Std. Error**	**t-Stat**	**Prob.**
a_0 = Excess rtn (1 day lag)	–0.0644	0.0425	–1.5140	0.1300
a_1 = CPI	–0.0105	0.0251	–0.4173	0.6765
a_2 = GDP	0.0009	0.0042	0.2125	0.8317
a_3 = UE	0.0270	0.0260	1.0364	0.3000
a_4 = RET	0.0004	0.0004	0.9861	0.3241
a_5 = NAB	–0.1679	0.1118	–1.5015	0.1332
a_6 = WEST	0.0116	0.0739	0.1564	0.8757
ε	0.7754	0.4194	1.8488	0.0645
Panel B: variance equation	**Coeff**	**Std. Error**	**t-Stat**	**Prob.**
A	0.2530	0.2586	0.9784	0.3279
Γ	–0.5473	0.2305	–2.3743	0.0176
a_0 = Excess rtn (1 day lag)	–0.6209	0.4959	–1.2520	0.2106
a_1 = CPI	0.0408	0.0403	1.0114	0.3118
a_2 = GDP	–0.0045	0.0076	–0.5927	0.5534
a_3 = UE	–0.0470	0.0587	–0.8013	0.4229
a_4 = RET	0.0006	0.0009	0.6747	0.4998
a_5 = NAB	–0.4083	0.2174	–1.8779	0.0604
a_6 = WEST	0.0638	0.1270	0.5021	0.6156

ARCH Test:

F-statistic	1.231372	Probability	0.218644
Obs*R-squared	24.55784	Probability	0.218873

Test Equation:

Dependent Variable: STD_RESID^2

Method: Least Squares

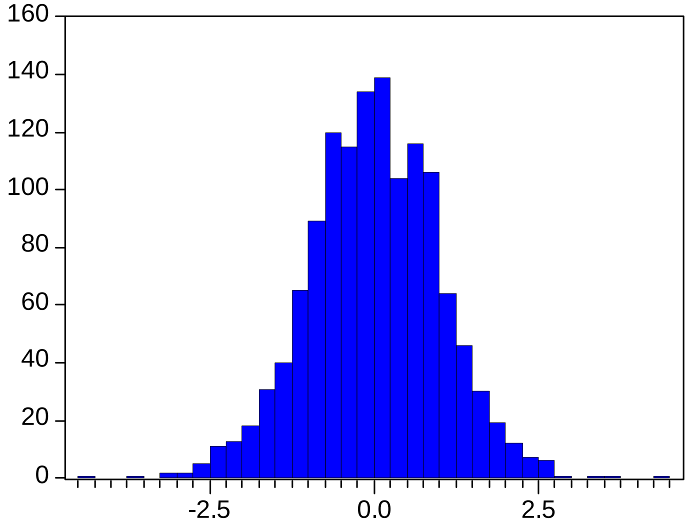
Date: 11/15/05   Time: 00:24

Sample (adjusted): 5/01/1998 6/13/2003

Included observations: 1280 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.765921	0.115925	6.607016	0.0000
STD_RESID^2(-1)	0.001267	0.028183	0.044968	0.9641
STD_RESID^2(-2)	0.028844	0.028163	1.024175	0.3059
STD_RESID^2(-3)	0.009135	0.028178	0.324191	0.7458
STD_RESID^2(-4)	0.074623	0.028147	2.651219	0.0081
STD_RESID^2(-5)	0.011033	0.028226	0.390885	0.6959
STD_RESID^2(-6)	0.009997	0.028221	0.354244	0.7232
STD_RESID^2(-7)	0.013759	0.028224	0.487488	0.6260
STD_RESID^2(-8)	0.008780	0.028221	0.311112	0.7558
STD_RESID^2(-9)	–0.032899	0.028210	–1.166196	0.2438
STD_RESID^2(-10)	0.071277	0.028222	2.525546	0.0117
STD_RESID^2(-11)	0.001140	0.028224	0.040392	0.9678
STD_RESID^2(-12)	0.024669	0.028210	0.874454	0.3820
STD_RESID^2(-13)	0.013597	0.028220	0.481825	0.6300
STD_RESID^2(-14)	–0.003769	0.028219	–0.133546	0.8938
STD_RESID^2(-15)	0.027345	0.028220	0.969013	0.3327
STD_RESID^2(-16)	–0.012896	0.028229	–0.456834	0.6479
STD_RESID^2(-17)	–0.046710	0.028151	–1.659294	0.0973
STD_RESID^2(-18)	0.010803	0.028177	0.383387	0.7015
STD_RESID^2(-19)	0.040069	0.028164	1.422703	0.1551
STD_RESID^2(-20)	–0.011783	0.028291	–0.416476	0.6771

R-squared	0.019186	Mean dependent var	1.005943
Adjusted R-squared	0.003605	S.D. dependent var	1.630594
S.E. of regression	1.627653	Akaike info criterion	3.828425
Sum squared resid	3335.410	Schwarz criterion	3.912993
Log likelihood	–2429.192	F-statistic	1.231372
Durbin-Watson stat	1.996406	Prob(F-statistic)	0.218644



Series: Standardized Residuals
Sample 4/01/1998 6/13/2003
Observations 1300

Mean	0.000733
Median	0.002727
Maximum	4.403930
Minimum	-4.325710
Std. Dev.	1.000928
Skewness	-0.054165
Kurtosis	3.617820
Jarque-Bera	21.31119
Probability	0.000024

5.5 Technical considerations

A number of technical considerations need to be addressed because they are important and have a certain degree of influence on the overall study. The first issue is the inability to account for foreign news, both news only and content surprise, to the bond futures market. Generally, any type of news event that can convey information on the future growth of the economy and the path of monetary policy can affect interest rate expectations. News releases from major markets overseas are no exception, and their surprise element also has certain influences on the domestic market. A study by Kim and Sheen (1998) found that U.S. macroeconomic activity announcements significantly moved Australian interest rates, particularly at the short end. Also, a study by Kleischer (2003) found that volatility links between Australia and the U.S. are based on two sources: common information and information spillovers. Common information is expected to be important across different financial markets because they are largely influenced by the same macroeconomic announcements. Information spillovers are expected to be significant because they are largely affected by cross hedging. Kleischer (2003) also reported that his model found strong cross-market linkages instead of traditional proxies for volatility. As a result, it is obvious that one of the deficiencies of the current study is the lack of overseas news release and content incorporated into the sample and models to explain 3- and 10-year bond futures.

Secondly, market efficiency also plays an important role in explaining the nature of the market, i.e., instead of focusing on daily excess returns of bond futures, it may be more appropriate to concentrate on intraday data and the price movement within a small interval of the day. Ederington and Lee (1993, 1995) utilised tick data from Eurodollar future prices and reported that most of the price adjustment mechanism to U.S. data concluded within the first minute of the news release. Similarly in Australia, Kim (1993) found that most of the market adjustment to new information, either price or volatility, was completed during the first minute. This clearly shows that another deficiency is using two successive days of market closing observations to measure the news effect. Potentially, the use of intraday data could produce a slightly different result.

6 Conclusion

6.1 Important results

Economic information is important to investors because it has a practical and theoretical role to play in asset price movement. This paper has covered considerable ground and touched on numerous issues of macroeconomic news releases and content surprises for the Australian fixed income markets. I considered the impact of news release and content for six of the major domestic economic indicators: CPI, GDP, retail sales, unemployment rate, NAB business survey and Westpac Melbourne Institute consumer sentiment.

The news releases of some economic indicators have a significant effect on the average returns of bond futures. News releases about retail sales cause an above average return for both bond futures, but in particular, they play an important role in the market volatility of 3-year contracts. An explanation is that in recent years, retail sales has become widely accepted by market participants as a key microeconomic indicator to reflect the general consumption of the private sector. Similarly, the NAB business survey also has a significant effect on average returns, but it generally lowered the average return upon release.

News releases of some fundamental economic variables also have a significant effect on market volatility. Both CPI and GDP raise the conditional volatility of 3- and 10-year bond futures contracts. CPI also plays an important role in content surprises for 3-year contracts. Although it looks coincidental, it is not an unusual result; most academic research conducted previously has confirmed that CPI is a significant variable. Similarly, the unemployment rate also plays a significant content surprise role on average returns for 3-year contracts, but it has minimal impact on volatility. Finally, I found one abnormal outcome, which is the NAB business survey. It came up as a significant variable in content surprise for the conditional volatility of both 3- and 10-year bond futures, but theoretically it is only a leading indicator, so there shouldn’t be any content surprise.

The above indicates that market participants carefully watch the announcements of these variables for both news release and news content, and they adjust their positions in anticipation of and immediately after the announcements, leading to changes in the price and conditional volatility of bond futures.

6.2 Market implications and future research

The results of this paper have important industrial implications that relate primarily to trader and portfolio managers’ decision making process.

In relation to news release, the results of this paper suggest that there is a need to continuously research and come up with new market relationships and variables for the decision making process because fundamental macroeconomic variables such as CPI and GDP are having less direct impact on the market, whereas microeconomic variables such as retail sales are earning more credential from participants. Furthermore, it is necessary to allow leading indicators to play a slightly more important role in market expectations and the prediction of future economic movement. This is evidenced by the results from the average return and conditional volatility of the NAB business survey from both news releases and content surprises.

The results also suggest that both the act of releasing macroeconomic news and the news component of each release are important to the market. They are basically two separate but related processes to ensure sufficient information flow to decision makers, i.e., traders or portfolio managers. Therefore, variables can be statistically significant in one or both processes. For example, unemployment rate was significant at the 10% level for the average return of 3-year contracts for *news release*, but it was even more significant (i.e., 1%) for the average return of 3-year contracts for *content surprises*. This clearly demonstrates that to correctly monitor market movement, it is necessary to keep track of all the information flow, regardless of type. The results also demonstrate that variables or factors other than domestic news and content also have significant impact on the markets. That is particularly clear in the error term from the modelling of *news releases* and *content surprises* for 10-year futures contracts.

The most important avenue of further research opened by this paper concerns the cross-country impact of macroeconomic announcements and the timing of releases. In particular, events in the U.S. economy should be studied, such as announcement effects, content surprises and their relationship with Australian news because these announcements and surprises are frequently taken as leading indicators of future events in other economies. Their impact can be significant and often affects the decision making process of local market participants. Furthermore, timing of overseas news release can also be critical, and future research should take into account their post-release impact in other countries and whether it is possible to completely separate domestic releases on the subsequent day.

Further research might also focus on the arrival of specific types of news content, such as positive and negative news impact, the timing of releases and cross-country impact on the market.

7 Appendix

Survey: GDP		Table 7.1:
Actual Release	Surprise	% Deviation
Positive Surprise	12	25.52%
Negative Surprise	7	–9.84%
No Surprise	2	
Total	21	

Survey: Retail Sales		Table 7.2:
Actual Release	Surprise	% Deviation
Positive Surprise	25	59.78%
Negative Surprise	30	–28.04%
No Surprise	8	
Total	63	

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