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The Effect of Interest Rate Changes on Bank Stock Returns

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Abstract

This study examines the effect on the stock returns of the major banks in Australia from the publicly announced changes in official interest rates during the period 1990 to 2005. Previous studies of such effects have reported inconclusive and mixed results. US evidence suggests that banking stocks are generally negatively (positively) impacted by increases (decreases) in official interest rates. We find, somewhat unexpectedly that Australian bank stock returns are not negatively impacted by the announced increases in official interest rates. Furthermore, banks apparently experience net-positive abnormal returns when cash rates are increased, which is consistent with dividend valuation theory that suggests if income effects dominate, then stock returns need not be negatively impacted. We explain our findings by the fact that Australian banks, which operate in a less competitive and concentrated banking environment compared to the US, are able to advantageously manage earnings impacts when cash rate changes are announced.

JEL Classification: E52, E58, G21

Key Words: Event Study; Interest rates, Bank Stock Returns; Monetary Policy; Dividend Discount Valuation Model; Optimal Interest Rate Theory

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1 Introduction

Developed country economies such as that of Australia have enjoyed a long period of relatively stable low interest rates, together with a growing economy and low unemployment, during the period 1993 to 2006, within the interval of our study. The banking industry in Australia has also undergone significant change during this period with the entry of foreign competition and further deregulation although the industry is still less competitive than other developed economies such as the US. There are less than twelve banks offering a full range of services that are listed on the Australian stock exchange (ASX). Against this backdrop we investigate whether the effects on banking stock returns from interest rate changes are consistent with established theories of interest rate effects under competition.

The RBA¹ uses the cash rate to impact interest rates across the economy as its key lever for controlling inflation, in the context of ensuring the stability of the banking system. The RBA adopted the practice of public release of cash rate changes in January 1990 as part of a range of initiatives to improve financial market stability, with the RBA increasing the transparency of its monetary policy processes by announcing target cash rates. Prior to this, cash rate targets were not subject of official announcements but adjusted as and when needed with limited public disclosure. Thus data set now available for the period under this new policy provides an opportunity to test whether publicly disclosed cash rate changes elicit negative or positive share price effects. We investigate the manner in which bank stock returns in the share market react to each cash rate change by the RBA: this issue has not been studied by researchers. Depending on the types of firms, interest rate changes affect operating returns and implicitly stock returns, this is particularly so for financial institutions such as banks.

¹ The Reserve Bank of Australia (RBA) is the independent authority responsible for managing monetary policy in Australia, with the objective of minimising inflation, has been a key contributor to the stable economic performance of the Australian economy (RBA, 2005, Reserve Bank of Australia (The Reserve Bank of Australia)).

A large number of studies, notably in the US, documented that the share prices of banks are negatively affected by interest rate changes as predicted by Stone (1974). However, banks in less competitive environments with relatively greater market power may be able to benefit from interest rate changes to secure increased interest income (over and above the increase in deposit rates), and are thus likely to elicit a positive share price effect. Coppel and Connolly (2003) report that inflation rate targeting (within a narrow range) became official policy in Australia in 1996 and the RBA has clearly demonstrated that it will use cash rates to manage inflation by affecting interest rates. Understanding the resultant impacts of these changes is useful as there is little reported evidence of the effects of these announced changes on bank stock returns, particularly for the period following the entry of the foreign banks and the stable interest rate and good economic growth period of 1993 to 2005.

The RBA target cash rate represents the intended over-night borrowing rate that applies to banks transacting with the RBA for short-term funds. In practice, the target cash rate promulgated by the RBA, influences rates charged by banks between themselves in securing funds on a daily basis and as a consequence it gives effect to the prevailing interest rates in the market (Cook and Hahn (1989), Lowe (1995)). Studies in Australia examine some influencing factors on stock returns but do not examine the impacts when target rate changes are announced.

Stiglitz and Weiss (1981), suggest that under competition bank stocks lose value when the US Federal Reserve (Fed) increases discount rates. This has been explained as arising from sticky interest rates and increasing risks in a competitive US banking market. This implies interest rate changes resulting in higher interest rates would attract more risky borrowers so that existing clientele would switch (if switching costs are trivial) to a bank that did not increase interest rates (a choice available if banking is competitive, since not all banks will change interest rates following the regulator's change). Thus banks had limited ability to effect changes in net interest margins due to competition. This suggests that as a consequence of operating impacts of changed interest rates, and thus their net interest margins, banks experience income variations and thus affecting stock returns. In addition, if rates increase, lower stock prices are expected to achieve higher returns implied by higher interest rates.

Ho and Saunders (1981) hypothesised the determinants of bank net interest margins on the basis that banks acted as risk-averse dealers whose main source of risk

was from interest rate variability and were able to manage this by varying these margins depending on market structure.

Thus, the aim of this research is to identify any abnormal impact of cash rate announcements on banks' returns, and consider these results in the light of those in the US. We examine the period 1990 to 2005 and report the results using an event study following the approach in Campbell, Lo and MacKinlay (1997). We empirically examine cash rate change announcements involving adjustments to rates to measure the impact on banking stock returns. We show that the effect of these announcements is different to the US result, due to distinctive market characteristics.

This paper is organised as follows: Section 2 describes the Australian banking environment, Section 3 provides an overview of the literature, Section 4 describes the data and method employed, Section 5 discusses our findings and we conclude the paper in Section 6. Our findings are different to the US evidence and our results conform to the earnings valuation theory and the model of banks as risk averse agents. This study concludes that as Australian banks operate in a different and less competitive environment than those of the US and thus there is scope for banks to exercise greater control over income streams at the time of changes to interest rates. Thus each change, on average, provides an opportunity to increase the earnings of banks, at least in the short term.

2 Australian Banking Environment

The Australian banking environment has had significant changes both in its market structure and in regulations during the 1980s and 1990s. After deregulation and up to the early 1990s the Australian economy experienced periods of high and volatile interest rates as well as a recession in 1991. This was in contrast to the favourable interest, inflation and unemployment rates as well as the continuous positive economic growth experienced during the subsequent period from 1993 to 2005.

The banking industry is characterised by a large concentration of market share in four banks, whether measured by deposits, loans, or market capitalisation. It was not until 1983 that financial markets were deregulated in Australia and limited competition from foreign banks was allowed thereafter. The deregulation included a raft of reforms such as the float of the Australian dollar, relaxed rules on capital retention and the introduction of more competition. Market changes in the late 1980s to early 1990s were embodied by the

entry of a substantial number of foreign multinationals. In spite of this, the large domestic banks have been able to leverage their market position to minimise the impact of competition as evidenced by their significant growth in earnings and stock prices.

Panel A of Table 1 provides statistics to illustrate the extent of concentration in the Australian market using the Herfindahl-Hirschman index² applied to 2004 data. This method is used very commonly by regulators, such as the US Commerce Department, to consider the anti-competitive implications of planned mergers and acquisitions in particular industries.

(Insert Table 1 here)

Despite deregulation, the Four Pillars policy, introduced to maintain viable banks and competition, has had the effect of limiting competition and promoting the safety of the top four banks. The Australian banking market with an index of 1251 is moderately concentrated. However, this only provides a limited perspective and does not indicate the extent of market power actually held by larger participants. The four largest banks, namely the ANZ, Commonwealth, National Australia and Westpac banks hold a very large share of the market. Panel B of Table 1 provides more detail with basic information about the Australian market including assets, loans and advances and mortgages to provide a better insight into the concentration in the market (APRA (2005)).

From panel B of Table 1 it is clear that the largest 4 banks account for close to 76 percent of the mortgage market and the sample banks altogether account for 91 percent of all mortgages and 68 percent of assets. This may be contrasted with the US where 93 of 1,593 of the larger banks account for 68 percent of assets (Fed (2006)). Bank mortgages in the Australian market have a broader effect due to "lock-in" practice. Mortgager banks often require mortgagees to hold accounts with them and also offer discount credit cards and other services: refinancing charges are also relatively high thus limiting switching once locked in. Mortgagees would incur non-trivial switching costs which together with the other factors make these clients more 'sticky' to these banks. In an interesting contrast,

² The index is calculated by weighting each bank's assets as a percent of the total market to indicate market share and is then squared, weighting the market share by the asset proportion. An index of less than 1000 implies low concentration where as an index above 1000 but less than 2000 implies moderate concentration. An index above 2000 implies very high concentration such as an oligopoly and possibly approaching monopoly status.

we find that the banks' share of the business lending market is more consistent with their assets as they are not able to give effect to the same market power. Claessens and Laeven (2004) found that the Australian market, based on the H test, was characterised as one of monopolistic competition with an index that suggested less competition compared to most of the developed markets in their study.

In such an environment, banking clients incur non-trivial costs to switch from one bank to another, which are less likely in a more competitive environment. Domestic banks have by virtue of their market power been able to increase their non-interest income in the consumer market whilst reducing their share of such income in the business market due to greater competition.

3 Literature Relevant to Interest Rate effects

Sharpe (1964) and Lintner (1965) in the Capital Asset Pricing Model (CAPM) provided us with a method for understanding returns and a firm's systematic risk as measured by its relative sensitivity to market factors.

$$R_i = R_f + \beta_i(R_m - R_f) \quad (1)$$

Where, R_i represents the expected return on a security (also by k in equation (3)), R_f the risk-free rate, β_i the risk of the asset where $(R_m - R_f)$ is the market risk premium and R_m the market rate of return. In practice the interest rate on secure debt securities, such as government bonds is often used as the surrogate for the risk-free rate. Stone (1974) explained that there were variations in the cross sectional returns of securities that the CAPM was unable to explain using a single factor sensitivity. He introduced a second factor, in addition to a stock's beta, the interest rate sensitivity; and thus provided a model that allowed the inclusion of interest rate impacted securities such as bonds and banking stocks to be better understood.

$$R_i = +\beta_i R_m + \theta_i R_d \quad (2)$$

Where, θ_j represents the sensitivity of a security to the market debt index and R_d represents the return on the market debt index.

Stone's adaptation of the CAPM suggests that interest rate impacts on returns may be positive or negative depending on the nature of the interest rate sensitivity. Stone's work was built on and further enhanced by Lynge and Zumwalt (1980) who found that

interest rate sensitivity varied depending on the term of interest rates, namely short versus longer term interest rates. They found that stock returns of banks were more sensitive than non-financial stock returns; however, there were still significant extra-market and extra-interest rate effects that are unexplained. In addition, they also found that the sensitivity of bank stock returns had changed over time. Later work done by Ross (1976) in developing Arbitrage Pricing Theory (APT), provided for multifactor dependencies that included interest rates although it was not specifically targeted at considering bank stock returns.

We draw on three theories, in the CAPM context, to examine the expected impacts on banks stock returns in the face of announced interest rate changes: Stiglitz and Weiss (1981) Optimal Interest Rate Theory and Gordon (1962) Dividend Valuation Theory as well as Ho and Saunders (1981) theory of banks as risk averse dealers in the market for deposits and loans. Stiglitz and Weiss suggested that interest rates are sticky in a competitive credit environment, as bank profitability might not grow with increases in interest rates. This theory is based on the proposition that there are optimal interest rates that banks can charge where their profits are maximised, hence banks will ration funds and charge lower interest rates in accordance with that principle, rather than increase lending rates and meet the higher demand arising from the suggested market equilibrium. In other words, disequilibrium exists between the market-clearing rate and the actual rate charged on funds that is applicable if the banking system is competitive and not concentrated.

They postulated that a risk neutral borrower firm would be willing to undertake projects with a higher probability of failure when interest rates increased. Banks typically endure asymmetric information about the nature of a borrowing firm's behaviour and thus experience increased moral hazard problems brought about by higher interest rates, hence they prefer to ration their capital. They proposed that banks would rather ration lending, charging lower interest rates than the market would be willing to pay. Increasing interest rates causes existing, less risky clients, to switch banks but is likely to attract more risky, albeit higher interest rate business. In these circumstances, the additional risk inherent in such loans negatively offsets any gains from increased income from higher interest rates; this in turn reduces income and thus the value of bank stocks.

Interest rates are a primary input factor for investors expected returns in the context of alternative uses of their capital. We discuss the Dividend Valuation Model and

the CAPM to show how interest rates taken together with investor risk perceptions, expected future earnings and growth rates; affect the valuation of banking stocks. Williams (1956) from his early work in the 1930s provided the linkage between earnings growth and valuations of stock returns, later simplified by Gordon in 1962 (Sorensen and Williamson (1985)). Gordon's Dividend Valuation Theory sometimes is criticised for its simplicity, but is often used for that very reason. The theory as explained by Hurley and Johnson (1994) in its simplest manifestation, suggests that the current value of a stock is determined according to the equation below:

$$V_{i0} = \frac{D_{i1}}{k_i - g_i} \quad (3)$$

Where, V_{i0} is the value of the firm in the current period, D_{i1} : is the dividend paid by the firm in the subsequent period, k_i is the firm's expected future return and g_i is its expected future growth.

Gordon (1962) suggests a formal relationship between a firm's value today (V_{i0}) with its dividends in the following period (D_{i1}), income growth rate (g_i) and interest rates which are reflected in the cost of capital (k_i). When interest rates increase, if expected returns on stocks are perceived to be negatively affected, then we may see capital flows to bond markets and other classes of securities. This is implied by the Dividend Model: depending on the timeframe *ceteris paribus*, the denominator "k" will increase when the interest rate increases, hence the impact of equation (3) is to have a negative effect on returns. However, why should that be negative if the interest rate changes are capable of creating higher earnings (thus more dividends) when the bank is a price setter under a less competitive banking environment?

Stone's adaptation of the CAPM in (2) suggests that, when interest rates change, markets will perceive changes as good or bad depending on the net effect on expected returns. If the risk-free rate of return is altered upward by interest rates and related sensitivities of bank stocks suggest a positive earnings impact should the impact on expected returns be lower? In a less competitive market, an increase in interest rates in the short term at least at the time of disclosures may cause banks to pass on these costs leading to higher income, which as predicted by Gordon's Dividend Valuation Theory, should lead to an increase in stock returns. Furthermore, an increase in interest rates may have positive effects since future income is likely to increase by more than the cost of

securing the funds, namely net interest margins which, as predicted by the same theory, should increase returns.

Ho and Saunders (1981) investigated the determinants of net interest margins of banks and proposed a model of banks as risk-averse dealers facilitating deposits and loans. In attempting to minimise the impact of the major source of risk, namely risk arising from interest volatility they showed that banks managed net interest margins in the context of their market structure and management's aversion to risk. The idea is that banks are able to manage net interest margins to their advantage in the face of interest rate changes, when they have market power, that is when the banking industry lacks competition. A study of the Australian market following the model of Ho and Saunders by Williams (2007), confirms that Australian banks are able to increase net interest margins and thus profitability as a consequence of increased market power.

In Fama's seminal paper on efficient markets hypothesis (Fama (1970)), it is posited that stock prices reflect relevant information that is known about the stock in the market. So whilst economic indicators such as inflation or unemployment that signal problems in the economy, may influence the RBA to adjust interest rates; the market knowing this, is likely to have absorbed this information into stock prices; if the market is semi-strong form efficient. Kuttner (2001) examined the impact of surprise rate changes and found that they have a significant measurable effect on the stock returns of banks. Using interest rate futures to proxy expectations, he showed that in the absence of surprises, changes in interest rates had limited effects, to the extent that information conveyed was similar to that already contained in other economic indicators or data. He also showed that the markets did not totally rely on the discount rate as an indicator of future expectations but also looked to other economic indicators. Accordingly, if there is no information value in the rate change announced by the RBA, we expect this will be evidenced by the lack of any measurable abnormal effects on the bank stock price. This implies that the target cash rate changes may have no significant direct impact on returns if there is limited "news" or surprise value. Bernanke and Kuttner (2005) examined the broader stock market and concluded that unexpected monetary policy actions prompted relatively strong and consistent responses by the stock market but only accounted for a small proportion of the overall variability in stock returns. In addition, they showed that responses to monetary policy differ across industry portfolios and are consistent with the predictions arising from the CAPM.

Coppel and Connolly (2003) show that, as a result of the RBA's open communication policy, there has been a reduction in the volatility of interest rates and investors show a better anticipation of policy changes. They suggest that financial markets have become relatively efficient in interpreting economic data and policy announcements. A later study by Connolly and Kohler (2004) found that cash rate change announcements whilst important to markets, were always weighed in the context of other economic indicators in determining expectations of future interest rates. Macro-economic news was often seen as a better longer term indicator, so that any RBA announcements were considered in the context of other economic events and information. Additionally, the market paid attention, in a qualitative sense, to the commentary that came with the announcements and not just the quantitative value of the data. The news impact of such events was even stronger when Australian news was supplemented by US economic news.

Madura and Schnusenberg (2000) examined the interaction between the bank stock returns and the US Federal Reserve discount rate and found they were negatively related. Using a comprehensive methodology, the research showed that there was an asymmetric response in bank stock returns to changes in target rate. More specifically, increases in the target rate evoked a disproportionate response to decreases. Further, Madura demonstrated that Fed rate change effect varied significantly depending on the size of banks concerned. A further important finding was that rate change impacts on stock returns were inversely related to the capital ratios of the banks studied.

Berger, Demirguc-Kunt, Levine and Haubrich (2004) and Beck, Demirguc-Kunt and Levine (2003) showed that market concentration and regulation are amongst the key variables that determine the stability and profitability of banks. A later study by Thorsten, Demirguc-Kunt and Ross (2006) confirmed that banks in countries with higher market concentration experienced lower likelihood of crisis and risks as well as better profitability. During the 1990s and early 2000s there has been considerable consolidation of banks globally, suggesting banks are able to manage risk more than in the past. Australia experienced some of this consolidation with the acquisition of smaller banks by the four larger banks. The government has employed the "four pillars" policy that has since discouraged further consolidation of the larger banks to encourage competition. This has however, strongly entrenched national distribution of the older established

participants giving them strong market power in the retail market but less power in the business or corporate market.

Berg and Kim (1998) have observed significant differences in bank operating practices due to asymmetries in market power between retail and corporate banking activities. Differences in the power of consumers and “stickiness” of retail customers in Australia compared to the US may explain differences in the sensitivity of bank stock returns. This has also impacted the ability of new entrant foreign firms to advance into the retail segment. Consequently, the “four pillar” banks are able to achieve favourable rate spreads in these segments, with positive impacts on their profitability.

Bikker and Haaf (2002) showed that banking concentration impaired competitiveness and a few large, cartel like banks, were able to limit the competitive impact of smaller fringe players and new entrants. Their study although focussed on Europe, included Australia for limited comparative purposes. Williams (2002) examined the relative profitability and competitive participation of foreign banks in Australia found that they faced reduced profits in retail banking, effectively experiencing an entry barrier. As a result, foreign banks did not compete in all segments, with competition being greatest in the wholesale and corporate sectors. Dennis and Jeffrey (2002) report that in Australia, using data from the period 1981 to 1993, bank returns are not adversely affected by rising interest rates.

Berg and Kim (1998) found that banks are more accommodating to competition in corporate markets than retail markets. This is a similar situation in Australia due to the limited power of consumers to negotiate and may be a point of difference with the US. This suggests that banks may be able to increase returns as per Gordon's Dividend Valuation Theory contrasting US studies. If, based on Gordon's model, bank stock returns do not decrease with interest rate increases; it contrasts Stiglitz-Weiss theory which suggests the opposite. Prima facie, we expect different effects on banking stock returns due to fundamental differences industry competitiveness between the Australian and US markets.

Since the RBA was officially sanctioned with the specific objective of managing the inflation rate in a target range of 2 - 3 percent it has actively practiced a philosophy of transparency on its policy mechanisms and motivations. Fama (1970), Fama (1991) in his Efficient Markets Hypothesis suggests that stock prices should reflect all available information known to impact a stock. This means that in the case of changes to the cash

rate by the RBA, anticipated effects of interest rate changes may cause investors to interpret a potential rate change as good or bad for stock returns and impute their altered valuation perspectives through the stock price.

We assert that as a result of market power enjoyed by the sampled local banks arising from Australian market conditions, these banks would not be adversely affected by bad news (increases) in interest rates in the short term. Due to the established practices arising from the market power of the larger domestic banks, customers that try to switch banks experience sticky deposits and loans (Bikker and Haaf (2002)). This in turn enables banks to pass on the adverse affects of interest rate changes to customers and minimise the negative affects on their margins. Thus we would not expect to show sustained negative impacts from cash-rate change announcements as measured by abnormal bank stock returns. Additionally we expect limited effects to be measurable on the announcement day consistent with the view that the rate change itself would anticipated by a semi-strong form efficient market (Fama (1970)).

The following is a formal statement of hypotheses to be tested:

H1: The cumulative abnormal returns of the selected banks' stock returns will be negatively (positively) affected by RBA announced increases (decreases) in cash rates.

This implies that Australian banks operate in a competitive industry and behave in a manner expected under Stiglitz-Weiss theory, namely that banks will be adversely impacted by increases and positively affected by decreases (Stiglitz and Weiss (1981)). If this is not the case, it provides evidence of a less competitive market that enables banks to manage earnings to compensate for risks arising from upward movements in interest rates and vice versa. Consistent with Gordon's theory, the market perceives that banks are able to improve their returns allowing for cost of funds, and shield themselves from adverse effects when cash rates increases are announced by the RBA.

We expect to observe an increasing run-up in the abnormal returns for bank stocks in the days prior to the announcement due to anticipation effects arising from the availability of other economic data as well communicated monetary policy statements of the RBA so that there will be limited surprises. Therefore, the rate change itself is not a surprise but an affirmation of expectations, albeit with some adjustment to the initial anticipated returns, once the announcement is absorbed.

H2: The market will exhibit strong anticipatory effects and significant abnormal returns will be measured in the days leading to the event with little or no significance in the post event period.

Madura showed that there is an asymmetric response to changes in the Federal Reserve target rate (Madura and Schnusenberg (2000)). Do bank stock returns in Australia exhibit asymmetric impacts; namely do increases in the target rate elicit a disproportionate response to decreases?

H3: Bank stock returns have asymmetric responses to changes in interest rates affected by the RBA's policy.

Lynge and Zumwalt (1980) found that stock returns of banks were more sensitive than non-financial stocks but there were still significant extra-market and extra-interest rate affects that were unexplained. In addition, they also found that the sensitivity of bank stock returns had changed over time.

H4: The stock returns of non-financial stocks will not be significantly impacted by RBA announcements.

We expect to measure the impact of these cash rate changes, by examining the average abnormal and the cumulative abnormal returns of the common stock prices of non-financial stocks using an index of their daily returns. As for bank stocks, abnormal returns are examined in the days preceding and following the announcement of a rate change by the RBA.

4 Data and method

The source for stock and index data was Thomson DataStream whilst the cash rate data was sourced from the RBA website (RBA (2005)). There were approximately 51 banks in Australia in the study period, 11 of which are listed on the Australian Stock Exchange (ASX). Banks that were merged, de-listed or wound up during the period of our study, January 1990 to June 2005, have not been examined as they are not useful for comparisons over this period. New banks that had started operations after 2000, such as the AMP bank were also excluded; additionally specialist merchant banks and small mortgage lenders were excluded. We also left out foreign banks as their operations in

Australia represent too small a proportion of their total business to have a material impact on their stock returns in their home country stock market.

Furthermore, we also undertook an analysis of the stock market index of non-financial firms to provide a contrast for our banking stock results. We obtained daily index data, for the same period as the banks, on the following non-financial industry sectors namely: Food, Health, Insurance, Industrial, Media, Mining, Retail and Staples. Daily data is used for the event study to ensure the abnormal return wealth effect is measurable on a day by day basis, so that the timing of the response to the cash rate change can be observed. In addition it allows us to examine identified movements in our results, in the context of other events that may overlap following (Campbell, Lo and MacKinlay (1997)).

We obtained RBA cash-rate change announcements, identified the dates of rate target announcements, and also examined them to ascertain the direction of changes in these rates. Changes in cash rate targets were classified as good for decreases and bad for increases (presuming competition exists). Table 2 lists the event dates used for our study. The Australian market underwent a total of 27 downward rate changes and 13 upward rate changes of which 15 occurred consecutively between January 1990 and July 1993. Events were grouped into increase or decrease events and overlapping event windows were removed from the sample. The end result was that our cross-section size comprised 33 events partitioned into good (23) and bad (10) impacting on 10 banks: this provides a satisfactory number of observations for inference purposes. Our study was able to examine the period 1990 to 2005 with observations in our sub-samples exceeding 95 observations.

[Insert Table 2 about here]

To ensure the validity of our measured responses to RBA rate change events, we needed to consider the impact of other common or clustered events contemporaneous to these rate changes. These announcements also signal expectations about inflation and so need to be considered with other macro-economic announcements, as suggested by Connolly and Kohler (2004), thus they may substitute for the information value of cash rate change announcements. We examined the CPI announcements made regularly by the Australian Bureau of Statistics, and none of the announcements occurred on the same day as the RBA's announcements, although few have occurred at some dates in the event window.

Coincident “shock” events such as 11 September 2001 or announcements of other economic indicators may cause innovations in returns. We investigated all stocks in our sample for event contamination by checking coincident announcements and shock events in the press. We considered the significance or otherwise of regular announcements such as annual reports, profit warnings and other reports and announcements to the market. We feel that our sampling approach mitigated contamination effects having examined over 33 events for 10 banks. Due to the length of our estimation windows and the number of events and stocks used, no significant distorting effects of other individual events were found with the exception of the 11 September 2001 terrorist attack. Whilst that particular event had an impact, it did not alter the overall significance of our results.

To determine the impact of cash rate changes on bank stock returns, we employed the market model, event study methodology following Brown and Warner (1985), Boehmer, Musumeci and Poulsen (1991) as well as Campbell, Lo and MacKinlay (1997). The method involves calculating expected returns from a period just prior to the event (the estimation period) and comparing this to the actual returns observed at the time of the announcements (the event period) to determine abnormal returns.

Event windows were chosen after an examination of the literature to consider the efficiency by which the market absorbs news regarding cash rate changes (Coppel and Connolly (2003)). We also examined the financial press for chatter regarding interest rates in the weeks preceding rate change events. The foregoing suggested that a window of 26 days, namely 15 days prior and 10 days after the event would be adequate due to the manner in which the market is conditioned by the communication process and from the RBA, Government and media sources. This was also confirmed by testing different event window sizes to observe the effects. The estimation period used to compute the beta that in turn is utilised to calculate expected returns was 200 days, known as T_0 (-215 days) to T_1 (-16 days) prior to the event day (date of announcement). The estimation period is much longer than the event window as it is important to minimise any short term volatility effects in the expected return calculations as we approach the event.

We first calculate returns for the stocks and indices themselves. Returns were calculated using end of day or week prices without dividends. Daily or weekly returns are best calculated by taking the log of the price on day t (week w) divided by the price lagged by 1 period (day or week) as depicted in the equation 4 below (Strong (1992)):

$$R = Ln(P_t / P_{t-1}) \quad (4)$$

To calculate abnormal returns we use the data in our estimation period to regress the individual security returns against the returns on the market in accordance with the equation (5) below to derive an estimated β and α for the security.

$$R_{it} = \alpha_i + \beta_i R_{mt} + u_{it} \quad (5)$$

A β is also calculated using weekly returns. To compute a daily alpha value from weekly data used in regression, we carry out a 2 step procedure to minimise the volatility on the intercept. First, we calculate a weekly α and then convert it to a daily α in accordance with equation (6) below.

$$\hat{\alpha}_i = (1 + \alpha_{i,week})^{\frac{1}{5}} - 1 \quad (6)$$

The coefficients (α_i) and (β_i) are then used as estimates in equation (4) to calculate the abnormal returns (AR) for the event period.

$$AR_{it} = R_{it} - (\hat{\alpha}_i + \hat{\beta}_i R_{mt}) \quad (7)$$

Clustering problems caused by a common event across stocks require special attention to the t-test for significance. We discuss this standardised cross sectional t-test later. For a particular day in event time the t statistic is given by the standardised return

$$\frac{AR_{it}}{\sigma_{it}} \quad (8)$$

Following Boehmer, Musumeci and Poulsen (1991) the standard error is determined by equation (9) which uses the estimation period residuals to compute the standard deviation for the event period. This is done to adjust for the clustering effect as variance increases in this period may be caused by the event itself. The second term with the square root is to correct for sampling error.

$$\sigma_{it} = \sigma_{i,est} * \sqrt{1 + \frac{1}{L} + \frac{(R_{mt} - \bar{R}_m)^2}{\sum_{-215}^{-16} (R_{mt} - \bar{R}_m)^2}} \quad (9)$$

The numerator term under the square root in equation (9) is the event period market abnormal return; the denominator term is the market return, squared residual from the estimation period. Equation (10) uses estimation period residuals to calculate the variance due to the expected impact of the event itself on the variance.

$${}_{est}\sigma_i = \hat{S}(A_i) = \sqrt{\frac{\left(\sum_{t=-215}^{t=-16} (A_{it} - \sum_{t=-215}^{t=-16} A_{it})\right)^2}{199}} \quad (10)$$

To calculate the daily cross-sectional average abnormal return (AAR_t or \bar{A}_t) we use the following formula:

$$AAR_t = \bar{A}_t = \frac{\sum_{i=1}^N AR_{it}}{N} \quad (11)$$

To determine the significance of the cross-sectional average abnormal returns on a particular event day, we follow Boehmer, Musumeci and Poulsen (1991, Brown and Warner (1985) and calculate t (or z in this case) as in the equation below.

$$Z = \frac{\frac{\sum_{i=1}^N SAR}{N}}{\sigma_t} \quad (12)$$

The cross-sectional standard deviation as suggested by Boehmer using the standardised abnormal return (SAR) is computed in equation (13). This allows stocks to bring forward individual variances, from the estimation period providing more power to our test. (Boehmer, Musumeci and Poulsen (1991, Brown and Warner (1985)).

$$\sigma_{SAR_t} = \sqrt{\frac{\left(\sum_{i=1}^N (SAR_{it} - \sum_{i=1}^N SAR_{it} / N)\right)^2}{N(N-1)}} \quad (13)$$

Returns are accumulated over the event period in accordance with equation (14) as the test statistic for significance. Returns are accumulated across events, within the event window, cumulated through the pre-event, on-event and post-event sub-periods.

$$\sum_{t=-15}^{+10} \overline{SAR}_t / \left(\sum_{t=-15}^{+10} \sigma_{SAR_t}^2 \right)^{\frac{1}{2}} \quad (14)$$

It should be noted that the average SAR in (14) is accumulated both as a cross section of securities and across increase or decrease events, thus it can represent the number of events and or the number of securities. The formula for the average SAR is:

$$\overline{SAR}_t = \frac{\sum_{i=1}^N SAR}{N} \quad (15)$$

In order to validate our results, we also utilise non-parametric tests, because our parametric methods assume assumptions of normality and therefore expose the specification of our significance tests to these assumptions per MacKinlay (1997). We use a generalised sign test following Cowan and Sergeant (1996), a measure that examines the sign of the abnormal returns. The test provides more power than other non-parametric tests such as the rank test which is likely to reject the null in events with longer event windows. In addition, it is well specified in a variety of circumstances, as it is more powerful in detecting abnormal returns and relatively robust to increases in the variance as we approach the event window. The test statistic is:

$$Z = \frac{(W - n\hat{p})}{[n\hat{p}(1 - \hat{p})]^{\frac{1}{2}}} \quad (16)$$

In Equation (16) W represents the number of positive abnormal returns on the event day or event sub-period in our sample, n is the sample size and p represents the proportion of positive returns measured during the estimation period. \hat{p} is calculated by the following equation:

$$\hat{p} = \frac{1}{N} \sum_{j=1}^N \frac{1}{T} \sum_{t=1}^{T_j} \varphi_{jt} \quad (17)$$

5 Results

Banking Stocks

The results of our event study are now presented; we separately report the results for banks and non-financial stocks (using indices) and within this we examine the rate increase events and decrease events for each sample group. There were 33 events collated into 23 increase and 10 decrease rate events: consider that these 33 events over 11 bank stock prices over 26 observation days. A cross sectional average is taken across banks and indexes (grouped as banks and non-financial firms) and across all rate change events (as increases or decreases) as sub-groups for each day in the event window on a day by day basis over 26 days. These abnormal returns are then accumulated progressively into cumulative abnormal returns (CARs) for each of the sub-periods in the event window.

The event sub-periods are defined as: the *pre*-event sub period (event day -15 to event day -2), the *on*-event sub-period (event day -1 to event day +1) and the *post*-event sub-period (event day +2 to event day +10). In addition, we also accumulate the returns over the entire event window. We also report the tests of significance for all these CAR values. We then present graphs that plot the CARs on a day by day basis for the overall event window (event day -15 to event day +10) to visualise the progressive anticipatory aspects pre-event through to the event day itself.

Reported in Panel A, Table 3, are the bank stock CARs measured during rate increase events. We note that there are CARs of +1.14 percent at end of the pre-event period with significance at the 1 percent level. This suggests early anticipation in the market of a change in interest rates with the result reflecting a positive abnormal impact on bank stock returns. In the subsequent on-event period, we see that once the market has received the information from the announcement there is a negative CAR suggesting some correction to the anticipated effect on the abnormal returns during the pre-event period. The CAR in the on-event period is significant at the 5 percent level but does not reduce the overall anticipation effect in the abnormal returns accumulated in the pre-event period, suggesting that the event maintains abnormal positive gains made in the pre-event period. As we enter the post-event period the CAR values fail significance tests although they remain negative, albeit with CARs that are much smaller in absolute value than those accumulated pre-event and on-event.

[Insert Table 3 here]

Remembering that we are measuring cumulative abnormal returns, we note that the net effects of the measured CARs during the pre-event and on-event period are significant and positive. There is no significant evidence of a correction to CARs in the post event period. The market made some corrections once the rate change is announced however; the gains in returns are not reversed following the pre-event period. Taking the pre-event returns and the on-event returns together suggests a net positive effect of a 0.6 percent increase to banking stock returns. Thus we are able to reject H1, lending support to the view that the stock returns of Australian banks are not adversely impacted by announced increases in the cash rate.

The graph in Figure 1 shows the CARs of the sampled banks aggregated through all increase events, plotted from day -15 to day 10 in our event window, a duration of 26 days. It can be seen that as the market anticipates the change it affects the value of the cumulative abnormal returns. This may also reflect other contemporaneous announcements and information such as economic data supporting current expectations. The early rise of the graph suggests that the market is anticipating a positive impact from the cash rate announcement but corrects the magnitude of the return once the actual announcement occurs.

[Insert figure 1 about here]

We observe, consistent with Connolly and Kohler (2004), that as a result of a anticipation in the market, there was an apparent increase in the cumulative abnormal returns up to 2 days prior to the event. However, once the rate is announced the market adjusts for this information and the abnormal returns reduce to reflect the value of information inherent in the announcement. In the days subsequent to the event, the graph shows cumulative returns eased, losing any gains made in abnormal return levels prior to the announcement; however, this net effect is not statistically significant. CARs are however significant in the pre-event period and the on-event period. The net positive effect of at least 0.5 percent to 0.6 percent observed during this period suggests a market value impact, using the March 2005 event data, of \$1.0 billion to \$1.2 billion for the banks studied. The overall impact, looking at the full event window suggests no net-negative impact on banking stock returns but rather a net-positive short-term impact. We conclude that for cash rate increases, contrary to the theory, we find that cash rate

increase announcements do not negatively affect Australian bank stock returns in the short term and reject H1 for rate increases.

We now examine the results for rate decrease events reported in Panel B Table 3. The results for banking stocks, as before, are summarised across all events which represent rate decreases or good news events. A summary of the CARs and related Z values accumulated over event sub-periods is presented as before. We can see that the CARs of banking stocks in the pre-event period are significant at the 5 percent level and prices react generally positively, as measured by the abnormal returns to anticipated announced decreases in the cash rate. This result is a positive abnormal return of +0.67 percent; namely strong pre-event anticipation by the market. Positive returns are continued through the on-event period where we find that an additional significant positive return of +0.39 percent. In the post-event period returns reverse to marginally negative but there is no significance in the Z value and the magnitude is relatively small.³ However, the CAR for the total event period show a significant positive effect on bank stock returns so we report a net positive increase in the CARs of 0.99 percent.

The graph in Figure 2 plots the CARs of the sampled banks during rate decrease events for each day in the event window. In a similar manner to rate increases, there is an upward trend in the CARs very early in the event period, albeit with some fluctuation, which stabilises as we approach the event. Again, it can be seen that as the market anticipates the change, it has increased the value of the cumulative abnormal returns in anticipation of good news. The early rises of the CARs in the graph continue all the way past the event day when it approaches +1.1 percent and then oscillates at the levels reached on event day of about 1 percent and do not decline. This suggests the market has expected good news and, on confirmation of good news, the positive effect in abnormal returns is sustained after the event day.

[Insert figure 2 here]

Although the graph illustrates continuity of the positive CARs after the event day they are not significant in the post event period. Interest rate reductions create a

³ During the period 1990 to 1993 there were consecutive interest rate reduction that followed an extremely volatile and high interest period in the economy when interest rates reached record levels and when the cash rate was in excess of 17.5 percent. We conducted a sensitivity test and the conclusions drawn in our analysis were not altered by the exclusion of these events.

favourable environment for the banking market, as evident from the graph, supporting well established theory and the experience of other markets that bank stocks experience positive effects when cash rates are decreased.⁴ This represents a cumulative benefit of approximately 0.9 percent for the overall event period or 1.1 percent for the pre-event and post-event periods. This reflects a market value impact, based on March 2005 data, of \$1.6 billion to \$2 billion.

We conclude the analysis of our results by observing that our first hypothesis H1 is supported for rate decreases but not for increases. We have demonstrated significant abnormal returns during the pre-event period supporting our hypothesis H2, that there will be significant abnormal returns in the pre-event period, as markets anticipate the impact of cash rate changes on banks stocks. We also find sufficient evidence to empirically support hypothesis H3 regarding asymmetrical effects. Increases and decreases have similar responses in the pre-event period, symmetric responses in the on-event period and inconclusive results in the post event sub-period.

To enhance the robustness of our findings, given the relatively small number of firms in our sample, we have conducted the non-parametric generalised sign test. The generalised sign test is of benefit to our study as it does not require us to assume normality in our data, although it does assume independence between observations Cowan and Sergeant (1996). The results are summarised in table 5 below.

[Insert table 5 about here]

In our test we look at the incidence of positive abnormal returns, and we can see from the Table 5 that our event period ARs for both increases and decreases indicate that our results are statistically significant at the 10 percent and the 5 percent level. However we also report no significant support for negative effects on stock returns in the overall event period for increase events supporting our rejection of H1 for increases but very strong significance in the results for the decrease events.

⁴ During our testing of events, we noted that there were two situations that were tested to ensure they did not distort our results. We refer to the 11 September 2001 and the period 1990 to 1993 when there were 15 consecutive decreases. These circumstances were examined by way of a sensitivity analysis to see if our results were altered by their exclusion. There was no change in the conclusions drawn due to these circumstances.

Non Financial Firms

In Panel A of Table 4 we report the impacts of rate increase events for non-financial firms and again we present the cumulative average abnormal returns and the corresponding Z values, grouped by event sub-period and the event period overall. We see that the reported CAR value is -0.61 percent during the pre-event period. This suggests a negative relationship with the rate change however, the Z value fails to achieve significance at the 10 percent level. In the on-event period however, we report a positive return of 0.13 percent once again with no significance. In the post-event period, we report a negative return of -0.53 percent also with no significance. Therefore, we find no significance in the CARs in any of the sub periods, namely the pre-event, on-event and post-event period somewhat consistent with the literature which suggests non-financial firms are not impacted by monetary policy, rate change announcements, in the short term.

[Insert table 4 here]

The graph in Figure 3 plots the cumulative average abnormal returns as before for non-financial firms for rate increase events. We observe that the results are not clear with respect to movement through the event period. The graph starts with negative returns and does not indicate a trend and neither does it indicate possible anticipatory effects of the event. There are large movements of the CAR line with oscillation at negative levels of abnormal returns all the way through to the event period. The CARs become increasingly negative post-event, remain at around -0.4 percent and then fall 3 days after the event. It is possible that non-financial firms have a more significant lag effect that is not observable in the event window. However, there is no reason to pursue this based on the literature. Contrasting the results observed for bank stocks, we find no significance in the abnormal returns of non-financial stock returns in the on-event period due to RBA rate increase announcements.

[Insert Figure 2 here]

We now consider the impact of rate decrease events for non-financial firms in Panel B of Table 4. We find that decrease events show spurious results with negative CARs in the pre-event and on-event periods and positive CARs on-event. In all cases the Z values are not significant, and do not allow any conclusions to be drawn. Contrasting the pre- and on-event sub-periods, the CARs for the post-event period are positive but,

again are not significant. Figure 4 below illustrates the movement of the cumulative abnormal returns of the non-financial stocks over the event days.

[Insert Figure 4 here]

We can see that the CARs start and finish at approximately the same point on the graph vertical axis with enormous variations that in between, with the CARs remaining negative throughout the event window. There is an initial negative abnormal return that increases as it approaches day 12, oscillates between -0.2 and -0.4 percent, and gradually returns back to its starting level. There are no anticipatory effects evident as we approach the event day. The graph suggests a negative CAR that eventually returns back to original levels found at entry into the event window, however as we have seen from Table 4 this is not statistically significant. We therefore find that there is no significant impact on the stock returns of non-financial firms in the event window arising from RBA rate decrease announcements. We therefore find support for hypothesis H4.

6 Conclusion

We undertook this study to examine the reaction of bank stock returns to changes in the cash rate, as measured by their abnormal and cumulative returns. The results were obtained by examining the stock returns of selected listed Australian banks, studied as a group, representing in excess of 80 percent of the market. We contrasted the response of these stocks to those of non-financial firms using a selection of industry indices. These returns were examined for 10 rate increase events and 23 rate decrease events affecting 10 banks using the well established event study methodology. We find that, for rate increase events, contrary to one theory which suggests a negative relationship, bank stocks report significant net-positive CARs in total during the pre-event and on-event period. We find no significance in CARs for returns of the post-event sub-period and therefore conclude that bank stock returns in Australia are *not negatively* impacted in the short term, by cash rate increases. Cash rate increases have a small positive short term effect. This finding is inconsistent with the US literature. In the case of rate decreases, we found that CARs for bank stocks are positive and significant in both the pre-event and the on-event sub-periods. RBA decreases in the cash rate target have a significant and positive effect on bank stock returns consistent with the established theory. We also analysed the effects of these returns on non-financial firms. In the case of increases and

decreases, there was no significance in the abnormal returns of non-financial firms for rate increases or decreases.

The positive impact on bank stock returns due to rate increases needs to be considered in the context of two perspectives; the market power of the dominant banks and the economic environment. The Australian economy has benefited from relatively low inflation and interest rates. The majority of the interest rate increases initiated by the RBA were to control overheating of sectors in the economy to prevent a boom bust cycle. Sectors such as housing have boomed during the late 1990s and early 2000s and the RBA tried to discourage what it regards as the formation of large asset bubbles on the back of strong demand for consumer debt.

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Table 1 Industry concentration

The following table illustrates the relative concentration in the Australian Banking Industry. Panel A shows the Herfindahl Index for the top 4 banks. Panel B illustrates the market shares in loans and assets for banks in our sample as a percentage of the banking market. It also shows the relative value of those categories for the Big 4 banks

Panel A	Resident Assets		
	No	%	Herfindahl Index
Four firm industry concentration	4	68	1,179
Event Sample banks	10	82	1,231
All Banks	51	100	1,251

APRA (2005).

Panel B

Category	% of market	Sample Banks (\$M)	All Banks (\$M)
Assets	82%	1,040,768	1,264,697
mortgage loans	91%	447,854	491,856
Other loans	81%	290,510	359,578
Total loans	87%	738,363	851,434
All Mortgages as % of loans	58%		

Category (Big 4 Banks)	% of market	Big 4 Banks (\$M)
Assets	68%	863,515
mortgage loans	76%	371,840
Other loans	67%	242,710
Total loans	72%	614,550

Table 2 : RBA cash rate change event dates (event calendar).

The data in the following table are the announcement dates of the RBA cash rate changes when this practice commenced in January 1990 and constitutes our event calendar. We have excluded 7 announcements due to overlapping event windows leaving a total of 33 events, 10 increases and 23 decreases in the target cash rate.

Date	Rate Change	Rate	Type
23/01/1990	-1.00%	17.50%	Good
4/04/1990	-1.50%	15.00%	Good
2/08/1990	-1.00%	14.00%	Good
15/10/1990	-1.00%	13.00%	Good
18/12/1990	-1.00%	12.00%	Good
4/04/1991	-0.50%	11.50%	Good
16/05/1991	-1.00%	10.50%	Good
3/09/1991	-1.00%	9.50%	Good
6/11/1991	-1.00%	8.50%	Good
8/01/1992	-1.00%	7.50%	Good
6/05/1992	-1.00%	6.50%	Good
8/07/1992	-0.75%	5.75%	Good
23/03/1993	-0.50%	5.25%	Good
30/07/1993	-0.50%	4.75%	Good
17/08/1994	0.75%	5.50%	Bad
24/10/1994	1.00%	6.50%	Bad
14/12/1994	1.00%	7.50%	Bad
31/07/1996	-0.50%	7.00%	Good
11/12/1996	-0.50%	6.00%	Good
23/05/1997	-0.50%	5.50%	Good
30/07/1997	-0.50%	5.00%	Good
2/12/1998	-0.25%	4.75%	Good
3/11/1999	0.25%	5.00%	Bad
2/02/2000	0.50%	5.50%	Bad
3/05/2000	0.25%	6.00%	Bad
2/08/2000	0.25%	6.25%	Bad
7/02/2001	-0.50%	5.75%	Good
4/04/2001	-0.50%	5.00%	Good
3/10/2001	-0.25%	4.50%	Good
5/12/2001	-0.25%	4.25%	Good
8/05/2002	0.25%	4.50%	Bad
5/11/2003	0.25%	5.00%	Bad
2/03/2005	0.25%	5.50%	Bad

Table 3 Banking Firm CARs

Panel A contains the cumulative CARs during rate increase events for our sample banks. The CARs are calculated by accumulating the cross sectional average abnormal returns during each event sub-period on a day by day basis into pre-event, on-event and post-event sub-periods together with the associated Z scores. The cross sectional abnormal returns are calculated by taking a average for each event day across all sampled banks and across all rate increase events on a day by day basis for each of the days in the event window.

Panel B contains bank CAR data during rate decreases calculated as for Panel A

Panel A Bank Stocks – Rate Increases		
Window	CAR	Z (CAR)
-15 to -2		
Pre-event	1.144%	2.599***
-1 to +1		
On-event	-0.545%	-2.486 **
+2 to +10		
Post-event	-0.083%	-0.362
-15 to 10		
Total event	0.517%	0.828

Panel B Bank Stocks – Rate Decreases		
Window	CAR	Z(CAR)
-15 to -2		
Pre-event	0.671%	2.231**
-1 to +1		
On-event	0.393%	2.439**
+2 to +10		
Post-event	-0.075%	-0.443
-15 to +10		
Total event	0.990%	2.152**

* significant at 10% ** significant at 5% *** significant at 1%

Figure 1 Banking firms' CARs during RBA increase events

Shown below is the graph of financial firms abnormal returns graphed during event time on a day by day basis. The vertical axis is the abnormal return in percentages and the horizontal axis days relative to the event day, 0 being event day.

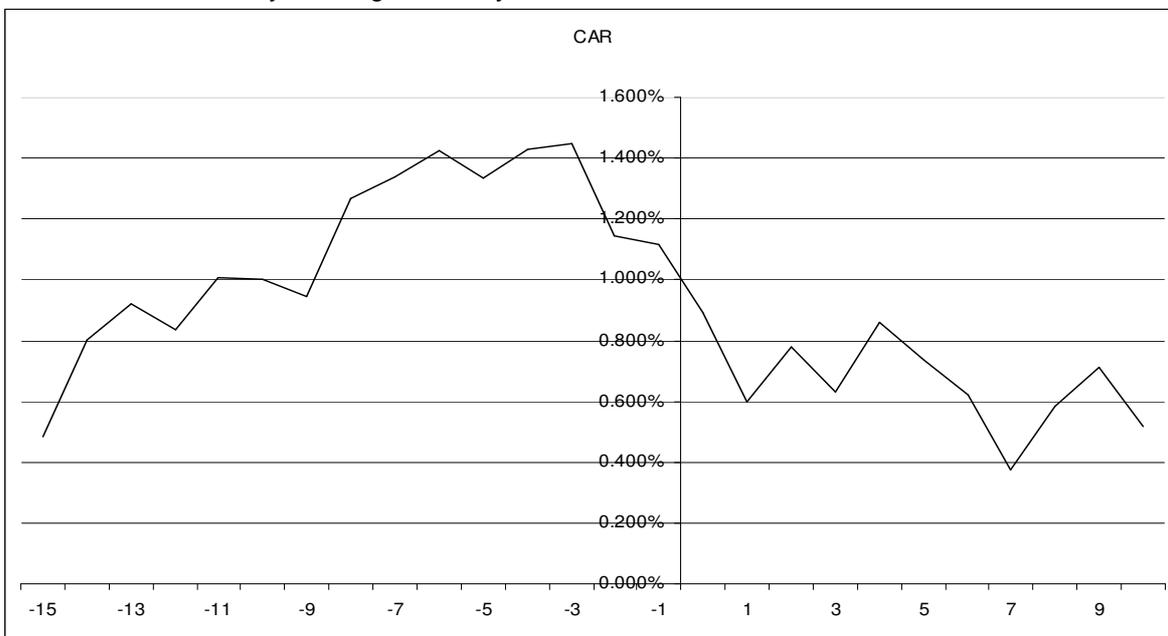


Figure 2 Banking firms' CARs during RBA decrease events

This graph presents financial firms cumulative average abnormal returns graphed during event time on a day by day basis. The vertical axis is the abnormal return in percentages and the horizontal axis days relative to the event day, 0 being event day.

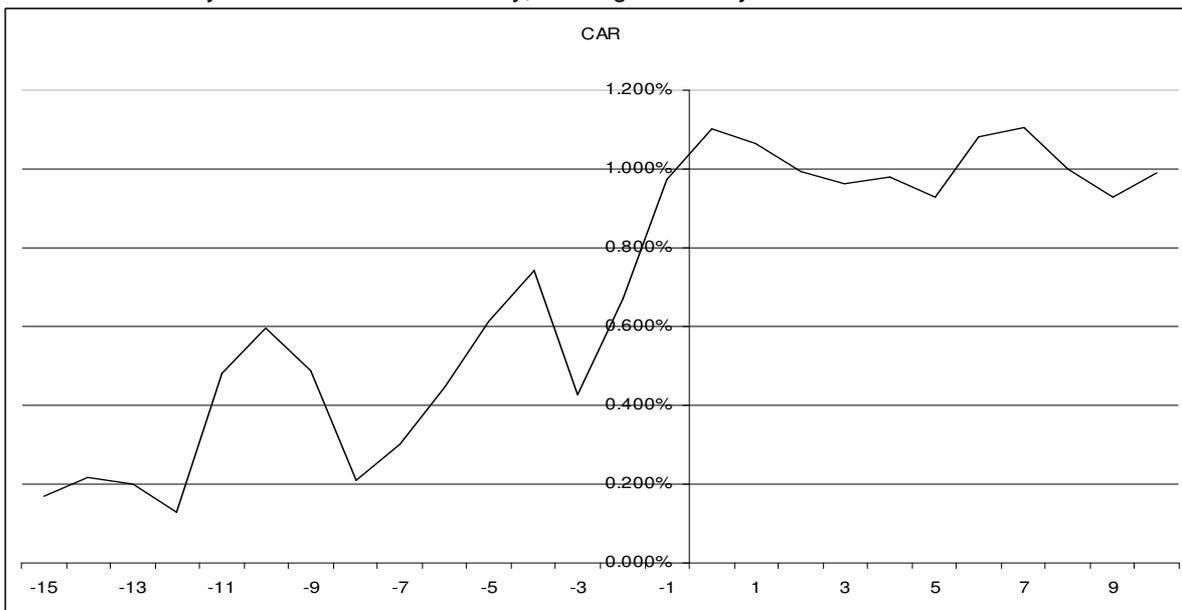


Table 4 Non-financial Firms' event period CARs

Panel A contains the cumulative CARs during rate increase events for our sample non financial indices. The CARs are calculated by accumulating the cross sectional average abnormal returns during each event sub-period on a day by day basis into pre-event, on-event and post-event sub-periods together with the associated Z scores. The cross sectional abnormal returns are calculated by taking an average for each event day across all sampled non-financial indices and across all rate increase events on a day by day basis for each of the days in the event window. Panel B contains non financial indices CAR data during rate decreases calculated as for Panel A.

Panel A		Non-financial firms – Rate increases	
Window	CAR	Z(CAR)	
-15 to -2			
Pre-event	-0.610%		-1.596
-1 to +1			
On-event	0.128%		0.317
+2 to +10			
Post-event	-0.532%		-1.433
-15 to 10			
All Event	-1.015%		-1.820*

Panel B		Non-Financial Firms - Rate Decreases	
Window	CAR	T (CAAR)	
-15 to -2			
Pre-event	-0.280%		-1.218
-1 to +1			
On-event	-0.015%		-0.230
+2 to +10			
Post-event	0.267%		1.182
-15 to 10			
Total Event	-0.028%		-0.415

* significant at 10% ** significant at 5% *** significant at 1%

Figure 3 Non-financial firm CARs during RBA increase events

Shown below is the graph of non-financial firms abnormal returns graphed during event time on a day by day basis. The vertical axis is the abnormal return in percentages and the horizontal axis days relative to the event day, 0 being event day.

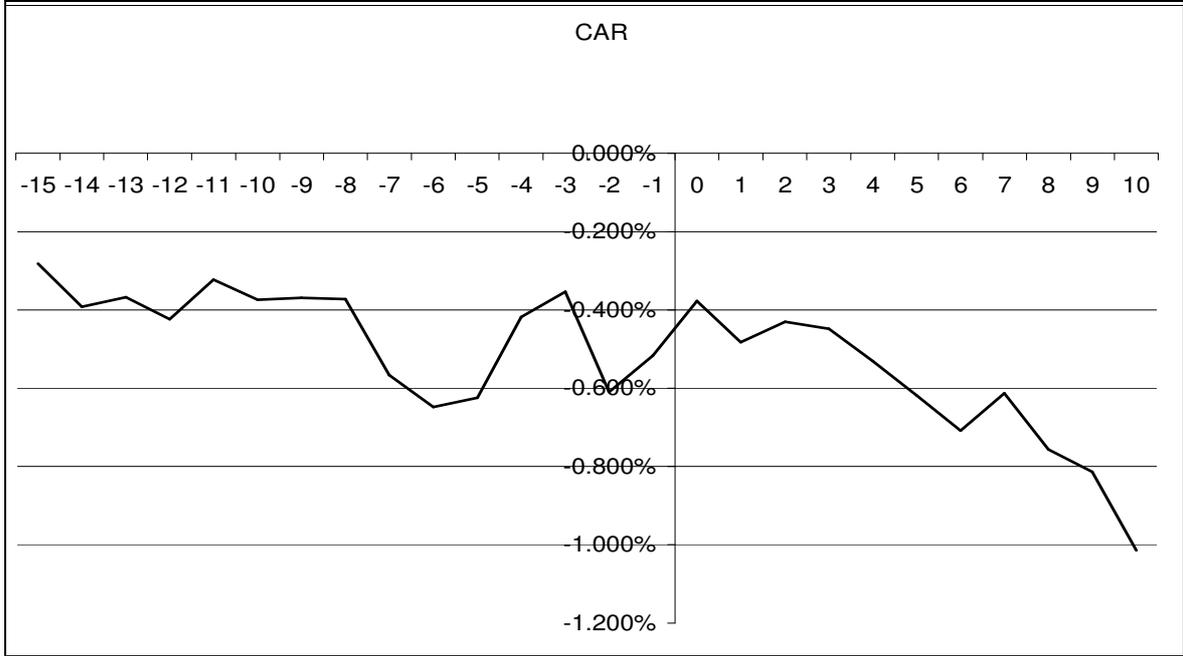


Figure 4 Non-financial firms' CARs during RBA decrease events.

This graph presents non-financial firms abnormal returns graphed during event time on a day by day basis. The vertical axis is the abnormal return in percentages and the horizontal axis days relative to the event day, 0 being event day.

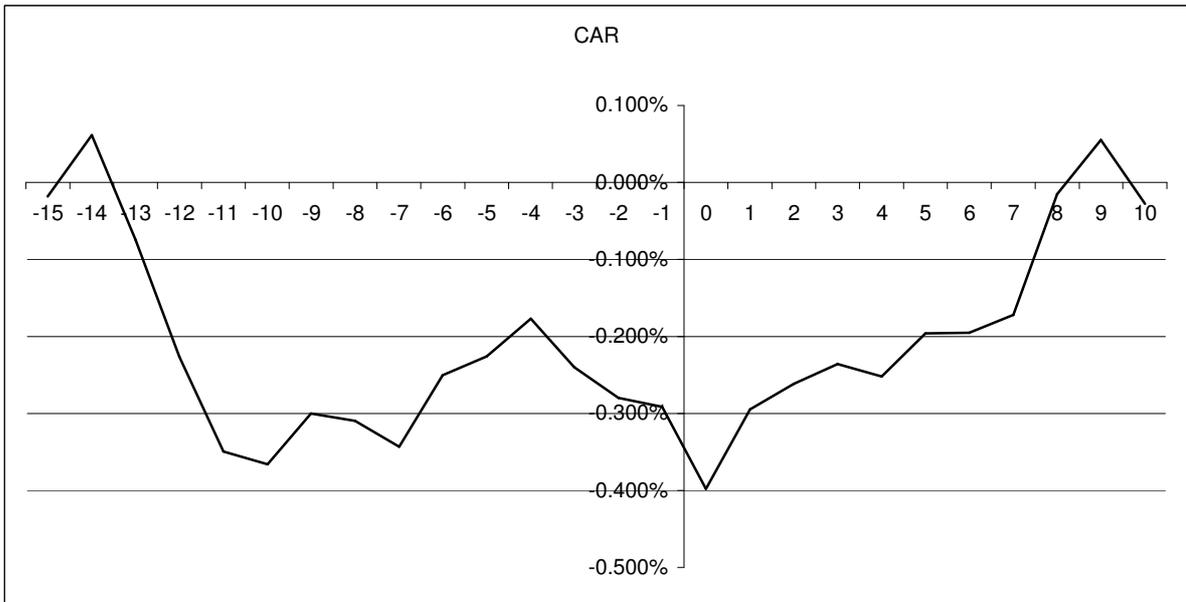


Table 5 Generalised sign test for positive abnormal returns

Reported below are the results of our generalised sign test. The table shows a count of the observations used during each of the increase and decrease estimation periods for cumulative returns to determine the expected proportion of positive returns. This is then used as a bench mark to test the count of the positive returns during the event period for rate increase and decrease events.

Generalised Sign Test for Positive Cumulative Abnormal returns				
		Est. Period	Event Day	Event Per.
Increases	Positive returns	9682	39	51
	No.	19,200	96	96
	Proportion	50.4%	40.6%	53.1%
	Z value		(1.92) *	0.53
Decreases	Positive returns	15157	89	98
	No. ARs	31,000	155	155
	Proportion	48.9%	57.4%	63.2%
	Z value		2.12 **	3.57 ***

* significant at 10% level ** significant at 5% level *** significant at 1% level