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Interest rate pass through and the asymmetric relationship between the cash rate and the mortgage rate

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Abstract

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Keywords

cash, between, relationship, mortgage, asymmetric, interest, rate, pass

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Interest Rate Pass Through and the Asymmetric Relationship between the Cash Rate and the Mortgage Rate*

There is an ongoing controversy over whether banks' mortgage rates rise more rapidly than they fall due to their asymmetric responses to changes in the cash rate. This paper examines the dynamic interplay between the cash rate and the standard-variable mortgage rate using monthly data in the post–1989 era. Unlike previous Australian studies, our proposed threshold and asymmetric error-correction models account for both the amount and adjustment asymmetries. We found that the RBA's (Reserve Bank of Australia) rate rises have a much larger and more instantaneous impact on the mortgage rate than rate cuts.

JEL classification codes: C24, C58, E43 and E58.

Keywords: Banks' mortgage rates, Asymmetric and threshold error-correction models, Australia.

I Introduction

Examining the asymmetric behaviour of banks has been an important and ongoing empirical issue in macroeconomics and finance since the pioneering work of Eichengreen, Watson and Grossman (1985) in which they analysed the Bank of England's discount rate policy under the interwar gold standard (1925–31). They found that there was asymmetry in the Bank's response to reserve gains and losses: the Bank increased its discount rate upon losing reserves but failed to reduce it upon gaining them. In the contemporary literature this phenomenon is referred to as Bacon's (1991) "rockets-and-feathers hypothesis". Bacon argued that gasoline prices "shoot up like rockets" in response to a positive rise in oil prices and "float down like feathers" in response to a fall. *Inter alia*, Hannan and Berger (1991) and Neumark and Sharpe (1992) are among earlier studies that have tested the "rockets and feathers hypothesis" in the context of the banking

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industry. Neumark and Sharpe (1992) found that consumer deposit interest rates respond more slowly to positive than negative changes in the market interest rates.

In this paper we examine two specific issues. First, in overall terms, do standard-variable mortgage rates respond asymmetrically to changes in the RBA's cash rate? If the cash rate changes, will Bacon's (1991) "rockets-and-feathers hypothesis" be applicable in the context of Australia's mortgage rates? Second, when the cash rate increases by 1 per cent, how much and how quickly does the standard-variable rate rise? If there exists a significant degree of asymmetric rate adjustments, one may then argue that financial institutions are profiting from the RBA rate changes. The second issue is of immense interest in the light of publicly held beliefs regarding increasing bank profits. Liu, Margaritis and Tourani-Rad (2011) argued that banks in Australia and New Zealand are very slow to pass on reductions in official interest rates and/or cost of funds to borrowers and they are profiting at the expense of their customers.

The cash rate is not the only factor that affects lenders' behaviour. The response of individual lenders to changes in their funding cost is also influenced by a number of other factors such as the extent of securitisation and individual bank exposures to external sources.[1] However, the cash rate has become increasingly politicised and is the focus of much attention by media commentators. This is not hard to understand as for many families, mortgage payments constitute a substantial part of their income and interest rate changes have a direct and appreciable effect on their consumption. When the RBA lowers the cash rate, the media tends to focus on which lenders reduce their rates more quickly and how much of the change is passed onto borrowers.[2]

[1] Maudos and Fernandez de Guevara (2004, p.2277) examined the interest margin in the banking sectors of five European countries (*i.e.* Germany, France, the UK, Italy and Spain) during the period 1993–2000 and found that "the 'pure' interest margin depends on the competitive conditions of the market, the interest rate risk, the credit risk, the average operating expenses and the risk aversion of banking firms, as well as … opportunity cost of reserves, payment of implicit interest and quality of management."

[2] The 7:30 Report (ABC), 'Banks quiet on rates cut', 7 Dec 2011: http://abc.net.au/7.30/content/2011/s3386046.htm (accessed 6 March 2012).

Politicians of all persuasions in Australia have also advised banks (particularly the “Big 4”) against increasing mortgage rates by more than increases in the RBA’s cash rate.[3] For example, in December 2009, three of Australia’s four largest banks caused outrage by raising rates more than the RBA’s rate rise, while in February 2010 former Prime Minister, Kevin Rudd, urged banks to follow a decision by the National Australia Bank to keep interest-rate adjustments in alignment with any official rate rise.[4] Banks have responded in a variety of ways, with some justifying rate rises in excess of those of the RBA’s cash rate based on the increased cost of funding while others have taken advantage of rate rises to increase their market share.[5] It should be noted that this is not a new issue (see Gittins, 1991).

The asymmetric pass through of funding costs into mortgage interest rates is by no means Australia specific. Other developed countries face the same dilemma. Corvoisier and Gropp (2002) and Bikker and Haaf (2002) have highlighted substantial differences across European countries in terms of the pass through of monetary policy interest rate changes into money market rates. Bikker and Haaf examined banking-sector competition in 23 countries and discovered that competition is much weaker in local markets. Using the Dutch data, both Toolsema and Jacobs (2007) and de Haan and Sterken (2011) found that there is asymmetric pass through of funding costs into mortgage-interest rates as banks tend to raise interest rates immediately once costs rise, while hesitating to lower their rates when costs drop. Their pass-through parameter was estimated to be around half of the Euro-zone average (de Haan and Sterken, 2011).

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[3] ABC Radio, ‘PM plays down bank rate rise chances,’ 26 October 2007: http://www.digradio.com.au/news/stories/2007/10/26/2071270ABC.htm, ABC Radio, ‘Costello warns banks against rates rises,’ 23 October 2007: http://www.abc.net.au/news/stories/2007/10 /23/2068276.htm (both accessed 7 November 2011).

[4] Money, ‘Kevin Rudd warns banks not to raise interest rates,’ 2 February 2010: http://money.ninemsn.com.au/ (accessed on 5 November 2011)

[5] ABC Radio, ‘Banks have grounds to raise home loan rates: Deloitte,’ 2 November 2007: http://www.digradio.com.au/news/stories/2007/11/02/2080595.htm (accessed 7 November 2011.)

There are numerous studies in the literature which found evidence of asymmetric pass through in the mortgage market (*e.g.* Allen, Rutherford, and Wiley, 1999; Haney, 1988; Hofmann and Mizen, 2004; de Haan and Sterken, 2011). Hofman and Mizen (2004) observed downward rigidity of the mortgage interest rate in the UK, the US and Dutch markets. Payne and Waters (2008) also found that the response of the prime rate to changes in the federal funds rate in the US was asymmetric. By adopting the methodology proposed by Enders and Siklos (2001), Payne (2007, 2006) provided convincing evidence that US mortgage rates were cointegrated with the federal funds rate in the long run but with incomplete short-run pass through. Other international evidence on incomplete pass through exists for New Zealand retail rates (Liu et al., 2008); Canadian mortgage rates (Allen and McVanel, 2009) and the US online mortgage rates (Arbatskaya and Baye, 2004).

Lim (2001) examined the asymmetric adjustments between three different types of interest rates in Australia: a bank bill rate, a loan rate and a deposit rate. She uses a multivariate asymmetric error-correction model to capture the long- and short-run relationships between the levels of the rates and short-run relationships between the changes in the rates. Her empirical results indicate that "banks value their borrowing customers and tend to pass on decreases in the loan rates faster than they pass on increases" (Lim, 2001, p.146).

In a recent article Karamujic (2011) used monthly data (June 1994–March 2004) to examine the nature of seasonality in the mortgage interest rates of two major banks in Australia (*i.e.* National Australia Bank and Commonwealth Bank of Australia). By adopting a structural time series modelling approach, he finds evidence of significant seasonal variations in the standard-variable mortgage rates in May, June, November, December and January. He concludes that "the observed seasonalities are not related to the bank's intervention and can be attributed to the particular stage of the interest rate cycle" (Karamujic, 2011, p.337).[6]

[6] Some of these seasonal variations in the data have been captured in this study by the AR(1), AR(6) and AR(9) terms in Table 2.

This paper offers an analytical modelling framework to quantify and assess the "rocket-and-feathers hypothesis". The results increase our understanding of the mortgage lending market in Australia. By testing two different types of possible asymmetries (*i.e.* the amount asymmetry and adjustment asymmetry), in this paper we address an important policy issue not recently tackled in the Australian context. To the best of our knowledge, only three overseas studies have incorporated both the amount and adjustment asymmetries in their short-run dynamic models for mortgage rates: (1) Allen and McVanel (2009) in their study of the Canadian mortgage market; (2) de Haan and Sterken (2011) in their work on the daily interest rate adjustment in the Dutch mortgage market; and (3) Liu, Margaritis and Tourani-Rad (2011) in their aggregate analysis of the interplay between the six-month deposit rate and two retail interest rates (the standard-variable mortgage rate and the business lending rate) in New Zealand. The majority of previous studies have only tested for the adjustment asymmetry (see for example Sarno and Thornton, 2003; Chong et al., 2006; Liu et al. 2008; Chong, 2010).

The rest of this paper is structured as follows. In Section II our threshold and asymmetric error-correction models are briefly presented. Section III discusses the choice of our sample period and presents the normality and unit-root test results. Section IV presents the empirical results of the short- and long-run mortgage rate models and finally Section V provides some concluding remarks.

II Theoretical Framework

The cash rate is the baseline for rates charged by Australian financial institutions for their various loans including mortgage rates. Based on a relationship between the cash rate (r_t) and the mortgage rate (i_t) in the long run we assume that $i_t = \beta r_t + \varepsilon_t$. In this equation β denotes the long-run pass-through parameter, and ε_t is the residual term. In the case where i_t and r_t are cointegrated an ECM version of this relationship, with thresholds for positive or negative deviations from the long run relationship, can be specified.

In this paper two short-run dynamic models are estimated: in the first model (equation 1) the threshold parameter is zero (or $\tau = 0$) and in the second model (equation 2) this parameter is data-determined through a grid search. Thus:

$$\Phi_k(L)\Delta i_t = \xi_0 + \sum_{s=0}^{q} \lambda_s^+ \Delta r_{t-s}^+ + \sum_{s=0}^{q} \lambda_s^- \Delta r_{t-s}^- + v_t + \begin{cases} \omega^+ ECM_{t-1}^+ & \text{If } ECM_{t-1}^+ > 0 \\ \omega^- ECM_{t-1}^- & \text{Otherwise} \end{cases} \quad (1)$$

$$\Phi_k(L)\Delta i_t = \xi_0 + \sum_{s=0}^{q} \lambda_s^+ \Delta r_{t-s}^+ + \sum_{s=0}^{q} \lambda_s^- \Delta r_{t-s}^- + v_t + \begin{cases} \theta^+ ECM_{t-1}^+ & \text{If } ECM_{t-1}^+ > \tau \\ \theta^- ECM_{t-1}^- & \text{Otherwise} \end{cases} \quad (2)$$

where $\Phi_k(L) = (1 - \rho_1 L - \rho_2 L^2 - ... - \rho_k L^k)$ represents a *k*-order polynomial lag operator (which is assumed to have no zero within or on the unit circle), *k* is the number of autoregressive terms, ω^+, ω^-, θ^+ and θ^- are the error correction parameters, which are expected to be negative, $\hat{\varepsilon}_t = ECM_t$ and λ_s^+ and λ_s^- are the short-run effects of positive and negative changes in the cash rate on the mortgage rate at time *t-s* (where *s* can range between 0 and 12), respectively. This choice of lags allows for potential seasonality effects. The superscripts + and – denote the positive part and negative part of the time series, respectively as defined below.

$$\Delta r_t^+ = max\left\{\Delta r_t^+, 0\right\} \Rightarrow \Delta r_t^+ = \Delta r_t \text{ if } \Delta r_t > 0 \text{ and } \Delta r_t^+ = 0 \text{ if } \Delta r_t \le 0 \quad (3)$$

$$\Delta r_t^- = min\left\{\Delta r_t^-, 0\right\} \Rightarrow \Delta r_t^- = \Delta r_t \text{ if } \Delta r_t \le 0 \text{ and } \Delta r_t^- = 0 \text{ if } \Delta r_t > 0 \quad (4)$$

Equations (1) and (2) capture any possible short- or long-run asymmetric effects of changes in the cash rate on the mortgage rate. This is the first Australian study in which both the amount $(\lambda_s^-, \lambda_s^+)$ and adjustment $[\omega^-, \omega^+$ (or θ^-, θ^+)] asymmetry coefficients have been incorporated in a short-run dynamic model for mortgage rates.

In both equations (1) and (2) the magnitude of short-run coefficients (*i.e.* λ_s^+ and λ_s^-) depends on whether changes in r_t are positive or negative. This means the short-run effects of rate rises on the mortgage rate are allowed to be different from those of rate cuts. Unlike the asymmetric model formulated in equation (1), in the threshold model (equation 2), the parameter τ is assumed to be different from zero. Once the resulting residuals have been sorted in ascending or descending order, we conduct a grid search within the middle 85 per cent of the observations and select an optimum value of the threshold, which yields the lowest residual sum of squares.

Using equations (1) and (2), a Wald test can be employed to test the above two types of asymmetries. First, if the null hypothesis $\lambda_s^+ = \lambda_s^-$ (for all s values) is rejected, then positive and negative short-run changes in the cash rate have asymmetric effects on mortgage interest rates. Accordingly, if $\lambda_s^+ > \lambda_s^-$, then in the short-run lenders pass on market-interest rate rises more than market-interest rate decreases. This phenomenon is referred to as the amount asymmetry.

Second, if the null hypotheses $\omega^+ = \omega^-$ or $\theta^+ = \theta^-$ are rejected, one can argue that the adjustment process towards the long-run equilibrium is also asymmetric and hence there is evidence of adjustment asymmetry. If $|\omega^-| > |\omega^+|$ or $|\theta^-| > |\theta^+|$, then a lagged negative disequilibrium between the actual interest rate and its equilibrium path results in a relatively swift error correction as compared to the case of a lagged positive disequilibrium. This is consistent with financial institutions preferring to increase the mortgage rate to its long-run path when $ECM_{t-1} < 0$ or $ECM_{t-1} < \tau$, but having less desire to lower their rate to its equilibrium path, thus causing the speed of adjustment to be more sluggish or sometimes non-existent. This means that in the case of adjustment asymmetry either $|\omega^-| > |\omega^+|$ or $|\theta^-| > |\theta^+|$, depending on whether equation (1) or equation (2) is being used in the testing procedure. For a detailed discussion of the distinction between the amount and adjustment asymmetries in the literature see Chen et al, (2005), Bachmeier and Griffin (2003) and Bettendorf et al (2009) in the context of petrol prices; Allen and McVanel (2009) and de Haan and Sterken (2011) in the context of mortgage rates.

III Data

(i) Choice of the Sample Period 1989–2011

Since 1989, the RBA has conducted monetary policy by setting the desired interest rate on overnight loans in the money market (Grenville, 1990). This year is the starting point for our sample period (April 1989–October 2011). Figure 1 suggests that there is a very close relationship between the cash rate and the standard-variable mortgage rate. We use monthly data as lower frequencies have been found to obscure asymmetries (see Brannas and Ohlsson, 1999).

[FIGURE 1 ABOUT HERE]

(ii) Normality and Unit Root Test Results

Based on the reported Jarque-Bera statistic in Table 1, the null hypothesis of normality is rejected at any conventional level for all series as their distributions are positively skewed and show a typical leptokurtic pattern with the kurtosis statistic exceeding well above 3.0. The augmented Dickey-Fuller (1981) and Kwiatkowski-Phillips-Schmidt-Shin (KPSS, 1992) test results have been presented in Table 1. In this paper the lowest value of the Schwarz criterion (SC) has been used as a guide to determine the optimal lag length. In Table 1 we have also reported the results of the Lee and Strazicich (2003) test, which endogenously incorporates two structural breaks in the testing procedure. The resulting two break dates for r_t and i_t are shown in Figure 1 by the vertical dotted lines and solid lines, respectively. Irrespective of which test is considered, it appears that both r_t and i_t contain a unit root and the residuals obtained from

$i_t = \beta r_t + \varepsilon_t$ are stationary.[7] Hence, one can argue that r_t and i_t are cointegrated and this is easily backed up by the visual inspection of the graph presented in Figure 1. Lowe (1995) also found similar results based on his sample period which ran from January 1986 to October 1994.

[TABLE 1 ABOUT HERE]

IV Empirical Results

A cursory look at Figure 1 reveals that during the entire sample period 1989–2011 there are four specific periods when both the mortgage rate and the cash rate witnessed a noticeable downward trend: January 1990–July 1994 (as a result of a recession), May 1996–January 2000 (as an outcome of the Asian financial crisis), January 2001–April 2002 (due to another recession) and September 2008–August 2009 (as a consequence of the recent global financial crisis). As can be seen from Figure 1, while the cash rate was on a downward trajectory during these periods, the reduction in the mortgage rate was not of the same magnitude over time. As a result, the gap between these two rates became wider when both rates were decreasing. This phenomenon is more noticeable in the first (January 1990–July 1994) and the last periods (September 2008–August 2009). Such behaviour was not exhibited at times when the cash rate was on the rise. Attention is now directed to examine such an asymmetric behaviour using a more formal econometric approach.

(i) Estimated Threshold Error-Correction Models

In this section, we estimate the long-run relationship between the standard-variable mortgage rate and the cash rate by OLS. With R^2=0.637, the resulting residuals from our estimated relationship, $i_t = 1.252 r_t$, appear to be stationary (ADF=-4.316). Thus, $ECM_{t-1} = i_{t-1} - 1.252 r_{t-1}$ can

[7] The non-stationarity of interest rates has important implications for macroeconomic modelling at both the theoretical and the empirical levels. If interest rates contain unit roots, a one-time shock to interest rates will have permanent effects through time. On the other hand, if interest rates are stationary, then innovations are of transitory nature and reversible. The presence of a unit root in the nominal interest rates is found in many studies in the literature. However, DeJong et al. (1992) argue that this non-stationarity can be attributed to small samples and the well-known low power of unit root tests, which cannot distinguish between an I(1) and a near unit-root process.

be used as an error correction mechanism in a short-run dynamic model. The long-run pass-through parameter is estimated at 1.252, which is statistically significant at the 1 per cent level with a correct sign. This means that in the long run a 1 per cent rise in the cash rate by the RBA leads to a 1.252 per cent increase in the mortgage rate. We also tested the hypothesis that the long-run pass through parameter is equal to 1. Given $F(1,270)=305$ and p-value=0.00, such a hypothesis is rejected. Before using OLS, we also conducted the Hausman (1978) test in the following two stages to ensure that there is no simultaneity between the mortgage rate (i_t) and the cash rate (r_t). First, we regressed r_t on our selected instrumental variables (*i.e.* i_{t-1}, i_{t-2}, r_{t-1} and r_{t-2}) and then the fitted values (*i.e.* $\hat{r}_t$) and the resulting residuals (*i.e.* $\hat{e}_t$) were obtained. Second, i_t was regressed on the estimated $\hat{r}_t$ and $\hat{e}_t$. Since the coefficient for $\hat{e}_t$ (-0.113) was not statistically significant (p-value=0.67), it was concluded that the cash rate was weakly exogenous with respect to the dependent variable.

As discussed in the previous section, we have adopted two dynamic error-correction models (*i.e.* equations 1 and 2). In the first short-run dynamic model (Model I) the threshold parameter (τ) was assumed zero. However, in Model II, which is based on equation (2), this parameter is determined endogenously by the data. In other words, after sorting the resulting residuals, we searched within the middle 85 per cent of the observations and selected a value of the threshold which yielded the lowest residual sum of squares as an estimate of the optimal threshold. The lower and upper values in our grid search were 0.2262 and 1.9194, respectively, with an increment of 0.01 at each step leading to an optimal threshold value of 0.2462.

In terms of determining the optimal lag length (q) in equations (1) and (2), given that we are using monthly data, an upper band of 12 lags was allowed. Following the general-to-specific methodology, insignificant variables in equations (1) and (2) were omitted on the basis of a battery of maximum likelihood tests. We imposed joint-zero restrictions on explanatory variables in the unrestricted (general) model to obtain the most parsimonious and robust equation. The estimation results for both Model I and Model II have been presented in Table 2.

[TABLE 2 ABOUT HERE]

According to Table 2, all of the estimated coefficients are statistically significant at the 1 per cent level and have the expected theoretical signs, with the only exception being ECM^{+}_{t-1}. Both models also perform well in terms of goodness-of-fit statistics. The adjusted R^2 is as high as 0.64 and the overall F test rejects the null hypothesis at the 1 per cent level of significance. Furthermore, both estimated models pass a battery of diagnostic tests and show no sign of serial correlation (see the Breusch-Godfrey LM tests), misspecification (see the Ramsey RESET test), heteroskedasticity (see the ARCH tests) or instability (see the Chow forecast tests in three different out of sample periods). The only diagnostic test that our models could not pass was the Jarque-Bera normality test of the residuals. One should not be concerned about the normality test results as we have used a large sample size with 261 monthly observations.[8] The estimated coefficients of AR(1), AR(6) and AR(9) are also statistically significant. This indicates the presence of some seasonality as also found by Karamujic (2011). The corresponding inverse roots of AR polynomials for both models are well within the unit circle. As can be seen from Table 2, the estimated coefficients in both Models I and II are very similar in terms of their magnitudes and statistical significance.

Ceteris paribus, if in the short run the cash rate increased, say by 1 per cent in a particular month, this would have immediately led to a rise of 1.158 per cent in the mortgage rate. On the other hand, a similar 1 per cent rate cut would have resulted in only 0.550 per cent instantaneous fall followed by a subsequent 0.290 per cent cut a month later. The total short-run effect associated with the RBA's rate cut would then be only 0.84 per cent (0.55+0.29), whereas the

[8] Although the Jarque-Berra statistic rejects the normality of the errors, the reported F statistics are asymptotically justified as the method of moments' diagnostic tests. See Hayashi (2000, sections 2.7 and 2.10).

corresponding effect for a rate rise would be 1.158 per cent. This proffers support for the short-run applicability of the "rockets-and-feathers hypothesis" in the context of the mortgage market in Australia.

What about the adjustment asymmetry? In Table 2 $|\omega^-| > |\omega^+|$ and $|\theta^-| > |\theta^+|$, it is thus clear that whenever the actual mortgage rate is below its equilibrium path at time *t-1 (i.e.* $ECM_{t-1} < 0$), the mortgage rate quickly adjusts towards its equilibrium with an estimated feedback coefficient of -0.176 per month. However, when the mortgage rate is above the equilibrium value or $ECM_{t-1} > 0$, such an adjustment does not take place as the corresponding *t* ratio for the feedback coefficient is insignificant (see the *t* ratio for the coefficient of ECM^+_{t-1} in Table 2). It appears that the Australian mortgage lenders charge above equilibrium rates when such a deviation from the equilibrium path occurs. Conversely, when their actual rates are below the market equilibrium (*i.e.* Model I) or less than a certain threshold (*i.e.* Model II where $\tau = 0.2462$), they correct the prevailing gap by raising their mortgage rates with a feedback coefficient of -0.17.

We have also formally tested the absence of both the amount asymmetry (*i.e.* the short-run asymmetry) and the adjustment asymmetry (*i.e.* the long-run asymmetry) using a Wald test with the results presented in Table 3. The null hypotheses are rejected at the 1 per cent level of significance, irrespective of which model has been used in the testing procedure. Based on these results, one can argue that there is convincing evidence for the existence of both amount asymmetry and adjustment asymmetry. Our results are also consistent with previous studies. An overwhelming majority of previous studies suggest that there is a great deal of asymmetry in the short-run changes in mortgage rates. See for instance Heffernan (1997), Payne (2007, 2006), Toolsema and Jacobs (2007), Saadon, et al. (2008), Liu, et al. (2008), Allen and McVanel (2009) and de Haan and Sterken (2011).

[TABLE 3 ABOUT HERE]

What can possibly explain this phenomenon? In general, Peltzman (2000) believed that various measures of imperfect competition, the existence of consumer search costs, inventory cost, inflation-related asymmetric menu costs, and input price volatility, determine the extent of asymmetric changes in the prices of goods and services. Since interest rates represent the price of borrowed or loaned funds, one can relate to Peltzman's findings with a slightly different perspective regarding changes in interest rates. Previous interest rate studies have identified five explanations for the rigidity in the rate adjustment process: fixed menu cost, high switching cost, imperfect competition, asymmetric information, and interest rate regulation (see *inter alia* Hannan and Berger, 1991; Scholnick, 1996; Chong et al., 2006; and Chong, 2010).

In the context of Australian mortgage rates, Lowe and Rohling (1992) provided a detailed account of the stickiness of various types of loan rates. They argued that the two most important explanations for the downward stickiness of the mortgage rates in Australia are switching costs and risk sharing. Switching costs (such as loan establishment fees, stamp duty, early repayment fees) associated with moving from one housing loan to another could be quite high. It is also argued that "if borrowers are more risk averse than the shareholders of the bank, there exists an implicit risk insurance argument for the stickiness of interest rates" (Lowe and Rohling, 1992, p.11). If competition is not strong and customers' decisions are interest-rate inelastic, then changes in the cash rate may have relatively little impact on mortgage rates.

V Conclusion

Banks' asymmetric behaviour in setting mortgage rates is a cause of concern in the community. As in many other countries, mortgage interest payments constitute a significant proportion of consumer spending in Australia. However, little empirical work has been conducted regarding the dynamic effects of a change in the cash rate on Australia's retail mortgage rate. This paper quantifies the extent of asymmetric behaviour exhibited by the banking industry as a whole by tracing out the dynamic asymmetric responses of lenders to changes in the cash rate over time. Specifically, this paper tests the “rockets-and-feathers hypothesis” in the Australian residential mortgage market. The framework can be adapted to model the asymmetries in other types of retail and wholesale interest rates, including those for credit cards, personal loans, and business loans.

Using monthly data from 1989 to 2011, we found that rate rises are passed onto the consumer faster than rate cuts. The short-run effects of a 1 per cent rise and fall in the cash rate on the mortgage rate are 1.158 per cent (occurred almost instantaneously) and 0.84 per cent (eventuated within 1–2 months), respectively. In sum, one can conclude that when actual mortgage rates are below the market equilibrium value, Australian banks quickly fill the gap by raising their mortgage rates. Conversely, when actual mortgage rates are above the equilibrium path, lenders usually hesitate to lower their rates.

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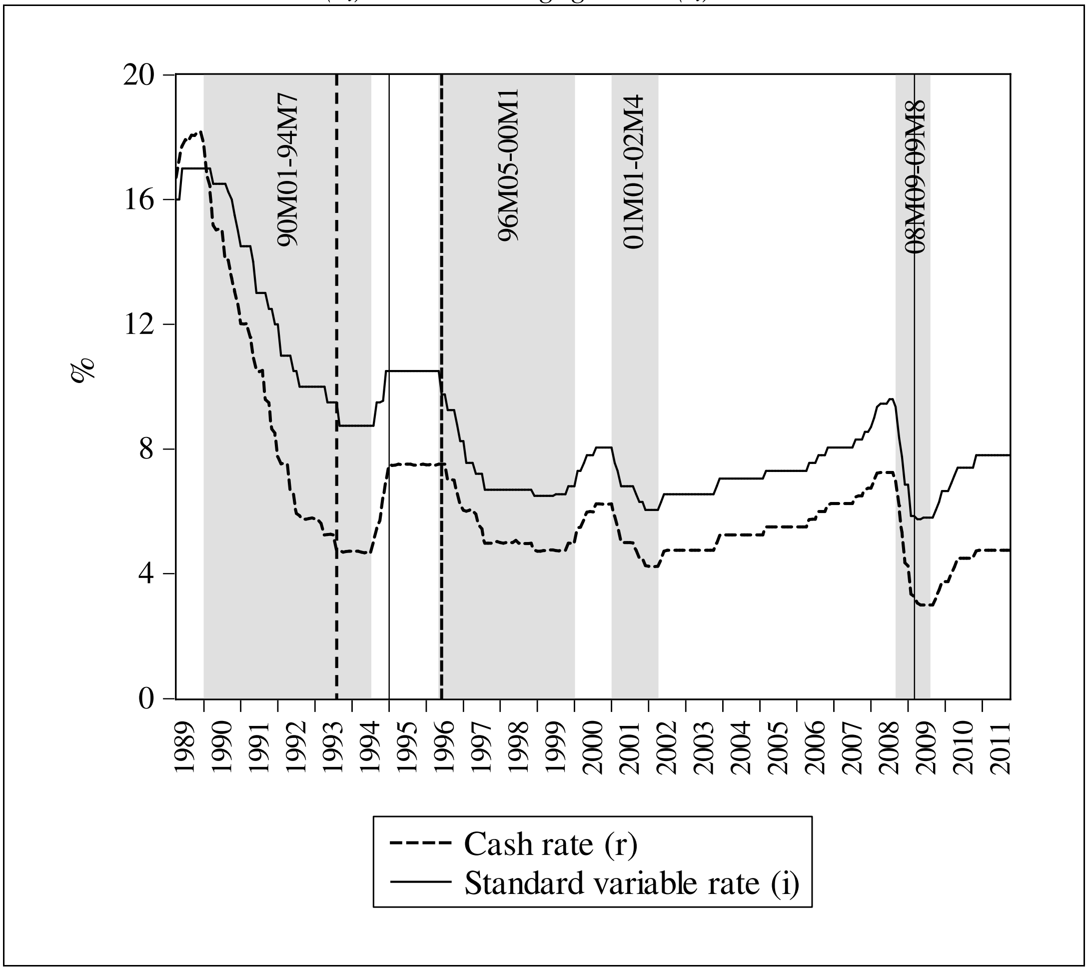
FIGURE 1

The Cash Rate (r_t) and the Mortgage Rate (i_t) 1989M4-2011M10



Note: The endogenously-determined two break dates for r_t and i_t are shown by the vertical dotted lines and solid lines, respectively.

Source: The Reserve Bank of Australia (RBA, 2011).

TABLE 1

Normality and Unit Root Test Results

Description	i_t	Δi_t	r_t	Δr_t	ECM_t
Skewness	1.62	-1.06	2.33	-1.69	-1.976
Kurtosis	4.88	9.42	7.96	8.30	9.051
Jarque-Bera	159*	517*	523*	446*	590*
ADF test:					
t stat.	-2.576	-8.315*	-2.426	-6.854*	-4.316*
Optimal lag	4	1	2	1	4
KPSS:					
LM stat.	0.400*	0.041	0.274*	0.095	0.119
Bandwidth	12	9	12	10	12
Lee and Strazicich LM_τ test:					
t ratio	-2.950	-7.281*	-2.693	-6.856*	-6.617*
Optimal lag	6	6	6	1	8
$\hat{T}_B$	1993:8 2009:3	1993:08 1996:06	1995:01 2009:03	1992:03 1995:01	1994:10 2008:11

Notes: (1) * indicates that the corresponding null hypothesis is rejected at 1 per cent level of significance. (2) The choice between the crash model and the trend break model in the Lee and Strazicich (2003) test was based on the statistical significance of the corresponding parameters.

TABLE 2

Estimated Asymmetric Short-Run Dynamic Models For (Δi_t)

Variable	Model I (Equation 1)			Model II (Equation 2)		
	Coefficient	*t* ratio	*p*-value	Coefficient	*t* ratio	*p*-value
Intercept	-0.009	-0.6	0.55	-0.003	-0.2	0.85
Δr_t^+	1.158*	13.0	0.00	1.153*	13.0	0.00
Δr_t^-	0.550*	11.1	0.00	0.548*	11.1	0.00
Δr_{t-1}^-	0.290*	6.2	0.00	0.291*	6.2	0.00
ECM_{t-1}^+	-0.006	-0.5	0.58	-0.008	-0.8	0.40
ECM_{t-1}^-	-0.176*	-6.1	0.00	-0.175*	-6.2	0.00
D_t	-0.656*	-5.7	0.00	-0.653*	-5.7	0.00
AR(1)	-0.319*	-5.4	0.00	-0.317*	-5.3	0.00
AR(6)	0.218*	4.1	0.00	0.220*	4.1	0.00
AR(9)	0.130*	2.8	0.00	0.131*	2.9	0.00
Goodness of fit statistics:						
R^2	0.657			0.659		
$\overline{R}^2$	0.645			0.647		
Overall $F(7, 251)$	53.5*	0.00		53.9*		0.00
Akaike info criterion	-1.045			-1.050		
Schwarz criterion	-0.908			-0.913		
Hannan-Quinn criterion	-0.990			-0.995		
Diagnostic tests						
DW	1.932			1.932		
Serial correlation LM Test:						
2 lags	1.455		0.24	1.225		0.30
4 lags: $F(4,247)$	1.523		0.20	1.359		0.25
6 lags: $F(6,245)$	1.520		0.17	1.363		0.23
8 lags: $F(8,243)$	1.563		0.14	1.455		0.17
10 lags: $F(10, 241)$	1.280		0.24	1.191		0.30
Ramsey RESET: $F(1,250)$	1.695		0.19	2.257		0.13
Jarque-Bera: $\chi(2)$	535.9*		0.00	528.4*		0.00
Heteroskedasticity ARCH test:						
1 lag: $F(1,259)$	1.892		0.17	2.043		0.15
2 lags: $F(2,258)$	1.400		0.25	1.450		0.24
3 lags: $F(3,257)$	1.284		0.28	1.233		0.30
4 lags: $F(4,256)$	1.255		0.29	1.168		0.33
Chow forecast test:						
2007M01-2011M10: $F(58,193)$	0.774		0.87	0.806		0.83
2008M01-2011M10: $F(46,205)$	1.026		0.44	1.040		0.41
2009M01-2011M10: $F(34,217)$	0.651		0.93	0.661		0.93

Notes: (1) * indicates that the corresponding null hypothesis is rejected at 1 per cent level of significance. (2) EViews and WinRats software packages have been used in generating our results.

TABLE 3

Test Results For Amount and Adjustment Asymmetries

Null hypothesis	Model I		Model II	
	F statistics	*p*-value	*F* statistics	*p*-value
Amount asymmetry:				
$\lambda_0^+ = \lambda_0^-$	F=(1,251)=33.04	0.00	F=(1,251)=32.74	0.00
$\lambda_0^+ = \lambda_0^- + \lambda_1^-$	F=(1,251)=8.99	0.00	F=(1, 251)=8.77	0.00
Adjustment asymmetry:				
$\omega^+ = \omega^-$	F=(1,251)=33.23	0.00	—	—
$\theta^+ = \theta^-$	—	—	F=(1,251)=33.23	