# The behaviour of mortgage interest rates in New Zealand

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*Between February and October 1994, mortgage interest rates rose from an average of 7.4 percent to 9.2 percent in October. This article discusses a simple model of mortgage rate setting which models first mortgage rates as a mark-up over bank funding costs. The model accurately predicts the behaviour of mortgage rates over 1994 and identifies clearly why mortgage rates have risen so sharply this year - namely large increases in bank funding costs have led to higher mortgage rates as banks try to maintain their lending margins.*

## Introduction

This article discusses how mortgage interest rates are determined in New Zealand. Our research shows that mortgage interest rates behave in a manner consistent with a simple mark-up model of mortgage rates where mortgage interest rates are set at a fixed margin over bank funding costs.

Bank funding costs are best approximated as a roughly equally-weighted average of short and long-term wholesale interest rates. This suggests that banks are forward-looking when they set mortgage rates. Long-term rates are less volatile than short-term rates and better reflect the trend in future interest rates. Banks may not wish to change retail mortgage rates as often as wholesale rates move for many reasons including: the preferences of mortgage borrowers for stable interest rates; the degree of competition in the retail lending market; and the fact that banks incur costs if they frequently move retail rates. As a consequence, when setting mortgage rates, banks place a significant weight on expected funding costs, as represented by long-term wholesale rates, not just on actual current funding costs as represented by short term wholesale rates. Retail deposit rates do not appear to be useful in explaining the long-run behaviour of mortgage interest rates.

Although there is some evidence over the last year of stronger competitive pressures between banks to attract mortgage borrowers, bank margins over funding costs have not moved appreciably from their historical levels. Consequently, the relationship between mortgage rates and wholesale rates in 1994 is similar to that observed historically.

Wholesale interest rates have risen appreciably over 1994, taking bank funding costs and mortgage rates up with them. But mortgage rates have been risen more slowly than funding costs - in part due to the volatility in short-term interest rates over this year. This volatility has made it difficult for banks to accurately assess the longer-term trends in their funding costs. Thus they have chosen not to raise mortgage rates as fast as wholesale rates have risen. This behaviour is typical of the past response of mortgage rates to periods of more volatile wholesale interest rates.

## I. How are mortgage rates determined? - a framework

A simple view of a bank is that it is an organisation which borrows money and then on-lends it to others at a profit. Thus banks borrow money from investors, depositors and the public at some interest rate and sell it again at a margin. In the case of mortgage interest rates this relationship can be expressed as:

$$FIRSTM = MARKUP + COSTS \qquad (1)$$

where: FIRSTM is the First Mortgage Interest rate;
MARKUP is the margin that banks charge on top of their funding costs for providing the mortgage;
COSTS represent bank funding costs or what it costs the bank to obtain the funds which it then lends to mortgagors.

### 1. What is the margin?

The margin in this model does not represent the pure profit associated with providing mortgage finance. Banks must fund the various costs of intermediation (e.g administrative costs, bank workers' salaries) from this margin. The effects of cross-subsidisation may also cloud the interpretation of the margin in equation (1). Cross-subsidisation occurs when banks choose to make smaller profits (or even small losses) on some operations to retain competitiveness and market share in that sector. The smaller profits from some operations are offset by larger profits from others such that overall corporate profitability is preserved. If these types of effects are prevalent then the observed margin over funding costs may not be at all representative of the costs associated with provid-

ing that banking service or the profits made from providing that service. But as long as the degree of cross-subsidisation remains relatively constant then a relation such as equation (1) may exist, be stable, and hence be useful in analysing mortgage rate setting.

## 2. What are bank funding costs?

In a pure accounting framework bank funding costs are a weighted average of all the interest rates the bank must pay to attract funds. The weights on each source of funding would be the amount of funding raised from a given source as a percentage of all funding that the bank obtains. Banks attract funding from a variety of sources and at a number of different maturities, e.g. banks take deposits from an at-call basis to up to five years' term from small retail depositors. They also deal in the wholesale markets and raise funds in instruments such as bank bills, bonds and equity issues. Taken literally, therefore, the COSTS term would include perhaps 20 or 30 different funding instruments. But we can cut this down considerably by assuming that the interest rate on one particular instrument is representative of a number of other similar funding instruments. For example, we could include the 6-month deposit rate as a proxy for all retail funding or the 90-day Bank bill rate to represent all of the sources of short-term wholesale funding to which banks have access.

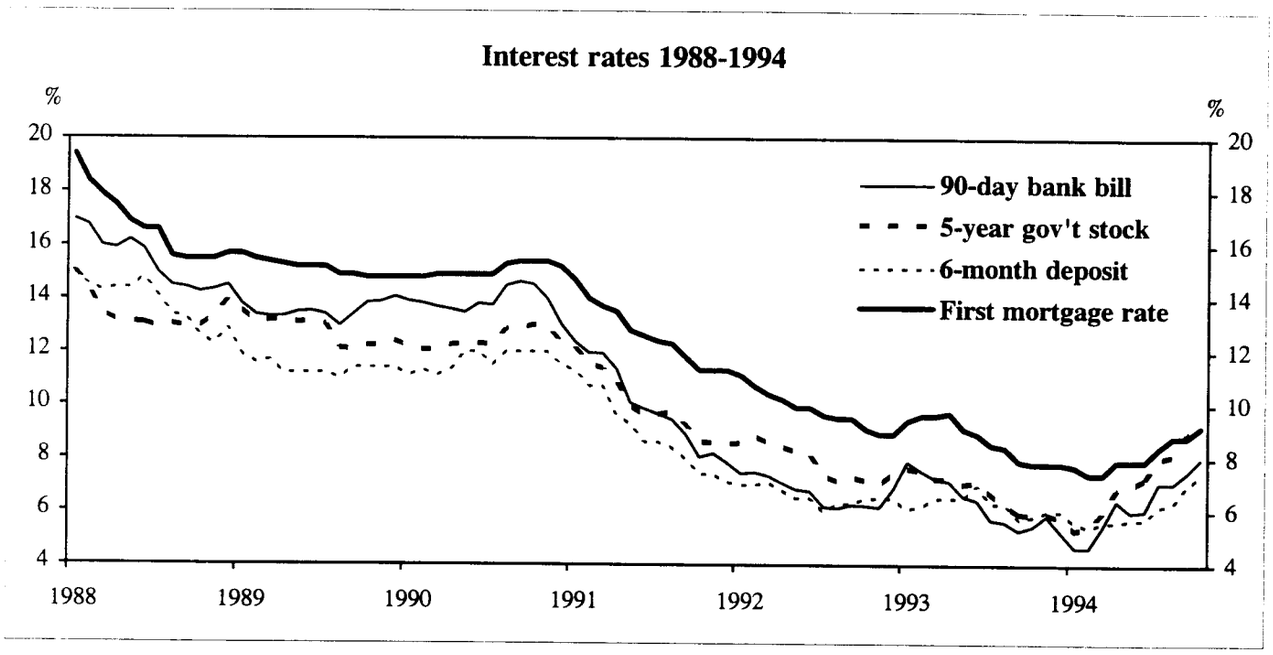
A natural grouping is to separate all funding sources into retail and wholesale funding sources. Given the diversity among the wholesale funding instruments available, we may also find it useful to distinguish between short and long-term wholesale funding sources.

So in a pure accounting view of the funding costs relevant to mortgage rates, we might proxy COSTS as a weighted average of retail and short and long-term wholesale financing instruments. The weights for each instrument would be the total value of the funding obtained from that instrument divided by the total funding that the banks draw in.

In a very simple world, banks might simply set mortgage and other lending rates as a simple (risk adjusted) markup over their cost of funds. This would imply the necessity of changing lending rates constantly because actual funding costs will vary from day to day. If, however, banks change some of their lending rates infrequently or, equivalently, offer some loans at fixed rates for specified periods of time, then setting the rates for such loans will require banks to focus on expected funding costs, not just current costs. Expected funding costs may be better represented by long-term rather than short-term interest rates along the lines posited by the expectations theory of the term structure of interest rates. In this case, longer-term wholesale rates may be more important for mortgage rates than the actual proportion of long-term funding relative to total funding suggests.

Figure 1 plots the behaviour of the first mortgage interest rate and its proposed determinants: the 6-month deposit rate; the 90-day bank bill rate; and the 5-year government bond rate over the 1988-94 period. All of the rates share a common downward trend over the period, so it is diffi-

**Figure 1**



cult to identify which particular rates correlate best with the mortgage rate. But it does appear that there are instances where mortgage rates move with the wholesale rates, but perhaps fewer instances where mortgages move in line with deposit rates.

## II. A model of New Zealand mortgage rates

To examine the influence of alternative types of funding costs on New Zealand mortgage rates, an error correction model of New Zealand mortgage rates is estimated over the 1988 - 94 period. The actual specification and diagnostics are reported in the technical appendix.[1]

An error correction model differentiates between long and short-run influences on mortgage rates. In the long run, mortgage rates are assumed to be determined according to an equation such as equation (1). In the short run however, mortgage rates may well deviate from levels consistent with the long-run relationship with funding costs. This could be due to temporary influences from competition in the retail markets or simply due to the fact that banks find it costly to adjust their mortgage rates frequently. For this reason, a short-run equation for mortgage determination is also estimated. This equation is linked to the long-run equation by virtue of the presumption that although the mortgage rate may well deviate from the long-run equilibrium rate, it will be influenced by it. The mortgage rate in any one month is represented as follows:

$$FIRSTM_t = FIRSTM_{t-1} + \alpha(FIRSTM_D - FIRSTM_{t-1}) + DYNAMICS \quad (2)$$

or:

Mortgage rate this month = Mortgage rate last month + An adjustment to the long-term equilibrium mortgage rate + Dynamic adjustment terms

where: FIRSTM is the First Mortgage interest rate;
$FIRSTM_D$ is the long-run equilibrium First Mortgage interest rate;
DYNAMICS represent the effects of short-run influences on the mortgage rate.

1 Further details on the estimation of this model are available from the author.

Thus the current mortgage rate is equal to last month's rate, plus an adjustment term which reflects the previous month's difference between the actual and long-run equilibrium mortgage rate. If the actual rate is below the long-run equilibrium rate then the mortgage rate rises, but not by enough to completely eliminate the gap. Instead banks adjust their rates slowly towards the long-run equilibrium level over a number of months. The number of months it takes to get to the long-run equilibrium level depends on the size of the term $\alpha$ in equation (2) above. If $\alpha$ is large, then more of the difference between actual and long-run equilibrium rates is closed up every month. The $\alpha$ term for New Zealand suggests that banks take six to nine months to adjust rates fully to the long-run equilibrium level following changes to their funding costs. To some extent this represents the competitive pressures inherent in the mortgage market. The slow adjustment of rates to long-run levels implies that banks favour a "wait and see" attitude to changes in funding costs - preferring to wait and see whether a given wholesale interest rates structure is permanent before adjusting mortgage rates too much. This may also reflect a leadership problem in the market where no one bank wants to be the first to change their lending rate, instead preferring to wait for a competitor to move first. The result is that there is no movement in retail rates for some time until one bank finally "gives in" and is quickly followed by the others in the industry.

Another feature of the equation for mortgage interest rates are the dynamic adjustment terms. These terms are included to account for the short-run deviations of actual from long-run equilibrium mortgage rates. The main dynamic variable in this model is the current change in the 90-day bank bill rate. This term captures the effects on mortgage rate setting of current movements in funding costs. The coefficient on this term is small indicating that it is only relevant when short-term rates move a lot in the current month.

### What determines long-run equilibrium mortgage rates in New Zealand?

Long-run equilibrium mortgage rates are given by an equation such as (1) above. Specifically long-run equilibrium mortgage rates are found to be determined by wholesale interest rates only; retail deposit rates are not found to have any significant explanatory power. The relationship which holds in the long run is:

$$FIRSTM = 1.86 + 0.54 \times 90DAY + 0.46 \times 5YEAR \quad (3)$$

where 5YEAR is the 5-year government bond rate and 90DAY and FIRSTM are as given before.

Short and long-term wholesale interest rates determine mortgage rates in the long run with approximately equal importance. The 90-day rate represents the influences of current funding costs on mortgage rates and the 5-year rate represents the influences of expected funding costs in the future. The high weighting of expected funding costs relative to actual funding costs indicates that banks prefer to keep mortgage rates relatively stable and prefer to move them only when they are certain that changes to the interest rate structure are likely to last.

The constant term in (3) represents the margin that banks earn over their (approximated) funding costs. Therefore, the long-run equation suggests that mortgage rates typically lie around 1.86 percentage points above aggregate funding costs in long-run equilibrium. As noted above, this does not represent pure profits to banks as they must fund intermediation costs from this margin and the effect of cross-subsidisation can cloud the interpretation of the margin.

It is interesting to note that deposit interest rates do not appear to be relevant in determining long-run equilibrium mortgage rates despite the fact that retail deposits represent an important source of funding for most major banks in New Zealand. This is in contrast to previous work on New Zealand mortgage rate determination by Grimes (1994) who finds deposit rates, along with short and long-term wholesale interest rates, to be relevant in determining mortgage rates. The result reported above appears to be very robust to the method of estimating the model presented here. The difference in results may be explained by the use of better data and a superior estimation technique in this article. A reason why deposit rates may not appear in the model above is that retail deposit rates may be driven off wholesale interest rates in a similar manner to mortgage interest rates. In this case retail deposit rates themselves would not appear directly in the mortgage rate equation because the underlying determinants of deposit rates already appear in the model.

## III. Mortgage rates over 1994

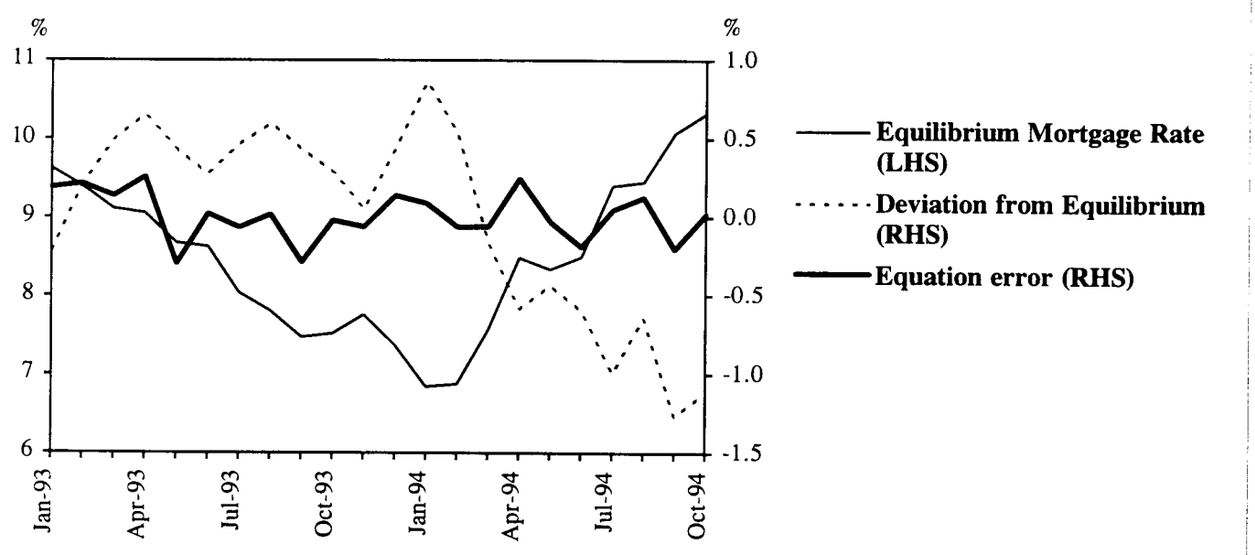
This year mortgage rates have risen considerably, from around 7.4 percent in February to 9.2 percent in October. The model presented here shows clearly why this has occurred - namely sharp rises in wholesale interest rates have meant that banks have had to increase their mortgage rates to retain profitability.

The full dynamic form of this model predicts mortgage rates extremely well over the course of this year making no more than a 0.2 percentage point error in any month. To get a better idea of the driving forces behind mortgage rates this year, it is useful to look at the behaviour of long-run equilibrium rates . Figure 2 shows long-run equilibrium mortgage rates, the deviation from long-run equilibrium mortgage rates, and the full equation forecast error since early 1993.

The graph shows that over the course of 1994 actual mortgage rates have risen by considerably less than long-run equilibrium rates - i.e. banks have been slow to adjust their rates upward in response to rising wholesale interest rates. As explained above, this is a feature of the estimated model. Because full adjustment to the long run

**Figure 2**

**Equilibrium and actual mortgage interest rates**



takes around 6-9 months, actual mortgage rates can diverge significantly from long-run rates for a considerable period. The gap between actual and long-run mortgage rates has been further exacerbated by the quite large and fast rises in wholesale interest rates that we have seen this year. Nonetheless, mortgage rates over 1994 have moved to close the gap between long-run and actual rates in a manner consistent with the predictions of the model. However, the gap between actual and long-run rates had still not been fully closed up by October. The stability of this model over 1994 and other testing suggests that there has been neither a contraction of bank margins on mortgages nor a change in the make-up of the funding costs relevant to the setting of long-run equilibrium mortgage rate levels this year.

## IV. Conclusion

New Zealand mortgage interest rates move in a manner consistent with a simple mark-up model of mortgage interest rates. Mortgage rates are set at a fixed margin above bank funding costs where funding costs are a simple average of short-term and long-term wholesale interest rates.

There is no evidence of a change in the behaviour of mortgage rates over the course of 1994. Wholesale rates have increased markedly, raising bank funding costs and thus mortgage interest rates, but mortgage rates have not risen as much as bank funding costs have. This is because mortgage rates adjust slowly in response to changes in funding costs, partly as a consequence of the competitive environment that characterises the first mortgage market in New Zealand.

## References

Grimes, A (1994). "The Determinants of Mortgage Rates", *National Bank of New Zealand Working Paper No. 94-1*, February 1994.

## Technical Appendix

This section presents the estimated specification along with some useful diagnostic tests. The actual specification is an Unrestricted Error Correction Model (UECM). Its structure incorporates both the long and short-run influences on mortgage rates into one equation. Data are available from August 1987 to October 1994 at a monthly frequency. The estimated equation is (t-statistics in parentheses):
Sample Period 1987M8 to 1994M10.
Observations: 87.

$$\begin{aligned}\Delta(\text{FIRSTM} - \text{90DAY}) = {} & 0.52 - 0.28\ (\text{FIRSTM} - \text{90DAY})_{-1} \\ & (7.7)\quad (-9.5) \\ & + 0.13\ (\text{5YEAR} - \text{90 DAY})_{-1} \\ & \quad (6.9) \\ & - 0.77\ \Delta(\text{R90DAY}) \\ & \quad (-20.1) \\ & - 0.09\ \Delta(\text{R90DAY})_{-6} \\ & \quad (-3.6) \\ & - 0.79\ \text{DUM88M9} \\ & \quad (-4.7)\end{aligned}$$

$R^2 = 0.88 \qquad s = 0.166 \qquad DW = 1.81$

**Diagnostics** (Significance levels in parenthesis)

| | | | | |
|---|---|---|---|---|
| Autocorrelation | F(1,80) | = | 0.36 | (0.55) |
| Ramsey Reset | F(1,80) | = | 0.69 | (0.40) |
| White | $\chi 2(9,71)$ | = | 1.47 | (0.17) |
| Normality | $\chi^2(2)$ | = | 1.40 | (0.50) |

**Notation:**
Variables are named as follows:
FIRSTM - First Mortgage interest rate.
90DAY - 90-day Bank bill rate (Month Average).
5YEAR - 5-year Government bond rate (Month Average).
DUM88M9 - Impulse dummy variable to account for an outlier in September 1989.
$\Delta$ denotes a first difference in the variable concerned.

There is no indication of parameter instability or any other diagnostic problems. The long run of the equation cointegrates at the 1 percent level as indicated by the high coefficient on the error correction term.

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