OCR: New Zealand's Inflation Fighting Tool

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Abstract

In March 1999 the Reserve Bank of New Zealand (RBNZ) introduced an Official Cash Rate (OCR) as a tool for implementing New Zealand's monetary policy.
We detail New Zealand's monetary policy and RBNZ's OCR tool. We measure the volatility of interest rates pre and post OCR to assess the OCR's impact on volatility. To assess the effectiveness of the OCR, the relationship between it and interest rates, both on deposits and lending is tested. Results indicate that it is effective in the control of interest rates, but further work is required to full understand its impact on New Zealand's inflation.

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William R Wilson* and Eric Jiaan Li

Introduction

The Reserve Bank of New Zealand Act 1989, (2003 section 7) states that "the primary function of the bank is to formulate and implement monetary policy directed to the economic objective of achieving and maintaining stability in the general level of prices". Section 9 of the act then details that the Minister of Finance and the Governor of the Reserve Bank shall negotiate specific targets for the achievement of price stability which are contained in a Policy Targets Agreement (PTA).

Since the introduction of the RBNZ Act 1989 there have been seven PTAs, the current one between Minister of Finance Dr Michael Cullen and Bank Governor Dr Allan Bollard was signed in September 2002. This agreement sets price stability as inflation of one to three percent on average in the medium term as measured by the Consumer Price Index, published by Statistics New Zealand. Once the PTA has been negotiated the Governor is accountable for the achievement of targets and is free to implement monetary policy as seen fit, with the only proviso being that the bank shall "implement monetary policy in a sustainable, consistent and transparent manner and shall seek to avoid unnecessary instability in output, interest rates and exchange rates" (RBNZ PTA, 2002). While it is possible for the government to direct the RBNZ to change the economic objectives of monetary policy any such direction must be publicised.

New Zealand as with many countries suffered from the effects of high inflation in the 1970's and 80's (see Figure 1) hitting a peak of 18.9% in mid 1987. There can be little doubt that high inflation is damaging to an economy, where decisions are based not on their production returns but their inflation returns. This was further compounded in New Zealand as New Zealand's inflation was generally higher than our trading partners. This set the scene for New Zealand to be the first country to

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introduce a formal inflation target for their monetary policy at the end of the 1980's (Brash, 2002).

The RBNZ main tool, in the 1990's, for implemented monetary policy was its ability to change the economies money supply through manipulation, or threat of manipulation of the settlement cash target. Manipulation of settlement cash proved to be a complex process and the linkage between settlement cash and inflation proved to be unreliable. These difficulties gave rise to the introduction by RBNZ in 1997 of the Monetary Conditions Index. The MCI was based on exchange rates (Trade Weighted Index) and interest rates (90 Day Bill rates) with the RBNZ setting, on a quarterly basis, an MCI range in which they would be comfortable.

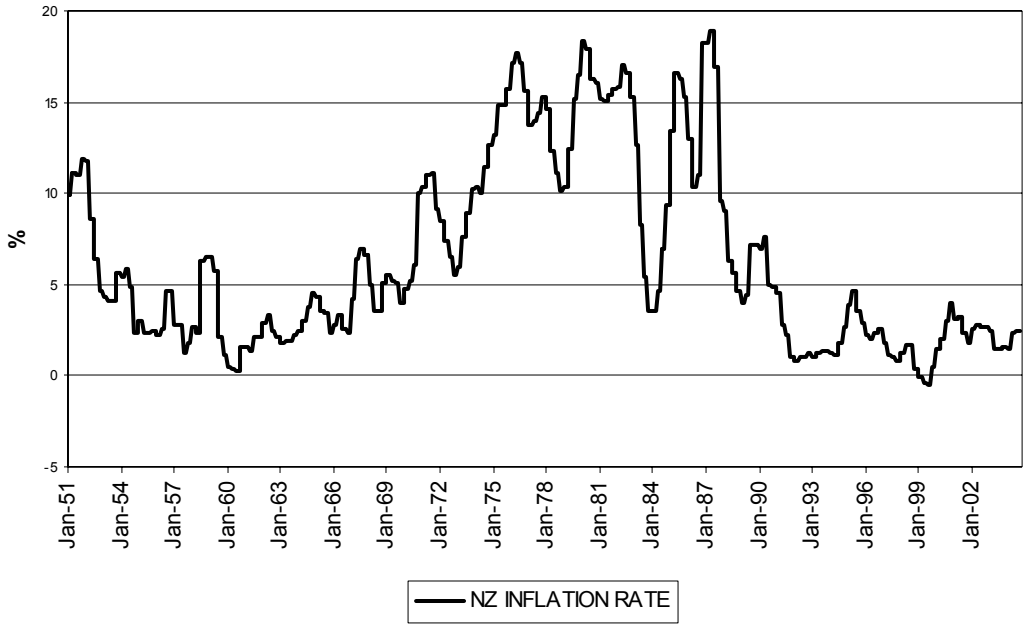


Figure 1: NZ Inflation (Source DataStream)

One of the few tests of the effectiveness of the MCI was that of Hunt (1999) who compared the MCI to systems in the United States, England, and Canada. Results suggest that although both fixed-instrument and MCI-based strategies can reduce inflation and output variability, the MCI-based strategy can increase inflation variability compared to a fixed-instrument strategy. Other criticisms of the MCI were that market participants both domestically and internationally often found it difficult to interpret (RBNZ Staff, 1999), furthermore the volatility of exchange rates requiring the RBNZ to "jawbone" the economy on a more and more frequent basis than they desired. These problems led the RBNZ to replace the MCI system with the OCR in March 1999.

The OCR is a conventional cash rate system, that the RBNZ hoped would be more transparent and hopefully reduce the volatility of short term interest rates. The base of the system is the rate that the RBNZ applies to settlement accounts held by 'Registered Banks' with the RBNZ. The RBNZ is prepared to provide or absorb unlimited funds overnight to registered banks at 25 basis points over and under the OCR respectively. Therefore the OCR should have a material bearing on all other interest rates in the economy. The OCR is reviewed by the RBNZ eight times a year or approximately every six weeks (OCR review dates are announced at least a year in advance).

The RBNZ decision to replace the MCI was endorsed by Professor Svensson in 2001, when he was engaged to conduct an independent review of the implementation of monetary policy in New Zealand. Professor Svensson stated that in the period between mid-1997 and March 1999 there was a "significant deviation from best international practice" (pg.2), before confirming that the current system was "entirely consistent with the best international practice of flexible inflation targeting with a medium-term inflation target that avoids unnecessary variability in output, interest rates and the exchange rate"

Brookes and Hampton (2000) reported on the consequences of the OCR over its first in operation year. They concluded that it appeared to be effective and efficient, and that the financial market behaviour had been affected by the change of system with the volatility of short-term interest rates successfully reduced.

Petro, McDermott and Tripe (2001) look at the pass through of money market rates to bank mortgage rates before and after the introduction of the OCR. They find a more stable and transparent market has resulted, but results are restricted to one bank, the BNZ.

Krippner and Gordon (2001) tested the forward term-premium (FTP) between forward 1-day rates calculated from the New Zealand bank-risk yield curve and the corresponding ex-post OCR from March 1999 to December 2001. The results show that the FTP is statistically significant for all forward horizons tested. The results also indicate that the estimates of the FTP became an increasing function of the forward horizon, and that the FTP may be provisionally implied as a simple monotonically increasing analytical function. The model may be converted in reverse to present current ex-ante expectations of the OCR.

This research has a number of aims; firstly we address the question of interest rate volatility by examining volatility before and after the OCR, at both the short and long ends of the yield curve. Secondly we look at how the OCR transmits monetary policy by testing its impact on other interest rates in the economy, particularly bank lending and deposit rates.

Interest Rate Volatility

When the RBNZ proposed the introduction of the OCR a claimed benefit was a reduction in the volatility of interest rates.

We test the volatility of interest rates across the yield curve before and after the OCR introduction. Daily interest rates are tested for the; inter-bank call (IBC), 90 day bank bill (BB90D), three month Treasury bill (TB3M), one year Government bond (GB1Y), two year Government bond (GB2Y), five year Government bond (GB5Y), and ten year Government bond (GB10Y). The two time periods tested are, pre OCR 22nd September 1993 until 16th March 1999 and post OCR 17th March 1999 until 15th October 2004. All data for volatility testing was sourced from DataStream.

Volatility Hypothsis$_0$:

The volatility of NZ interest rates pre OCR is equal to the volatility of interest rates post OCR.

Results

Visual inspection of the graph (figure 2)1 of inter-bank call interest rates suggests that volatility of the series has been reduced over the test period, with an obvious structural break at the beginning of 1999. Further the range has been reduced from 10% (12-2%) to 2% (6.5%-4.5%), with a reduction in the mean inter-bank call rate from 7.5% to 5.5%.

[1] Appendix 1 contains Interest Rate Graphs for all seven series.

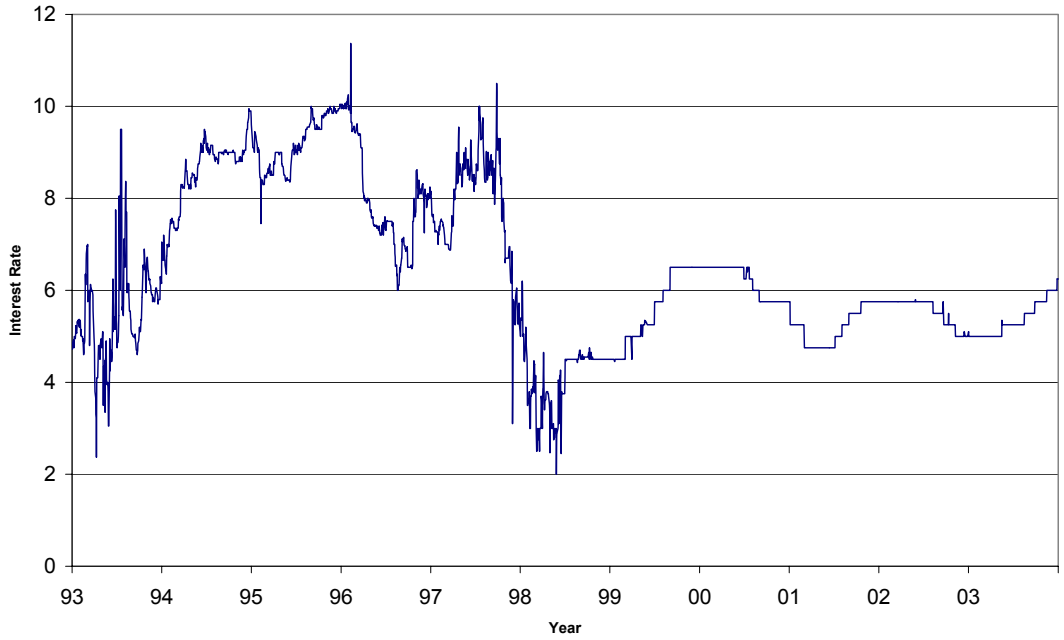


Figure 2: Inter-bank Call Interest Rate

The means were calculated for all seven interest series, and we see as reported below (figure 3) there has been a statistically significant reduction in interest rates between pre and post OCR periods.

Table 1: Mean Interest Rates Pre & Post OCR

	Pre OCR	Post OCR	t-test equality of mean	
IBC	7.44	5.48	36.50	***
BB90D	7.74	5.71	42.80	***
TB3M	7.52	5.48	43.07	***
GB1Y	7.52	5.57	46.77	***
GB2Y	7.32	5.84	40.85	***
GB5Y	7.27	6.20	34.38	***
GB10Y	7.23	6.40	29.07	***

While it is interesting that NZ interest rates have reduced after the introduction of the OCR it is unrealistic to say that this was due to its introduction. The OCR introduction just happened to coincide with a world wide reduction in interest rates as a number of major economies slowed. A popular sentiment in the market place is that interest rates in New Zealand are too high in comparison to our trading partners, stifling economic growth and placing undue pressure on the exchange rate.

Regardless of the interest rate level, what is of interest is the volatility of that interest rate. The standard deviation of each interest rate pre and post OCR introduction (figure 4) show, that as expected by the RBNZ, the volatility of interest rates has been

reduced. All tests indicate that the null hypothesis of equality of variance pre and post OCR introduction should be rejected, with results that are large and highly significant.

Table 2: Standard Deviation of Interest Rates Pre & Post OCR

	Pre OCR	Post OCR	% Diff	F-Test		Levene	
IBC	1.93	0.62	-68%	9.62	***	1320.69	***
BB90D	1.69	0.62	-63%	7.47	***	1192.62	***
TB3M	1.68	0.63	-62%	7.10	***	1127.44	***
GB1Y	1.41	0.72	-49%	3.80	***	571.65	***
GB2Y	1.22	0.63	-48%	3.70	***	483.74	***
GB5Y	1.06	0.51	-52%	3.80	***	571.65	***
GB10Y	0.98	0.46	-52%	4.42	***	604.75	***

The greatest reduction in standard deviation occurred in the inter-bank call rate where the standard deviation has gone from 1.933 to 0.623 which is a 67.77% reduction. This is hardly surprising as after the introduction of the OCR New Zealand banks generally used the OCR as a default market rate for the inter-bank call rate.

However similar results are obtained for all market interest rates tested (appendix 1 graph) suggesting that if the aim of the RBNZ was to simply reduce interest rate volatility then they have been successful with a clearly obvious structural break at January 17 1999. Tests of the structural break show that it is statistically significant for the shorter term BB90D, TB3M and GB1Y, but not for the GB2Y, GB5Y and GB10Y.

To confirm that it is the RBNZ's management of the OCR which is responsible for the behaviour of the other interest rates in the New Zealand economy we firstly tested to see if they were co-integrated.

Table 3: Unrestricted Co-integration Rank Test

Series: OCR BB90D TB3M GB1Y GB2Y GB5Y GB10Y
Lags interval (in first differences): 1 to 4

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	5 Percent Critical Value	1 Percent Critical Value
None **	0.086436	295.8741	124.24	133.57
At most 1 **	0.050433	166.6	94.15	103.18
At most 2 **	0.021436	92.59878	68.52	76.07
At most 3 **	0.015007	61.61223	47.21	54.46
At most 4 **	0.012665	39.98913	29.68	35.65
At most 5 **	0.008915	21.76291	15.41	20.04
At most 6 **	0.006244	8.95664	3.76	6.65

*(**) denotes rejection of the hypothesis at the 5%(1%) level
Trace test indicates 7 cointegrating equation(s) at both 5% and 1% levels

The above results clearly show that these series are co-integrated at the 1% confidence levels.

After establishing that these interest rates are co-integrated they were next tested for Granger causality between series (appendix 2).

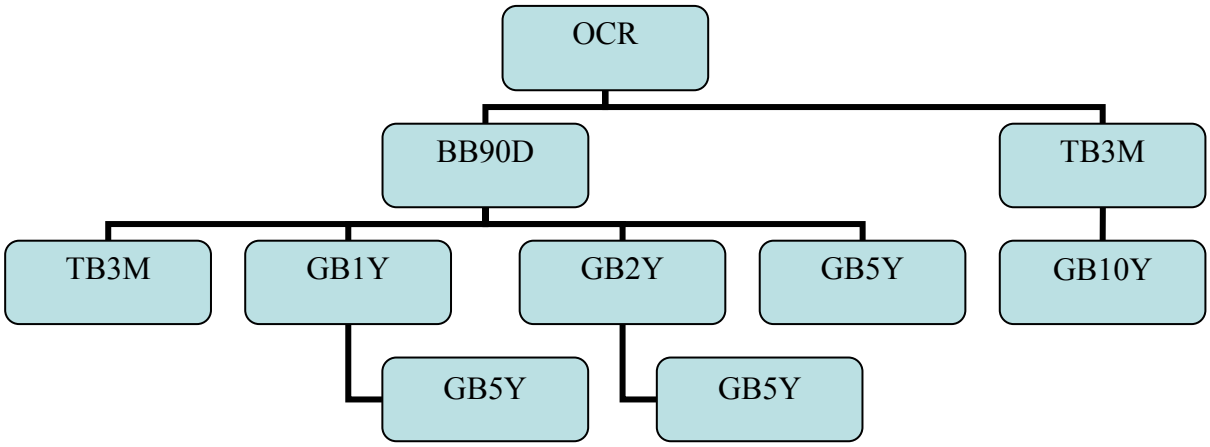


Figure 3: Granger Causality Post OCR & Wholesale Interest Rates

Changes in the OCR directly cause changes in the BB90D and TB3M which then result on changes in our other interest rate series.

If one wanted to forecast the OCR the following equation with an R2 of 94.8% could be used.

Equation 1: OCR Dependent Variable R^2 94.8%

$$OCR = 0.610782 + 0.433876 * BB90D + 0.777254 * TB3M - 0.152269 * GB2Y$$
$$0.601742 * GB5Y + 0.458928 * GB10Y$$
$$R2 \text{ is } 0.948049$$

OCR's Impact on Bank Rates

The RBNZ targets New Zealand inflation by changing the OCR. As Registered banks have an unlimited ability to either borrow from or lend to the RBNZ, at the OCR plus 25 basis points or OCR less 25 basis points respectively, the OCR acts as a fixed points for all other interest rates in the New Zealand banking system.

We apply time series analysis to the OCR, bank mortgage rates and bank deposit rates to determine their relationship. Two sets of hypothesis are developed and tested using weekly interest rate data. The OCR is obtained from the RBNZ web site, mortgage

data is the floating mortgage rate from New Zealand's five largest banks2, obtained from Datex NZ, and deposit rate data is the average deposit rates for all NZ bank sourced from DataStream.

Mortgage Hypothsis$_0$:

The OCR is not co-integrated with the bank mortgage rates of term,

Floating, Fixed 1Y, Fixed 2Y, Fixed 3Y, and Fixed 5Y.

If the null hypothesis is able to be rejected we can then test for causality between the series.

Firstly we test the relationship between the OCR and average mortgage rates offered by the banks Floating, Fixed 1Y, Fixed 2Y, Fixed 3Y, and Fixed 5Y. After applying a first difference to all series stationarity is achieved, enabling us to test for co-integration relationship.

Table 4: Unrestricted Co-integration Rank Test

Series: OCR FLOAT FIX1Y FIX3Y FIX5Y
Lags interval (in first differences): 1 to 2

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	5 Percent Critical Value	1 Percent Critical Value
None **	0.200618	122.4538	68.52	76.07
At most 1 **	0.115461	69.38556	47.21	54.46
At most 2 **	0.090656	40.30838	29.68	35.65
At most 3 *	0.059310	17.78577	15.41	20.04
At most 4	0.013808	3.295260	3.76	6.65

*(**) denotes rejection of the hypothesis at the 5%(1%) level
Trace test indicates 4 cointegrating equation(s) at the 5% level
Trace test indicates 3 cointegrating equation(s) at the 1% level

Table 4 shows that there are at least three co-integrating equations at the 1% confidence levels and four at the 5 % confidence level. Equations of the co-integrating equations for all mortgage rates in different time structures where T-statistics values are above 2 (which mean they are significant and are collected in the equation) are set out in appendix 3.

When Granger causality is calculated (appendix 4) we see that the OCR directly causes changes in the floating, fixed 1year, and fixed 3year mortgage rates. The

[2] The ANZ, NBNZ, BNZ, ASB and WBC who between them control approximately 95% of bank assets in New Zealand.

floating rates then causes changes in the fixed 1 year, fixed 3 year and fixed 5 year mortgage rates.

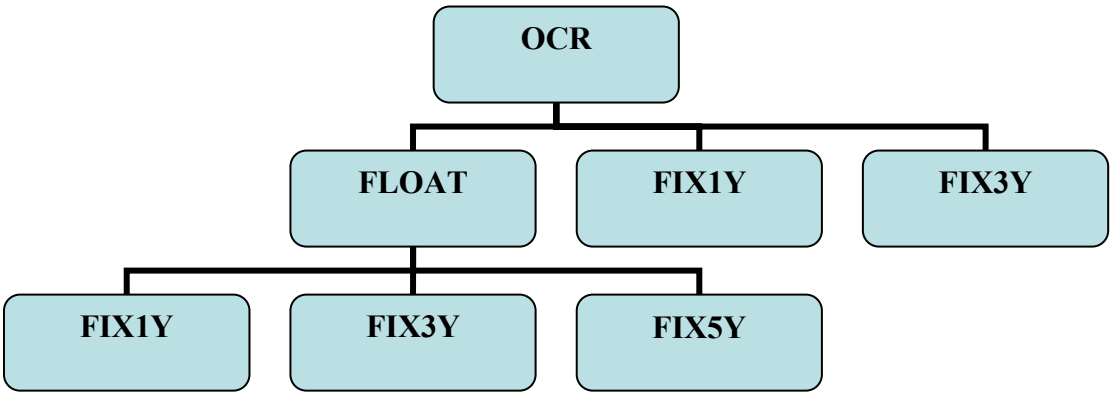


Figure 4: Granger Causality Post OCR & Bank Mortgage Rates

Deposit Hypothsis$_0$:

The OCR is not co-integrated with the bank deposit rates of term,

Call, 3 month, 6 month, and 1 year.

If the null hypothesis is able to be rejected we can then test for causality between the series.

Firstly we test the relationship between the OCR and the average deposit rates offered by all NZ banks Call, 1month, 3 month, 6 month, and 1 year. After applying a first difference to all series stationarity is achieved, enabling us to test for co-integration relationship.

Table 5: Unrestricted Co-integration Rank Test

Series: OCR CALL D1M D3M D6M D1Y
Lags interval (in first differences): 1 to 5

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	5 Percent Critical Value	1 Percent Critical Value
None **	0.050194	217.2885	94.15	103.18
At most 1 **	0.042534	141.6903	68.52	76.07
At most 2 **	0.024725	77.88403	47.21	54.46
At most 3 **	0.015119	41.13104	29.68	35.65
At most 4 *	0.007573	18.76620	15.41	20.04
At most 5 **	0.005168	7.606339	3.76	6.65

*(**) denotes rejection of the hypothesis at the 5%(1%) level
Trace test indicates 6 cointegrating equation(s) at the 5% level
Trace test indicates 4 cointegrating equation(s) at the 1% level

Table 5 shows that there are at least six co-integrating equations at the 5% confidence levels and four co-integrating equations at the 1% confidence levels. Equations of the co-integrating equations for all deposit rates in different time structures where T-statistics values are above 2 (which mean they are significant and are collected in the equation) are set out in appendix 5.

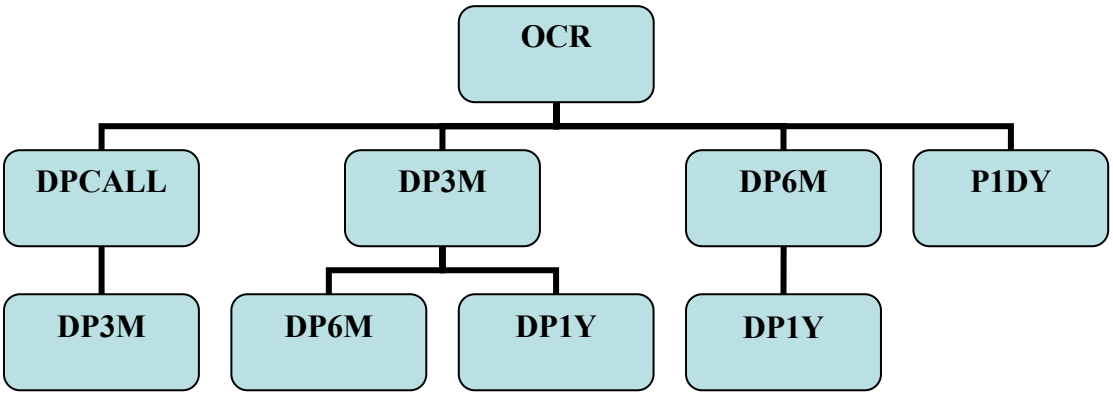


Figure 4: Granger Causality Post OCR & Bank Deposit Rates

When Granger causality is calculated (appendix 6) we see that the OCR directly causes changes in the Call, 3 month, 6 month and 1 year deposit rates. These rates then flow on to longer term rates.

Conclusion

The decision by the RBNZ in 1999 to replace the cumbersome MCI with a conventional cash rate system appears to have been well founded. Wholesale market participants enjoy a greater degree of certainty, than they did prior to 1999, with a significant reduction in interest rate volatility across the entire spectrum of the yield curve. Changes in the OCR directly cause the BB90D and TB3M to change which then flow onto all other wholesale interest rates.

With the ultimate aim of inflation control, the RBNZ alters the OCR in order to implement monetary policy. The RBNZ is not interested in interest rates per se but rather the combined spending of consumers and businesses. These two groups, who are the New Zealand economy, feel the effect of changes in the OCR in the rates they pay to borrow from banks. There is a significant linkage between the OCR and mortgage rates offered by the big New Zealand banks, with the OCR proving to be an

effective tool in the transmission of monetary policy to the economy at large. The OCR is certainly a more transparent than its predecessor the MCI being more easily understood by businesses and the public.

Further work is required to establish the exact relationship between the OCR and New Zealand's inflation rate. A cursory inspection of the graph (figure 5) showing the OCR and New Zealand's inflation rate suggests the relationship is quite tight.

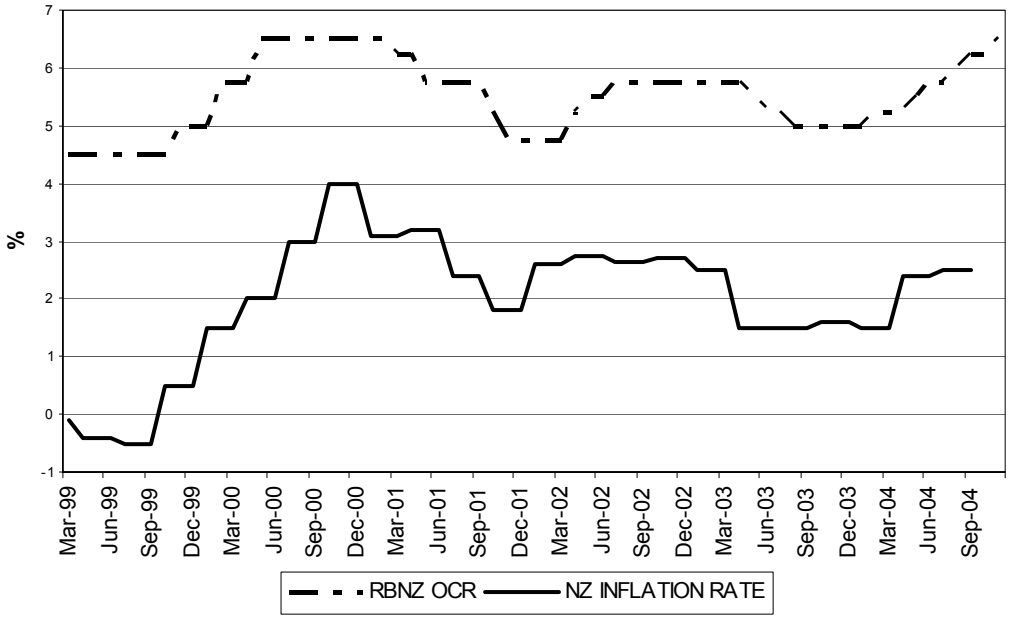
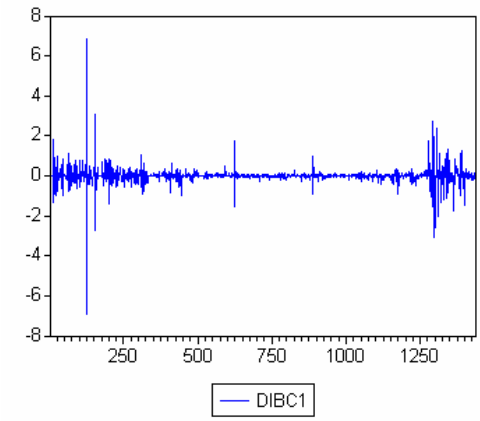
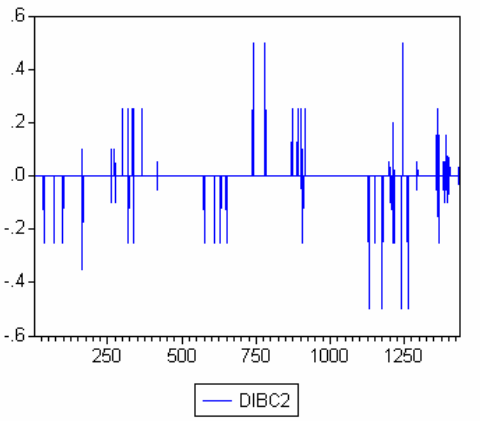


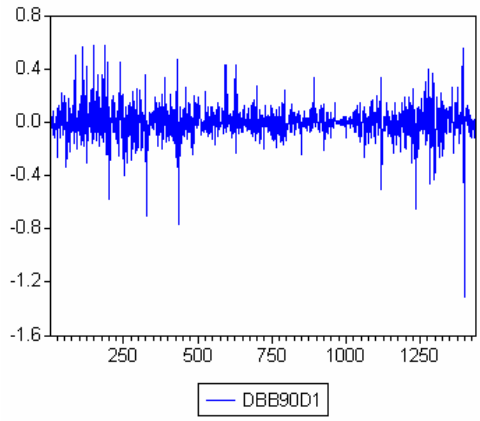
Figure 5: NZ OCR & Inflation

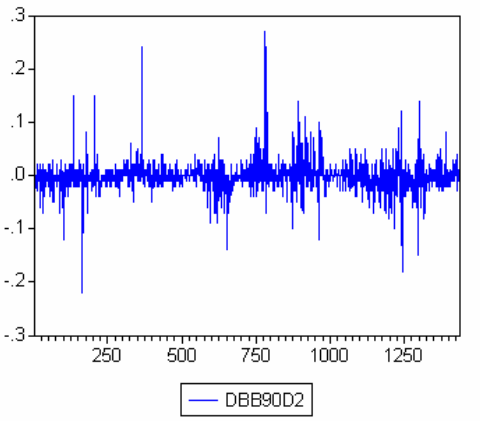
However it is likely to be more complex than it appears on the surface, with a confounding factor being the impact of the OCR on the New Zealand exchange rate. As the next stage of this research the intention is to look at the relationship between the OCR and the inflation rate as well as other economic indicators such as the exchange rate, retail spending, housing starts and business confidence.

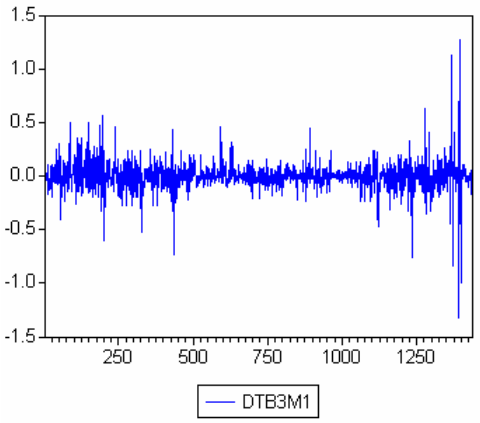
Appendix 1: Volatility Graphs of EX-ante (1) and EX-post Periods (2)

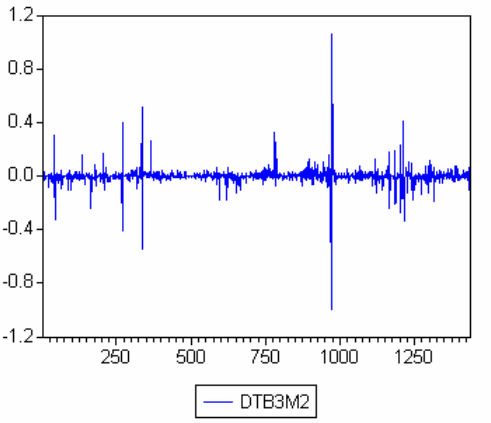


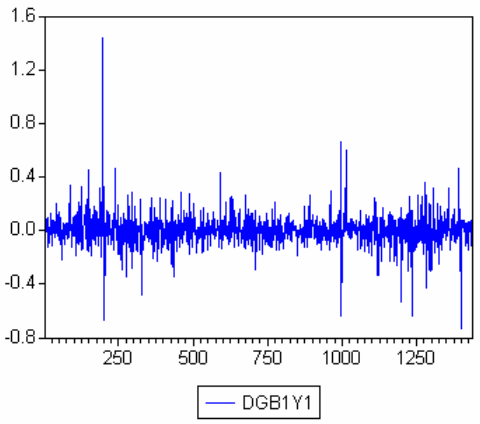


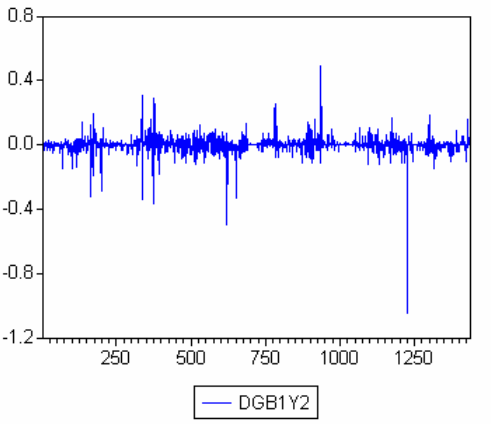


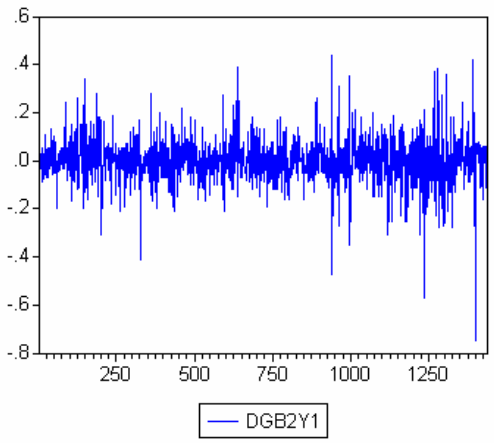








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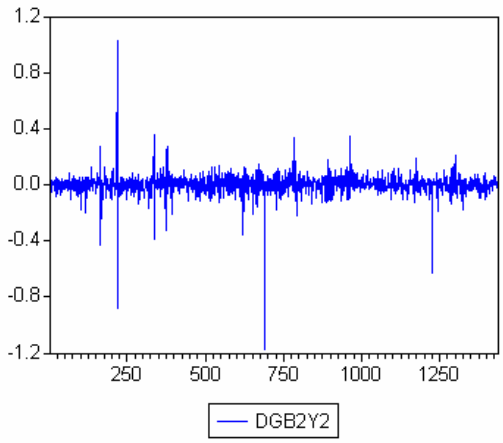
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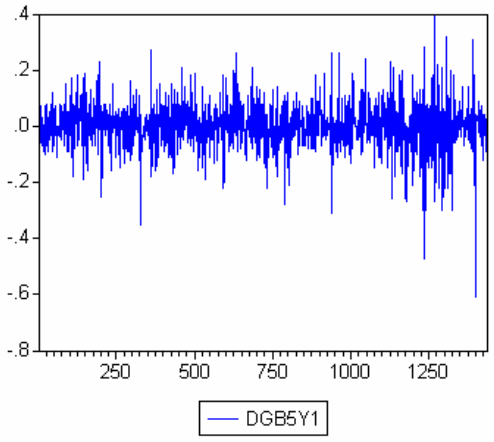
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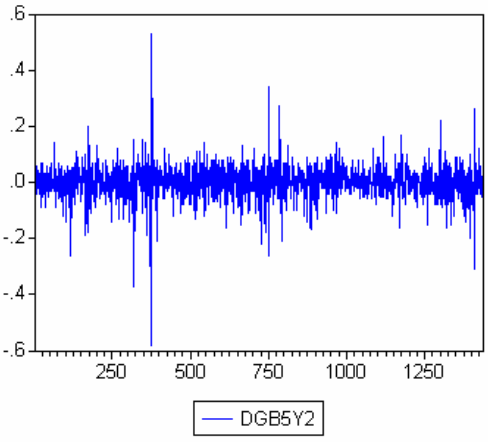
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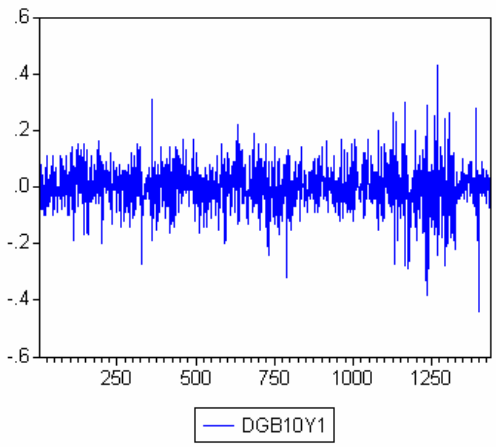
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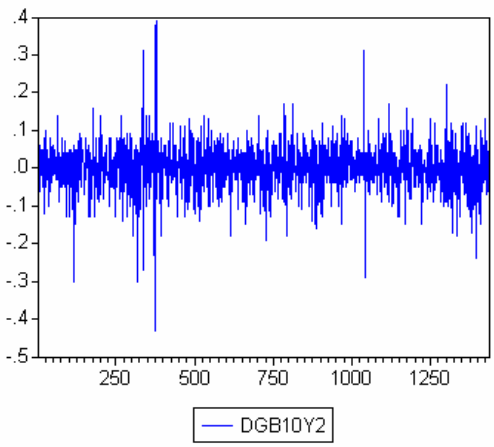
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Appendix 2: **Pairwise Granger Causality Tests** OCR - Interest Rate Ex-post

Sample: 3/17/1999 9/14/2004
Lags: 5

Null Hypothesis:	Obs	F-Statistic	Probability
BB90D does not Granger Cause OCR	1430	15.8393	3.3E-15
OCR does not Granger Cause BB90D		9.71378	3.9E-09
TB3M does not Granger Cause OCR	1430	14.5550	6.2E-14
OCR does not Granger Cause TB3M		2.22704	0.04937
GB1Y does not Granger Cause OCR	1430	8.25958	1.1E-07
OCR does not Granger Cause GB1Y		1.09455	0.36147
GB2Y does not Granger Cause OCR	1430	6.95245	2.0E-06
OCR does not Granger Cause GB2Y		0.85981	0.50748
GB5Y does not Granger Cause OCR	1430	3.61773	0.00295
OCR does not Granger Cause GB5Y		1.55651	0.16941
GB10Y does not Granger Cause OCR	1430	2.73813	0.01807
OCR does not Granger Cause GB10Y		1.44229	0.20613
TB3M does not Granger Cause BB90D	1430	2.41687	0.03416
BB90D does not Granger Cause TB3M		20.5650	0.00000
GB1Y does not Granger Cause BB90D	1430	3.06014	0.00940
BB90D does not Granger Cause GB1Y		2.49396	0.02937
GB2Y does not Granger Cause BB90D	1430	7.78375	3.1E-07
BB90D does not Granger Cause GB2Y		3.66367	0.00268
GB5Y does not Granger Cause BB90D	1430	7.00110	1.8E-06
BB90D does not Granger Cause GB5Y		2.97800	0.01112
GB10Y does not Granger Cause BB90D	1430	4.70673	0.00029
BB90D does not Granger Cause GB10Y		2.08388	0.06485
GB1Y does not Granger Cause TB3M	1430	8.16164	1.3E-07
TB3M does not Granger Cause GB1Y		0.58480	0.71169
GB2Y does not Granger Cause TB3M	1430	7.33490	8.5E-07
TB3M does not Granger Cause GB2Y		1.93927	0.08503
GB5Y does not Granger Cause TB3M	1430	5.19157	1.0E-04
TB3M does not Granger Cause GB5Y		3.13662	0.00804
GB10Y does not Granger Cause TB3M	1430	3.04650	0.00967
TB3M does not Granger Cause GB10Y		2.98572	0.01095
GB2Y does not Granger Cause GB1Y	1430	3.31107	0.00561
GB1Y does not Granger Cause GB2Y		1.95383	0.08276
GB5Y does not Granger Cause GB1Y	1430	3.75138	0.00223
GB1Y does not Granger Cause GB5Y		2.37019	0.03742
GB10Y does not Granger Cause GB1Y	1430	4.92220	0.00018
GB1Y does not Granger Cause GB10Y		1.66656	0.13960
GB5Y does not Granger Cause GB2Y	1430	2.99404	0.01077
GB2Y does not Granger Cause GB5Y		2.38317	0.03649
GB10Y does not Granger Cause GB2Y	1430	2.44005	0.03265
GB2Y does not Granger Cause GB10Y		1.06619	0.37734
GB10Y does not Granger Cause GB5Y	1430	3.39845	0.00468
GB5Y does not Granger Cause GB10Y		1.30684	0.25834

Appendix 3: OCR & Mortgage Equations

Vector Autoregression Estimates

$$Ocr = 0.843011 * Ocr(-1) + 0.335583 * Float(-1)$$

R2 is 0.972088

$$Floating = 0.22937 * Ocr(-1) + 0.714898 * Float(-1) + 0.851269$$

R2 is 0.965948

$$Fixed1Y = 0.116145 * Ocr(-1) + 0.134108 * Float(-1) + 0.866536 * Fix1Y(-1)$$

R2 is 0.983631

$$Fix3Y = 0.877765 * Fix3Y\ (-1)$$

R2 is 0.977673

$$Fix5Y = 0.661711 * Fix3Y(-1) + 0.641478 * Fix5Y(-1)$$

R2 is 0.990546

Vector Error Correction Estimates:

$$CointEq1 = 2.105982*Fixed1y\ (-1) + 4.919699*Fixed5Y\ (-1) + 4.311758$$

$$Ocr(-1) = 0.035998*CointEq1 + 0.382649*D(Floating(-1))$$

$$D(Floating) = 0.078662*CointEq1 + 0.1579*D(Ocr(-1)) + 0.134995*\ D(Fixed3y(-1)) + 0.354472*D(Fixed3Y(-2))$$

$$D(Fixed1Y) = 0.033648*ContEq1 + 0.163417*D(Floating(-1)) + 0.235503*D(Fixed3Y(-1))$$

D(Fixed3Y) T-test is not significant

$$D(Fixed5Y) = 0.43798*D(Fixed3Y(-1))$$

Appendix 4: **Pairwise Granger Causality Tests** OCR - Mortgage Rates

Sample: 1/07/2000 8/06/2004
Lags: 2

Null Hypothesis:	Obs	F-Statistic	Probability
FLOAT does not Granger Cause OCR	238	18.4359	3.7E-08
OCR does not Granger Cause FLOAT		13.9825	1.8E-06
FIX1Y does not Granger Cause OCR	238	10.4757	4.4E-05
OCR does not Granger Cause FIX1Y		14.5463	1.1E-06
FIX3Y does not Granger Cause OCR	238	5.87209	0.00325
OCR does not Granger Cause FIX3Y		6.11052	0.00259
FIX5Y does not Granger Cause OCR	238	4.61482	0.01083
OCR does not Granger Cause FIX5Y		5.24006	0.00594
FIX1Y does not Granger Cause FLOAT	238	7.41191	0.00076
FLOAT does not Granger Cause FIX1Y		14.9413	7.8E-07
FIX3Y does not Granger Cause FLOAT	238	7.17684	0.00094
FLOAT does not Granger Cause FIX3Y		9.65068	9.4E-05
FIX5Y does not Granger Cause FLOAT	238	7.16830	0.00095
FLOAT does not Granger Cause FIX5Y		7.04769	0.00107
FIX3Y does not Granger Cause FIX1Y	238	6.93187	0.00119
FIX1Y does not Granger Cause FIX3Y		9.33158	0.00013
FIX5Y does not Granger Cause FIX1Y	238	6.46345	0.00185
FIX1Y does not Granger Cause FIX5Y		23.7894	4.0E-10
FIX5Y does not Granger Cause FIX3Y	238	3.45984	0.03306
FIX3Y does not Granger Cause FIX5Y		91.1195	0.00000

Appendix 5: OCR & Deposit Equations

Vector Autoregression Estimates

OCR = 0.95939*OCR(-1) +0.039*Call(-2) +0.028538*D1M(-1)

R2 is 0.996146

CALL = 0.130195*OCR(-1) + 0.964491*CALL(-1) +C

R2 is 0.983001

D1M =0.954527*D1M(-1)

R2 is 0.977429

D3M = 0.48295*D3M(-1) + 0.129630*D3M(-2) +0.121909*D3M(-5) +0.261338*D6M(-1)

R2 is 0.991469

D6M =0.920534*D6M(-1) +0.229417*D6M(-3)

R2 is 0.992656

D1Y =0.216054*D6M(3) +0.721464*D1Y(-1) +0.183042*D1Y(-2)

R2 is 0.990439

Appendix 6: **Pairwise Granger Causality Tests** OCR- Deposit Rates

Sample: 9/15/1999 9/14/2004
Lags: 5

Null Hypothesis:	Obs	F-Statistic	Probability
DPCALL does not Granger Cause OCR	1300	2.32740	0.04073
OCR does not Granger Cause DPCALL		4.54812	0.00041
DP3M does not Granger Cause OCR	1300	6.01507	1.6E-05
OCR does not Granger Cause DP3M		4.24062	0.00079
DP6M does not Granger Cause OCR	1300	9.53846	6.0E-09
OCR does not Granger Cause DP6M		3.85867	0.00178
DP1Y does not Granger Cause OCR	1300	7.48206	6.2E-07
OCR does not Granger Cause DP1Y		6.03197	1.6E-05
DP3M does not Granger Cause DPCALL	1300	2.41419	0.03440
DPCALL does not Granger Cause DP3M		3.81886	0.00194
DP6M does not Granger Cause DPCALL	1300	1.67176	0.13839
DPCALL does not Granger Cause DP6M		3.46228	0.00411
DP1Y does not Granger Cause DPCALL	1300	0.89337	0.48467
DPCALL does not Granger Cause DP1Y		3.71591	0.00241
DP6M does not Granger Cause DP3M	1300	7.95032	2.2E-07
DP3M does not Granger Cause DP6M		7.91215	2.4E-07
DP1Y does not Granger Cause DP3M	1300	10.9114	2.7E-10
DP3M does not Granger Cause DP1Y		14.3602	1.0E-13
DP1Y does not Granger Cause DP6M	1300	5.86428	2.3E-05
DP6M does not Granger Cause DP1Y		7.61721	4.6E-07

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