RESERVE BANK OF NEW ZEALAND
TE PŪTEA MATUA

ANALYTICAL NOTES

Has the Reserve Bank responded differently to upturns and downturns in inflation and economic activity?

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Key findings

- We find no evidence that suggests the Reserve Bank has responded differently to rises and falls in inflation and economic activity from targeted levels during normal times.
- However, during sharp downturns in activity as witnessed during the Asian Crisis, the Global Financial Crisis and the Christchurch earthquake, the Bank eased its monetary policy stance rapidly to bolster the economy. This contrasts with the Bank's milder policy responses during booms in economic activity.

Introduction

The mandate for monetary policy formulation at the Reserve Bank, as specified by the current Remit, is to keep consumer price inflation and employment at target levels.

The Remit does not explicitly state that the Reserve Bank should respond in equal measure to deviations of inflation and employment above or below target levels. However, a 'symmetric' response to negative and positive deviations of variables from target is one possible interpretation of the mandate.[1] The Bank's target of keeping inflation within a 1% to 3% band with a focus on the mid-point may imply a symmetric approach towards stabilising inflation. The Remit also stipulates that the Bank "contributes to public welfare by reducing cyclical variations in employment" around its maximum sustainable level. The emphasis on reducing the cyclical volatility of employment may suggest that upswings and downswings around the target are treated equally.

This paper presents an empirical framework to assess potential unevenness or 'asymmetries' in the responses of the Bank to inflation and economic activity over the past three decades.[2]

We find no evidence that suggests the Reserve Bank has responded differently to positive and negative deviations from target in inflation and economic activity during normal times. It is only during extreme downturns in economic activity that the Bank's monetary response may have exceeded that implied by a conventional symmetric approach.

In particular, the Bank substantially lowered the Official Cash Rate from 8.25% to 2.5% during the Global Financial Crisis (GFC). A similar approach appears to have been taken during the Asian Crisis of 1997-98, when the policy rate was eased considerably. The decline in economic activity due to the 2011 Christchurch earthquake also appeared to have contributed significantly to the policy rate stance during that period, as the Bank cut the OCR from 3% to 2.5% and did not change the rate for another three years.

These policy actions, particularly those in the aftermath of the GFC, could be attributed to the Bank's preference to respond quickly and decisively with monetary policy during a weakening of economic activity, rather than do too little and experience worsening conditions in the future. We find this asymmetric effect on interest rate settings disappeared when economic activity normalised after these extreme events.

Why should the Reserve Bank be symmetric in responding to increases and decreases in inflation and economic activity from target?

The Bank's Monetary Policy Handbook notes that a symmetric approach to inflation stabilisation helps to anchor inflation expectations at the target mid-point, improving the effectiveness of monetary policy. Responding unevenly to cyclical deviations in economic activity measures such as employment gaps and output gaps could have adverse effects on inflation expectations and interest rate stability, and

[1] See also subsection 7.3.2 of the Reserve Bank's Monetary Policy Handbook that explains monetary policy strategy.

[2] We focus on the output gap, which is a broader measure of economic activity, rather than the employment gap. Over much of the sample period we consider, the Reserve Bank practised flexible inflation targeting; the dual mandate that places equal emphasis on inflation as well as employment stabilisation came to existence only in 2018 (See Policy Targets Agreement 2018). The two measures of activity are however, highly correlated.

that may result in more volatility in economic activity over time.

The importance of symmetry in the central bank's monetary policy objectives has also been highlighted in the academic literature. Several papers (*e.g.* Cukierman and Lippi 2005; Cukierman and Gerlach 2003; Cukierman 2002) delve into how the combination of uncertainty about the future state of the economy, and central bank behaviour that is always more sensitive to economic activity undershooting the targeted level rather than overshooting, which can lead to a permanent increase in inflation above target. In other words, a positive inflation bias may be generated if the central bank is relatively more sensitive to falls in activity below target. The papers also show the more the variability of economic activity over the business cycle, the higher would be the degree of the bias.

What do we already know about the Reserve Bank's monetary policy responses to target variables?

Several papers have estimated the sensitivity of monetary policy settings to inflation and economic activity in New Zealand, (*e.g.* Jacob and Wadsworth 2018, Kendall and Ng 2013, Reserve Bank of New Zealand 2007 and Plantier and Scrimgeour 2002). In these papers monetary policy behaviour was modelled as simple linear responses to target variables. This framework was originally developed by Taylor (1993) who found the statistical relationship between the monetary policy stance and target variables as inflation and economic slack could be modelled using a linear regression. If the Reserve Bank followed a linear monetary policy 'rule', an increase or a decrease in, for example, inflation from target, would induce a policy rate gap increase or decline of similar size.

To the best of our knowledge the only paper that has previously examined the issue of asymmetry in the Reserve Bank's monetary policy responses is that of Karagedikli and Lees (2007). They find no evidence to suggest the Reserve Bank has been more or less sensitive to negative output and inflation gaps compared to positive gaps.

How does this paper build on previous work?

Our analysis differs from that of Karagedikli and Lees (2007) in several ways.[3] Perhaps the most important distinction is that we are able to use a much longer sample. The only substantial dip in economic activity during the sample window of 1993-2002 that Karagedikli and Lees (2007) consider is the Asian Crisis of the late 1990s. Our sample period extends through to 2019 and consequently includes more cyclical downturns, the most extreme being the post-GFC period.

Unlike all the papers mentioned in the previous section, our results are informed by a 'real-time' dataset drawn from the Bank's assessment of the current state of the economy at the times when the interest rate decisions were made. Data on inflation and GDP are released by Stats NZ only with a time lag and the time series, particularly those related to GDP, may also be subject to major revisions over history. The data we use includes the deviation of the OCR from the Bank's real-time estimate of the neutral rate, the real-time expected deviation of economic activity from the potential level and the real-time expected deviation of inflation from target.

How do we test for potential asymmetries in the Bank's monetary policy responses?

A conventional linear monetary policy rule that explains the policy stance using only the levels of the inflation and activity gaps as the predictors is not capable of generating asymmetric policy responses.

In our regression specification, the gap between the OCR and the Bank's real-time estimate of the neutral rate, that is, the policy rate stance, is the dependent variable. However, unlike the standard linear specification of the policy rule, the explanatory variables we use include not merely the levels of the quarterly inflation and output gaps but also the squares of these gaps. These 'squared' terms are further separated into those associated with negative and positive values for the respective gaps.

[3] See also the accompanying technical appendix for more discussion on the distinctions between our framework and that of Karagedikli and Lees (2007).

This final technical adjustment allows us to examine whether the response of monetary policy to the inflation gap and the output gap depend on the level of these predictors, and also whether these effects are different for positive and negative gaps.

Our key findings

We present the regression results in Table 1.[4] Unsurprisingly, the estimated coefficients on inflation and the lagged interest rate gap (which measures policy rate smoothing) are positive and also statistically significant. The significant coefficient on inflation implies that through much of the sample period we consider, the Bank stabilised fluctuations in inflation. The high coefficient of nearly 0.8 on the lagged interest rate gap indicates the Bank has, on average, smoothed moves in the OCR in order to avoid unnecessary interest rate instability. In contrast, the coefficients on the squared terms associated with positive and negative inflation gaps are statistically insignificant, suggesting the Bank's response to inflation has not depended on how high or low the gap was assessed to be.

The most striking result in the context of the literature on monetary policy settings in New Zealand is related to the coefficients on economic activity variables. In particular, even though the coefficient on the level of the output gap is not significantly different from zero, the coefficient on the square of the output gap, when the output gap is negative, is negative and also highly statistically significant. This result suggests the Bank's response to economic activity is not linear, with the Bank easing monetary policy more strongly to support the economy when the output gap was more negative. On the other hand, the estimated coefficient on the squared output gap associated with positive output gaps is statistically insignificant. This means the Bank has not tightened monetary policy as much when the economy is overheating.

Moreover, a hypothesis on the equality of the coefficients on the two squared output gap terms is easily rejected, while a similar hypothesis on the equality for the coefficients on the squared inflation terms cannot be rejected. The high sensitivity of the Reserve Bank's policy rate gap to large negative output gaps appears to be the exception in the estimated reaction function. There is no evidence that suggests the Bank has responded unevenly to upward or downward movements in inflation. Also, the monetary policy response to the output gap is insignificant during normal times.

Table 1: Regression estimates

Variable	Coefficient estimate
Intercept	-0.07 (0.72)
Lagged interest rate gap	0.78*** (0)
Inflation gap	1.12* (0.10)
Output gap	-0.11 (0.51)
Squared output gap for positive gaps	0.15 (0.12)
Squared output gap for negative gaps	-0.14** (0.04)
Squared inflation gap for positive gaps	-0.19 (0.78)
Squared inflation gap for negative gaps	-0.63 (0.44)
F test on equality of coefficients on	
(a) Positive and negative squared output gaps	4.42** (0.04)
(a) Positive and negative squared inflation gaps	0.25 (0.62)

Note: Parentheses report p-values, computed using HAC standard errors. The superscript stars correspond to statistical significance levels of 1% (***), 5% (**) or 10% (*) respectively for the corresponding t-test statistics. F-tests are also based on HAC-based covariance matrices.

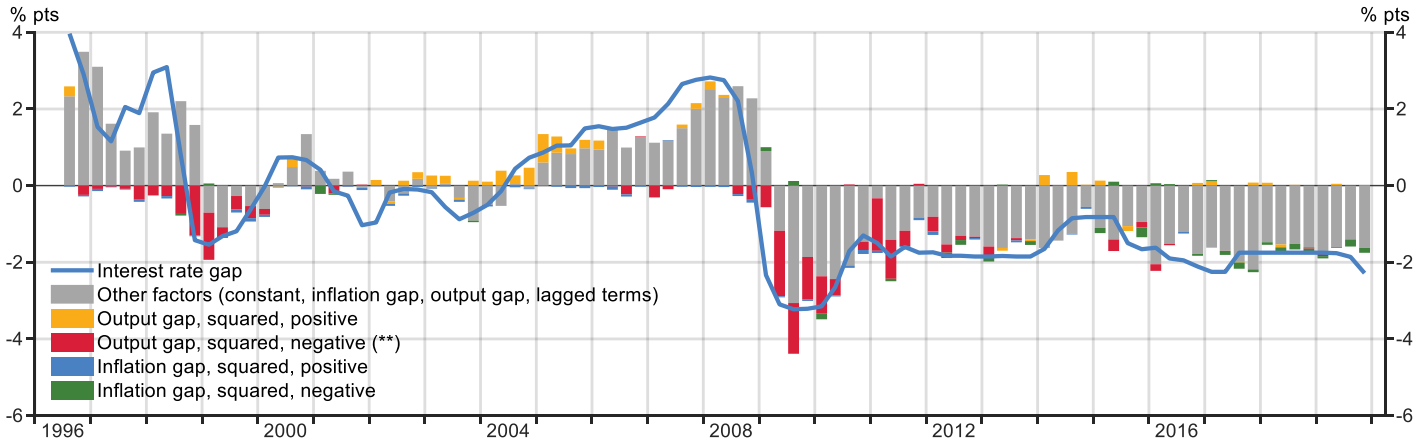
The effects of the various predictors become starker when we plot the estimated contributions to the real-time interest rate gap in Panel (a) of Figure 1, followed by the raw data on the real-time output in Panel (b).

The red bars in Panel (a) indicate the contribution of the effect which comes from the Bank's stronger reaction to a more negative output gap.

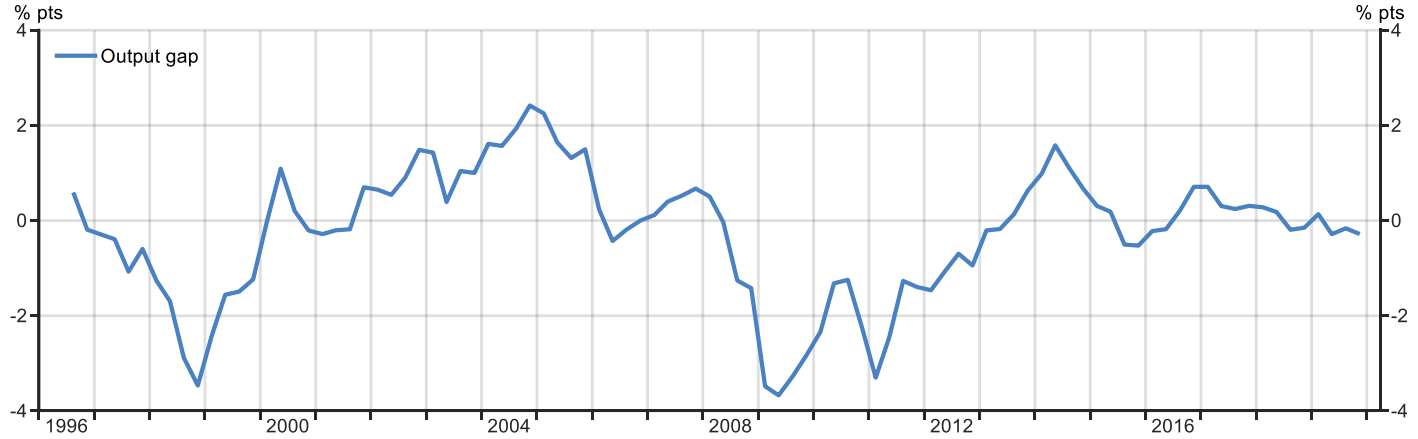
[4] A more detailed version of the table is also presented as Table 2 in the technical appendix that accompanies this paper.

Figure 1

(a) Decomposing the real-time policy interest rate gap from the neutral rate



(b) The real-time output gap from potential output



Note: The symbol '**' that marks the legend to the red bars in Panel (a) indicates that the associated regression coefficient is statistically significant at the 5% level.

The biggest red bars are observed in the aftermath of the GFC, with the contribution to the interest rate gap peaking at nearly 170 basis points as the Bank cut the OCR aggressively. The estimated contributions also spiked around the period of the Asian Crisis of 1997-98 and the Christchurch earthquake of 2011, hovering around the 130 basis point mark on both occasions. The Asian Crisis predates the introduction of the OCR in 1999, and the indicator of the policy stance during 1997-98 is based on the 90-day rate. The Bank also cut the OCR in March 2011, soon after the Christchurch earthquake, which clearly strengthened the estimated effect of the falling economic activity variable on the monetary policy stance.

Interestingly, as economic activity was assessed to be recovering after the various economic downturns, as indicated by increases in the real-time output gap in Panel (b), the asymmetric effect waned and later disappeared.

What do our results imply for monetary policy in New Zealand?

We find no evidence that suggests the Reserve Bank has responded differently to negative and positive cyclical gaps in inflation and economic activity during normal times. Modelling monetary policy behaviour as simple linear responses of the policy rate gap to the inflation and economic activity gaps in a conventional policy rule appears to be a reasonable approximation under these conditions.

However, during sharp downturns in activity as experienced during the Asian Crisis, the GFC and the Christchurch earthquake, the Bank cut interest rates by much more than a standard symmetric policy approach would imply, in order to bolster the economy. Allowing for the nonlinear interest rate gap response to economic activity considerably enriches the description of the Bank's behaviour during economic crises. In contrast, our results do not indicate any nonlinearity in the policy response when economic activity is rising during booms.

The estimated asymmetry in the monetary policy response during severe downturns may be explained by the Bank's preference to respond quickly and decisively, rather than do too little and then experience worsening economic conditions in the future. We find this uneven effect on interest rate settings disappeared when economic activity improved and returned to normal.

Since the easing of the monetary policy stance during various severe economic downturns has been temporary, it is less likely it exerted persistent upward pressure on inflation and generated a bias above target. In fact, in the years following swift and aggressive OCR cuts by the Reserve Bank between 2008 and 2011, inflation has been quite subdued in New Zealand, in line with the global experience.

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