The implications of modified inflation targets for the behaviour of inflation

David Hargreaves, Economics Department

Introduction

This paper reports the results of some simple simulation experiments that show roughly how the variability of inflation might change under various possible Policy Targets Agreements. The paper's primary purpose is to analyse how inflation variability would change if we adopted an explicit "zone of inaction" in the inflation target - for example, if we did not react to inflation so long as it was between 1 and 2 per cent. This is contrasted with a situation where monetary policy always gradually attempts to return inflation to the centre of the target band, as with the current approach to the inflation target.

We find that a substantial zone of inaction would make breaches of the target band much more likely, particularly if the zone of inaction was not centred at the middle of the target band. A large zone of inaction would also lead to a significant decrease in the predictability of changes in the nominal price level over long periods.

The simulation experiment

In this paper, we characterise our current monetary policy process as attempting to shift inflation to the mid-point of the target band within 6 to 8 quarters. Of course, inflation cannot be precisely controlled, given that monetary policy operates with a lag, and because inflation is constantly being influenced by unforeseen events (such as fluctuations in New Zealand's terms of trade). To reflect this, for the purpose of this paper we model inflation as a process which is affected by random shocks, as well as by the control behaviour of the monetary authority. We then use simulation techniques to consider how the pattern of actual inflation outcomes would change if we changed the monetary policy process in response to a new Policy Targets Agreement. For example, we consider how the behaviour of inflation would change if we retained the existing 0 to 3 per cent band, but only reacted to inflation when it got very near the edges of the target band.

The analysis in this paper is based on a very simple simulation. It does not use the Reserve Bank's macroeconomic model (FPS) and does not attempt to model the entire macroeconomy. This means there are some policy issues we cannot cover in this simulation, such as how exchange rate variability might change with different policy behaviour. However, the simplicity makes the results easier to generate and interpret.

We perform these simulations with periods of 18 months. This is because we have tended to produce forecasts where inflation is near the centre of the target band about 18 months in the future. In this simulation, we assume that inflation in 18 months time is equal to the target rate specified by the Reserve Bank, plus or minus a random shock. On this basis, when we simulate monetary policy under the current inflation target arrangements, we assume that inflation in 18 months is equal to 1.5 percent, plus or minus a random shock. This is not a precise characterisation of current monetary policy, but is sufficiently close to give indicative results.

If we adopted a policy target involving a "zone of inaction" (ie an inflation range where, if the inflation rate is forecast to be anywhere in that target range, no monetary policy action would be taken), the inflation rate that we attempt to achieve next period will be related to current inflation. For example, suppose we only react to inflation when it is less than 0.5 per cent or more than 2.5 per cent. In this case, if inflation is 2 per cent, the Bank would be content for it to still be 2 per cent in 18 months. So in our experiment, inflation would be 2 per cent, plus or minus a random shock. If inflation was 4 per cent, we would seek to shift it back to 2.5 per cent (the upper edge of the "zone of inaction" in this simulation), and in 18 months it would be at that level, plus or minus a random shock.

Table 1
Aiming points and outcomes

1. Aiming point or zone	2. Intended range of outcomes	3. Expected probability of outcomes outside 0 to 3 percent	4. Expected probability of average inflation outside of target band over any given five year period
1.5%	0 to 3%	15%	1.5%
1 to 2%	0 to 3%	18%	6%
0 to 3%	0 to 3%	35%	31%
2 to 3%	0 to 3%	34%	28%

To complete these simulations, we need to set the size of the shock to inflation that occurs over the 18 month period. Existing research[1] done with our macroeconomic model suggests that inflation could be expected to fall outside of the inflation target around 15 to 20 per cent of the time. On this basis, for our simulation we calibrated the shock size in order to give us a 15 per cent proportion of breaches in the mid-point targeting base case. This meant the shock had a standard deviation around 1 per cent[2].

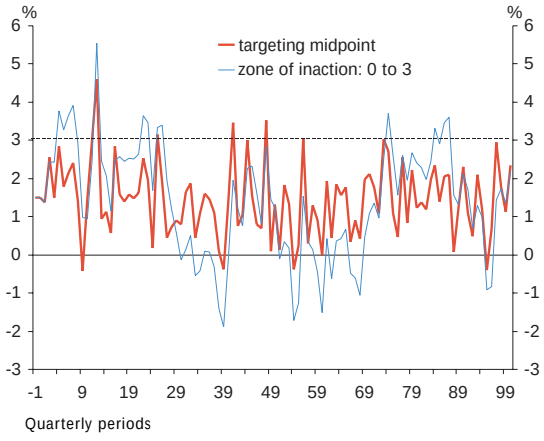
Results

As a control, we first simulated the model assuming we continued to target the 1.5 per cent mid-point, as described above[3]. As expected, this meant that inflation in 18 months was outside the band 15 per cent of the time, with a standard deviation equal to the standard deviation of the shock we were putting in (1 per cent).

We then assumed that the Bank utilised a zone of inaction. Initially, we looked at the extreme example where the Bank only reacted to inflation when it was outside the 0 to 3 per cent target band, and then only returned it to the edge of the target band. The effect of this on the behaviour of inflation can be seen in figure 1. Because inflation is being controlled less rigorously, target breaches are more frequent and more persistent.

The simulation depicted in figure 1 is just one draw (ie random simulation) of 100 periods in length. It is possible that it is not a representative simulation, perhaps because of an unusual series of random shocks. To prevent this distorting

Figure 1
Inflation variability with two different control behaviours: sample simulation



[1] See for example Drew and Orr (1999). Being outside of the band 15 per cent of the time is also consistent with our actual performance since the 1996 PTA.

[2] The size of the shock that would give this proportion of breaches was calculated using standard normal distribution theory, not through simulation. Technically, the base case experiment then served as a control: if the proportion of breaches was significantly different to 15 per cent, we would have known the simulation wasn't working properly. Our estimates of our typical 18-24 month inflation forecast errors are also close to 1 per cent, which is an additional check on our simulation framework.

[3] Simulations were performed in Excel, with 100 draws (separate simulations), each containing 100 simulation periods. The first 10 quarters initialised the simulation and were excluded from the calculation of results.

[4] This makes sense: inflation in each period in this simulation is a constant plus or minus a random shock with a standard deviation we have set at 1 per cent. This is a test to ensure the simulation is working properly, or "control".

our results, we perform 100 draws and average the results to calculate the variability of inflation and the frequency of breaches of the target band.

Table 1 shows (in column 3) that the proportion of target breaches only rises slightly when we switch from aiming at an inflation rate of 1.5 per cent to aiming at 1 to 2 per cent, but rises substantially if we switch to targeting 0 to 3 per cent. We also calculated the standard deviation of the inflation outturns we had simulated. As noted above, the simulation where we targeted 1.5 per cent had a standard deviation of inflation outturns (measured every 18 months) of almost exactly 1 per cent[4]. This only rose slightly with the 1 to 2 per cent band of inaction, but had risen to about 1.5 per cent with a 0 to 3 per cent band of inaction. In other words, the variability of inflation outturns had risen by approximately 50 per cent.

We then went on to consider a couple of other issues. First, we considered the possibility of targeting a zone that was not centred on the mid-point of the target band. As an example, the table above shows the consequences of using a 2 to 3 per cent "thick point" in a 0 to 3 per cent target band. This caused target breaches almost as frequently as when the full width of the band was used. The intuition is that the asymmetric treatment of the band raises average inflation outcomes, so that it only needs a small positive shock to push inflation outside the top of the band.

Second, we performed a different thought experiment: we calculated the number of times that inflation was on average outside the target band for 3 of the 18 month periods in a row (roughly 5 years). The results are shown in column 4 of table 1. As column 4 shows, under our characterisation of current behaviour it is very unlikely that inflation will average outside the band for 5 years or more. It only becomes a little more likely with a 1 to 2 per cent zone of inaction. However, a 0 to 3 or 2 to 3 per cent zone of inaction makes sustained deviations of inflation from the target band much more likely - as much as 20 times more likely than current policy.

The logic behind this is quite simple. If the full band is a zone of inaction, whenever inflation is pushed outside the band, the monetary authority only returns it to the edge of the target band. Unless the monetary authority is lucky with the inflation shocks that follow, inflation may take a while to move back within the band (see figure 1 for examples of this). Once inflation does come back to the edge of the band, because nothing pulls it towards the mid-point (except "lucky" shocks) it is likely that inflation would move outside the band again soon afterwards.

In contrast, in the case of targeting the mid-point, a statistical property called the "weak law of large numbers" operates. In this context, the weak law of large numbers says that if the central bank always seeks to bring inflation to the mid-point, the random shocks will wash out over time, meaning that sustained deviations of inflation from the target band are unlikely.

In this simulation, we have assumed that the way people form inflation expectations is unaffected by alterations in the behaviour of monetary policy. In reality, frequent sustained deviations of inflation from the target might make inflation expectations more volatile, which could make the inflation control process more difficult. In this sense, our results may under-state the potential consequences of a wide zone of inaction.

Conclusion

In conclusion, our simple analysis suggests that, while a small zone of inaction around the mid-point of a target band would not greatly compromise inflation outcomes, a substantial zone of inaction would lead to more frequent and persistent departures of inflation from the target band. In turn, this could be expected to weaken the credibility of the inflation targeting regime and possibly lead to higher inflation expectations.

References

Drew, A. and A. Orr "The Reserve Bank's role in the recent business cycle: actions and evolutions", *Reserve Bank of New Zealand Bulletin*, March 1999