Bandwidth, bandlength, and inflation targeting: some observations

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This article looks into the similarities and differences between inflation rate and inflation band targeting. It also considers the empirical literature on optimal bandwidths and explores the issue of optimal bandlength.

I Introduction

Bandwidth, bandlength and adjustment speed in relation to inflation targeting are three different but interrelated concepts. Loosely speaking, bandwidth relates to the range within which inflation can vary without monetary policy being deemed unsuccessful. Until recently, monetary policy in New Zealand has been operating with a bandwidth of 2 percentage points per annum, but since early December 1996 the band has been widened to 3 percentage points.

Bandlength relates to the time span over which the target is measured. In New Zealand the Policy Targets Agreement (PTA) specifies an annual inflation rate as the monetary policy target. Thus the Reserve Bank of New Zealand operates with a bandlength of four quarters, or one year. Conceivably, however, a quarterly rate of inflation could be targeted, or a six-monthly rate, or a two-yearly rate - corresponding to bandlengths of one quarter, two quarters, and eight quarters respectively.

The term "adjustment speed" describes how quickly policy makers return inflation to their objective, their inflation target, following a shock. For example, if a shock occurs which sends inflation to 3 percent per annum, should policy makers attempt to return inflation to around the middle of the target range the very next period, or should inflation be lowered gradually over a number of periods? The greater the number of periods used to bring inflation back to the target, the slower the implied adjustment speed.

This article discusses these issues within the following structure. The next section examines the merits of targeting a specific, or point, inflation rate versus having a target range for inflation. We find that the theoretical literature suggests that, in practice, these two objectives are quite similar. In section III we discuss the empirical literature investigating optimal bandwidth. In general the literature suggests that the bandwidth should be wider than the 2 to 3 percentage points central banks have typically adopted, athough there are reasons for thinking that the methodologies used may overstate what is required in practice. Section IV discusses the literature on bandlength. This literature suggests that the appropriate inflation bandlength to target is four quarters long. In section V we conclude.

II Inflation rate and inflation band targeting

Policy credibility and accountability

Central banks announce specific inflation targets to help anchor inflation expectations and to raise the level of monetary policy credibility (see Debelle and Stevens (1995)). Generally, however, it is argued that in setting inflation targets, there is a trade-off between credibility and flexibility. Targets also provide a yardstick against which the central bank's success can be measured, allowing the monetary authority to establish a reputation as an inflation fighter. A good reputation leads to increased credibility. But the downside is that a tight inflation objective ties the central bank's hands and leaves it less freedom in how it responds to economic shocks.

Credibility is important because it reduces the costs of achieving the announced inflation objective. A central bank with low credibility will find that its target is not believed, and that inflation expectations remain systematically different from the announced inflation target. This inflation bias occurs because people do not expect policy makers to be able to commit themselves to their announced objective. In light of this concern, an inflation point target may be thought superior to an inflation band target if it instils higher policy credibility.

Finland has a specific inflation rate target: the Bank of Finland endeavours to keep annual inflation equal to 2 percent per annum. However, unanticipated shocks and uncertainty about the structure of the economy conspire to ensure that in any given period an inflation rate target is inevitably missed. Explanations from the monetary authority are then called for (see Goodhart and Vinals (1994)).

Of course when the Finns adopted an inflation rate target they appreciated that they were committing themselves to targeting a variable that they could not precisely control, and that uncertainty would make it impossible for them to hit the target exactly period after period (Brunila and Lahdenpera (1995)). For these reasons inflation outcomes on either side of 2 percent were allowed for.

If departures from the inflation rate target are to be expected in virtually every period, the question arises how large these misses can be before they are considered unacceptable, and result in loss of reputation. Intuitively, the answer depends on the reason for missing the target.

To justify misses from the inflation target, "escape" clauses could be brought into play (Flood and Isard (1988), and Lohmann (1992)). Provided these escape clauses, or caveats as they are colloquially known in New Zealand, are made explicit and established *a priori*, no credibility should be lost by their use. Nevertheless, if such escape clauses are continually invoked, then the targeting arrangement will become almost identical to inflation band targeting.

Cukierman (1994) explores this line of argument, pointing out that an inflation point target with rational agents is similar to an inflation band target. His reasoning is that rational agents, provided they share the same information as the central bank, will be able to determine for themselves the appropriate tolerance range associated with inflation point targeting.

Having recognised that an inflation point target with escape clauses is operationally very similar to an inflation band target,[1] it seems natural, for transparency reasons, to specify a target range (possibly with a few caveats) rather than an inflation point with a whole host of escape clauses. As the width of the bands increases the list of necessary escape clauses decreases.

Earlier we described how an inflation point target will virtually always be missed at least to some extent. But it is not always easy for agents to discern exactly why inflation missed the target. A miss may have been caused by an unanticipated shock, but it may also reflect that the monetary authority was deflected from its inflation objective. The latter will result in lost credibility. Similarly, material mis-judgements of inflation pressures may also harm credibility.

A similar problem can occur with inflation band targeting. As the bands widen the door opens for the central bank to take other considerations into account without inflation breaching the announced band. For this reason, wide bands may be perceived as a weakness of resolve to maintain control of inflation.

1 Or, alternatively, that a target band may serve as a substitute for exemptions, or for state-dependent targets (Yates (1995)).

Policy independence

When inflation bands are announced, typically only the upper and lower edges of the band are mentioned: the centre point is left implicit and it is assumed that inflation outcomes should be scattered on either side of the target range. The Reserve Bank of New Zealand now targets a 0 - 3 percent inflation band; the Reserve Bank of Australia targets a 2 - 3 percent inflation band over the medium term (Debelle and Stevens (1995)); the Bank of Spain aims to keep inflation below 3 percent (Ortega and Bonilla (1995)); the Bank of Israel targets an 8 - 11 percent inflation band (Ben-Bassat (1995)) and the Bank of England targets a 1 - 4 percent inflation band (Bowen (1995)), to name a few.[2] For each of these central banks, however, the centre of the band is not explicitly defined.

One important consequence of not defining explicitly the centre of the target range is that it gives the central bank the latitude to choose its own "centre of the range", which need not be the middle of the declared band. If a central bank can choose its policy goals (rather than have them set by the government), then it has goal independence. Similarly, if a central bank has the authority to choose its instrument settings, then it has instrument independence. However, with an inflation goal set by the government specified in terms of a band, the monetary authority gains some goal independence insofar as it can choose where in the band to target. The wider the inflation band, the more goal independence the government passes over to the central bank, and the more scope the central bank has to apply policy with discretion without inflation breaching its target range.

But central bank accountability does not demand inflation bands: accountability only requires that the central bank be responsible for its actions in light of the objectives set for it. So why then do so many governments, who wish to stabilise prices, define their inflationary objectives in terms of bands?

Inflation variance

It is often argued that the costs of inflation stem not only from the level of inflation but from its variability (Ball and Cecchetti (1990)). Moreover, there is some evidence to suggest that the variance of inflation rises with the level of inflation (Ball and Cecchetti (1990) and Chowdhury

2 The Bank of Canada has a targeting arrangement where the mid-point is defined. They target a 2 percent inflation rate with a band of ± 1 percentage point. The Sveriges Riksbank (Bank of Sweden) also targets a 2 percent inflation rate ± 1 percentage point (Andersson and Berg (1995)).

(1991)). If economic damage is caused by both the level and variance of inflation, then it is natural to set up an inflation targeting framework that constrains them both. It is not easy, however, to articulate to firms, households and policy makers alike an inflation targeting arrangement expressed in terms of inflation's variance. An advantage inflation bands have is that they act as a proxy for the variance of inflation, but are easily understood: to contain inflation inside a "narrow" band policy makers must limit inflation's variability.

An alternative argument for inflation bands is that there may not be a unique "best" rate of inflation. If the economic cost of having inflation at 1 percent per annum is the same as that at 2 percent, or 3 percent, then it is appealing to target an inflation band. Equivalently, if the costs of inflation really only begin to bite for inflation rates above, say, 3 percent and less than 0 percent, then it may be natural to target a 0 - 3 percent inflation band.

Speed of adjustment

Yet another argument for inflation bands comes from the relationship between bandwidth and optimal adjustment speed. When an economic disturbance hits the economy, the problem facing policy makers is not just that of returning inflation to the target: the path inflation takes is also important. The optimal path for inflation back to the target can be summarised in terms of an optimal speed of adjustment. Following a shock, it may not be optimal to return inflation directly to the target. Instead, it may be preferable for policy makers to employ their instrument(s) such that, in the absence of further shocks, 50 percent of the difference between last period's inflation rate and the target rate is removed each period.

Unfortunately, it is difficult to express an inflation targeting objective in terms of an adjustment speed that is clearly stated, widely understood, transparent, and to which policy makers can be held accountable. However, it can be shown that the more policy makers are concerned with the real economy relative to inflation the slower the optimal speed of adjustment should be.[3] In this sense, wider inflation bands are a way of enabling account to be taken of the effect of disinflationary policies on the real economy. Wider bands permit a slower speed of adjustment while retaining transparency and central bank accountability.

III How wide should the inflation band be?

The theoretical literature discusses and contrasts inflation point targets with inflation band targets, but it cannot tell us what bandwidths are reasonable in practice. Empirical papers exploring bandwidths have used stochastic simulations of economic models to generate bands that are interpreted as probability intervals. The bands these methods produce reveal the percentage of inflation observations that one should expect to lie outside the band purely by statistical chance. Consequently, these papers are ideally suited to produce bands appropriate for accountability uses, but less suited to determine bands on grounds of economic costs of inflation, or on grounds of optimal adjustment speeds.

The empirical papers we refer to are those by Haldane and Salmon (1995), Debelle and Stevens (1995), Fillion and Tetlow (1993), and Turner (1996). The bands they develop are based on the criterion that, given appropriate instrument (policy) settings, no more than 5 percent of inflation observations should lie outside the target range. In other words, they address the question of how wide the inflation target range needs to be if a central bank pursuing an inflation control policy is going to be able to keep inflation within range of its target 95 percent of the time.

While only Turner's paper relates directly to the New Zealand economy, these papers generally produce optimal bandwidths far in excess of those that have been adopted by central banks. Haldane and Salmon (1995), in a paper relating to the UK economy, estimate that the band width should be 14 percentage points wide if only 5 percent of inflation outcomes are to breach the band by chance. Similarly, Debelle and Stevens (1995) estimate an optimal band for Australia to be 5 percentage points wide; Fillion and Tetlow (1993) estimate an optimal band for Canada to be 7 percentage points wide and Turner (1996) estimates an optimal band for New Zealand to be 3 percentage points wide.[4]

A weakness with some of these studies is that their models are not based on the price variable targeted by the monetary authority. For example, Turner (1996), in his New Zealand study, models core inflation - not underlying inflation - and thus does not allow for the caveats

3 Similarly, one may want to put restrictions on how much policy instruments can move, as instrument movement can impose costs on the economy. This sort of restriction will also reduce the optimal speed of adjustment.

4 These quoted results are all based on 95% confidence intervals.

present in New Zealand's PTA.[5] By not allowing for these adjustments, these papers are likely to overstate the size of the inflation "forecast errors" made by policy makers. At the same time, each of these studies assumes that once the model parameters are estimated they are known with certainty: parameter variability does not add to the bandwidth they derive.

IV Bandlength[6]

Bandlength relates to the period over which the target inflation rate is calculated. Throughout the world only annual rates of inflation are targeted. While many different bandlengths could be targeted there are practical limits. It is impossible to target a bandlength less than the period over which price series are calculated. In New Zealand price series are constructed quarterly: thus the shortest possible bandlength that could be targeted is quarterly inflation.

Instability and volatility

However, there are other practical concerns to consider with short bandlengths. Since monetary policy only affects inflation with a lag, targeting too short a bandlength may give rise to economic instability as policy makers struggle to target an inflation rate they can scarcely affect with their instruments. Closely related to this, inflation rates are more volatile the shorter the period they are calculated over. If a volatile inflation measure is targeted, then frequent, and possibly severe, policy changes will be needed to keep it within the target range. Alternatively, a wider bandwidth (or more caveats) will be needed to make the target achievable with the same degree of accuracy as one defined on a lower-frequency inflation rate.

Flexibility and accountability

Bandlengths longer than one year allow greater flexibility for monetary policy. When inflationary shocks occur the central bank does not need to intervene immediately, and if inflation is forecast to return to its band, no policy intervention may be needed at all. Increased flexibility, then, means that policy is less likely to intervene unnecessarily.

However, while longer bandlengths may appear to have some advantages over shorter bandlengths, they also have a number of important disadvantages. The longer the bandlength targeted the closer the monetary policy regime comes to one of targeting the price level. In the longer run high inflation in one year must be countered by lower inflation in subsequent years if the inflation target is to be met over the full length of the band. Hence the greater flexibility described earlier is only a short-run property.

Furthermore, long bandlengths make it more difficult to assess the success or failure of monetary policy, weakening the central bank's incentive to pursue the target with diligence. If the central bank's governor is formally accountable for its track record - as is the case in New Zealand - then long bandlengths make it more difficult to assess the governor's performance. To demonstrate this point: if it takes six months for monetary policy to affect inflation and the bandlength is two years, then two and a half years would have to pass before the governor could be made accountable for his/her performance. If the governor's contract length were five years, then that means that half of the governor's contract period would have elapsed before his/her performance could be measured.

Other scenarios, such as linking the bandlength to the length of the business cycle are problematic because the length of the business cycle is not constant and is influenced by monetary policy. Similarly, having a three year bandlength, ie, the length of the electoral cycle, may make monetary policy more susceptible to political pressure, thus reducing the central bank's independence.

Overall, having a bandlength of one year can be justified because it balances the variability costs of short bandlengths against the loss of accountability stemming from long bandlengths. Moreover, an annual inflation rate is practical because it removes seasonal variation from the targeted variable, and is appealing because many contracts (such as employment contracts) are specified in annual terms.

V Conclusions

The relationship between inflation rate targeting and inflation band targeting is both subtle and intricate. Inflation point targeting is easy to understand, highly transparent, and thus easy to monitor for accountability purposes. Yet uncertainty means that an inflation point targeting framework is similar to having an inflation band target with the centre of the target band explicitly stated.

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5 Core inflation is a measure of inflation stripped of its more volatile components, eg, fruit and vegetable prices and energy prices. Underlying inflation is calculated by adjusting for a specified range of "external" price shocks (when they are significant), eg, oil price shocks, and change to the rate of GST.

6 This section draws on Yates (1995). Mayes and Chapple (1995) also discuss the issue of optimal band length.

While wide inflation bands provide scope for policy makers to employ their discretion when shocks occur, they may also present policy makers with some goal independence.

In practice, central banks and governments have balanced these considerations by choosing to target an inflation band in preference to a point inflation rate, but with bandwidths having been set quite narrowly. This is probably not because inflation band targeting provides any significant advantages in terms of transparency or accountability. Rather it is more likely due to the fact that inflation bands formally constrain the variance of inflation, while giving monetary policy some flexibility in its response to shocks.

Empirical studies investigating the optimal bandwidth typically suggest that the bandwidths selected by policy makers are too narrow. If they are correct, inflation outcomes can be expected to violate the target range (like the 2 percentage point band adopted by New Zealand in 1989) more than just very occasionally. Nonetheless, countries which have adopted narrow bands do not seem to have experienced as volatile inflation as the empirical studies suggest. For example, in contrast to Turner's (1996) results, New Zealand's inflation rate has tracked within a 1.5 percentage point range for the past five years. Breaches of the band have been caused more by the level of inflation than by its volatility.

When it comes to selecting the most appropriate inflation bandlength, an annual inflation rate is in many ways an obvious choice. It eliminates seasonality from the inflation rate targeted, people are familiar with the concept of annual inflation, and many contracts, such as employment contracts, have a term of one year.

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