The Australian Approach to Inflation Targeting

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Abstract:

The past decade has seen an increasingly widespread adoption of inflation targeting as the framework for monetary policy. While inflation-targeting regimes share a number of similarities, there are a number of differences in terms of their practical implementation. The paper describes the Australian approach to inflation targeting, which lies towards the more flexible end of the spectrum, and argues that such an approach may be more appropriate for emerging market countries. It compares the framework adopted in Australia with that in other countries, primarily New Zealand and the United Kingdom, and also with that prescribed in the academic literature. It shows that the outcomes in Australia in terms of both inflation and economic growth have been at least as good as those in other countries, and the degree of predictability of the monetary policy decision is on a par with other countries. The paper concludes that, to a large extent, the various inflation-targeting frameworks appear more different on paper than they are in practice, and that over the past decade, this practice has tended to converge.

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1. Introduction

The past decade has seen an increasingly widespread adoption of inflation targeting as the framework for monetary policy. While inflation-targeting regimes share a number of similarities, most importantly the focus on an inflation rate as the objective of monetary policy, there are a number of differences in terms of their practical implementation.

One approach which has become the boilerplate for the growing number of emerging market countries that are adopting inflation targeting is that practised by the Bank of England. This approach places a strong reliance on model-based forecasts (while still providing some scope for judgemental adjustments) and places great store in transparency. Most aspects of the monetary policy process are made known to the public including detailed forecasts, the minutes of the monetary policy discussion and the voting record of the monetary policy committee.

The Australian approach lies towards the other end of the spectrum. The inflation target is to maintain '***consumer price inflation between 2 and 3 per cent, on average, over the cycle***.' This definition of the inflation target is perhaps the most flexible amongst the inflation-targeting countries. The degree of transparency, while high, is not that of the Bank of England or the Reserve Bank of New Zealand, and while the monetary policy decisions are made public, a detailed account of the meeting is not. Despite these differences, as will be shown below, the outcomes in Australia in terms of both inflation and economic growth have been at least as good as those in other countries, and the degree of predictability of the monetary policy decision is on a par with other countries.

The Australian approach may be characterised as less demanding than other inflation-targeting frameworks, and hence perhaps more appropriate for emerging market countries which face problems resulting from large external shocks, extensive structural change, inadequate data to allow historical relationships to be reliably estimated, as well as a lack of relevant data on the current state of the economy. For such reasons, Leiderman (2002) has suggested that emerging markets consider the Australian model. The Australian approach also takes more explicit account of the dual mandate of price stability and full employment. Hence, former Federal Reserve Governor Larry Meyer (2001) has also commented favourably on the Australian model as a potential inflation-targeting framework for the US.

This paper describes the Australian approach to inflation targeting by drawing together various papers and speeches published by the Reserve Bank of Australia over the past decade. The next section provides details of the inflation-targeting framework in Australia. Section 3 focuses on the aspects of the framework in Australia that provide scope for greater flexibility. In doing so, the paper compares the framework adopted in Australia with that in other countries, primarily New Zealand and the United Kingdom, and also with that prescribed in the academic literature. Section 4 describes three episodes over the past decade to demonstrate the flexibility of the Australian framework. Section 5 summarises the macroeconomic outcomes and compares them to those in other countries over the same period.

The paper concludes that, to a large extent, the various inflation-targeting frameworks appear more different on paper than they are in practice, and that over the past decade, this practice has

tended to converge. However, there remain some differences in the Australian targeting framework which may give rise to a more flexible approach to the setting of monetary-policy.

2. Institutional Details of the Inflation-targeting Framework in Australia

The central features of an inflation-targeting framework are a publicly announced numerical inflation target as the primary objective for monetary policy, and the complete operational independence of the central bank in achieving the target. In addition, inflation-targeting central banks have a high degree of transparency and an extensive communication strategy. While these latter features are now commonplace amongst central banks operating under other monetary policy frameworks, one key difference is that the inflation target provides a focal point for the communication strategy and a guiding framework for public accountability and scrutiny.

Within this general definition, there are a number of variations amongst inflation-targeting central banks in the details of their monetary policy frameworks. In this section, the Australian model is compared with that of other countries, in terms of the key features of an inflation-targeting framework identified in Debelle (1997), Bernanke et al (1999) and Schaechter et al (2000). The comparison focuses on the Bank of England and the Reserve Bank of New Zealand (RBNZ) frameworks as being most representative of the other end of the spectrum of inflation-targeting frameworks. The three frameworks are summarised in Table 1.

The discussion in the rest of this section focuses on the institutional aspects of the Australian framework (and can be skipped for those not interested in these details). The aspects of the Australian framework which allow for the possibility of greater flexibility in the conduct of monetary policy are discussed in Section 3.

Legislation

Unlike a number of other inflation-targeting countries, Australia's adoption of an inflation-targeting framework was evolutionary rather than revolutionary. To a large extent, the evolutionary shift reflected the absence of a catalytic crisis such as the radical program of economic reform that occurred in New Zealand following a prolonged period of poor economic outcomes, or in the case of the UK and Sweden, the sudden departure from the ERM.

In part for this reason, at the inception of the inflation target there was no change to the legislated framework, which has not materially altered since its inception in 1959.[2] Moreover, the existing legislative framework was regarded as satisfactory: the Reserve Bank of Australia (RBA) has always had a high degree of legislated independence (Macfarlane 1996a). However, as discussed in more detail below, the operational independence was not always as high. The Australian experience reinforces the notion that legislation does not guarantee independence (although it can certainly hinder it); it is the practice which matters most.

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[2] At that time, the central banking and trading functions of the (then) government-owned Commonwealth Bank were separated, with the Reserve Bank of Australia created to handle the former and the Commonwealth Bank continuing as a commercial bank. The Commonwealth Bank's role as Australia's central bank dates back to the early part of the 20th century.

Table 1: The Inflation Targeting Frameworks in Australia, New Zealand and the UK

	Reserve Bank of Australia	**Reserve Bank of New Zealand**	**Bank of England**
Governing Statute	Reserve Bank Act 1959	Reserve Bank of New Zealand Act 1989	Bank of England Act 1998
Statutory goal	Stability of the currency and the maintenance of full employment	Price stability	Price stability
Inflation target	2 to 3 per cent on average over the cycle	1 to 3 per cent on average over the medium term[(a)]	2.5 ± 1 per cent
Target specified in	Statement on the Conduct of Monetary Policy	Policy Targets Agreement	Annual letter from the Chancellor to the BoE
Measure of inflation	CPI	CPI	Retail Price Index excluding mortgage interest charges[(b)]
Action in the event of a target breach	n.a.	Governor's appointment is reviewed by RBNZ board	Letter of explanation sent to the Chancellor
Inflation report	Statement on Monetary Policy	Monetary Policy Statement	Inflation Report
- inflation forecasts	Qualitative	Yes	Yes, graphical
- output forecasts	No[(c)]	Yes	Yes, graphical
Policy decision announcements	Yes	Yes	Yes
Explanation of policy decision	Detailed press release for policy changes	Detailed statement	Two weeks later when minutes are released.
Monetary policy decision-maker	Reserve Bank Board – 2 internal members, 7 external incl. Secretary of the Treasury	Governor	Monetary Policy Committee – 5 internal members, 4 external
Minutes published	No	n.a.	Yes

Notes: a) Since 2002. From 1996-2002 the target was 0-3 per cent, while from 1990-1996 it was 0-2 per cent. The current Policy Target Agreement also states that the RBNZ should 'seek to avoid unnecessary instability in output, interest rates and the exchange rate.'

b) Soon to be changed to the Harmonised Consumer Price Index

c) GDP growth forecasts are presented semi-annually in the Governor's testimony before a parliamentary committee (see below).

By way of contrast, in New Zealand, the inflation targeting framework was adopted as part of a radical economic overhaul of the New Zealand economy. The legislation governing the RBNZ was completely overhauled, and the inflation target was introduced as the performance benchmark determining the Governor's employment.

In the UK, the current monetary framework was adopted in two stages. An inflation target was adopted as the goal for monetary policy in the weeks following the currency crisis in 1993 as the UK lost the exchange rate anchor of the ERM. However, the monetary policy decision was still taken by the Chancellor, under advisement from the Bank of England. The independence of the Bank of England did not eventuate until 1998, on the election of the Blair government, when new legislation set out the parameters of independence for the Bank of England, as well as codifying the primacy of price stability as the goal for monetary policy.

The Reserve Bank of Australia Act also grants the RBA full power to set monetary policy to pursue its legislated goals, although it is required to inform the government 'from time to time' of its policy. As is appropriate in a democracy, Section 11 of the Act allows for a governmental override, but the requirements on the government in such circumstances are quite onerous, reinforcing the RBA's independence. The government is required to make public in the parliament the details of the disagreement and the decision to override the Bank, and take full responsibility for the consequences of its decision. In practice, this governmental override has never been used. Almost identical override powers exist in both the UK and New Zealand, with the requirement in both countries that the override be made public.

Announcement of the target

The manner in which the inflation target was first introduced has varied across countries. In Australia (as in Sweden and Finland), the inflation target was adopted first by the Reserve Bank in 1993, as an operational interpretation of the price stability goal of its legislated mandate.[3] The inflation-targeting framework in Australia was subsequently verbally endorsed by the government of the day, but was not formally endorsed until 1996, when a new government signed a letter of agreement with a new Governor, upon his appointment. This *Statement on the Conduct of Monetary Policy* re-iterated the Reserve Bank's broad goals stipulated in the Reserve Bank Act, and endorsed the inflation target as the practical interpretation of the medium-term goal of price stability. The status of the *Statement* has been reinforced by the issuance of a second Statement (almost identical to the first) upon the re-appointment of Governor Macfarlane in 2003.

In New Zealand, the inflation target was announced as part of a joint agreement between the government and the central bank. The target itself, contained in the Policy Targets Agreement, acts as the employment contract for the Governor, and is negotiated by both parties. In the UK,

[3] A case can be made that the first public exposition of the inflation target came in 1993 in a speech by then Governor Fraser (1993): 'My own view is that if inflation could be held to an average of 2-3 per cent over a period of years, that would be a good outcome.' Such a formulation was repeated and refined in subsequent speeches by Fraser and the inflation target was gradually elevated in prominence in the eyes of the public and financial markets. In particular, the inflation target was prominent in the justification for the interest rate increases in the second half of 1994. For more details, see Stevens (1999).

the target was announced by the Chancellor who, as mentioned above, had primary responsibility for setting monetary policy at that time. It is now annually set by the Chancellor in a letter to the Bank of England.

A joint announcement of the inflation target is generally preferable in demonstrating that there is unlikely to be any inconsistency between the setting of monetary and fiscal policy. The limited recognition by the public and financial markets of the government's acceptance of the inflation target may have contributed, at the margin, to the apparent lack of credibility that accompanied the early period of inflation targeting in Australia.

After those initial differences in terms of the target's introduction, the ongoing specification of the target is now very similar in Australia, the UK and New Zealand. The *Statement* in Australia is very similar to the current Policy Targets Agreement in New Zealand and the Letter of Remit from the Chancellor to the Bank of England in defining the practical interpretation of the goal of price stability. The latter two are required by legislation, whereas the *Statement* is not.

Instrument independence

Like other inflation-targeting central banks, the Reserve Bank has complete instrument independence in setting monetary policy. This independence has been present at least since the end of the 1980s. Prior to that, it was constrained by a number of factors, including the fixed exchange rate regime which was in place until 1983; although the exchange rate peg was adjusted frequently, the Governor of the RBA was only one of the members of the committee that determined the adjustment. In addition, until the mid 1980s, the RBA was required to be the buyer of last resort of government bonds, which constrained its market operations. Moreover, for much of the RBA's early history, the major monetary policy decisions were generally taken by the Treasurer or Cabinet.

The removal of these features together with the deregulation of the financial system that occurred at the same time, allowed the RBA to use the cash rate (the interest rate on banks' settlement balances with the RBA) as the sole instrument of monetary policy. The shift to one instrument contributed to the RBA's increasingly taking full responsibility for the monetary policy decision over the 1980s. Thus by the end of the 1980s, the RBA's independence had increased greatly both operationally and politically (Macfarlane 1996b). To some extent, this was made concrete in 1990 by the RBA commencing the practices of announcing, by press release, changes in the stance of monetary policy at the time they occurred.

Target value

The midpoint of Australia's inflation target, at 2½ per cent, is the same as that in the UK, although slightly higher than in Canada, Sweden and New Zealand. The choice of this level, in part reflected that inflation had declined to 2 per cent at the time of the adoption of the inflation target, and it was decided that the costs of reducing inflation further below that level were likely to exceed any benefits from having a lower medium-term inflation rate. Furthermore, at that time, no country had maintained an inflation rate below 2 per cent for any sustained period of time (Stevens 2003).

In addition, the positive measurement bias in the CPI, concerns about nominal rigidities in the economy, the costs of deflationary episodes and the zero bound on nominal interest rates all supported an inflation target at a moderate positive level. The historical variability in inflation prior to the introduction of the target suggested that problems resulting from nominal rigidities, deflation and the zero bound on interest rates were likely to be encountered with reasonable frequency if the target was set too low. Such a concern may be an important issue in emerging market countries where inflation has tended to be particularly volatile. Arguing against this concern, problems associated with nominal rigidities in particular may be endogenous to the previous high inflation regime, and as the economy adjusts to a low inflation environment, such costs will decline. In the event, the volatility of inflation has been considerably lower in the inflation-targeting period.

Similar considerations motivated the choice of level of the inflation target in other countries, including the Bank of England. New Zealand took account of these arguments in adjusting upward its inflation target from 0 to 2 per cent to 0 to 3 per cent, and then most recently in 2002, to 1 to 3 per cent. In Canada, the specification of the target from 1995 as 1 to 3 per cent was originally intended to be temporary pending a review of the appropriate long-term rate of inflation, once the economy had adjusted to a low inflation regime. After examining the issue, however, the Bank of Canada concluded in 2001 that 'good theoretical arguments can be made that support further reduction in the target, but it has thus far proven difficult to quantify the longer-term benefits of such a change.'[4]

Measure of inflation

The original formulation of the RBA's inflation target was specified in terms of 'underlying inflation'. The primary reason for this was the inclusion of mortgage interest charges in the Consumer Price Index (CPI). This led to the perverse outcome that an increase in interest rates would mechanically lead to an increase in inflation in the short term, as mortgage interest rates rose. Similar problems were present in New Zealand and the UK where the RPI-X measure, which excludes mortgage interest charges, is the targeted rate of inflation.

The underlying measure of inflation used in Australia excluded the mortgage interest component of the CPI, along with a number of other goods and services whose prices were thought to be subject to temporary supply influences (eg fruit and vegetable prices) or government charges. This measure, constructed originally by the Treasury and subsequently published by the official statistician (the Australian Bureau of Statistics), had the advantage of being a pre-existing measure of underlying inflation that was not constructed by the Reserve Bank. The Australian Bureau of Statistics changed the methodology of the CPI for calculating housing costs in 1998 thereby removing the direct inclusion of mortgage interest rates, and hence from that point on the inflation target has been specified in terms of the CPI.[5]

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[4] Renewal of the Inflation-Control Target - Background Information May 2001. http://www.bankofcanada.ca/en/press/background.pdf

[5] For more information, see Box D in the November 1998 semi-annual Statement on Monetary Policy. A similar change has taken place in New Zealand.

The choice of the CPI rather than alternative measures such as the private consumption deflator in the national accounts, reflects the fact that the CPI has the greatest public awareness, enhancing the inflation target's role as a communication device and anchor for the public's inflation expectations. In addition, the consumption deflator is subject to frequent revision, whereas the CPI in Australia is not revised. In any case, the private consumption deflator and CPI have been highly correlated (0.9) in the inflation-targeting period.

While the CPI is the targeted measure of inflation in Australia and the one for which the RBA is accountable, underlying measures of inflation tend to be the main focus of policy analysis. Underlying measures of inflation attempt to filter out the noise in the inflation process to determine the driving momentum of inflationary pressure in the economy. A range of measures of underlying inflation are used by the RBA, including statistical measures such as the weighted median or trimmed mean, and measures which exclude particular categories of the CPI such as fuel prices, food and vegetable prices etc.[6] These measures all tend to be cointegrated with the CPI in the medium term (Kearns 1998).

Price-level or inflation target

The inflation target is defined on average over the [business] cycle, which if taken literally suggests that it may be interpreted as a price level, rather than an inflation rate, target. However, the averaging refers more to the distribution of inflation outcomes than to a strict average of CPI outcomes. That is, the intent is that over the course of the business cycle, the bulk of the distribution of year-ended inflation outcomes should lie between 2 and 3 per cent, not that the annualized average inflation rate from the start of the business cycle to the end should necessarily lie between 2 and 3.

Practically, this translates into a policy of letting bygones be bygones and allowing 'base' drift in the price level. A shock to the price level which temporarily lowers the inflation rate below 2 per cent does not imply that monetary policy will be set to ensure an offsetting period of high inflation.

While no country has adopted a price-level target, Ball, Mankiw and Reis (2003) argue that a price-level target rather than an inflation-rate target should be the optimal goal for a central bank. Current Bank of England Governor Mervyn King has argued for a hybrid target which returns the price level only very gradually to a long-run path (King 1999). The primary justification for their proposal is that an inflation-rate target is costly because it does not permit long-run predictability of the price level, which has first-order welfare effects in their models.

Ball et al's argument depends importantly on their assumption that agents have completely forward-looking expectations. After a positive shock to the price level, knowing that the central bank has a price level target, agents fully anticipate the disinflation required to return the price level to target. As the disinflation is fully anticipated, there are no expectational errors and hence there is no cost in terms of lost output from the disinflation.

[6] The measures of underlying inflation are discussed in Box B in the November 2002 Statement on Monetary Policy.

In a model where there are costs to disinflation (which would include a model with backward-looking expectations or less than full credibility of the central bank) the gains from full predictability of the price level may not offset the costs of occasional disinflations following positive price level shocks.[7] The general absence of long-term indexed contracts suggests that the benefits of long-run price predictability are not that large.

Inflation forecasting process

Inflation targeting can be characterised as inflation-forecast targeting (see below). The approaches taken in forecasting inflation by the various central banks have some similarities and some differences. The main difference is that both the RBNZ and the Bank of England make greater use of large scale macro-models, whereas the RBA puts greater reliance on single-equation models.

The RBA's inflation forecast is based on a suite of single-equation models of inflation supplemented with judgmental adjustments. In this respect, the RBA's approach to inflation forecasting corresponds to Blinder's recommendation: 'use a wide variety of models and don't ever trust any of them too much' (Blinder 1998, p.12).

The central inflation forecasting equation is based on a mark-up model of underlying inflation. Various measures of capacity are used based on different estimating techniques for the output gap, including a production-function based approach, a Hodrick-Prescott filter, and a estimate derived from a Kalman filter. Alternative Phillips-curve based models are also used, along with single equation AR models. As discussed in more detail below, the estimated passthrough of exchange rate changes to inflation has changed significantly over the past decade. Consequently, models are calibrated with different passthrough coefficients to that estimated by the central model. The output forecast is derived from an aggregation of single-equation models of the individual components of GDP allowing for feedback between the various components. A small model of the macro-economy[8] is also used as a consistency check on the inflation and output forecasts.

The RBA has used larger macroeconomic models in the past, but generally found their performance to be unsatisfactory from a monetary policy perspective. In part, this is because the large scale of the models diminishes the ability to observe the key macroeconomic relationships central to the policy decision.

In contrast, the RBNZ makes extensive use of its large model of the New Zealand economy. Judgemental adjustments may be made to the forecasts generated by the model, particularly with regard to short-term forecasts, but by and large the model forecasts are given greater prominence than they are in Australia. In the UK, the Bank of England also makes extensive use of a large-scale macro-model, and a significant portion of the policy formulation process is taken up with the discussion of the necessary judgemental adjustments to the equations of the model to reflect

[7] Batini and Yates (2001) and Williams (1999) examine this issue more formally.
[8] The model is based on Beechey et al (2000).

current developments. In addition, various smaller alternative models are used to provide information on relationships not well handled by the central model.[9]

In each country, these models are based on the average outcomes over the estimation period. At any point in time, the central bank may have some knowledge about the current and future residuals in the equation which are not easily incorporated into the modelling framework. Hence, all of the central banks make judgemental adjustments to the forecasts generated by the models.

Communication

The adoption of inflation targeting has coincided with a large increase in the written and spoken output of central banks. Increased communication and transparency is beneficial for any monetary policy framework but it has played a particularly prominent role in inflation-targeting regimes. In part this reflects the starting point of many central banks who adopted inflation targeting: they generally had a poor inflation history and low credibility with the public and financial markets. Thus a high degree of communication and transparency was necessary to build credibility as quickly as possible, to enhance the transmission of monetary policy and to provide an anchor for the public's expectations of future inflation. In this respect, Mervyn King (1997) has characterised inflation targeting as 'trust building by talk' (see also Kuttner and Posen 1998). Indeed, the inflation target's role as a coherent framework for the central bank to communicate with the public may be one of its greatest benefits.

There are two important issues for the central bank to communicate to the public. Firstly, the central bank should use every opportunity to re-iterate the target itself and emphasise their commitment to it, to increase the likelihood that it acts as an anchor for inflation expectations. Secondly, it needs to communicate a general understanding of the central bank's reaction function.

Speeches by the Governor and senior officials of the RBA have been a primary vehicle to enhance the status and understanding of the inflation-targeting framework in Australia. Aspects of the framework may also be conveyed in the press release that the RBA issues announcing changes in monetary policy, which includes detailed reasoning for the policy change. From the inception of the inflation-targeting regime, the press releases have made explicit reference to the inflation target as the primary justification for the monetary policy decision. For example, the press release accompanying the first interest rate increase in August 1994 stated: 'Today's action is intended to help keep underlying inflation around 2 to 3 per cent over a long period.' The second tightening in October 1994 again stated: 'Today's forward looking adjustment in monetary policy will help to control those pressures [on wages and prices], and help to keep underlying inflation around 2 to 3 per cent.'

The other major source of information on the central bank's reaction function has been the quarterly inflation reports or their equivalent. The RBA had traditionally published a detailed assessment of its monetary policy actions only in its annual report, with very brief accounts of current economic conditions published quarterly in the RBA *Bulletin*. However, with the

[9] For more detail on forecasting at the Bank of England, see Pagan (2003).

inception of the inflation target, the quarterly assessments on its view of the current and future state of the Australian economy gradually increased in length and depth of analysis, to reach their present form where they are published as a stand-alone document – the quarterly *Statement on Monetary Policy*.[10] In this sense too, the RBA's communications strategy has evolved more gradually than other central banks, but practice has converged over time.

The inflation target has served as a useful organising framework for this document. Analysis is provided on all of the variables that feed into the RBA's overall outlook for inflation and output, with the concluding section focusing on the outlook for inflation and the risks to that outlook.

There is some variation in the information presented in the inflation reports of the RBA, RBNZ and Bank of England. The RBNZ provides the most information on its forecasts. It publishes numerical projections for all the major macroeconomic variables that feed into the inflation forecast. However, in recent times, the RBNZ has shied away from publishing quarterly numerical forecasts for inflation and output, preferring to present the information graphically, and by presenting the numbers to the nearest ¼ percentage point and for half years or full years rather than quarters.

The Bank of England publish forecasts for both inflation and output, presented in the form of a 'fan chart' which shows the probability distribution of outcomes for inflation and output around a central forecast. No explicit numerical forecasts are presented although it is straightforward to determine the central forecast from the fan chart.

The RBA also does not publish precise numerical forecasts, instead preferring to provide a qualitative outlook for inflation and the balance of risks around the central outlook.[11] This may be described as a 'verbal fan chart'. For example, the inflation forecast in August 2003 was presented as: 'year-ended underlying inflation now appears likely to decline to around 2 per cent in the first half of 2004. Assuming no further change in the exchange rate, it would be expected to remain around that level during the second half of the year before edging up slightly in mid 2005 as the effects of the appreciation on prices begin to dissipate.' A forecast for GDP is presented semi-annually when the Governor testifies before the parliament (see below), and as in New Zealand, the forecast is to the nearest ¼ percentage point and for the year ahead.

One primary reason for the RBA's strategy is the desire to avoid excessive focus on the central bank's short-term forecasting performance and create a sense of false precision (see Kohn 2000). The quarterly forecasts are subject to a large degree of noise whereas it is the overall trend in the inflation process which is the key element for the monetary policy decision.

Ex post it is important to explain why observed CPI outcomes are, or are not, consistent with the central bank's view of inflation, and some time is spent in the RBA's quarterly Statement on Monetary Policy explaining the details and implications of the quarterly CPI outcomes. Whether or not the central bank accurately forecasts the next quarter's outcomes to the nearest decimal point, however, implies a degree of knowledge and precision that a central bank does not

[10] The 1996 *Statement on the Conduct of Monetary Policy* reinforced the status of these documents as a primary means of accountability and communication for the RBA.
[11] The forecasting assumptions for the exchange rate and oil prices are also published.

possess. Thus the focus of the public and financial markets should be on the accuracy of the central bank's inflation forecast at the policy horizon.

While the details of the RBA Board's decision are made public in a press release at the time of changes in monetary policy, they are not made public when the stance of monetary policy is left unchanged. However, over the past year or so, the introduction to the Statement on Monetary Policy has also summarised the deliberations taken by the RBA Board at their monthly meetings on monetary policy, whether policy was changed or not. The detailed minutes of the meeting are not published, rather the consensus view is presented. The minutes of the Monetary Policy Committee meeting are published with a two-week lag in the UK, while in New Zealand, the Governor's views are contained in the monetary policy statement released at the time of the policy decision.

Bernanke et al (1999) discuss the possibility of a tradeoff between flexibility and transparency. They argue that the less the central bank communicates, the more flexibility it gives itself in its future actions. In practice, this tradeoff does not seem to have been an issue in most circumstances. A primary aim of the communication has been reinforcing and clarifying the inflation objective of the central bank in the public's mind. The increased focus on the target and the public's understanding of the central bank's commitment to the target has in turn allowed the central bank more flexibility in dealing with unexpected shocks.

It is however possible that there is a limit to transparency. If the central bank's communications suggest that it has greater knowledge or greater precision in its inflation control than it does in reality, then when this becomes apparent and the public's expectations are disappointed, the central bank's credibility may be damaged. There is likely to be some advantage from being modest in communicating what the central bank knows and can do. This does not mean that the central bank can hide behind a veil of uncertainty but rather that it should acknowledge that uncertainty and convey to the public the implications of the uncertainty for its inflation forecasts and policy actions.

Decision-making process

The means by which the final decision on monetary policy settings is made vary across the inflation-targeting countries. Most countries including Australia have a decision-making board or committee, but in New Zealand, the final decision on interest-rate settings rests solely with the Governor.

The composition of the RBA Board differs from that in comparable countries in two ways. Firstly, the Secretary of the Treasury (a bureaucratic position) is a voting member of the board. In some other countries (eg, the UK), a treasury representative is present, but does not vote. Secondly, the Board consists of a mix of businesspeople and trained economists – the latter including the Governor, Deputy Governor and Treasury Secretary, and by long tradition, an academic economist. While in the UK some members of the Monetary Policy Committee (MPC) come from the private sector, they have, to date, been trained economists. Thus, in Australia, a significant part of the Board consists of non-economists.

Accountability

In exchange for the independence and greater discretion that an inflation-targeting framework permits a central bank, it is important that the central bank be held accountable on a regular basis to the public. To some extent, financial markets are continuously holding a central bank accountable for its actions. Any deviation from a 'sensible' course for monetary policy would likely be penalised by movements in the longer end of the yield curve or by movements in the exchange rate.

However, more formally (and democratically), the *Statement on the Conduct of Monetary Policy* requires that the Governor and other senior central bank officers appear before a parliamentary committee twice a year to explain its thinking and actions on monetary policy. These appearances are in public, and allow the public via the parliament, to question whether the central bank's actions remain consistent with the inflation target. The Governor has traditionally used this opportunity to update the Bank's outlook for the economy and inflation and the risks to that outlook, and explain why these forecasts may have changed. Over the past year or two, the Governor has also provided an indication of the Bank's medium term outlook for the stance of monetary policy (ie, monetary policy bias).

3. The Flexibility of the Australian Approach

The different features of the various inflation-targeting frameworks that allow for varying degrees of flexibility are most usefully considered using the following simple model, standard in the inflation-targeting literature (eg, Svensson 1997, 2003). The model is easily extended to an open economy (Ball 1999 and Svensson 2000).

$$L = E_t \sum_{s=t}^{\infty} \delta^{s-t} [(\pi_s - \pi^*)^2 + \lambda y_s^{\,2}] \qquad (1)$$

$$y_t = \alpha y_{t-1} - \beta (r_{t-1} - r^*_{t-1}) + z_t + \varepsilon_t \qquad (2)$$

$$\pi_t = \pi^e_t + \gamma y_t + \eta_t \qquad (3)$$

The model consists of a quadratic objective function in inflation and the output gap (1). The central bank targets an inflation rate π^*, by setting an interest rate r. The aggregate IS curve (2) assumes a one-period lag for monetary policy. z_t is a vector of other exogenous influences on the real economy, such as foreign demand. r^* is the equilibrium real interest rate (Wicksellian natural rate of interest). The expectations term in the Phillips curve (3) may be a linear combination of backward-looking and forward-looking expectations.

The optimal policy in this model can be characterised as inflation forecast targeting, 'setting the instrument so that the corresponding conditional inflation forecast, conditional on all relevant information and judgment, is consistent with the inflation target and the output-gap forecast not indicating too much output-gap variability' Svensson (2003, p. 466). In other words, the inflation target acts as a filter for all the information available to the central bank on the current and future state of the economy.

While it is possible in the simple framework above to derive the optimal rule (reaction function) for monetary policy, in practice none of the inflation-targeting regimes stipulate a commitment to a particular rule. The primary reason is that central banks are facing a much larger information set, a much more complicated economic structure than the models assumed in the monetary policy rules literature and much greater uncertainty. Simple Taylor-type rules may approximate the reaction function of the central banks in many circumstances, and hence may be a useful input into the policy discussion. They will not be able to explain monetary policy actions in circumstances that lie outside the structure of the model (such as the effect of the Asian crisis on the Australian economy).

In any case, inflation targeting takes a somewhat different approach to the rules versus discretion debate by shifting the focus to outcomes rather than actions. The inflation target itself constrains the actions of the central bank rather than an instrument rule. Hence Bernanke et al (1999) characterise inflation targeting as 'constrained discretion' rather than a rules-based approach to monetary policy. The track record on inflation is what predominantly influences the credibility of the central bank, rather than its adherence to any particular monetary rule. While the lags in monetary policy may imply that is difficult to monitor the central bank's performance, the large increase in transparency of inflation-targeting central banks has served to mitigate this problem.

Models of this form generate a tradeoff between output variability and inflation variability (sometimes referred to as a Taylor curve),[12] as λ, the relative weight on the output term in the objective function, is varied. The differences between the various inflation-targeting frameworks observed in practice can be considered to be different choices about the position on this tradeoff curve. The frameworks determine how much variability in output will the central bank tolerate in achieving its inflation target. Importantly, this assumes that greater inflation variability does not affect the credibility of the inflation-targeting regime and that greater output variability does not have any effect on the real economy. That is, the choice of λ does not affect, in expectation, the average level of inflation or output in the economy, only the variability around the mean.

The aspects of the Australian framework which have the potential to deliver greater flexibility are the dual mandate specified in the goals, the emphasis on a (thick) point target rather than a band, and the specification of a horizon for the target. These are discussed in the remainder of this section.

Goals

The legislation specifies that the goal of the Reserve Bank is to set monetary policy to best contribute to:

(a) the stability of the currency of Australia;

(b) the maintenance of full employment in Australia; and

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[12] Taylor 1979. These curves are the efficient frontier of combinations of output and inflation variability given the structure of the economy and the shocks to the economy (generally based on the estimated historical shocks) assuming optimal monetary policy. In theory, an indifference curve can be drawn in the same space, resulting in an optimal choice of λ.

(c) the economic prosperity and welfare of the people of Australia.

These goals were determined for a fixed exchange rate regime. With the floating of the currency in 1984, the first of these goals has been interpreted to mean price stability, rather than literally the stability of the exchange rate.

The legislation clearly states that monetary policy has both nominal and real objectives, similar to the goals specified for the Federal Reserve Board.[13] The *Statement on the Conduct of Monetary Policy* clarifies the possible tension between the real and nominal goals. It recognises that price stability is the main contribution that monetary policy can make to sustained growth in output and employment, but also recognises that monetary policymakers need to be cognisant of the short-term effects of monetary policy on the real economy. The current Governor of the RBA has characterised the interaction between the two goals thus: 'monetary policy is set in a way which allows the economy to grow as fast as possible, consistent with the inflation objective, but no faster' (Macfarlane 1996b).

In New Zealand, the UK and Europe, there is a clear lexicographic ranking of these two objectives, with the primary goal of the RBNZ, the Bank of England and the ECB being price stability, while real economy goals are given a subordinate weighting. For example, the Bank of England Act 1998 states that the objectives of the Bank of England shall be (a) to maintain price stability, and (b) subject to that, to support the economic policy of Her Majesty's Government, including its objectives for growth and employment.

The recognition that growth/employment outcomes were an important consideration for the central bank initially set the RBA apart from other inflation-targeting central banks where the rhetoric (at least) reinforced the primacy of price stability. But despite these apparent differences, in practice the experience suggests that there has been little substantive difference between Australia, New Zealand and the UK in this aspect of the framework. Any differences have been further reduced by the recent changes to the Policy Targets Agreement in New Zealand which now states that 'in pursuing its price stability objective, [the RBNZ] shall seek to avoid unnecessary instability in output.'[14]

In the event of demand shocks, there is not a large conflict between the real and nominal objectives; the monetary response is the same to meet both objectives, and the actions of all the inflation-targeting central banks would not be significantly different. There may be some difference at the margin in terms of the speed with which inflation is returned to the target range. The Australian system potentially puts more emphasis on minimising short-term output variability and tolerating greater inflation variability (i.e., a higher value of λ). In doing so, it needs to rely less on transmission channels such as the exchange rate which can have a more immediate effect on inflation, than working through the output gap.

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[13] The similarity reflects the fact that the goals of both central banks were determined immediately after the Second World War (in Australia's case, these goals had been given to the Commonwealth Bank in 1945), with the Depression still relatively fresh in the minds of the legislators.

[14] Policy Targets Agreement 2002. http://www.rbnz.govt.nz/monpol/pta/0124848.html

In the case of most supply shocks, where the required response to meet the two objectives may differ in the short term, each of the frameworks is sufficiently flexible to cause no material difference in the central bank's response. Only in the event of a large supply shock (such as the oil price shocks of the 1970s) might any difference in response across the different frameworks become apparent.

All of the central banks have both inflation and output (employment) in their objective functions and practice some form of flexible inflation targeting (Svensson 1997). That is, none of the central banks are an inflation 'nutter' where inflation only is in the objective function.[15] The dual mandate of the Reserve Bank of Australia would again tend to suggest a higher value of λ than the other central banks, in that if a shock were to drive inflation and output away from target in divergent directions, it would tolerate a slower return of inflation to target (ie inflation variability would be higher) to reduce output variability.

Svensson (2003) has criticised central banks for not providing more information on the relative weights on inflation and output in the objective function. He argues that increased transparency in this regard would further enhance the accountability of the central bank. There would appear to be a number of practical difficulties with this proposal. It assumes that the public welfare function maps into a quadratic objective function for the central bank, although Woodford (2002) describes a model where this is the case. It also assumes that the public and the central bank have similar models of the economy – different models can generate different variability tradeoffs. Nevertheless, Cecchetti et al (2002) derive estimates for λ for a range of countries (both inflation-targeting and not), assuming a simple structural VAR model of each economy. They also show that their derived values of λ are relatively robust to the choice of economic model.

Moreover, one could argue that the weights are conveyed to the public implicitly in the central bank's discussion of the outlook for the economy and in their policy decisions. That is, the inflation forecast and the discussion of the risks surrounding the forecast effectively summarise the central bank's preferences. Hence discussion of whether the central bank is setting policy appropriately can be viewed as a discussion of whether the central bank has the 'right' value of λ.

Point target or target band

The '2 to 3 per cent' specification may appear to suggest that the inflation target in Australia is a narrow band. However, the intent of this language is that the target is a 'thick point' rather than a range, or in other words, the desirable rate of inflation for the Australian economy is '2 point something' (Stevens and Debelle 1995).

One explanation for the decision not to specify an inflation-targeting band is that the historical experience of inflation in Australia suggested that a band within which inflation could be expected to remain most of the time needed to be at least 4 percentage points wide (Stevens and Debelle 1995). Accordingly, it was considered that announcing such a wide target band would be detrimental to the credibility of the regime. As it has turned out, the inflation process has been

[15] Note that even an 'inflation nutter' central bank will have a positive weight on output in its reaction function, even with a zero weight on output in its objective function (see Debelle 1998).

considerably less volatile (particularly in underlying terms) over the inflation-targeting period. The target rate of inflation has remained within a range of 2.5 ± 1 percentage point in all bar three quarters since 1993.

Another aspect of this issue, which reflects the greater flexibility of the Australian framework, is that given the target is interpreted as a thick point, there are no explicit penalties imposed on the RBA should inflation move outside the 2 to 3 per cent range. In part, this reflected a concern that a hard-edged band with explicit penalties would introduce a discontinuity in the payoff function which might induce unnecessary instability in monetary policy settings. Alternatively, a hard-edged band would imply a lower value of λ, with less tolerance for inflation variability. The penalties in the Australian framework are less explicit. The RBA is increasingly uncomfortable at an increasing rate as inflation moves away from the desired level.

In contrast, in New Zealand, the inflation target is the employment contract for the Governor. Whenever inflation lies outside the 1 to 3 per cent range specified in the Price Target Agreement, the RBNZ board must assess whether the Governor's appointment should be terminated. (To date, the decision to terminate employment has never been taken, although the band has been breached.) In the UK, should inflation fall below 1½ per cent or rise above 3½ per cent the Monetary Policy Committee is required to write a letter of explanation to the Chancellor. The accountability in Australia is, in this regard, less formalised, with the penalties being imposed via financial markets, the parliamentary testimonies and through loss of reputation.

Target Horizon

Related to the above issue, and at the heart of the variability tradeoff discussed at the beginning of this section, is the horizon over which inflation is returned to target. The RBA's inflation target is defined 'over the course of the cycle', 'allowing for the natural short-run variation in inflation'. While the allowable short-run variation is not defined, the aim is that in most circumstances, the Bank's inflation forecast should lie between 2 and 3 per cent at the monetary policy horizon (eighteen months to two years), that is, the maximum impact of changes in monetary policy on inflation.

In circumstances where the forecast lies outside the range over the policy horizon, the forecast path for inflation should be such that inflation would be expected to return to between 2 and 3 per cent within a reasonable period, that is, the trend in inflation should be clearly back toward the target range. Such a situation has not occurred since the introduction of the inflation target, although the forecast for inflation has, at times, included near-term forecasts of inflation outside the target range. In Australia, there is thus no specific horizon for the inflation target, allowing greater flexibility in policy-setting, and less variability in output.

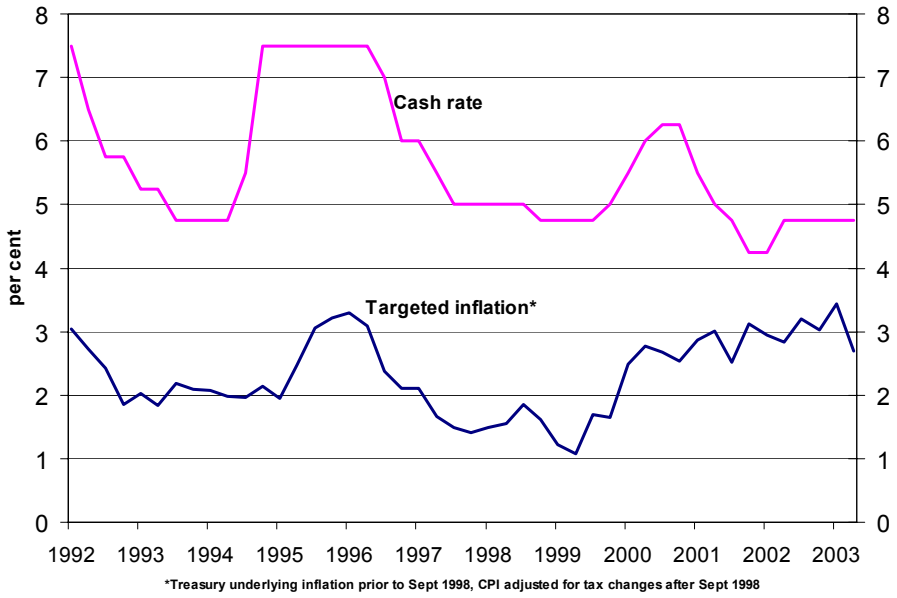
The Bank of England has been more explicit in focussing on an optimal horizon of eighteen months to two years (Batini and Haldane 1999). More recently, Charles Bean (2003) has countenanced a more medium-term horizon in the context of the appropriate response of monetary policy to asset prices. For most of the inflation-targeting period in New Zealand, the hard-edged nature of the inflation target has required the RBNZ to be less tolerant of inflation variability and operate with a shorter horizon. In general, the inflation forecast was required to lie within the target band at all times. However, in the most recent PTA instituted in 2002, the

RBNZ has moved to a much more medium-term timeframe with very similar wording to Australia; the policy target is now 'to keep future CPI inflation outcomes between 1 per cent and 3 per cent on average over the medium term'.

4. Flexibility in Practice

To illustrate the practical application of the inflation-targeting framework in Australia and its flexibility, it is useful to focus on the operation of monetary policy in three particular episodes. The first in 1994 demonstrates the pre-emptive monetary policy response to demand shocks. The second is the Asian crisis where there was a major negative shock to external demand and a large depreciation of the exchange rate. The third is the introduction of the goods and services tax in 2000 which boosted the price level by 3 per cent in one quarter.

Graph 1: Inflation and Monetary Policy



Source: ABS, RBA

4.1 Responding to demand shocks

By the middle of 1994, signs of inflationary pressure were evident as economic growth was accelerating toward 6 per cent. The labour market had tightened as the unemployment rate had declined by around 3 percentage points in two years, and wage pressures were building. Inflation expectations in financial markets had increased by around 2 percentage points. However, underlying inflation was still at 2 per cent.

In anticipation of a rise in inflation, and reflecting its inflation forecasts, the Bank raised the cash rate by 275 basis points in three moves over the second half of 1994. The press releases that accompanied these tightenings emphasised the need to act pre-emptively to curtail the upward movement in inflation. Subsequently, in 1995, inflation did indeed rise to slightly above 3 per cent in underlying terms, but by less than would have been the case had the tightening in monetary policy not taken place. Indeed, the financial markets anticipated significantly more

tightening than actually occurred reflecting their lack of faith in the credibility of the relatively new inflation-targeting framework.

In 1996, as demand pressures were easing, inflation was forecast to move lower, even though inflation at the time was still 3.1 per cent. The stance of monetary policy was moved back toward a more neutral setting, reflecting the inflation forecasts.

In this situation, the overall monetary policy decision was relatively straightforward as the required movement was the same to meet both inflation and output goals, as is the case in the event of demand shocks.

This episode also demonstrates the flexibility offered by the medium-term nature of Australia's inflation target. In 1994, monetary policy could have been tightened sufficiently to ensure that underlying inflation did not rise above 3 per cent. But the rise was forecast only to be temporary after which inflation was expected to fall back below 3 per cent, hence the additional tightening was not delivered. As a result, there was less volatility in output. The critical issue in determining the extent of the tightening was whether inflation was forecast to return to the 2 to 3 per cent range within the policy horizon (around eighteen months). In both instances, the flexibility of the framework also allowed the decision of whether the target was in jeopardy to be reassessed as the situation evolved.

4.2 The Asian crisis and exchange rate shocks

At the onset of the Asian crisis, the Australian economy was growing at around trend rates, with domestic demand beginning to accelerate, and underlying inflation at 1.6 per cent. Monetary policy had been eased over the past year or so in anticipation of the decline in inflation that subsequently occurred. Thus the shock hit the Australian economy at a time when it was in reasonable shape with the stance of monetary policy already relatively expansionary.

Exports to east Asia accounted for around one-third of Australia's exports. In the year following the onset of the crisis, Australia's exports to the region declined by nearly 20 per cent, directly subtracting around one percentage point from aggregate growth. Thus the decline in output in the east Asian region represented a significant negative demand shock to the Australian economy. Australia's terms of trade also fell sharply as commodity prices declined, further exacerbating the decline in export demand.

At the same time, the Australian dollar depreciated by around 20 per cent. In the past, such a large depreciation of the exchange rate would have led to a rise in inflation expectations, a pick-up in inflation due to higher import prices and would have necessitated a sharp increase in interest rates to bring about a disinflation. This policy response was contemplated at the time but rejected because it was considered that the inflation target in the medium term was not expected to be in jeopardy, even though in the short term, inflation was forecast to rise above 3 per cent as the depreciation was passed through to consumer prices. The forecast rise in inflation was not expected to be permanent, because the contractionary impulse from the decline in export demand, combined with the credibility of the inflation target was expected to keep inflation expectations in check. Again, the flexibility of the target allowed the validity of this assumption to be reassessed as time passed.

In the event, inflation rose by less than was forecast, in part because of the decline in the pass-through of the exchange rate depreciation (discussed above), as well as a greater than expected disinflationary impulse from the Asian region which put downward pressure on import prices.

If policy had been set to ensure that inflation did not rise above 3 per cent, the rise in interest rates would have exacerbated the contractionary shock to foreign demand. With the benefit of hindsight, given the lower than expected inflation outcomes, this would have resulted in a significant undershooting of the inflation target.

The flexible inflation target served as a useful framework to think about the Asian crisis. Strong consideration was given to the goal of output stabilisation because the inflation target in the medium term was not felt to be in jeopardy. In addition, the policy credibility that had built up since the adoption of the inflation-targeting regime also allowed the Reserve Bank greater flexibility in its policy response.

4.3 Price level shocks

On 1 July 2000, a 10 per cent broad-based goods and services tax was introduced, replacing a wide range of indirect taxes that had been levied primarily on goods. As a result, the price level measured by the CPI rose by 3 per cent. Year-ended CPI inflation was thus boosted by 3 percentage points until this rise in the price level dropped out of the calculation one year later. Underlying measures of inflation were similarly boosted because of the broad-based nature of the tax. In the September quarter 2000, the CPI inflation rate was 6.1 per cent, while the weighted median inflation rate was 5.4 per cent.

The increase in the price level was fully anticipated by households and financial markets. However, the increase in the CPI did not feed through to medium-term inflation expectations or into wage outcomes.[16] This was helped by the provision of income tax cuts at the same time (and adjustment of benefits) which offset the effects of the rise in the price level so that real incomes were not harmed.

The Bank did not seek to offset the effect of the GST on the price level. It assumed that the boost to the price level would be once-off, and that the credibility of the inflation-targeting framework would ensure that inflation expectations remained anchored at the target rate. It announced this strategy well in advance of the event, to help condition expectations that the rise in inflation would only be temporary. Again, the assessment was made that the inflation target was not in jeopardy in the medium-term with year-ended inflation forecast to be within the targeted range once the effect of the GST had passed.

In the event, the Bank's strategy was successful and the inflation target proved to be credible. Almost all of the public discussion at the time on the appropriate setting for monetary policy focussed on the inflation outcomes excluding the influence of the changes in the tax rate. The price level shock was mostly regarded as a non-issue. Medium-term inflation expectations remained stable.

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[16] Some wage agreements did have a clause which allowed for larger increases should the boost to the CPI be greater than expected.

Monetary policy was tightened reflecting the combination of other sources of price pressure, including strong economic growth, a sharp rise in oil prices and the depreciation of the exchange rate.

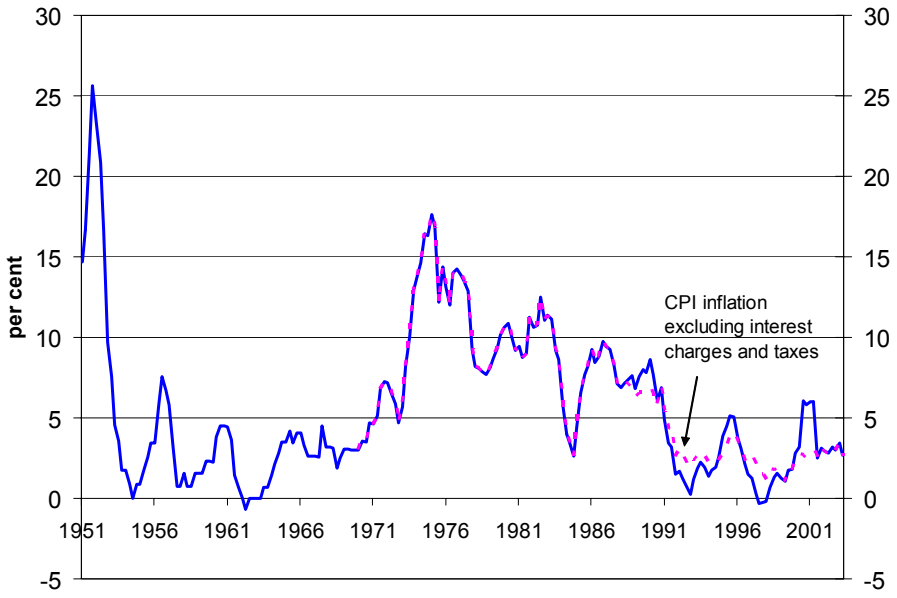
5. Economic Outcomes

5.1 Inflation

In the 1970s and 1980s, Australia had a relatively poor record on inflation (Graph 2). Inflation was already at a relatively high level prior to the first oil price shock, in part due to a large shift upward in wages in the early 1970s. The rise in oil prices helped to entrench inflation at a high rate. While other countries experienced a similar inflationary burst during the 1970s, Australia's inflation rate remained high relative to other OECD countries throughout the 1980s, averaging around 8½ per cent.

Graph 2: Inflation

year-ended percentage change in the CPI



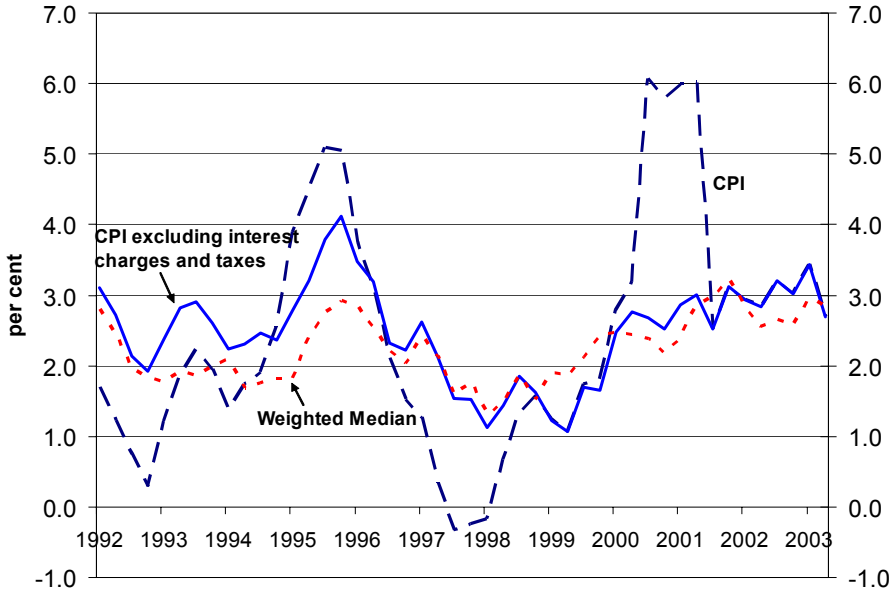
Source: ABS, RBA

A number of monetary policy frameworks were used over this period.[17] A fixed or adjustable pegged exchange rate regime was in place until the early 1980s. After the floating of the exchange rate in 1983, monetary targeting was tried for a short period followed by 'checklist' approach which took account of a wide range of economic data but tended to confuse instruments and objectives and lacked a coherent organising framework for analysis. Inflation declined sharply following the recession in 1990/91, to be 2 per cent at the beginning of 1992. Thus, the inflation target was introduced when inflation was already low, but at risk of rising again as the economy emerged from the recession.

[17] The history of Australia's monetary frameworks including the adoption of inflation targeting is covered in detail in Grenville (1997) and Macfarlane (1998).

Since the inflation target was introduced in 1993, CPI inflation has averaged 2.6 per cent. CPI inflation has fluctuated between -0.3 per cent and 6.1 per cent (Graph 3), suggesting a reasonable amount of inflation volatility. However, as mentioned above, much of this fluctuation resulted from the inclusion of mortgage interest charges in the CPI prior to 1998 and hence this measure is not a useful measure of the success of the framework. In addition, the introduction of a goods and services tax (GST) on 1 July 2000, raised the price level by just under 3 per cent resulting in the temporarily high readings for year-ended inflation in 2000/01. Using a measure of the CPI that abstracts from these two influences, which is of more relevance to the monetary policy decision, inflation has averaged just under 2½ per cent and ranged between 1.1 and 4.1 per cent over the inflation-targeting period.

Graph 3: Measures of inflation



Source: ABS, RBA

The inflation target was defined in terms of underlying inflation prior to 1998. Reflecting this, a 'target' series for inflation may be characterised as the 'Treasury' underlying measure of inflation prior to 1998, and the CPI adjusted for tax changes post 1998. This series has averaged 2.3 per cent over the target period. Similarly the weighted median measure of underlying inflation[18] (adjusted for the effect of the GST) has averaged 2.3 per cent and fluctuated between 1.3 per cent and 3.2 per cent.

Thus on any of these benchmarks, the inflation outcomes have been consistent with the inflation target. The policy-relevant measures of inflation have not fluctuated by much more than a percentage point around 2½ per cent. CPI measures of inflation have exhibited greater fluctuations than this, but the RBA has been prepared to tolerate these fluctuations on the judgement that these deviations from the inflation target would prove to be temporary. This assessment has proven to be correct, with no deviation lasting more than one year.

[18] This uses the median price change in the quarterly distribution of the price changes of all the components of the consumer price index, where each price change is weighted by the weight of the good or service in the CPI basket.

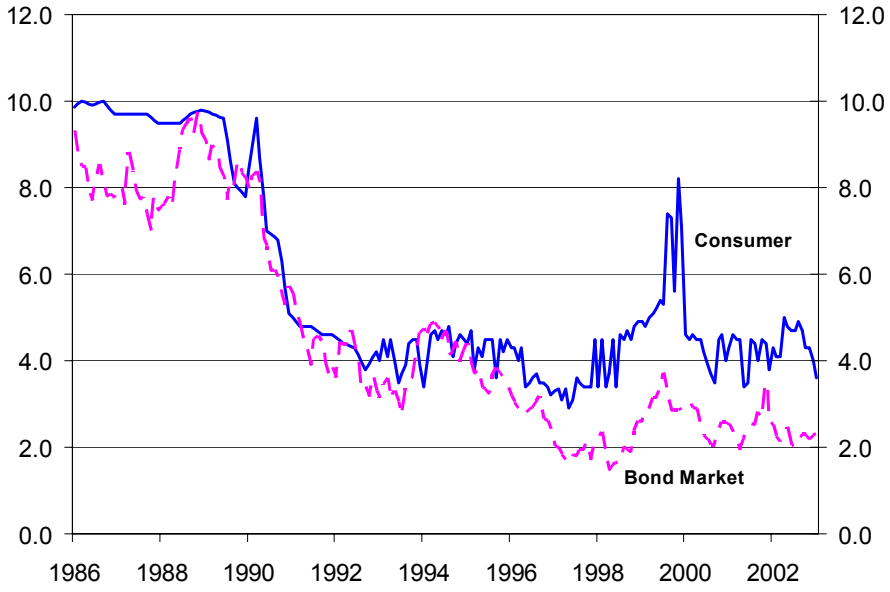
In addition to the mean level of inflation being noticeably lower in the inflation-targeting period than in earlier decades, the volatility of the inflation process has also declined. The standard deviation of the 'target' inflation series was 0.6 percentage points compared with 2.5 percentage points in the period from 1980-1992, and 4.2 percentage points in the 1970s. This is consistent with the proposition that the inflation target has acted as an effective anchor for inflation expectations, so that inflation is now less persistent and price-level shocks have a smaller impact.

Of course, this decline in volatility may be caused by an exogenous decline in the number of shocks to the inflation process in the 1990s compared with earlier decades, which had nothing to do with the change in the monetary framework. This issue is taken up in more detail below, where the experience of other countries is used as a benchmark and where the inflation process is examined in more detail.

5.2 Inflation expectations

There are two primary sources of information on inflation expectations in Australia. A time series of households' inflation expectations at a monthly frequency is available from a private research body, the Melbourne Institute. An alternative measure of inflation expectations of financial market participants is available from the bond market by examining the difference in yield between nominal and inflation-indexed bonds. These two series are shown in Graph 4.

Graph 4: Inflation Expectations



Source: Melbourne Institute, RBA

The Melbourne Institute series suggests *prima facie* that the inflation-targeting framework is still not fully credible with Australian households. Inflation expectations have stubbornly fluctuated around 4 per cent. To some extent this reflects a round-number problem on the part of households. There is a tendency in answering this question for households to answer in whole numbers such as 0, 2, 5 or 10. There is still a non-trivial number of households who expect inflation to be 5 or 10 per cent in the coming year, although the greatest mass of respondents expect inflation to be 2 or 3 per cent. The number of respondents expecting inflation to be either

2 or 3 per cent in the coming year has increased over the past decade, suggesting that the inflation-targeting framework has had an effect on inflation expectations.

Overall, the high level of the series means that it may not be a particularly useful reflection of inflation expectations in terms of their influence on actual wage and price-setting behaviour, although movements in the series do have some information content.

The largest shift downward in households' inflation expectations occurred in the early 1990s as the inflation rate declined, and before the announcement of the new framework. This may suggest that actual inflation outcomes have had a greater influence than the framework itself. However, the fact that household inflation expectations did not rise much as CPI inflation picked up from 2 to 5 per cent in 1994/95 provides some evidence that the inflation-targeting framework itself has helped anchor inflation expectations. Similarly, the spike in expectations just prior to the introduction of the GST in mid-2000 was a rational response by households, as year-ended CPI inflation did indeed spike upwards. That inflation expectations spiked back down immediately after the introduction of the GST indicates that households realised that the spike in inflation was only temporary and that the Bank was intent on maintaining inflation consistent with the target, once the boost to the price level from the GST had passed (see Section 4.3 above).

A more indirect measure of households' inflation expectations can be gauged from wage outcomes. Wage outcomes in enterprise bargaining agreements have averaged around 3½-4 per cent over the past few years, down from 4½-6 per cent in the mid 1990s, even though the unemployment rate has declined over this period. With labour productivity growth a little over 2 per cent, this suggests inflation expectations of wage-setters in recent years have been consistent with the inflation target.

The inflation target appears to be well understood by, and fully credible with, financial market participants. Expectations have fluctuated between 2 and 3 per cent since early 1997. However, a lack of credibility in the early stages of the inflation-targeting regime can be seen in the move upwards in inflation expectations to above 4 per cent in 1994, coinciding with the build-up in inflationary pressures as the economy gathered pace during the recovery from the early 1990s recession. The global shift upwards in bond yields around this time was accentuated in Australia, as financial market participants assumed the inflation regime of the 1980s was about to resume. Bond market expectations peaked in late 1994, following the three tightenings in the stance of monetary policy, and then drifted down as it became clear that low inflation was entrenched and as the inflation-targeting framework became more widely accepted.

5.3 Inflation process[19]

An alternative assessment of the effect of the change in the monetary policy framework on inflation can be made by estimating a simple model of the inflation process, and testing for structural change.

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[19] This section is based on Section 4 in Debelle and Wilkinson 2002. Tim Robinson provided excellent assistance in updating the results.

The model is based on a Phillips curve of the form described in equation 3 above. Inflation depends on inflation expectations, import prices, a measure of capacity and a speed limit term (that is, a measure of the speed with which excess capacity is reduced).

Inflation expectations are assumed to take one of the two following forms:

$$\pi_t^e = \sum_{k=1}^{s} \beta_k \pi_{t-k} + (1 - \sum \beta_k)\pi^* \qquad (4)$$

$$\pi_t^e = \sum_{k=1}^{s} \beta_k \pi_{t-k} + \gamma \pi_t^e \qquad (5)$$

In equation (4) expectations are a weighted average of a backward-looking component and a component which is anchored on the inflation target. A forward-looking element is not allowed for in this specification, although to some extent, the inflation-target component can be regarded as such. In equation (5), a forward-looking component is explicitly allowed for, and is measured by the inflation expectations series derived from the bond market.

Thus when expectations are of the form specified in equation (4), the reduced form equation for inflation which is estimated is:

$$\pi_t = \alpha_0 + \alpha_1 \pi_{t-1} + \alpha_2 \pi_{t-2} + \alpha_3 \pi_{t-1}^m + \alpha_4 y_t + \alpha_4 \Delta y_t + \varepsilon_t \qquad (6)$$

where π^m denotes import prices, y is the output gap, and the implicit inflation target, $\pi^* = \alpha_0/(1-\alpha_1-\alpha_2-\alpha_3)$. This assumes that the constant term is a function of the implicit inflation target. However, the constant may reflect mismeasurement of the output gap, and any other sources of mis-specification present in the equation. Furthermore, given that the other explanatory variables have a mean of close to zero over the sample period, the model is close to an AR(2) model of inflation and the constant term is effectively the mean of the inflation process over the estimation period.

The change in the output gap term (Δy_t) allows for a speed-limit term, that is, the possibility that inflation may accelerate if growth is too rapid, independent of the size of the output gap. When expectations take the form in equation (5), a term measuring contemporaneous bond-market expectations is included in equation (6).

The model was estimated with quarterly data over the period since 1983 (when the exchange rate was floated) using the weighted median measure of underlying inflation (excluding mortgage interest charges and adjusted for the effect of tax changes in 2000) as the dependent variable. The measure of the output gap is based on an HP-filter.[20] The results are presented in Table 2. The first three columns exclude the explicit measure of inflation expectations, while the latter three columns include it.

[20] Other measures of the output gap, including one based on Gruen, Robinson and Stone (2002), yielded very similar results.

As the table shows, these simple models explain the inflation process in Australia well over the full sample period. The coefficients have the expected sign. Over the full sample, the inflation process has a high degree of persistence, regardless of which model is used, although much of this results from the high degree of persistence in the first half of the sample. The passthrough to consumer price inflation of a 10 per cent shock to import prices is around 0.6 per cent in the first year (ie inflation is 0.6 percentage points higher) and 0.4 per cent in the second, while the long-run passthrough is around 1.8. In the second model, bond-market inflation expectations are a significant explanator of inflation expectations, although the weight placed on them is relatively low.

Table 2: The Inflation Process

Estimation period	Full Sample	1983Q1-1992Q4	1993Q1-2003Q1	Full Sample	1983Q1-1992Q4	1993Q1-2003Q1
Constant	0.00095 (1.68)	0.0011 (0.70)	0.0040 (3.25)	0.0006 (1.04)	-0.0008 (-0.35)	0.0036 (2.09)
π_{t-1}	0.43 (4.22)	0.38 (2.58)	0.17 (0.82)	0.33 (3.01)	0.32 (2.02)	0.13 (0.78)
π_{t-2}	0.44 (4.56)	0.48 (3.36)	0.12 (0.74)	0.33 (3.10)	0.41 (2.59)	0.12 (0.73)
Output gap $_{t-2}$	0.051 (2.16)	0.072 (2.32)	0.020 (0.46)	0.024 (2.51)	0.070 (2.26)	0.0025 (0.05)
ΔOutput gap	0.079 (1.78)	0.16 (2.46)	-0.0034 (-0.59)	0.056 (1.68)	0.14 (2.13)	-0.029 (-0.51)
ΔImport prices$_{t-1}$	0.024 (2.46)	0.033 (2.32)	0.013 (0.94)	0.024 (2.51)	0.032 (2.26)	0.017 (1.17)
Inflation Expectations				0.17 (2.08)	0.18 (1.53)	0.09 (0.57)
Adj R squared	0.84	0.72	0.051	0.83	0.69	0.08
Inflation Persistence	0.86	0.89	0.27	0.66	0.73	0.25

Notes: Figures in brackets are t-statistics.

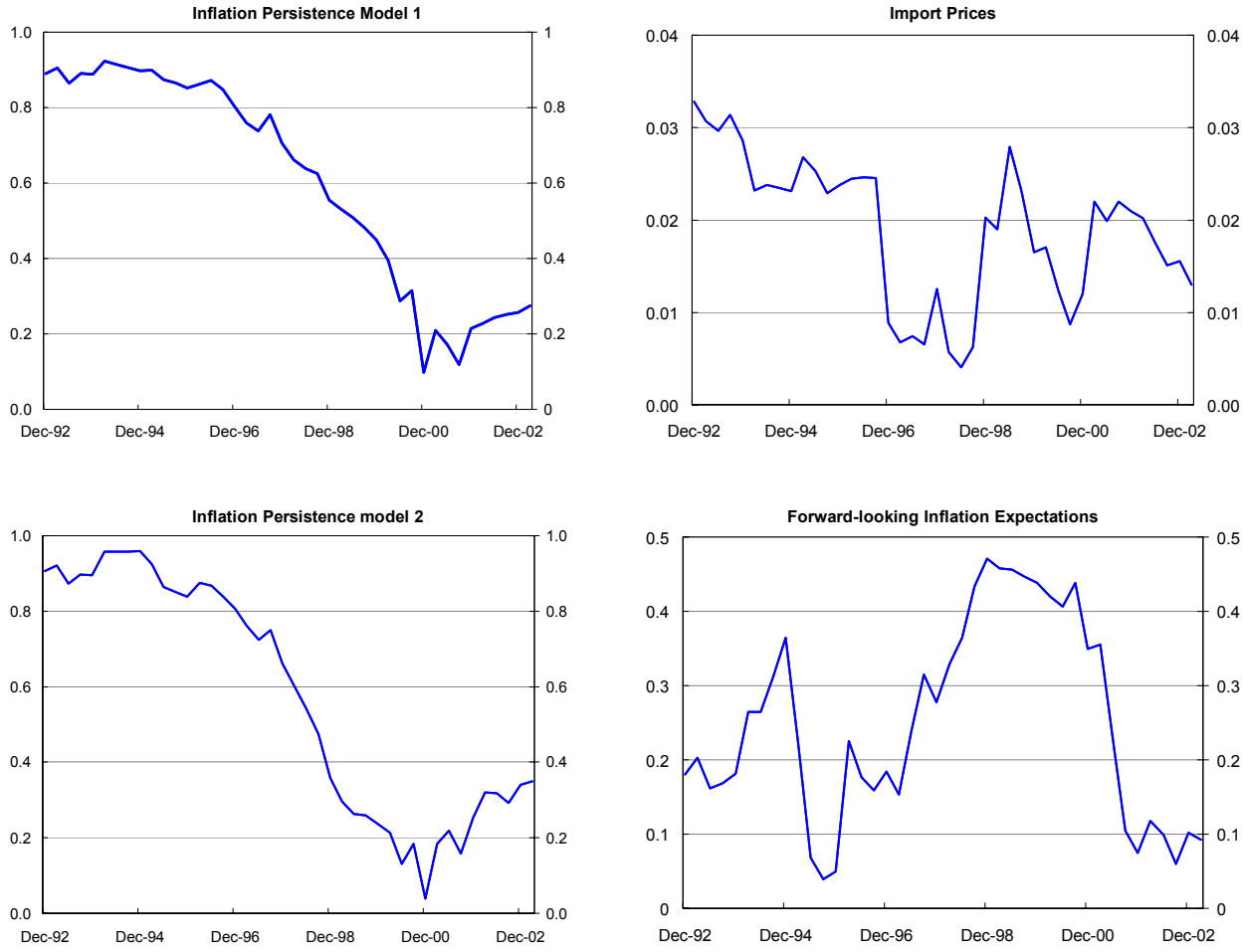
To examine how these parameters have changed over time, a rolling regression with a 10-year window was estimated. Table 2 shows the coefficients for the first 10-year window in columns 3 and 6, while the results from the most recent window are shown in columns 4 and 7. The evolution of the coefficients over time are shown in Graph 5. The rolling regressions suggest a substantial change in the inflation process over the past decade. A Chow test also indicates that the inflation process before and after 1993Q1 is structurally different in both models.

The results suggest that the persistence of inflation has declined markedly over this period, from 0.9 to 0.3 in the first model and 0.7 to 0.3 in the model with explicit forward-looking inflation expectations. This result supports the Kuttner and Posen (1999) hypothesis that the adoption of inflation targeting has increased the capacity of the central bank to manage inflation, by reducing the propagation of inflation shocks. The results could also be interpreted as providing support for Taylor's (2000) hypothesis that the persistence of inflation shocks decreases in a low-inflation environment. However, this decline in persistence was not observed in the other countries

examined in Debelle and Wilkinson (2002), with the exception of New Zealand. In the UK and the US, the persistence was estimated to have increased over the sample period, although Kuttner and Posen (1999) find a decline in persistence in inflation in the UK and New Zealand.

Graph 5: Rolling regression parameter estimates

10-year window



In the estimated version of equation (4), the decline in persistence corresponds directly to a significant increase in the weight that is being placed on the inflation target when expectations are being formed. Although other explanations are possible for the decline in persistence, this evidence supports the proposition that the credibility of the inflation target has increased over the past decade. The increased credibility of the target means that the public expects that any shock to inflation will be short-lived. It suggests that the inflation process has moved from an atuo-regressive one to a white noise process centred around the inflation target.

The rolling regressions also show a noticeable decline in the passthrough of import price movements to consumer prices through the 1990s, although there is some suggestion the estimate has picked up again in recent quarters. In part, this may be caused by the inclusion in the earlier part of the sample of the large exchange rate deprecation that occurred in the mid 1980s,

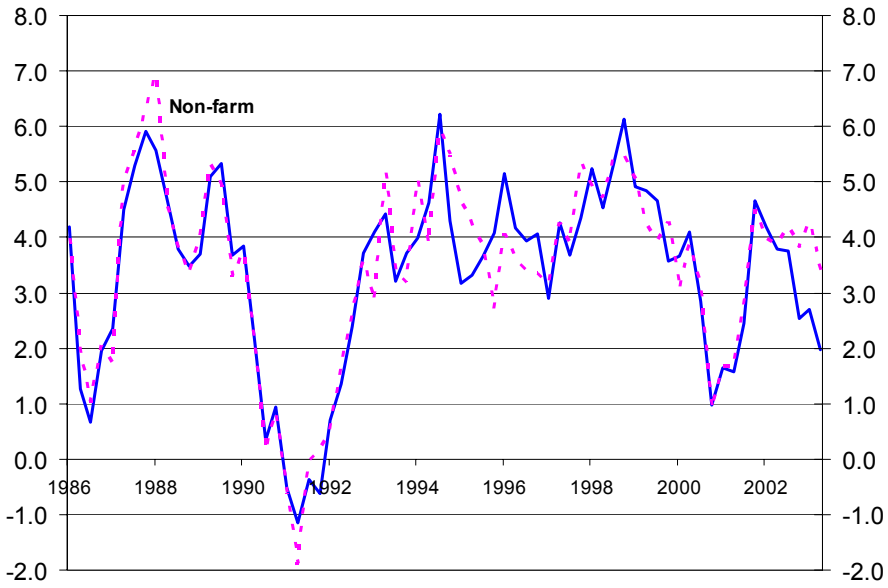
although the latter part of the sample also includes some large sharp depreciations in the exchange rate. This evidence of a decline in the passthrough of exchange rate changes to consumer prices is also evident in a number of other countries (Goldfajn and Werlang 2000, Cunningham and Haldane 1999). In Australia's case, the passthrough to landed imported prices is as fast and as complete as it was historically. The decline in passthrough has occurred at the next stage: between the importer and the final consumer of the good.

5.4 Output

The previous sections show that the inflation process has become more stable around a lower average in the inflation-targeting period. Has this come at the expense of worse performance on output?

The average growth rate of real GDP over the inflation-targeting period has been 3.7 per cent, higher than the average of 3¼ per cent experienced in both the 1970s and 1980s. Not only was the average growth rate higher over this period, but the volatility of output was also noticeably lower: the standard deviation of year-ended real GDP growth has been 1.1 compared with 2.7 in the 1980s and 2.5 in the 1970s.

Graph 6: GDP growth
chain-linked, year-ended percentage change



Source: ABS

5.5 Comparison with other countries

The analysis above obviously does not control for the counter-factual. It is possible that the improved inflation and output performance over the inflation-targeting period has resulted from the greater incidence of a number of positive supply shocks, and/or the absence of negative supply shocks such as the rise in oil prices in the 1970s. In support of this proposition, inflation has been lower in most OECD countries over the past decade than in earlier decades, and

Blanchard and Simon (2002) document the decline in output volatility in the US in the 1990s, compared with the 1970s and 1980s.

Stevens (2003) compares the inflation and output performance of OECD countries over the past two decades and distinguishes inflation-targeting countries from non-inflation-targeting countries.[21] The latter group consists primarily of the US, Japan and EMU countries. The results are reproduced in Table 3.

Table 3: Inflation and growth before and after the adoption of Inflation Targeting

	Inflation		Real GDP growth	
	Mean	Standard deviation	Mean	Standard deviation
Australia				
1980-1992	7.2	2.4	2.8	2.7
1993-present	2.3	0.6	3.7	1.1
Other OECD IT countries(a)				
1980 – adoption of IT	13.0	9.1	2.8	2.9
IT period	3.1	1.2	2.9	1.6
OECD non-IT countries(b)				
1980-1992	5.9	3.5	2.5	2.0
1993-present	2.1	0.9	2.7	1.7

Source: Stevens 2003

Notes: (a) Canada (1991-), Finland (1993-1999), Greece (1998-2001), Iceland (2001-), Korea (2001-), Mexico (2001-), New Zealand (1990-), Norway (2001-), Spain (1994-), Sweden (1993-), UK (1992-).
(b) Austria, Belgium, Denmark, France, Germany, Ireland, Italy, Japan, Luxembourg, the Netherlands, Portugal, Switzerland and the United States. Finland, Greece and Spain are included upon their entry to the EMU.

The decline in inflation for the inflation-targeting countries is evident, as is the decline in inflation volatility. However, a decline in the mean and variance of inflation was also observed for the non-inflation-targeting countries. Similarly, a decline in output volatility is evident for both groups of countries. This suggests that the economic environment was generally more benign in the inflation-targeting period than in the earlier period, and that some of the observed improvement in economic outcomes may have happened in the absence of a change to the

[21] The table updates earlier analysis at the IMF by Brooks (1998).

monetary policy framework. Nevertheless, the decline in inflation is noticeably larger for the inflation-targeting group of countries, as is the decline in volatility of both output and inflation.

Ball and Sheridan (2003) conduct a similar analysis and conclude that this does not provide conclusive evidence that inflation targeting has been beneficial. They argue that inflation has a tendency to regress towards the mean, so that all that is being observed here is this process of mean reversion occurring for the inflation-targeting group of countries. Because of their relatively poor inflation histories, the adoption of an inflation-target is an endogenous event that did not have a significant additional benefit beyond that which would have occurred through the 'natural' process of mean-reversion.

One problem with this argument is the assumption that inflation is a mean-reverting process. There is little theoretical foundation for this proposition. Empirically, it would appear difficult for this theory to explain the timing of the mean reversion. Why didn't the inflation-targeting countries' inflation rates mean revert in the 1980s, after the oil price shocks, to the low inflation outcomes observed in Germany, Japan and the US? Inflation expectations remain entrenched at higher levels in the inflation-targeting countries. The monetary frameworks in place at the time where likely to have contributed to the lack of credibility and the high level of inflation expectations.

Table 4 shows that the pick-up in the growth of the Australian economy was larger than the other groups of countries where, on average, no significant pick-up in growth was observed. Furthermore, the Australian economy experienced below-average volatility in output and inflation. Monetary policy alone can clearly not be responsible for these economic outcomes. Other reforms to the economy which increased the flexibility of product and labour markets certainly played a major role. However, it is difficult to argue in Australia's case that these improvements result solely from a more benign economic environment. During the inflation-targeting period, the Australian economy has been faced with the Asian crisis (see below), the financial disruption of the LTCM collapse associated with a large depreciation of the Australian dollar, the global recession of 2001 and a large rise in oil prices in the late 1990s.

5.6 Measures of Transparency

How has the adoption of the inflation-targeting framework and the associated increase in transparency affected financial markets?

As discussed above, yields on inflation-indexed bonds suggest that the inflation-targeting framework is fully credible with financial markets. This decline in inflation expectations has been associated with a marked decline in nominal bond yields and consequently a large reduction in the yield differential between Australian bond yields and those in the US.

Connolly and Coppel (2003) examine whether the increase in transparency has affected the behaviour of short-term yields. They find that the volatility of 30-day and 90-day yields has declined considerably over the past decade, consistent with a greater understanding by financial markets of the Reserve Bank's monetary policy reaction function. This decline in volatility in short-term yields has also been evident in other countries and could again be instead explained by a more benign economic environment.

A more direct test of an increase in transparency is to examine how much movements in the stance of monetary policy are surprises to the market. Connelly and Coppel show that the surprise component in monetary policy moves has decreased significantly since the 1980s. They find that around 20 per cent of a policy move was anticipated in the second half of the 1980s. In this period, policy moves were unannounced, and it was often difficult for the market to discern whether a change in the stance of monetary policy had actually taken place. Consequently, even two weeks later, only around 75 per cent of the change had been passed through to short-term yields.

From 1990 onwards, policy changes were announced by press release at the time they occurred. In the first half of the 1990s, around half of a change in monetary policy was anticipated in advance, while over the most recent period (1996-2002), around 75 per cent of a monetary policy change was anticipated, or alternatively only around 25 per cent of the change was a 'surprise'. Indeed, in many instances, Connolly and Coppel found that movements in the short end were no different from the average daily volatility in the yields. The announcement of the policy change also meant that short-term yields adjusted completely on the same day as the policy change, in contrast to the experience in the 1980s. The increase in predictability was thus in part due to the focus on the cash rate as the instrument of policy and the announcement of changes in the cash rate when they occurred, but a significant part of the increase in predictability occurred after the introduction of the inflation target.

Connolly and Coppel also present evidence that the degree of predictability of monetary policy changes in the later period is similar to that in the UK, the United States, Canada and Sweden over the same period. These results suggest that the varying forms of transparency and communication across these countries has had little effect on financial markets' understanding of the central bank's objectives and reaction function.

6. Conclusion

Inflation targeting in Australia has coincided with a period of low and stable inflation, and a prolonged economic cycle with a high average rate of growth. Monetary policy alone clearly can not take the credit for these outcomes, but one can argue it has been supportive of them. Monetary policy appears to have been broadly successful in its aim to 'let the economy grow as fast as possible, consistent with the inflation target.'

Australia's inflation-targeting framework has remained basically unchanged since its adoption in 1993. In 1993, the Australian framework was at the flexible end of the spectrum of inflation-targeting practice, and was criticised for being too lax. The economic outcomes suggest that the greater flexibility of the Australian approach has not been at the expense of economic performance. Equivalently, the experience also suggests that a rigid application of an inflation targeting framework may not be necessary, and that there may be elements of the Australian approach which may be applicable to emerging market economies considering adopting an inflation target.

Over the past decade, there has been a convergence in practice, arguably toward the more flexible end of the spectrum, with an increased focus on medium-term outcomes. To some extent, this shift has been possible because of the increased credibility of the inflation-targeting

central banks. While some differences may still remain across central banks in terms of the structure of the frameworks and in communication practices, in practice, these differences are generally superficial and have not appeared to have had a discernible impact on economic outcomes.

Nevertheless, a complete test of the inflation-targeting framework for monetary policy, and the differences in the frameworks, may only come with large shocks like the 1970s oil prices. Then the subtle differences in approach may become more substantive. It is possible that the asset price developments being observed in a number of inflation targeting countries at the moment may pose such a test. However, the past decade has not been completely benign. The decade has included the Asian crisis, the Russian debt default and the collapse of LTCM, large falls and large rises in oil prices, and (in Australia's case) a large depreciation of the exchange rate. The inflation targeting framework has navigated these potential problems with some success.

The success to date of the inflation-targeting framework in Australia does not mean that an ideal monetary policy framework has been reached, but the case can be made that this approach has been better than the frameworks which preceded it.

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