THE FUTURE OF INFLATION TARGETING

Economic Group
Reserve Bank of Australia

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Introduction

Christopher Kent and Simon Guttmann

Inflation targeting is now a well established framework for the conduct of monetary policy, having been in place for a decade or more in a number of countries, including Australia. In recent years the number of inflation-targeting countries has continued to grow. Australia's experience, like that of other countries, has been that the period of inflation targeting has delivered favourable economic outcomes. Australia's average inflation rate over the targeting period has been around 2½ per cent, consistent with the Reserve Bank's target of 2–3 per cent, on average, over the medium term. Furthermore, this has been associated with both stronger and less variable economic growth than in earlier times.

At present, around 20 central banks, in both industrialised and emerging market economies, have adopted inflation-targeting regimes. These regimes have evolved over time across a number of dimensions, including their degree of flexibility and their approaches to communication. Some early adopters have become more flexible, allowing greater scope for inflation to vary around the target and for broader macroeconomic goals to be taken into account. Inflation targeters have also become more transparent, increasing the scope of their communication and delivering it in more varied forms. But there remain important differences among countries with respect to both the operation and the rhetoric of inflation targeting. With a decade or more of experience now behind us, it is feasible to examine how the alternative approaches have fared and to consider how inflation-targeting regimes might evolve from here. In addition, it is significant that, while none of the central banks of the world's three largest economies have adopted inflation targeting at this stage, its possible implementation has been the subject of considerable debate. The Japanese experience is of particular interest, given that inflation targeting has been proposed to help the economy shift from deflation to inflation.

With this background in mind, the Bank considered it opportune to devote its 2004 annual conference to an examination of the future of inflation targeting. The conference papers examine the evolution of inflation-targeting regimes, issues related to monetary policy communication and transparency, and the measurement and modelling of inflation. One paper studies the case for adopting inflation targeting in Japan. Building on these papers, the conference discussions focused on how inflation targeting might need to adapt to possible challenges in the future. This introduction provides a broad overview of the themes to emerge from the conference.

The Evolution of Inflation Targeting

Ken Kuttner opened the conference with an examination of the evolution of inflation targeting, which he describes as having entered its adolescent phase. His paper defines inflation targeting as a public commitment to a numerical inflation objective, combined with a significant degree of monetary policy transparency and a mechanism for central bank accountability. Kuttner contends that among the 21 inflation targeters that he identifies, differences in the specific approaches to targeting are of second-order importance. In other words, what matters more is the existence of an inflation target. Critics argue that the observed improvements in performance following the adoption of inflation targeting can be fully explained by other factors. Kuttner, however, suggests that the empirical evidence for this view is unconvincing, and an important finding is that shocks to inflation are less persistent among inflation targeters than among non-targeters. This is consistent with inflation expectations being more firmly anchored under an inflation-targeting regime. In contrast to the view of some economists that inflation targeting leads to a loss of monetary policy flexibility, Kuttner presents evidence demonstrating that the actions of a number of inflation targeters are more flexible than is often indicated by their rhetoric.

Monetary Policy Communication and Transparency

An important facet of the evolution of inflation-targeting regimes has been the substantial increase in monetary policy communication and transparency. This has been driven, at least in part, by the desire to enhance the credibility of inflation-targeting regimes – thereby helping to better anchor inflation expectations. Related to this, central banks have also needed to become more accountable in light of their increased level of independence.

There are two aspects of communication and transparency worth distinguishing. First, there is the substance of the information provided, which can include things such as the central bank's objectives, its views on economic developments and prospects, and its ultimate policy strategy. The second aspect is the means of providing this information, which can include monetary policy statements, the appearance of central bank officials before parliament, and/or the release of minutes from policy deliberations. It also includes, for example, the way that central banks explain the derivation of their forecasts. These two aspects of communication and transparency are examined in three related papers.

Rick Mishkin's paper focuses primarily on the substance of communication. He concludes that transparency in general helps to enhance the effectiveness of monetary policy, but that it could go 'too far'. Some economists have suggested that central banks should increase transparency by, for example, communicating a precise formulation of their objective function. Mishkin argues that this would detract from the effectiveness of monetary policy: it is not feasible for a policy committee to agree on, or commit itself to, a specific formulation of the objective function, and to attempt to do so would mask the true complexity of the policy process. If the central bank chooses to publish such a formulation and to stand by it, then policy could end up being less flexible than is optimal. Alternatively, flexibility could be retained, but this would occasionally require modifying the published objective function in response to new risks, structural change in the economy or changes in the make-up of the policy-making committee. This would also be undesirable because the appearance of inconsistency would be likely to reduce central bank credibility. While Mishkin argues against increasing transparency across a number of dimensions, he suggests that central banks would be well served by more openly discussing (at least in broad terms) how they would respond to shocks that cause substantial output fluctuations.

The paper by Malcolm Edey and Andrew Stone considers both aspects of transparency, namely the substance of the information provided, and the means of its provision. In terms of the substance of communication, they acknowledge that inflation forecasts are a critical element of communication for inflation targeters, although they argue that an excessive focus on the inflation forecast could be misleading or may unnecessarily impede policy-makers' flexibility. With reference to recent Australian experience, Edey and Stone suggest that in addition to the level of inflation, it is necessary for policy-makers to consider the trajectory of inflation at the end of the forecast period to determine the appropriate stance of policy. They also note that the policy framework provides scope for a range of broader macroeconomic factors to be brought into consideration, even if they are not readily able to be incorporated in the inflation forecast.

When considering the means of communication, Edey and Stone argue that the widespread reduction in the volatility of interest rates across a number of countries, and small differences in volatility between countries, implies that attempts to identify the effect of remaining variations in communication strategies are likely to be inconclusive. In their discussion, they raise a recurring theme of the conference: the choice between presenting forecasts based on an assumption of unchanged monetary policy, or basing forecasts on a projected path for the optimal policy interest rate. In contrast to some other participants, they stress that these are different, but logically consistent, approaches to the same problem. Like Mishkin, they agree that there are a number of practical problems with an approach based on an endogenous interest rate path. Mishkin stresses the difficulty of the monetary policy committee agreeing on a precise projection for the path of interest rates. Edey and Stone emphasise that an endogenous interest rate assumption is, in one important respect, not transparent, because the process of arriving at such forecasts is more difficult for the non-specialist to understand.

Ellis Connolly and Marion Kohler examine whether the means of communication matters to financial markets by estimating how monetary policy communication affects financial market expectations of the path of interest rates. More specifically, they estimate the impact of different forms of central bank communication on daily changes in interest rate futures in Australia, Canada, the euro area, New Zealand, the United Kingdom and the United States; their approach also controls for the impact of domestic and foreign macroeconomic news, and monetary policy surprises themselves. As the authors note, if a central bank operates a completely transparent (and rigid) monetary policy rule, their communication is redundant because financial markets can anticipate changes in policy solely from macroeconomic news. However, discretion is a necessary feature of policy since, with uncertainty and structural change, it is not possible to specify exactly how a central bank should respond to all contingencies. This creates a role for regular central bank communication to help financial markets filter macroeconomic news. Their results show, first, that communication matters, and second, that the forms of communication with the greatest effect on expectations are commentary accompanying rate decisions, monetary policy (or inflation) reports and parliamentary hearings. They find some differences in the impact of specific forms of communication across the economies they examine. However, as the authors note, this does not imply that some central banks convey more information than others, but rather that central banks use different channels to convey the same information. Connolly and Kohler conclude that the impacts of the Reserve Bank of Australia's communication practices on financial markets are in line with other central banks, and that they significantly influence and inform expectations of future monetary policy.

Measuring and Modelling Inflation

The measurement and modelling of inflation are important practical considerations in the operation of an inflation-targeting regime. Robert Hill's paper focuses on issues involved with inflation measurement and describes a number of developments that have the potential to affect typical measures of consumer price inflation. He reviews alternative conceptual approaches to the measurement of inflation, including whether the index should be calculated on a cost of goods or cost of living basis, and other issues such as how frequently the price index should be computed or its weights updated. Another important question is whether certain volatile items should be excluded from the price index targeted. Such issues are likely to assume greater importance as the increased availability of scanner price data could have dramatic effects on the construction of price indices, with more frequent computation of expenditure weights at lower levels of aggregation. A potential consequence of this is greater volatility of the price index. Also, Hill notes that the potential for enhancements to, and wider application of, methods to account for quality improvements could lead to a reduction in the (positive) measurement bias inherent in standard consumer price indices.

The paper by Alex Heath, Ivan Roberts and Tim Bulman focuses on two issues fundamental to understanding the behaviour and interpretation of inflation. The first issue considered is the measurement of underlying inflation. Reliable measures of underlying inflation are important because headline inflation may be affected by significant relative price movements which policy-makers may wish to discount if they are considered temporary. For Australia, the authors find a number of measures of underlying inflation are useful in the context of inflation targeting, although the additional information they provide has declined since the onset of sustained low inflation from the early 1990s. The second issue the paper addresses is the pass-through relationship from exchange rates to consumer prices, which is relevant for obtaining good forecasts of inflation in an open economy subject to large exchange rate movements. The authors find that the pass-through of import price movements to consumer price inflation in Australia has slowed, and they suggest that inflation now responds more slowly to shocks, and is consequently more stable, than was the case prior to the adoption of inflation targeting.

Using Inflation Targeting to Move from Deflation to Inflation

To date, inflation targeting has been introduced as a strategy to help maintain low inflation or to help facilitate a shift to a lower rate of inflation. Takatoshi Ito contends that inflation targeting could also have been used to help the Japanese economy shift from a state of deflation to one of inflation. His paper examines the inflation targeting debate within the Bank of Japan (BoJ) through a close reading of the minutes of its policy meetings. Proponents of inflation targeting argue that setting a target would impose greater accountability on the BoJ, provide an avenue for more effective communication with the financial markets and, most importantly, influence inflation expectations and so help to break the deflationary cycle. The opposing argument is that with the policy interest rate in Japan already at zero, the BoJ lacks an instrument to provide further stimulus to the economy to drive inflation higher. Without an instrument to ensure the target is attained, any announcement of an inflation target would therefore lack credibility. Ito rebuts this argument on a number of grounds and argues in favour of the adoption of an inflation target by the BoJ.

Conclusions

A number of key messages emerge from the conference and were summarised by the speakers during the wrap-up session. Foremost is the successful track record of inflation-targeting regimes. Claudio Borio summed this up by saying that inflation targeting passes the ‘no regrets’ test: no country that has adopted inflation targeting regrets having done so. It is true that inflation targeting has not yet faced the types of large adverse supply shocks that befell earlier policy regimes. However, there was general agreement among participants that by providing a solid anchor for expectations, inflation targeting would be as well, if not better, suited to address such disturbances as other regimes.

The potential for such events reinforces the desirability of a flexible approach to inflation targeting – as has increasingly become the norm across inflation targeters. Now that inflation expectations are low, and credibility has been well established, it is certainly more feasible for inflation targeters to lengthen the policy horizon, and to integrate broader macroeconomic concerns into the targeting framework. A recurring theme of the conference discussions was that inflation-targeting regimes have evolved in a direction that gives greater scope for this kind of flexibility, often more so than their rhetoric implies.

Another consequence of low and stable inflation is that it appears to have become harder to estimate models of inflation. This implies some difficulties for central banks that rely too heavily on model-based forecasts of inflation, particularly in light of the earlier conclusion that inflation targeters should consider lengthening their policy horizons. This raises a number of interesting challenges for future research, particularly in the areas of empirical modelling, alternative approaches to forecasting and how longer-run risks can be better incorporated into the inflation-targeting framework and explained to the public.

A Snapshot of Inflation Targeting in its Adolescence

Kenneth N Kuttner[1]

Abstract

The paper first seeks to clarify the definition of inflation targeting (IT), comparing 'practical' versus 'theoretical' definitions of the term, and how they relate to one another. Second, the paper reviews the range of IT practice across the 20 or so current inflation targeters and discusses the ways in which that practice has evolved in the past 10–15 years. Third, it assesses the criticism that IT is insufficiently 'flexible', considering both what inflation-targeting central banks *say* they do, and how they have responded in practice to output fluctuations. At least for New Zealand, the United Kingdom, Sweden and Canada, the implementation of IT appears to be relatively flexible – more so than one might suspect on the basis of many inflation-targeters' (ITers) rhetoric.

1. Introduction

It is not every day that one gets to observe the diffusion and evolution of a new monetary policy framework. However, the development, and subsequent spread, of inflation targeting, beginning in the early 1990s, has created just such an opportunity. Inflation-targeting central banks now number upwards of 20, and it seems likely to become the monetary policy framework of choice for a wide range of countries, displacing more problematic alternatives, such as money targeting or exchange-rate-based frameworks.

The popularity of inflation targeting should not be too surprising. At the most basic level, IT offers the possibility of a nominal anchor, free of the vagaries of the foreign exchange market, and the often-capricious behaviour of monetary aggregates. Many central banks have found IT to be a useful organising principle for focusing research, disciplining policy discussions, and communicating policy actions to the general public. And for a transition or emerging market economy, adopting IT provides an opportunity for the central bank to clearly define its objectives and delineate its responsibilities *vis à vis* other official policy institutions.

But IT, as a policy framework, is only 15 years old – quite young, compared with other, more seasoned policy frameworks, and still very much in its adolescence. Like many teenagers, IT is often misunderstood. And also like many teenagers, it still has some issues it needs to work out.

1. I am indebted to Georgios Chortareas, Özer Karagedikli, and Anders Vredin for making their respective central banks' historical forecast data available. Malcolm Edey, Christopher Kent, Rick Mishkin, Tony Richards, and Lars Svensson provided a number of valuable comments and suggestions. Ben Pierce assisted with the research.

Any developmental issues IT might have are certainly not caused by a lack of attention. Following something of a lull, during which many macroeconomists were preoccupied by Y2K, asset-price bubbles, and the 'new economy', the pace of research on inflation targeting appears to have accelerated in recent years with a string of major conferences and the publication of a comprehensive book on the topic (Truman 2003). Ironically, given its origins as a strategy to contain inflation, some of the current wave of interest in IT may be attributable to *de*flation in Japan, and the perceived threat of it in the United States. But whatever the cause, the recent flurry of research means that the already-large literature on IT has become truly vast. This paper will therefore not even attempt to cover it in its entirety, choosing instead to focus selectively on a few key misunderstandings and unresolved issues.

First, the paper takes on the deceptively simple question of how to define inflation targeting, considering both the common, practically-minded definition – if a central bank says it targets inflation, it is an inflation targeter – and a more theoretically-minded definition in terms of a policy rule. Second, it describes the ways in which the practice of inflation targeting has evolved over the past 15 years, concluding that most inflation targeters' frameworks have remained relatively static. There has, however, been something of a trend in recent years towards the publication of more explicit, longer-horizon forecasts.

Third, the paper considers some common critiques of inflation targeting, focusing primarily on the oft-heard charge (at least in the US) that IT is insufficiently 'flexible'. Reviewing both central banks' published statements and the conduct of policy in New Zealand, the UK, Sweden, and Canada, the paper concludes that IT is more flexible in practice than many inflation targeters' rhetoric would suggest. But this flexibility has yet to be seriously tested by persistent, adverse supply shocks. The paper concludes with some thoughts on how inflation targeting is likely to evolve in the future.

2. Defining 'Inflation Targeting'

Even after 15 years of inflation targeting, a certain amount of confusion persists as to exactly how to define the term and which countries to classify as inflation targeters. As Kohn (2003) remarked, 'one difficulty in assessing whether the United States has been practising inflation targeting is in defining the term'. This section reviews two alternative, but not mutually exclusive, ways to think about IT: the first is in terms of the observed characteristics of the policy framework, and the second is in terms of an optimal (or otherwise) policy rule.

2.1 A practical definition of inflation targeting

The easiest way to identify inflation targeters, of course, is by self-declaration: if a central bank says it targets inflation, it is an ITer. The problem with this way of defining the term, however, is that a declared objective for inflation is neither a necessary nor a sufficient condition for qualifying as a bona fide inflation targeter. Some central banks have a target for inflation but lack some of the other features associated with inflation targeting; others insist they are *not* ITers, but nonetheless possess most (or all) of the characteristics associated with other self-declared inflation targeters. Thus, while self-declaration may be a good starting point, it is surely not definitive.

As a result, practical definitions of inflation targeting have tended to emphasise a number of key features associated with established inflation-targeting frameworks. Based on the country experiences summarised in Bernanke *et al* (1999) and elsewhere, there seems to be broad agreement that 'real' ITers all share, at least to some extent, the following four characteristics:

- A stated commitment to price stability as a principal goal of monetary policy. However, price stability need not be the *only* goal; many ITers acknowledge, to varying degrees, a role for output stabilisation and other objectives.
- An explicit numerical target for inflation. Often, but not always, a time span will also be specified for returning to the target after any deviation.
- A high degree of transparency with regard to monetary policy formulation. ITers regularly publish extensive reports on economic conditions and the outlook for inflation. Often, but not always, the reports include the central bank's forecasts of inflation, GDP growth, and other macroeconomic variables.
- Some mechanism for accountability. Often, failure to fulfil the inflation target requires the central bank to take specific steps, such as publishing an explanation, or submitting a letter to the government.

A sensible definition of inflation targeting (or at least a reasonable algorithm for distinguishing ITers from non-ITers) would be any monetary policy framework that bore these four hallmarks.[2]

These criteria still leave a number of grey areas, however. The European Central Bank (ECB), for example, has a numerical inflation objective; but because that objective is still somewhat unclear, and because of a general lack of transparency in its policy-making, the ECB is not generally considered an inflation targeter (see Svensson 2000).[3] On the other hand Switzerland, by most accounts, comes close to satisfying all four criteria, and for that reason it often appears on lists of inflation targeters – despite Swiss National Bank officials' insistence that it is *not* an ITer.[4]

The US Federal Reserve presents an even more difficult taxonomic dilemma. Kohn (2003), among others, has noted that the US Federal Reserve has successfully achieved low and stable inflation, and seems to take price stability seriously as a primary objective of monetary policy – a commitment that has been strengthened

2. Truman (2003) lists 'time horizon for reaching the target' as a distinct criterion, but since a majority of ITers leave this unspecified, I have consolidated this feature with the numerical target. Unlike Truman, however, I include 'transparency' and 'accountability' as distinct attributes.
3. On 8 May 2003, the ECB's governing council announced a change in the target from 'below 2%' to below but 'close to' 2% – hardly a step forward in terms of clarity.
4. The Swiss National Bank maintains that because it omits any 'escape clauses', it has a tougher commitment to price stability than that of most ITers. See Truman (2003, p 30).

over the past 16 years in a series of speeches by Federal Reserve Chairman Alan Greenspan.[5] This has prompted some to label the Fed a 'covert' (Mankiw 2002), 'implicit' (Goodfriend 2003), or 'eclectic' (Carare and Stone 2003) inflation targeter.[6] And yet Kohn (2004) maintains that whatever it is that the Fed is doing, it is *not* inflation targeting.

How does the Fed rate on the four criteria? It is true, as noted above, that the Fed has repeatedly reaffirmed its commitment to the goal of price stability, even if that commitment has not been formally codified. It does operate under a dual mandate, but so do other inflation targeters – notably the Reserve Bank of Australia (RBA). The Fed still lacks the *sine qua non* of IT, an explicit numerical inflation target, however, and this alone might be enough to disqualify it.[7] It also falls short of the standards set by other ITers on other dimensions of transparency and accountability.[8] The Federal Reserve does publish a *Monetary Policy Report to the Congress* twice a year, which includes an extensive review of economic conditions and recent policy actions. It even reports a crude twice-yearly projection consisting of the 'range' and 'central tendency' of Board members' and Reserve Bank presidents' inflation, GDP and unemployment forecasts for the current year and, in the July report, for the year ahead. But in the absence of an explicit assumption about monetary policy, such forecasts are hard to interpret. And more importantly, there is no way to assess the Fed's performance in meeting its objective since it *has* no clear objective. For these reasons, the Federal Reserve is usually not included on lists of inflation targeters, despite some superficial similarities and its good inflation record.

2.2 Defining inflation targeting as a 'policy rule'

The practical definition of inflation targeting, summarised above, takes its cue from the view articulated by Bernanke *et al* (1999) that IT is best described as a monetary policy 'framework', rather than as a 'rule'. More recently, however, there have been efforts, spearheaded in large part by Lars Svensson (for example, Svensson

5. In what may be the first of these pronouncements, Greenspan (1988) stated: 'We should not be satisfied unless the U.S. economy is operating at high employment with a sustainable external position and *above all* stable prices … By price stability, I mean a situation in which households and businesses in making their saving and investment decisions can safely ignore the possibility of sustained, generalized price increases or decreases' [emphasis added].

6. Carare and Stone (2003) start from the premise that any central bank lacking an explicit exchange rate or money-based nominal anchor is, by default, an inflation targeter. Those with a 'clear commitment' to an inflation target – in practice, a declared IT framework – are classified as 'full-fledged' ITers. Those without such a commitment, but possessing a certain degree of anti-inflationary credibility are deemed 'eclectic' ITers; the remainder are assumed to follow a policy of 'IT lite'. Truman (2003) dismisses the value of this classification scheme, calling it 'dressed-up self-declaration'.

7. Its behaviour in recent years seems to be consistent with an implicit target of roughly 2 per cent. The Fed may have had a higher implicit inflation target prior to the 1990–91 recession, but reduced its target as the inflation rate fell in an application of the principle of 'opportunistic disinflation'.

8. It is worth making a distinction between transparency in policy *formulation* versus transparency in *implementation*. The Federal Reserve has, of course, become much more transparent in the implementation of policy, especially since the practice of announcing changes in the funds rate target began in February 1994.

1997, 1999) to define IT in terms of a policy rule. However, the theoretical literature has never meshed particularly well with the more practically- and institutionally-oriented approaches. Truman (2003), for example, observes that 'inflation targeting in practice involves both more and less than' a reaction function. Surely this is partly because inflation targeting as a policy framework predates the beginning of the policy rules literature by several years; it is worth recalling that the first six inflation targeters adopted the framework before the appearance of Taylor's influential article (Taylor 1993), and Svensson's subsequent work relating IT to optimal policy rules (Svensson 1997).[9]

Clearly inflation targeting represents *some* sort of a rule, defined broadly as a guiding principle for formulating monetary policy. But what *kind* of a rule, exactly? And does it matter?

One source of confusion that arises in relating the practice of IT to the rules literature is, as noted by Kuttner (2004), that the word 'rule' is itself used in so many different ways. One useful distinction is between *optimal* and *ad hoc* rules – that is, those based on an explicit optimisation problem, versus those that are not. Typically, the objective function underlying any optimal rule is the conventional quadratic loss function,

$$E_t \sum_{\tau=0}^{\infty} \delta^{\tau} \left[\left(\pi_{t+\tau} - \pi^* \right)^2 + \lambda x_{t+\tau}^2 \right] \tag{1}$$

involving the output gap x_t and the deviation of inflation from its target, $\pi_t - \pi^*$; the parameter λ is the weight on output fluctuations, relative to inflation deviations.

Another distinction is between *targeting* and *instrument* rules – that is, whether the rule is specified entirely in terms of the targets of monetary policy (inflation and output), or solved out for the optimal setting of the monetary policy instrument (typically the short-term interest rate under the central bank's control). Table 1

Table 1: A Classification of Policy Rules

	Ad hoc	Optimal
Instrument	Taylor rule Inflation forecast-based (IFB) rule	$i_t = \pi_t + \tilde{b}_1 \left(\pi_t - \pi^* \right) + \tilde{b}_2 x_t$
Targeting	Set $E_t \pi_{t+k} = \pi^*$	$E_t \sum_{\tau=0}^{\infty} \delta^{\tau} \left[\left(\pi_{t+\tau} - \pi^* \right)^2 + \lambda x_{t+\tau}^2 \right]$ $E_t \left[\pi_{t+1} - \pi^* \right] = -\frac{\lambda}{\kappa} E_t x_{t+1}$

Notes: The optimal instrument rule example is from Svensson (1997, Equation 6.11). The examples of optimal targeting rules are from Svensson (2003b, Equations 5.1 and 5.7). Throughout, π represents the inflation rate, π^* the inflation target, x is the output gap, and κ is the coefficient on the output gap in the inflation equation (Phillips Curve).

9. One is reminded of Goldfeld's (1984) quip – 'An economist is someone who sees something working in practice and asks whether it would work in principle'.

illustrates how policy rules can be classified on these two dimensions. Taylor's eponymous rule is, of course, the best-known example of an ad hoc instrument rule, a category that would also include Batini and Haldane's (1999) inflation forecast-based (IFB) rule. An optimal targeting rule could be represented by the objective function (Equation 1), or by the first-order condition expressing a linear trade-off between the deviation of inflation from its target and the output gap:

$$E_t\left[\pi_{t+1} - \pi^*\right] = -\frac{\lambda}{\kappa} E_t x_{t+1} \tag{2}$$

Simply put, rules of this form express the imperative to balance the expected marginal benefit of reducing inflation (the deviation of inflation from its target) with the expected marginal cost of the inflation reduction (the negative of the output gap, divided by the Phillips Curve coefficient κ, multiplied by the weight on the output gap in the objective function, λ). A larger λ (or a smaller κ) means the inflation reduction comes at a greater cost, and as a result the optimising policy authority will be willing to tolerate larger deviations of inflation from its target. Although the precise form of the targeting rule will depend on the model, it can always be expressed as an analogous trade-off between costs and benefits.[10]

Svensson (1999) unequivocally defines IT as an *optimal* targeting rule of this sort – derived from a 'reasonably explicit objective function'. While agnostic as to whether IT necessarily involves pre-commitment, he argues that IT can, at least, help reduce or eliminate any inflation bias resulting from an above-equilibrium output target. Svensson is not alone in regarding optimisation as the essential element distinguishing ITers from non-ITers: Woodford (2004) and Walsh (2002) also describe it in these terms. That would put IT in the right-hand column of Table 1, if not in the lower right-hand corner.[11]

But this is not the only way to map IT into a policy rule. Others prefer to think of IT simply in terms of an ad hoc instrument rule characterised by some fixed (but not necessarily announced) target of inflation π^*, and an inflation coefficient in excess of unity, thus ensuring that eventually inflation returns to π^*. Such a reaction function may, of course, also include a response to the output gap. Galí (2002) and McCallum (2002), among others, describe inflation targeting in this way.[12]

10. The form of the rule will also depend on whether the central bank is assumed to be able to commit to a future path for policy, or if it is free to re-optimise in each period.

11. In principle, it should be possible to test for optimising behaviour on the part of a central bank, just as the null of optimal consumption behaviour has been tested against an alternative that includes rule-of-thumb consumption. (The assumed existence of an interest-rate smoothing term in the objective function obviously means the interest rate, unlike consumption, will not follow a random walk.) To my knowledge, no econometric test of central bank optimisation in the context of IT has yet been performed.

12. McCallum and Nelson (2004) argue that optimal rules can be highly model-dependent, and that central banks would be better advised to select a rule that works well for a variety of different model specifications. They also object to Svensson's view that the objective function by itself represents a policy rule. Svensson (2004) rebuts.

Inflation targeting, as currently practised, maps only imperfectly into these theoretical characterisations. IT *does*, of course, involve setting an objective for a key target variable, namely inflation. Typically, policy is described as setting the interest rate in such a way that the annual inflation rate returns to its target at some specified horizon. Expressing things in terms of the behaviour of the target variable, rather than a specific reaction function for the interest rate, is what gives IT the 'look and feel' of a targeting rule.

But are ITers' simple targeting rules optimal? Clearly not – if ITers are optimisers, they generally do not reveal it in the targeting rules used to describe their policies. The reason is, as Woodford (2004) argues, that merely specifying a medium-term inflation objective fails to characterise *optimal* monetary policy; doing so would involve much nearer-term, one- and two-quarter-ahead projections of output and inflation, which is where the relevant trade-off between output and inflation stabilisation would occur. In the same vein, Svensson (2003a) has urged central banks to disclose the numerical values of the weight they place on output fluctuations in their objective functions. One potential criticism of IT is that it is not sufficiently optimising – ITers need to be more explicit about their objective function, and the economy's near-term transition path back to the target. (This critique, and others, will be discussed later in the paper.) In this light, IT perhaps belongs in the lower left-hand corner of Table 1, as an ad hoc targeting rule.

In any case, it is not clear why defining IT as an optimal targeting rule necessarily excludes central banks that are not generally thought of as ITers. After all, why would ITers have a monopoly on optimisation? Is there a reason to think that the Fed, with its legions of well-trained PhD economists, would be either unable or unwilling to conduct policy in an optimal manner? Apparently not, since Giannoni and Woodford (2003) model the Fed as an ITer (in the sense of following an optimal policy rule derived from the timeless perspective) and find – in contrast to Kohn (2004) – that such a rule is a good description of the Fed's behaviour.

And just to confuse matters further: while ITers tend to frame policy in terms of a targeting rule, some also employ ad hoc instrument rules – both in internal discussions, and in communicating their policies to the public. Since 2000, the March issue of the Sveriges Riksbank's *Inflation Report* has included an assessment of monetary policy using an econometrically estimated 'rule of thumb', based on the Riksbank's own inflation forecasts.[13] According to Archer (2003), a Taylor-style rule is used internally at the Reserve Bank of New Zealand (RBNZ) for assessing various policy options, and one issue of the *Monetary Policy Statement* (May 2001) actually included such a rule-based assessment. Nikolov (2002) reports that Bank of England staff and the Monetary Policy Committee periodically review the implications of a variety of policy rules, although neither the rules, nor the output gap data used to implement them, are published. Even the Norges Bank presents the interest rate path from a Taylor-style rule as a 'cross-check for interest rate setting'. One possible rationalisation for this informal use of instrument rules is

13. The reaction function published in the *Inflation Report* is described in detail in Jansson and Vredin (2000) and Berg, Jansson and Vredin (2002).

that the typical ITers' simple targeting rule, referring only to the medium-term, gives little or no guidance as to how the central bank is to go about achieving its objective in the *near* term.

The practical and theoretical definitions of IT do share common ground, of course: broadly speaking, both involve specifying an explicit inflation objective for monetary policy, and holding the central bank accountable for achieving that objective. But a careful look at the practice of IT confirms Truman's (2003) observation that IT is both *more* than and *less* than a policy rule, narrowly defined. It is more than a rule, in the sense that inflation-targeting frameworks involve a number of elements (for example, a strong emphasis on transparency and communication) that are not easily modelled in the optimal control theory from which policy rules are derived. But at the same time, the simple rule implied by the typical IT framework falls far short of completely specifying central bank behaviour, optimal or otherwise, hence the informal use of ad hoc reaction functions. On this dimension, the practice of IT is quite eclectic. But the literature on optimal policy rules does nonetheless provide a useful theoretical insight into the objectives of, and trade-offs facing, ITers, even if the practice of monetary policy only approximates that ideal.

3. Origins and Evolution of Inflation Targeting

The adoption of inflation targeting has occurred in two distinct waves. The first began with New Zealand in December 1989 (or March 1990, dated from the first of its Policy Targets Agreement, or PTA) and ends with Spain in January 1995. This was followed by a three-year lull, with no further adoptions. Then, beginning with the Czech Republic in January 1998, an additional 14 countries have become inflation targeters. It is not clear exactly what prompted the second wave, although some countries (for example, Korea and Thailand) were clearly eager for a nominal anchor to replace failed exchange rate pegs.

Table 2 lists the 21 countries currently practising IT, distinguishing between the 7 'early adopters' and the 14 'recent adopters'.[14] The table also summarises some of the key features of each framework, including the structure of the target, the previous policy framework, and the nature of the central banks' published forecasts. The key characteristics of the inflation targets are also summarised graphically in Figure 1.

As shown in the second column of the table, IT has replaced a variety of other monetary frameworks. For three of the early adopters, Australia, Canada, and New Zealand, IT replaced what might be described as an 'ad hoc' policy framework with no explicit nominal anchor. The other four countries in this group all relied on an exchange rate anchor prior to adopting IT. And two of these – Israel and Chile – combined IT with a crawling-band exchange rate for a lengthy transitional

14. The list includes Switzerland, as the sole 'undeclared' ITer. While one might debate whether the Swiss National Bank should be classified as a true ITer, clearly its abandonment of money as an intermediate target, its embrace of an explicit numerical inflation objective, and its publication of an inflation forecast, have all moved it a considerable distance in that direction.

Table 2: Current Inflation Targeters and their Key Characteristics *(continued next page)*

A. Early adopters

Country/ Adoption date	Prior policy framework	Current target		Forecasts: Official	Forecasts: Fan?	Forecasts: Unofficial
New Zealand	Ad hoc	1–3% annual CPI	GDP growth	2+ years		
		inflation 'on average	Inflation	2+ years		1–4 years (S)
Dec-89		over the medium term'	Output gap	2+ years		
			Policy rate	endogenous		
Chile	Soft peg	2–4% annual CPI	GDP growth	8 quarters	✔	2 years (S)
	(crawling	inflation, centred on	Inflation	8 quarters	✔	2 years (S)
Jan-91	band)	3%, 24-month horizon	Output gap			
			Policy rate	constant		
Canada	Ad hoc	1–3% for annual CPI	GDP growth	1+ year		
		inflation, midpoint	Inflation	1+ year		2 years (S)
Feb-91		of 2%, 6–8 quarter	Output gap	current		
		horizon	Policy rate			
Israel	Soft peg	1–3% annual CPI	GDP growth	1 year		
	(crawling	inflation, 12-month	Inflation	(1 year)		1 year (S, M)
Jan-92	band)	horizon	Output gap			
			Policy rate			
UK	Soft peg	2% for annual CPI	GDP growth	8 quarters	✔	2 years (S)
	(ERM)	inflation, 8-quarter	Inflation	8 quarters	✔	2 years (S), 5 years (M)
Oct-92		horizon; letter for	Output gap			
		deviations >1%	Policy rate	constant, market		2 years (M)
Sweden	Soft peg	2% ± 1% for annual	GDP growth	2+ years		
	(ERM)	CPI inflation, 1–2 year	Inflation	2+ years	✔	1–5 years (S)
Jan-93		horizon	Output gap	current		
			Policy rate	constant		
Australia	Ad hoc	2–3% annual CPI	GDP growth	(1 year)		
		inflation 'on average	Inflation	1+ year		1 year (S)
Mar-93		over the cycle'	Output gap			
			Policy rate			

B. Recent adopters *(Table 2 continued next page)*

Country/ Adoption date	Prior policy framework	Current target		Forecasts		
				Official	Fan?	Unofficial
Czech Republic	Soft peg (abandoned in May 1997) + money	2–4% annual CPI inflation, becoming 3% ± 1 % in 2006; unspecified horizon	GDP growth	1+ years	✔	1–3 years (S, M)
			Inflation	1+ years	✔	
Apr-98			Output gap	1+ years		
			Policy rate	endogenous		1 year (M)
Korea	Ad hoc	2.5% to 3.5% annual core CPI inflation, 3-year horizon.	GDP growth	(1 year)		
			Inflation	3 years	✔	
Apr-98			Output gap			
			Policy rate			
Poland	Money-based	2.5% ± 1% annual CPI over a ‘medium-term horizon’	GDP growth	(1+ years)		
			Inflation	(1+ years)		4 quarters (S)
Oct-98			Output gap			
			Policy rate	constant		3 months (M)
Mexico	Soft peg, followed by ‘weak’ IT, 1995–98	3% ± 1% annual CPI inflation, unspecified horizon	GDP growth	(1+ years)		1+ years (S)
			Inflation	(1+ years)		5 years (S)
Jan-99			Output gap			
			Policy rate			
Brazil	Soft peg	5.5% ± 2.5% (2004), 4.5% ± 2.5% (2005) annual CPI inflation, unspecified horizon	GDP growth	8 quarters	✔	
			Inflation	8 quarters	✔	1 year (S)
Jun-99			Output gap			
			Policy rate	constant, market		2 years (S)
Colombia	Soft peg + money	5% to 6% in 2004, reduced gradually to 3%	GDP growth	12 quarters		1+ years (S)
			Inflation	12 quarters	✔	1+ years (S)
Sep-99			Output gap	12 quarters		
			Policy rate	endogenous		1 year
Switzerland	Money-based	*Less than* 2% annual CPI, unspecified horizon; deflation prevention => de facto 0–2% range	GDP growth	(1+ years)		
			Inflation	12 quarters		
Jan-00			Output gap			
			Policy rate			

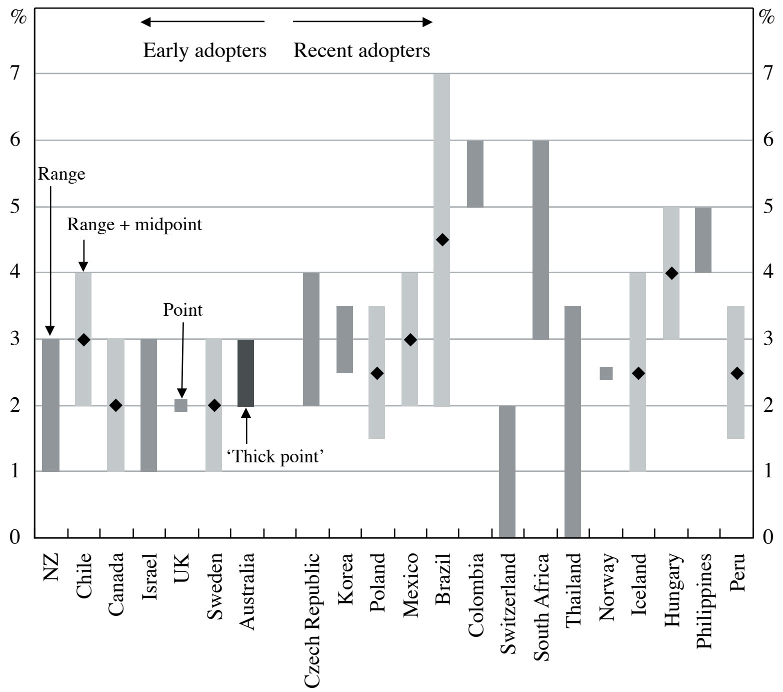
B. Recent adopters *(Table 2 continued)*

Country/ Adoption date	Prior policy framework	Current target		Forecasts: Official	Forecasts: Fan?	Forecasts: Unofficial
South Africa	Ad hoc	3 to 6% for annual	GDP growth			1+ years (S)
		CPIX inflation	Inflation	8 quarters	✔	2+ years (S)
Feb-00		(continuously), 18–24	Output gap			
		month horizon	Policy rate	constant		
Thailand	Money-based	0 to 3.5% quarterly	GDP growth	8 quarters	✔	1+ years (S)
		core CPI, unspecified	Inflation	8 quarters	✔	1+ years (S)
May-00		horizon	Output gap			
			Policy rate	constant		
Norway	Soft peg	‘Approximately’ 2.5%	GDP growth	3+ years		current year (S)
		for annual CPI inflation	Inflation	3+ years	✔	1+ years (S), 6–10 years (M)
Mar-01		over ‘a reasonable	Output gap	3+ years		
		time horizon, normally	Policy rate	market		3+ years (M)
		1–3 years’				
Iceland	Hard peg	2.5% ± 1.5% annual	GDP growth	2+ years		1+ years (S)
		core CPI inflation,	Inflation	9 quarters	✔	1+ years (S)
Mar-01		unspecified horizon	Output gap	2+ years		
			Policy rate	constant		2 years (S)
Hungary	Soft peg	4% ± 1% for annual	GDP growth	1+ years		1+ years (S)
	(crawling band)	CPI inflation as	Inflation	1+ years	✔	1+ years (S)
Jul-01		of year-end 2005,	Output gap			
		unspecified horizon	Policy rate	constant		
Philippines	Money-based	4% to 5% annual CPI	GDP growth			1+ years (S)
		inflation, unspecified	Inflation	8 quarters	✔	1+ years (S)
Jan-02		horizon	Output gap			
			Policy rate	constant		
Peru	Ad hoc	2.5% ±1% for	GDP growth	1+ years		current year (S)
		annual CPI inflation,	Inflation	1+ years	✔	1+ years (S)
Jan-02		unspecified horizon	Output gap			
			Policy rate	constant		

Notes: Forecast horizons given in parentheses are qualitative, or reported at semi-annual (or longer) intervals. Unofficial forecasts reported can be from surveys (S), market-based measures (M), or both. Australia’s adoption date corresponds to the declaration of the 2–3% target by then-Governor Fraser (see Stevens 1999 for a discussion). Bernanke *et al* contend that inflation targeting was not fully in place until September 1994.

Sources: Fracasso, Genberg and Wyplosz (2003, Tables 1.1 and 3.6); Mishkin and Schmidt-Hebbel (2002, Table A1); Truman (2003, Table 2.3); updated and expanded from central bank sources

Figure 1: Characteristics of ITers' Inflation Targets



Sources: See Table 2

period as the inflation target was ratcheted down. The same goes for the recent adopters, whose prior monetary regimes included soft pegs (Brazil, Colombia, the Czech Republic, Hungary, Mexico and Norway), hard pegs (Iceland), money-based anchors (Philippines, Poland, Switzerland and Thailand), and ad hoc policies (Korea, Peru and South Africa)

3.1 How have inflation-targeting frameworks evolved?

The early adopters listed in Table 2 have by now had IT policies in place for 10–15 years. What is striking about these countries is how *little* the basic outlines of the frameworks have changed over the years.[15] All state their targets in terms of annual overall ('headline') CPI inflation, and except for Chile's 2–4 per cent range, the targets all are somewhere in the 1 per cent to 3 per cent range; the modal midpoint is 2 per cent. No central bank has modified the form of its target: point targeters have remained point targeters, and range targeters have remained range targeters. Except for Chile and Israel, which went through extended transition periods, the numerical targets themselves have remained largely unchanged. (The Bank of England's target changed in December 2003, but the reduction in the target

15. As an aside, it is worth noting that two countries – New Zealand and Canada – experimented with, but abandoned, monetary conditions indices (MCIs) as operating targets. Svensson (2001) contains a detailed review of New Zealand's experience.

to 2 per cent from 2.5 per cent resulted from a switch to a new, harmonised CPI price index, whose average inflation rate was somewhat lower than the old RPIX.) And for those central banks that give a targeting horizon, that horizon has remained constant, typically in the 1–2 year range.

Among 'non-transitional' ITers, the salient exception to the pattern of stability is New Zealand, which has modified three key parameters of its framework. Until September 1997, the RBNZ used an index of 'underlying' inflation as its target. Between September 1997 and June 1999 it used a measure of 'core' CPI inflation, and since June 1999 it has simply used overall CPI inflation. And having begun with a target range of 0–2 per cent, the RBNZ in early 1997 raised the upper bound to 3 per cent, and in late 2002 it raised the *lower* bound to 1 per cent. In these two dimensions, the RBNZ has moved towards the best (or at least most common) practice of a target for overall CPI inflation with a non-zero lower bound. In a slightly more subtle modification, the September 2002 PTA changed the target to 'between 1 per cent and 3 per cent *on average over the medium term'* [author's emphasis]. This shift in language, reminiscent of the RBA's 'on average over the cycle', might be interpreted as signalling a shift towards placing somewhat greater weight on output fluctuations ('flexibility') in formulating its policy.

New Zealand notwithstanding, the lack of any significant modifications in these countries' IT frameworks is revealing – one might have expected somewhat more evolution towards a uniform set of characteristics. One explanation is that the frameworks really differ only in the details; that these details have remained largely unchanged suggests that they simply don't matter all that much. It seems that any relatively low (but non-zero) target will do. Similarly, point, range, and range-with-midpoint targets all appear satisfactory, or at least the perceived benefits from moving to a 'better' inflation target are sufficiently small that they are outweighed by the perceived costs of switching. The guiding philosophy seems to be 'whatever works'.

3.2 The evolution of inflation targeters' forecasts

This is not to say that the practice of IT has been completely static for 15 years. In more subtle ways, IT *has* evolved – particularly when it comes to what central banks choose to communicate. And perhaps the most prominent dimension of communication has to do with the forecasts central banks choose to report. Here, there *has* been a fair amount of change, at least for some central banks: the general trend is clearly towards reporting explicit forecasts over increasingly long horizons.

This dispersion in terms of what forecasts (if any) central banks choose to report is clearly evident in Table 2. The first column under the 'forecasts' heading indicates whether the central bank publishes official forecasts of GDP growth, inflation, and the output gap; and, if so, the horizon over which the forecasts are published. A blank entry indicates no forecast for that variable is published; forecasts that are more qualitative, or limited in terms of frequency, are indicated by parentheses. The 'policy rate' entries in the table report the nature of the policy assumption on which the forecasts are conditioned: forecasts conditioned on a constant or (published) market-implied path of interest rates are listed as such, while those that are based on a published, time-varying interest rate projection (presumably one consistent with bringing inflation back to its target) are labelled as 'endogenous'.[16] The policy rate entry is left blank in those cases where the policy rate assumption is unspecified. A tick mark in the second column indicates that a 'fan chart', or the equivalent, is used to report the uncertainty associated with the forecast variables.

In addition to (or, in some cases, instead of) official projections, many central banks report unofficial, private-sector forecasts of key macroeconomic and financial variables. These cases are noted in the last column of the table, with an indication as to whether the unofficial forecasts are based on surveys (S) or are market-based measures (M) derived from asset prices, such as the nominal-index bond spread.

At the full-reporting end of the spectrum are New Zealand and recent adopters Norway, Iceland, Colombia and the Czech Republic. New Zealand has, at least since 1997, reported relatively detailed annual projections for real GDP, inflation, and the output gap for a 2–3 year horizon. Quarterly projections for many of the key variables are also made public. While many of these are not tabulated, plots of the projections appear in the *Monetary Policy Statement*, and the data underlying the plots are made available publicly on the RBNZ's website.

As impressive as it is, New Zealand's high standard for forecast disclosure has recently been equalled or even surpassed by the Norwegian central bank.[17] The Norges Bank reports detailed forecasts for a 3–4 year horizon, compared with 2–3 years for the RBNZ. (The May 2004 *Inflation Report*, for example, reports forecasts through 2007.) Both central banks are also quite explicit about the interest rate path on which the forecast is conditioned: the RBNZ bases its forecast on a (non-constant) trajectory of interest rates consistent with attaining the inflation target at its chosen horizon, while the Norges Bank uses market expectations derived from the term structure of interest rates. (Similarly, the exchange rate forecast is derived from forward rates.) And the Norwegian central bank, together with the RBNZ, the Central Bank of Iceland, the Colombian Central Bank and the Czech National Bank are the *only* central banks to publish forecasts of the output gap – an essential ingredient in the sorts of optimal targeting rules advocated by Svensson (1999).

Among the established early-adopter central banks, it is fair to say that the Bank of Canada and the RBA, along with the Bank of Israel, occupy positions near the opposite end of the forecast-reporting spectrum, publishing only near-term, often qualitative, forecasts for a relatively small set of variables. (Some of the emerging-market countries among the recent adopters, not surprisingly, tend to report only minimal forecasts, presumably due in part to a shortage of experience and research infrastructure. But this is hardly uniform – see Colombia and Brazil.) But both the Canadian and Australian central banks have begun to include more information in

16. These official interest rate projections are published with varying degrees of specificity, however, with some, such as the Czech Republic, indicating only in general terms how they expect the interest rate to evolve.

17. Colombia's Banco de la República also publishes a surprisingly detailed forecast, comparable to that of the Norges Bank, but it is only available in Spanish.

recent years, gradually moving to slightly more explicit forecasts of a larger set of macroeconomic variables. Nonetheless, both still fall short of banks like the RBNZ and the Norges Bank in terms of forecast detail and horizon.

Of the three, Australia goes the farthest in de-emphasising forecasts.[18] The RBA's extensive *Statement on Monetary Policy* covers a very wide range of topics, but its focus is mainly on describing and interpreting recent trends. The *Statement* is not entirely backward-looking, however. The introduction (page 3 of the May 2004 issue) and the section entitled 'Inflation outlook' appearing on the last page of the document (page 51 of the same issue), contain a broad-brush forecast, such as 'inflation is now expected to decline to around 1¾ per cent at the end of this year, rising to around 2½ per cent by the end of 2005'. While this lacks the level of precision (spurious or otherwise) found in other ITers' published forecasts, it is slightly more specific than previous years' *Statements*. The May 1997 *Statement*, for example, said 'the Bank expects underlying inflation during 1997 to remain low, probably declining slightly below 2 per cent for a while. Some pick-up in inflation is likely in 1998 as the favourable exchange rate effects pass but, provided growth in labour costs is not excessive, price inflation should remain within the 2 to 3 per cent range'. Official GDP forecasts are generally not reported in the *Statement on Monetary Policy*, but instead are presented semi-annually in the Governor's Opening Statement to the House of Representatives Standing Committee on Economics, Finance and Public Administration.

The Bank of Canada's forecasts have undergone a similar evolution in recent years. When it was first published in 1995, the *Monetary Policy Report* contained no explicit forecasts of either inflation or output. But starting in 1996, GDP forecasts for the subsequent year began to appear. A section entitled 'Inflation projection' appeared in November 1997, and from 1998 onward GDP and inflation forecasts are consistently presented. (Only core inflation forecasts were reported during this period, and usually as a range.) In 2003, the *Report* added a table containing forecasts of core and overall inflation for the current and subsequent years. Still, it is perhaps telling that Canada's forecasts appear only at the very end of its monetary policy document. The ITers with a history of emphasising the forecast, like the UK, New Zealand and Sweden, typically feature their forecasts prominently in the opening section of their documents.

Israel's situation differs in many ways from those of Australia and Canada. Its failure to give an extensive forecast is probably more a function of the high level of economic uncertainty in that country than due to any intrinsic aversion to reporting a forecast. More than 12 years after adopting an inflation target, Israel is just now completing a transition period from relatively high inflation to its long-term objective of 1–3 per cent. Driven in part by exchange rate fluctuations, inflation has been extremely volatile in recent years, however, reaching 6 per cent in 2002 and –2 per cent in 2003. Clearly, making long-term forecasts in this kind of environment is difficult.

18. See Debelle (2003) for an excellent description of Australia's relatively relaxed approach to inflation targeting.

3.3 Why do forecasts matter?

Why do many ITers seem to attach such importance to publishing a forecast? And what explains the evolution of the practice of IT towards the publication of more complete, longer-horizon forecasts?

The immediate answer to both questions, of course, is simply that optimal monetary policy, whether framed in terms of a targeting rule or an instrument rule, is always framed in terms of expectations (or at least the policy authority's projections) of the relevant target variables. Inflation targeting is really inflation-*forecast* targeting, as noted in Svensson (1997). Indeed, along with the use of an optimal targeting rule, Svensson (1999) lists the publication of explicit forecasts for inflation and the output gap as the touchstone for inflation targeting. Thus, if the public is to understand what the central bank is doing in terms of a policy rule, published forecasts are essential. And more broadly, the publication of forecasts fits with ITers' overall emphasis on transparency.

Why transparency itself is important is a deeper question. Geraats (2002) suggests two broad categories of effects: information and incentive. The information effect is based on the idea that the central bank has some proprietary information about the state of the economy, and disclosing information can reduce the uncertainty associated with private-sector forecasts. This is a rather general point, however, and need not apply specifically to ITers – the same line of reasoning suggests that all central banks should disclose their forecasts, whether or not they choose to adopt the entire IT framework.

There is, of course, one key piece of information disclosed by inflation-targeting central banks, and not revealed by non-ITers: the *long-run* inflation forecast, which is, of course, equal to the inflation target itself. Orphanides and Williams (2003) show that, compared with the case in which expectations are formed by recursive least-squares regression, an inflation target improves economic performance by pinning down long-run inflation expectations. But this result only explains why setting an explicit target is helpful, and says nothing about the usefulness of releasing forecasts *per se*.

That leaves Geraats' so-called incentive effects. The idea here is that the disclosure of forecasts reduces or eliminates any incentive the central bank might have to 'cheat' on its commitment to low inflation by engineering higher-than-expected inflation, and thus achieving a higher level of output. This line of reasoning is based on models that include a Barro-Gordon (1983) style time-consistency problem, extended to include private information, along the lines of Canzoneri (1985). King (1997) argues, informally, that the overall transparency associated with inflation targeting effectively removes the possibility of cheating, and allows the central bank to attain the optimal state-contingent rule. Herrendorf (1998) formalises this idea, showing that the disclosure of 'planned' inflation (that is, the central bank's projection) reduces the inflation bias.

It is worth keeping in mind, however, that the issue of transparency is much more subtle in practice than these sorts of stylised models would suggest. Posen (2002) points out that there are many ways to promote transparency, and publishing a forecast by itself does not reveal all the information one would need to discern (or verify) the central bank's underlying preferences. Moreover, as discussed in Posen (2003), the effects of transparency may be highly varied, depending on the nature of the information being disclosed. He suggests, for example, that the largest effect of the publication of forecasts would be on the way in which financial markets respond to economic news. By contrast, the careful articulation of the policy framework through other forms of communication, such as speeches, would be more likely to build trust and convey flexibility. This particular aspect of communication is the focus of a subsequent section of the paper, dealing with the nature of central banks' stated policy goals.

Regardless of any effect the publication might have on anyone's behaviour, the availability of forecasts is unquestionably a boon to anyone seeking to understand and characterise the conduct of monetary policy. Below, the central banks' forecasts will be used in an effort to assess the degree of 'flexibility' in their response to inflation and real economic conditions. So even if the forecasts reveal nothing by way of private information about the state of the economy, their publication at a minimum facilitates the public's learning about the descriptive rule followed by the monetary authority.

4. Critiques of Inflation Targeting

Judging from its popularity, at least, inflation targeting is widely viewed as a success. It is also worth nothing that the framework has never been abandoned, except when Finland and Spain joined the European Monetary Union. And in light of the mixed reviews of the ECB's policy framework, such as that of Galí *et al* (2004), one wonders whether these two countries might not be experiencing a form of buyer's remorse.

Inflation targeting has its critics, however. Critiques of IT tend to fall into one of three categories. The first is that it simply doesn't matter – the performance of ITers is indistinguishable from that of comparable non-ITers. A second critique is that IT is too inflexible, in that it goes too far in constraining central banks' response to economic conditions – particularly real-side fluctuations in employment and output. The third is that IT, at least as practiced, does not come close enough to the theoretical ideal of *optimal* monetary policy. A case can be made, however, that the thrust of this third critique is really very close to the 'too inflexible' criticism.

4.1 The 'inflation targeting doesn't matter' critique

Discerning a distinct empirical effect of inflation targeting has posed a major challenge to IT advocates. The problems are threefold. The first is the relatively short sample available for evaluating ITers' track record. (Of course, the longer IT is debated, the more evidence is accumulated.) The second is disentangling the effects of IT from the generally favourable economic conditions prevailing in the 1990s. And the third, related problem, is specifying an appropriate counterfactual, in the absence of an exogenously-assigned control group of non-ITers.

In large part as a result of these obstacles, the evidence on whether IT 'matters' has been rather mixed. The general improvement in the performance of economic outcomes in inflation-targeting countries is by now reasonably well documented. Corbo, Landerretche and Schmidt-Hebbel (2002), for example, found that ITers were able to reduce their inflation rates and hit their inflation targets quite reliably while also reducing the volatility, relative to the pre-adoption period.[19] Neumann and von Hagen (2002) found that interest rate volatility also fell post-adoption; however, they were unable to detect any significant differences on this, or any other dimension, between the performance of ITers and industrialised non-ITers. In a similar vein, Ball and Sheridan (2003) concluded that much of the apparent improvement in ITers' economic performance can be attributed to a reversion to the mean, rather than to a distinct effect of IT *per se*. Hyvonen (2004), however, challenged the Ball and Sheridan conclusion, showing that mean reversion tends not to occur in the absence of a policy framework designed to effect such a reversion – mean reversion simply doesn't happen by itself. With no more than 15 years' worth of data (and for most countries, much less), however, the question of IT's effects on macroeconomic performance is sure to remain unsettled for some time to come.

The difficulty of discerning a first-order difference in macroeconomic outcomes has led to efforts to distinguish more subtle differences between ITers and non-ITers. Here the results have been somewhat more promising. One important finding is that the persistence of inflation among ITers is less than for non-ITers, a result reported by Kuttner and Posen (1999, 2001), Siklos (1999) and Levin, Natalucci and Piger (2004). The interpretation is that, with inflation expectations more firmly anchored by the inflation target, there is less of a tendency for inflation shocks to propagate through wage- and price-setting behaviour. This hypothesis is borne out by analyses that examine inflation expectations more directly. Kuttner and Posen (1999), for example, find a smaller impact of inflation shocks on long-term interest rates in Canada and the United Kingdom post-adoption. And in analysing survey-based inflation expectations, Levin *et al* (2004) find that recent inflation realisations have a much smaller impact on expectations for ITers than they do for non-ITers.

4.2 Flexibility and optimality – one goal, or two?

The objection most often raised to inflation targeting in the US is that it is too 'inflexible'. Usually, that is taken to mean that the adoption of IT would force the central bank to pay attention *only* to inflation, to the exclusion of output stabilisation – and potentially other central bank objectives, such as financial stability, as well. In other words, IT is viewed as a step in the direction of 'inflation only' targeting; or as Kohn (2004) put it, 'adopting IT, even in its softer versions, would be a slight shift along the continuum of constrained discretion in the direction of constraint, and the

19. It is worth mentioning a related study by Chortareas, Stasavage and Sterne (2002) examining the effects of central bank transparency, defined narrowly in terms of whether, and at what level of detail, a forecast is published. Using self-reported survey data, they find that those central banks that publish more extensive forecasts also tend to have lower inflation rates, on average.

benefits of such a shift are unlikely to outweigh its costs'. The Federal Open Market Committee (FOMC) has not formally taken up the question of inflation targeting since 1995, but the objections raised during that discussion were essentially the same. In arguing against the idea, Federal Reserve Governor Janet Yellen interpreted it as meaning that 'the inflation rate should be the sole objective of policy for current and future years, with no weight being placed on achieving competing, ultimate goals for real variables' (FOMC 1995). A similar objection was raised by Friedman and Kuttner (1996).[20]

The problem is, as Blanchard (2003) observes, that the intellectual (or at least academic) foundation of inflation targeting rests on the 'divine coincidence' that stabilising inflation is equivalent to stabilising output around its natural level. Cost shocks may be present, but their effect comes exclusively through their impact on the natural level of output; hence there is no conflict between the two objectives of output and inflation stabilisation. The conclusion follows logically from the absence of an error term in the New Keynesian version of the Phillips Curve. In this case, the optimal level of output can be attained by eliminating any dispersion in *relative* prices, which in the context of models with staggered price setting, requires complete price stability.[21] In this case, the two goals of output and inflation stabilisation collapse into a single objective.

For monetary policy to have two meaningfully distinct goals requires the existence of cost-push, or supply shocks. Woodford (2004) includes an exogenous cost-push shock in the aggregate supply relation, thereby creating 'a tension between the goals of inflation stabilisation and output-gap stabilisation' – a property shared by Svensson's various formulations of optimal monetary policy.[22] In the presence of these shocks, absolute price stabilisation will generally *not* be optimal. Faced with an adverse cost-push shock, the loss-minimising central bank will allow inflation to rise temporarily, rather than keep inflation constant at the cost of a sharper reduction in output. This is precisely the point made by Yellen in her argument against inflation targeting (FOMC 1995): 'Fortunately, the goals of price stability and output stability are often in harmony, but when the goals conflict and it comes to calling for tough trade-offs, to me, a wise and humane policy is occasionally to let inflation rise even when inflation is running above target'. This is, of course, exactly the trade-off represented by the optimal targeting rule (Equation 2) discussed above.

So if IT is nothing more than conducting policy based on an optimal targeting rule like Equation (2), as Svensson (1999) maintains, what accounts for Yellen's

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20. Unfortunately, much of the debate in the mid 1990s was framed by the proposed *Economic Growth and Price Stability Act* of 1995, which would have replaced the Fed's dual mandate with the single objective of price stability. For this reason, the Act was widely interpreted as specifying 'inflation-only targeting'.

21. The definitive statement of this idea in a New Keynesian setting is Woodford (2003), especially Chapter 6, Section 3. The New Classical rendition of the same argument can be found in Goodfriend and King (1997).

22. Interestingly, Woodford (2003) discounts the empirical relevance of these inefficient cost-push shocks: 'while it is certainly possible that substantial disturbances of this kind occur, the matter is far from established' (p 454).

objection? The most likely explanation is that inflation targeters often do not *talk* as if they were guided by (2), preferring to focus instead on the simple targeting rule of bringing the inflation rate back to its target over the medium-term horizon. This of course relates back to the point in Woodford (2004), that to implement policy optimally, ITers need to specify the transition path back to the inflation target, since it is along the transition path that the output-inflation trade-off becomes relevant. Thus, the charge that IT is too inflexible is, at least in this dimension, equivalent to the criticism that ITers should more closely follow the prescriptions of optimal policy rules.

4.3 What do inflation targeters say about output stabilisation?

Surely no inflation-targeting central banker would admit to being an 'inflation nutter', to borrow King's (1997) memorable phrase. All now claim to be 'flexible'. But pledges of flexibility are rather abstract – in concrete terms, how do inflation-targeting central banks state their policy objectives? And do they do so in such a way that communicates the potential trade-off between stabilising output and stabilising inflation, and indicates, at least roughly, how the central bank would balance those objectives should they conflict?

One might argue that what matters is what inflation-targeting central banks actually *do* – not what they *say*. But an essential element – if not *the* essential element – of inflation targeting is transparency; Bernanke *et al* (1999) maintain that IT is, more than anything else, a framework for improving communication. One would therefore hope that the flexible deeds of inflation-targeting central banks would be matched by equally flexible words. Adhering to the conventional wisdom that central banks should 'do what they do but talk only about inflation' would, as Friedman (2003) points out, obfuscate the real goals of monetary policy, and represent the antithesis of transparency. This would also open ITers up to the charge of *manipulating* rather than *managing* expectations. More worryingly, Friedman (2004) suggests that the single-minded focus on an inflation target may eventually lead to 'the atrophication of concerns for real outcomes'.

So how does lip service to flexibility translate into talk? In an effort to address that question, I perused the official online publications of all of the early adopters listed in Table 2, as well as those of a (not randomly) selected subset of the recent adopters. What I was looking for was a statement of the broad objectives of monetary policy, and how competing objectives might be balanced, if at all. Such statements often appear at the very beginning of the central banks' *Inflation Report*s, or the equivalent; in other cases, a statement of policy objectives can be found as a stand-alone page somewhere on the central bank's website, or as part of the document spelling out the criteria by which the policy authority was to be evaluated (for example, New Zealand's PTA). Occasionally, the relevant information was gleaned from a central bank official's speech, if that speech was represented as conveying the official views of the institution. This unscientific survey revealed a wide variation in ITers' communication strategy.

What ITers say about output stabilisation can be put into three groups. The central banks in the first, 'tough talk', category are those that either ignore or deny any responsibility for output stabilisation. On the other end of the spectrum are those that explicitly acknowledge the possibility that trade-offs may arise between output and inflation stabilisation – call these the 'explicit flexibility' ITers. Some banks occupy a middle ground, acknowledging some role for output stabilisation, but without clearly mentioning a trade-off. Table 3 displays an (admittedly subjective) assessment of where some of the ITers fall on this spectrum. Interestingly, where the central banks fall seems to bear no direct relation to whether they operate under a unitary, hierarchical, or dual mandate.[23]

Table 3: Selected ITers' Stated Role for Output Stabilisation

Tough talk	Intermediate	Explicit flexibility
New Zealand, pre-1999 (U)	New Zealand, post-1999 (U)	Norway (H)
UK (H)	Sweden (U)	
Canada (D)	Australia (D)	
Chile (U)		

Notes: (U) indicates a unitary legal mandate (price stability, or in the case of Chile, currency stability), (H) indicates a hierarchical mandate with price stability first, and (D) a dual or multiple mandate.

Sources: Debelle (2003); Truman (2003); central banks' publications

Statements from the 'tough talk' central banks' statements either assert that controlling inflation promotes real growth, or they ignore the issue altogether. In effectively establishing a unitary objective, these institutions present a view of the world characterised by Blanchard's 'divine coincidence'.

One of the best examples of the former is the Bank of Canada, whose policy statements have consistently promoted the view that low inflation is the means by which healthy growth is achieved. The November 2000 *Monetary Policy Report*, for example, states: 'Inflation control is not an end in itself; it is the means whereby monetary policy contributes to solid economic performance'. Similarly, the background information accompanying the renewal of the inflation target (Bank of Canada 2001) states: 'the targets contribute to the achievement of sustained, robust economic growth'. Even policy tightenings intended to curb inflation are described as necessary for promoting growth. The statement accompanying the 17 May 2000 rate hike, for instance, said it was 'deemed necessary to keep the future trend of inflation near the midpoint of the Bank's target range of 1–3 per cent *so that* the Canadian economy could continue to grow at a sustainable rate' [emphasis added]. The Chilean central bank takes a similar line, stating in its *Monetary Policy Report* that 'monetary policy's focus on inflation targeting helps to moderate fluctuations in employment and domestic output'. In the same vein, the RBNZ's 1996 and 1997 PTAs give its objective as maintaining 'a stable general level of prices *so*

23. Truman (2003) lists the RBA as having a hierarchical mandate, but here I follow Debelle (2003) in categorising it as a dual/multiple mandate central bank.

that monetary policy can make its maximum contribution to sustainable economic growth, employment, and development opportunities within the New Zealand economy' [emphasis added].

Other tough talkers ignore the output stabilisation issue altogether. This would describe the RBNZ prior to 1996, when its PTA mentioned only price stability. The Bank of England might also be put into this category, although its remit does acknowledge that 'the actual inflation rate will on occasions depart from its target as a result of shocks and disturbances. Attempts to keep inflation at the inflation target in these circumstances may cause undesirable volatility in output'.

This is *not* to say that tough talkers ignore output fluctuations entirely. But central banks in this group consistently describe monetary policy in terms of demand shocks, which, as we know, create no tension between output and inflation objectives. A 1998 brochure written by Don Brash, then-Governor of the RBNZ, is typical: 'if the economy underperforms, that creates a risk of deflation. In such a case, to achieve price stability, the Reserve Bank gives the economy a "kick start" by lowering short term interest rates. The inverse applies if the economy overheats, the Reserve Bank constraining inflation via higher short term interest rates' (Brash 1998). And this is largely consistent with the way in which real-side developments are treated in these central banks' official publications – as a determinant or predictor of inflation, rather than in terms of a distinct goal.

Even these tough talkers concede that there are situations in which complete price stabilisation would be inappropriate, however. These are instances of one-off price level changes, due, for example, to changes in indirect taxes or transitory oil-price shocks. (These might be thought of as one-time, serially uncorrelated cost shocks.) In these cases, central banks typically say they will not try to offset the first-round effects of the price changes, but instead hold the line against any follow-on inflationary effects. Sometimes, as in the early years of New Zealand's framework, an escape clause will be given with a very specific set of conditions under which target deviations would be allowed. (More recent PTAs still contain an escape clause with a list of conditions, but since 1996 the list seems intended to be illustrative, rather than exhaustive.) Thus, tough talkers stop short of hard-line 'inflation nutters'.

The ITers in the intermediate category are those that acknowledge – or at least hint at – an objective of output stabilisation that is distinct from inflation control; Sweden's Riksbank, the RBA, and the post-1999 RBNZ arguably fall into this category. A relatively direct statement to this effect can be found on the RBA's website: 'This approach allows a role for monetary policy in dampening the fluctuations in output over the course of the business cycle'. The RBNZ is a bit more oblique, but since 1999 its PTAs declare that the Bank shall 'implement monetary policy in a sustainable, consistent, transparent manner, and shall seek to avoid unnecessary instability in output, interest rates, and the exchange rate'.[24] The

24. As noted above, in 2002, following the appointment of a new governor, Alan Bollard, the horizon for RBNZ's inflation target was changed to 'on average over the medium term', suggesting somewhat greater flexibility. Ironically, Brash (1998) had argued against a similar relaxation of the horizon, which had been proposed by New Zealand's trade unions.

Riksbank's 1999 'clarification and evaluation' of its inflation target (Heikensten 1999), is the most detailed and specific of the three institutions in this category, stating that 'monetary policy does have consequences for the demand situation and employment *in the short run*' [emphasis in the original]. It goes on to say that for 'considerable shocks', there may be grounds for not attempting to return inflation to the targeted level immediately. In such a situation the Riksbank shall clearly state *in advance* – in the *Inflation Report* and in connection with monetary policy decisions – how it expects inflation to deviate from the target and why. In both cases, the justification for deviations are the social costs that might otherwise be incurred because of avoidable fluctuations in economic activity'.

Only one 'explicitly flexible' inflation targeter has turned up thus far: Norway. Compared with other central banks, the Norges Bank's directness on the issue of flexibility is exceptional. The opening pages of its *Inflation Report* declare that the 'Norges Bank operates a flexible inflation-targeting regime, so that weight is given to both variability in inflation and variability in output and employment'. And with respect to the targeting horizon, it states: 'The more precise horizon will depend on the disturbances to which the economy is exposed, and how they will affect the path for the real economy in the time ahead'.

Deputy Governor Jarle Bergo went even farther in a September 2002 speech, describing in detail the trade-off facing the central bank: 'Monetary policy can be used aggressively to bring inflation under control quickly, but with considerable fluctuations in the real economy as a consequence; or it may be used more gradually with less of an impact on the real economy, but with inflation being allowed to deviate from the target over a slightly longer period. In the short term, there will thus be a trade-off between output and employment developments and the variation in inflation around the inflation target' (Bergo 2002).[25]

The lessons from all this are twofold. One is that based on ITers' rhetoric, it is easy to see how even enlightened observers like Friedman and Yellen could conclude that inflation targeting is inflation-*only* targeting. The other lesson is that one way to convey flexibility is to be a little vague, like the RBA – but it is not the only way. The Norges Bank (and to a lesser extent, the Riksbank) convey a great deal of flexibility in much more precise terms, contradicting the view that a trade-off exists between transparency and flexibility. And the Norges Bank's approach, with its explicit acknowledgement of a role for output stabilisation, is arguably more consistent with transparency of the sort that Friedman (2004) finds lacking in ITers' descriptions of their policy objectives.

4.4 Have ITers demonstrated their flexibility?

No amount of talk matters, of course, unless it is also consistent with the central bank's actions. How then is one to assess the flexibility of central banks' policies? This section presents two complementary assessments for a small subset of the inflation

25. Bergo goes on to describe the trade-off in terms of a 'loss function', displaying a 'Taylor curve' along with hypothetical indifference curves. Although he stopped short of stating his value for λ in Equation (1), he noted that this was implicit in the horizon chosen for inflation stabilisation.

targeters discussed above. One method involves estimating simple reaction functions (that is, 'ad hoc instrument rules') in the hope of finding positive coefficients on the output gap or growth terms. The other, more informal method is to look directly at how central banks responded in situations where they were presented with a choice between output and inflation stabilisation. Following Kuttner (2004), the approach involves using inflation-targeting central banks' own published forecasts, rather than econometrically-estimated proxies for the relevant expectations. This has the advantages of incorporating central banks' own real-time judgement as to economic conditions, as well as simplifying the econometrics – an important consideration in working with such short samples, where methods like Generalised Method of Moments would be highly problematic. The main disadvantage, of course, is that it limits the analysis to those central banks which have a relatively long track record of published forecasts, and even then the time span covered is constrained by the availability of forecast data. For this reason, the analysis focuses on New Zealand, Sweden and the United Kingdom.

The reaction-function approach uses a variant of the forward-looking Clarida, Galí and Gertler (2000) specification,

$$i_t = \alpha i^* + \beta_1 x_{t,t} + \beta_2 \Delta y_{t+k,t} + \gamma\left(\pi_{t+k,t} - \pi^*\right) + \rho i_{t-1} + e_t \tag{3}$$

where $\Delta y_{t+k,t}$ and $\pi_{t+k,t}$ are the central bank's period-*t* forecasts of real GDP growth and inflation over the subsequent *k* quarters, $x_{t,t}$ is the estimate of the period-*t* output gap made at time *t* and i_t is the policy rate (typically the repo rate). The lagged interest rate on the right-hand side is usually interpreted as capturing interest rate smoothing. The attractiveness of the specification is that it assumes forward-looking behaviour on the part of the central bank. And because the bank's inflation forecast is included as a regressor, positive estimates of β_1 or β_2 are often loosely interpreted as reflecting a concern for output stabilisation over and above the extent to which output affects the inflation forecast.[26]

In implementing this approach, one immediately runs up against the problem that central banks do not generally report estimates of the output gap, $x_{t,t}$. Among the three banks analysed, New Zealand is the only one to have reported output gap figures with any degree of consistency.[27] But using an assumed rate of potential GDP growth, and assuming the output gap tends to zero as the end of the forecast horizon, it is possible to back out an implicit estimate of the output gap using the central banks' projections of real GDP growth. Although this procedure is less than ideal, it at least has the merit of using only information available to the bank in real time. Additional details on this procedure appear in Kuttner (2004).

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26. This interpretation is not entirely justified, however, as optimal instrument rules resembling Equation (3) typically include a non-zero coefficient on output (or the gap), even with a zero value for λ, the weight on output fluctuations in Equation (1).

27. The RBNZ reported quarterly output gap projections in its *Monetary Policy Statement*s from December 1997 through November 1999, and again from December 2000 through March 2001. For those periods in which quarterly figures were not reported, they were interpolated from the annual averages, which have been published consistently throughout the 1997–2003 period.

Results from estimating Equation (3) appear in Table 4 with the horizon *k* set to four quarters. The equation works 'well' for New Zealand and Sweden, in the sense that the estimated coefficients have the 'correct' sign, and are statistically significant.[28] The so-called Taylor Principle of a greater than one-for-one response of the nominal interest rate to inflation is satisfied. Taking into account the coefficient on the lagged interest rate, the implied long-run response is 4.9 for New Zealand, and 2.8 for Sweden. But with respect to the flexibility issue, the key result is that the estimated coefficients on output (real GDP growth for Sweden, the gap for New Zealand) are positive and statistically significant. Regardless of what they might say, therefore, these two central banks respond to real economic conditions *over and above* what those conditions might imply for future inflation.[29] The UK yields poor results, however. None of the coefficients are significant, although those on forecast GDP growth and inflation at least have the correct signs. The coefficient on the lagged interest rate is near unity, suggesting that over this very small sample, the Bank of England's repo rate looks more or less like a random walk.[30]

An alternative way to assess ITers' flexibility is to examine their response when confronted with a choice between controlling inflation and stabilising output – cost-push shocks, in other words. Discerning these shocks in the data is no easy task, of course. (This is presumably why Woodford (2003) views even the question of their existence as 'far from established'.) But here again, one can use central bankers' own forecasts to determine, at least qualitatively, the nature of the shocks experienced by their economies.

One way to do this is simply to examine the co-movement between the output and inflation forecast errors. Higher-than-expected realisations of both GDP *and* inflation would suggest a positive aggregate demand shock, for example. If, on the other hand, inflation came in higher than expected but GDP growth was *lower* than expected, an adverse supply shock would be the likely culprit. Similarly, higher-than-expected GDP growth combined with lower-than-expected inflation would be associated with a *favourable* supply shock.

As in the reaction-function analysis above, this approach also relies on the availability of published forecasts. That means focusing on the same set of countries – New Zealand, Sweden, and the UK – plus Canada, whose relatively sketchy forecasts are more amenable to this more qualitative analysis than they would have been to the estimation of a reaction function. Annual, rather than quarterly, forecast errors are analysed, simply because all of the forecasts are for annual changes in real GDP or the CPI, thus creating a great deal of overlap at a quarterly frequency.

Figures 2 through 5 contain scatterplots of the real GDP and inflation forecast errors for these four countries. (Note that the plots' scales differ considerably across countries.) Years characterised by demand shocks – output and inflation forecast

28. Very similar results are reported in Berg *et al* (2002).

29. It would be interesting to know whether the same would be true for New Zealand in the 1990–1996 sub-sample, which is often regarded as characterised by relatively 'strict' inflation targeting.

30. One reason for the poor results could simply be the lack of much significant variation in the inflation or the output gap forecasts since 1997.

Table 4: Estimated Forward-looking Reaction Function for New Zealand, Sweden and the UK

	N	Coefficient on: Intercept	Current output gap	Growth forecast	Inflation forecast	Lagged *i*	$\overline{R}^2$	LM test for 2nd order auto-correlation
New Zealand	23	1.20	0.42**	0.50*	1.22**	0.75***	0.78	9.00
1997:Q4–2003:Q2		(0.61)	(0.19)	(0.26)	(0.53)	(0.10)		0.011
Sweden	38	0.06	–0.18	0.31**	0.65***	0.77***	0.97	3.95
1994:Q1–2003:Q2		(0.41)	(0.13)	(0.12)	(0.10)	(0.05)		0.138
UK	23	–2.34	–0.06	0.53	0.09	1.19***	0.90	4.68
1997:Q4–2003:Q2		(1.39)	(0.32)	(0.39)	(0.37)	(0.13)		0.096

Notes: Estimation is by ordinary least squares. Numbers in parentheses are standard errors. Asterisks denote statistical significance: ***, ** and * at the 0.01, 0.05 and 0.10 levels, respectively. The inflation forecast is the forecast change in the target inflation rate over the subsequent four quarters, minus the inflation target (or the midpoint of the range, in the case of New Zealand). The growth forecast is for real GDP growth over the subsequent four quarters, or in the case of New Zealand, the change in the output gap.

Figure 2: Output and Inflation Forecast Errors – New Zealand

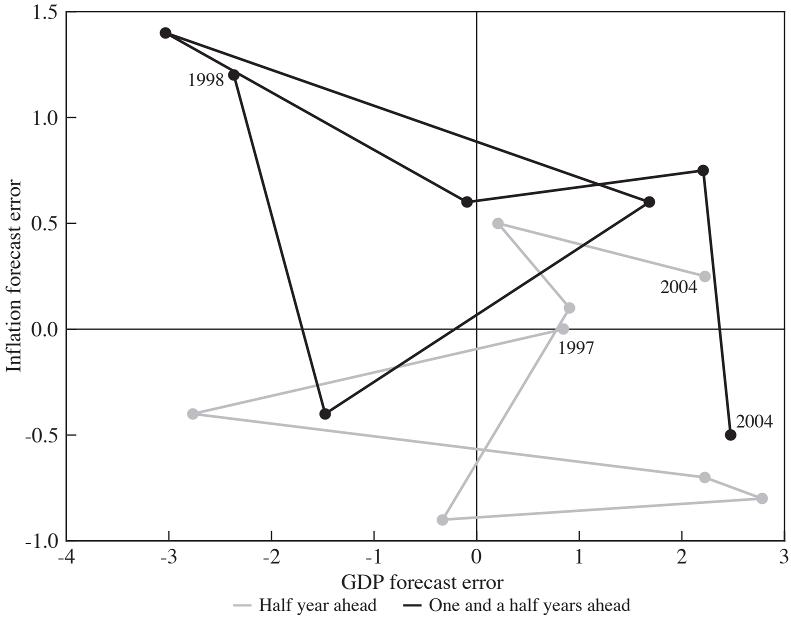


Figure 3: Output and Inflation Forecast Errors – Sweden

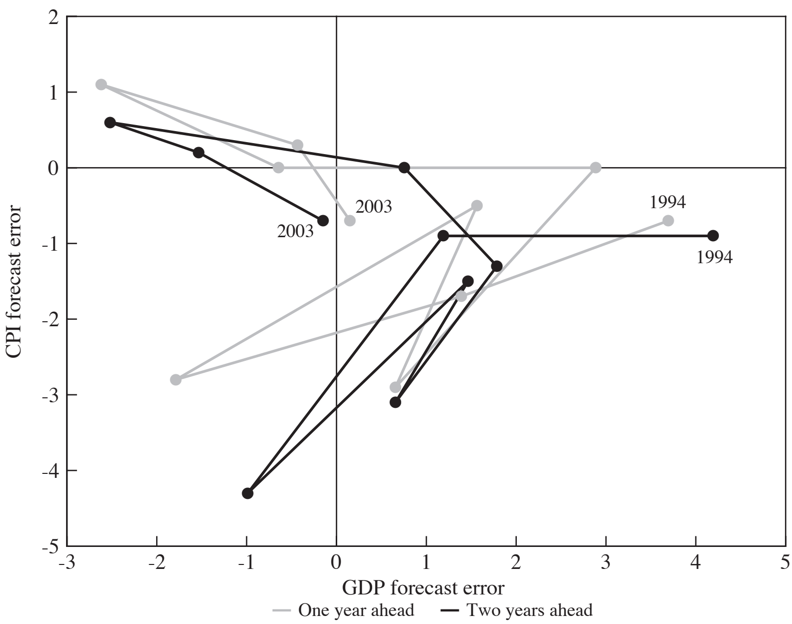


Figure 4: Output and Inflation Forecast Errors – UK

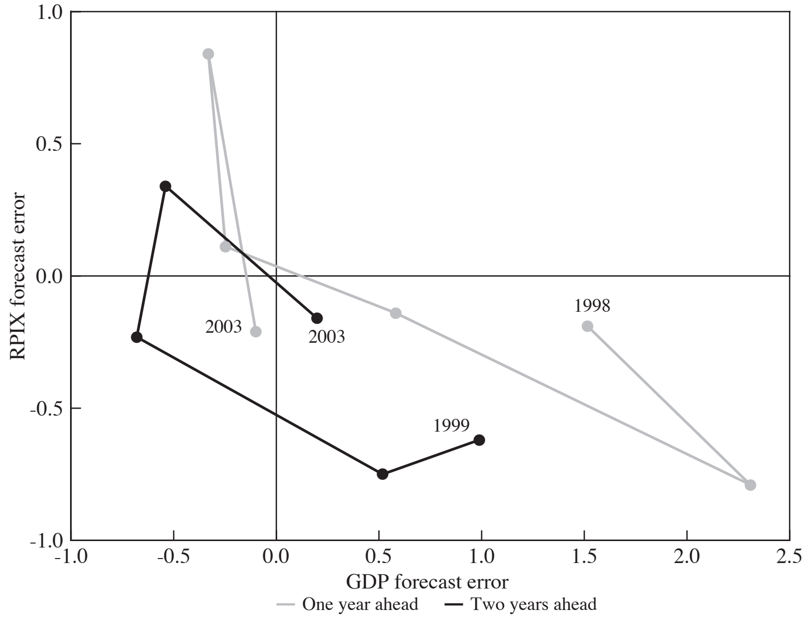


Figure 5: Output and Inflation Forecast Errors – Canada

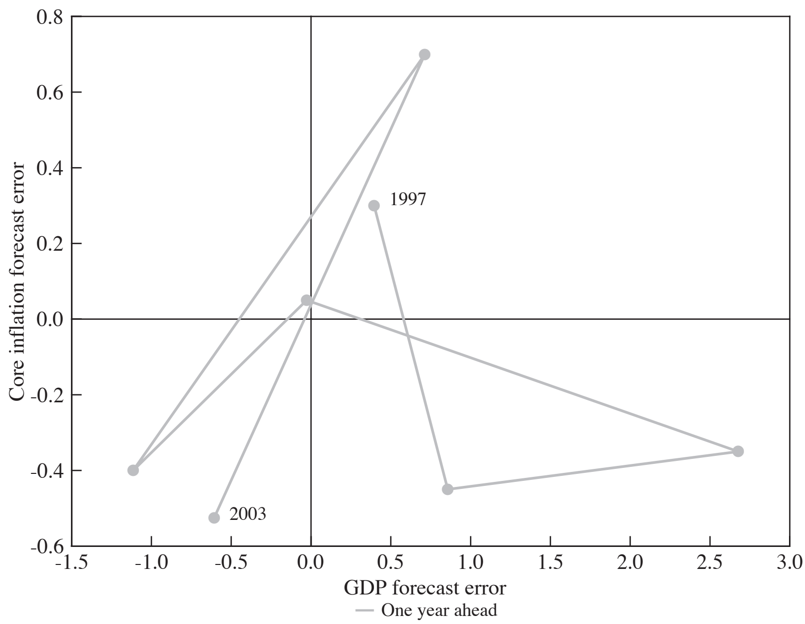
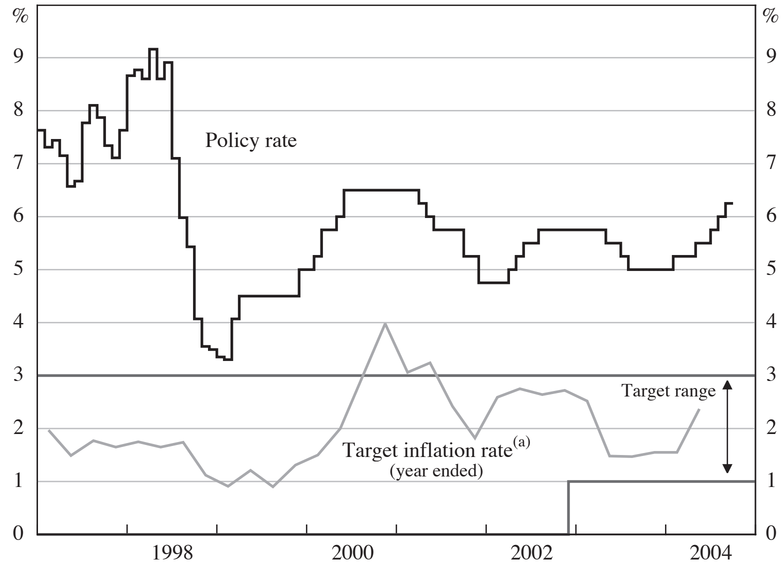


Figure 6: Inflation and the Policy Rate – New Zealand



(a) Until September 1997, an underlying measure of inflation was targeted. From September 1997 to June 1999, core CPI inflation was targeted and after June 1999 headline CPI inflation.

Figure 7: Inflation and the Repo Rate – Sweden

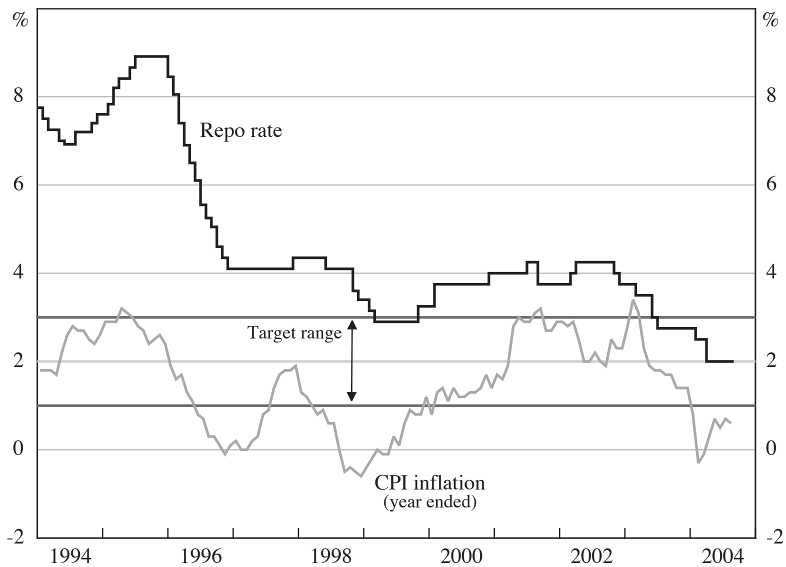


Figure 8: Inflation and the Repo Rate – UK

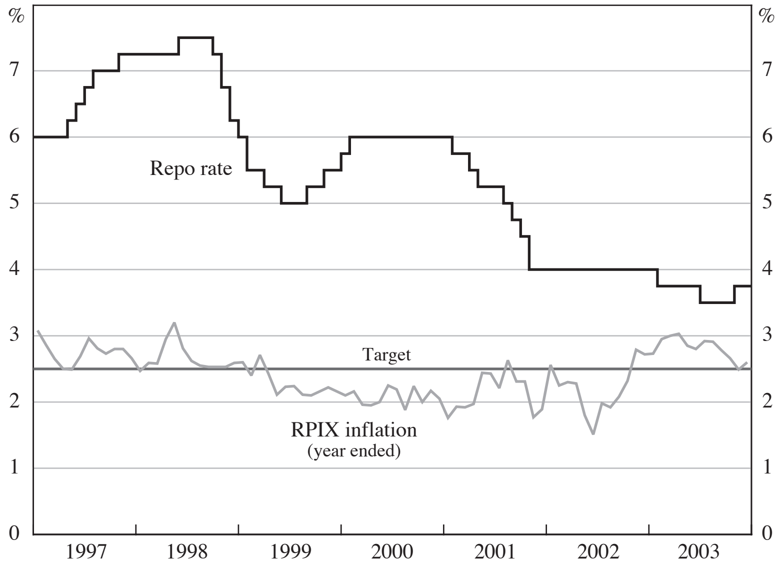
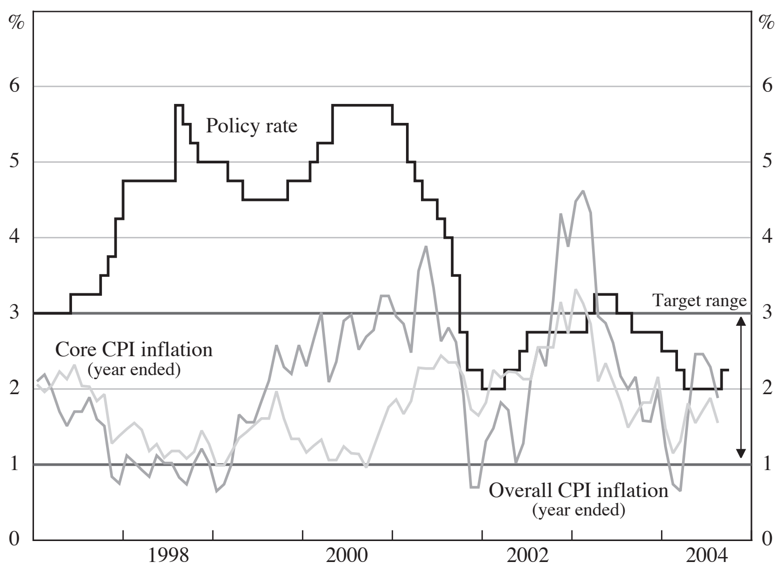


Figure 9: Inflation and the Policy Rate – Canada



errors of the same sign – fall in the northeast and southwest quadrants. Those years in which output and inflation unexpectedly moved in *opposite* directions fall in the northwest and southeast quadrants. These are the years in which policy-makers potentially faced a real trade-off between output and inflation stabilisation.

The first conclusions to be drawn from the figures is that a relatively large number of the observations lie in the northwest and southeast quadrants, suggesting the four countries' experiences are not dominated by demand shocks. There are a few notable exceptions, however: Sweden in 1996, and Canada during the 2001–2003 period. As shown in Figures 7 and 9, monetary policy responded pretty much as expected, with large movements in the policy interest rates.

A second conclusion to be drawn from the figures is that all four countries spent a lot of time in the southeast quadrant, with higher-than-expected GDP and lower-than-expected inflation. These are mostly the 'new economy' years, 1998–2000, when many central bankers around the world were surprised by their economies' capacity for non-inflationary growth. This favourable-supply-shock configuration clearly creates something of a trade-off, as reversing the fall in inflation would have entailed pursuing a more *expansionary* monetary policy – but this is surely an easier dilemma to deal with than that created by adverse supply shocks.[31] In any case, there is no clear tendency for any of the central banks to fight the drop in inflation with expansionary policy. In Canada, for example, the policy interest rate was kept in the vicinity of 4¾ per cent during 1998 and 1999, despite an inflation rate at or near the bottom of the target range. Similarly, there is not much of an overall trend in the UK's repo rate over this period. Rates were actually *raised* in both countries in 2000, despite below-target inflation, presumably reflecting the view that some of the late-90s expansion resulted from demand factors. (And indeed, the inflation forecasts were tending to rise during this period.) For all these reasons, the policy reaction to this 'new economy' growth spurt is not an ideal test case.

ITers' response to adverse supply shocks – observations in the northwest quadrant of the scatterplots – would provide a better gauge of flexibility. The problem is that there are very few of these observations in the relatively short sample for which forecast data are available. In fact, for New Zealand and Sweden the only points in this quadrant correspond to 2001; for the UK, it is 2002.[32] (Canada has *no* observations in this quadrant.) How did policy in these three countries respond to these episodes?

For the UK, the answer is simple: the Bank of England did nothing. Despite higher-than-expected inflation, the Bank kept the repo rate at 4 per cent throughout 2002, and even cut it 25 basis points in February 2003. Its May 2003 *Inflation Report* was very clear that it viewed the adverse inflation shock as due strictly to

31. A questionable feature of the conventional quadratic objective function used in the analysis of optimal monetary policy is its symmetrical treatment of favourable and adverse shocks.

32. The 1998 inflation forecast error for New Zealand is also large and positive, but this is the result of the bank's forecast of a sharp deceleration in inflation in that year, to 0.5 per cent from 2.0 per cent in 1997, which seems to have been based on an implausibly large degree of exchange rate pass-through.

transitory factors: higher petrol prices, a depreciation of the pound, and (puzzlingly) a fall in house prices. Clearly, the Bank looked past these factors in its decision to keep policy unchanged.

New Zealand's situation in 2001 was somewhat more difficult than that of the UK. Annual core CPI inflation breached the upper bound of the target range in late 2000, and remained above 3 per cent through the first half of 2001; and yet, annual GDP growth had slowed to 1.2 per cent in March 2001.[33] Despite the inflation spike, however, the RBNZ cut rates by 175 basis points over the course of 2001. Complicating the decision was the fact that transitory factors could not fully account for the rapid price rises; as discussed in some detail in the May 2001 *Monetary Policy Statement*, stripping out the volatile CPI components still left an inflation rate near the upper end of the target range. This episode, therefore, seems to demonstrate a willingness on the part of the RBNZ to respond to economic weakness, even when it involved a risk of higher inflation.[34]

Sweden's situation in 2001 is in many ways similar to that of New Zealand: significantly above-target inflation, combined with lower-than-expected growth. And like New Zealand, the inflation surge was not readily attributable to one-time or transitory factors. The Riksbank's response was relatively muted: a 25 basis point rate increase in July 2001, followed by a 50 basis point rate cut in September 2001 as inflationary pressures eased. Like the RBNZ and the Bank of England, the Riksbank did not over-react to higher-than-expected, above-target inflation when it was accompanied by slow economic growth.

5. Conclusions

An impressively large and rich literature on inflation targeting, from both practical and theoretical perspectives, has developed in the past 10 years. From the standpoint of stimulating interesting research on monetary policy, at least, IT should be judged a resounding success. But in spite of (or perhaps *because* of) all the research on the topic, a number of misunderstandings have persisted about inflation targeting – at least in non-IT countries, such as the US. This paper's goal has been to illuminate, if not completely resolve, some of those misunderstandings.

The first section of the paper took up the deceptively simple question of how to define IT, and identify ITers – both from a practical perspective, and theoretically, in terms of optimal monetary policy rules. The conclusion is that IT, at least as currently practised, does not translate neatly into one specific kind of monetary policy rule, although it can certainly be described as a rule in a broad sense of the word.

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33. Annual figures for New Zealand are conventionally reported on a March-over-March basis.

34. In a detailed narrative examination of RBNZ policy during three episodes in the 1990s (1992–93, 1995–96 and 1997–98), Svensson (2001) concluded that 'there is no evidence that policy has systematically resulted in unnecessary variability in output, interest rates and the exchange rate', despite the fact that the language about 'unnecessary instability in output, interest rates and the exchange rate' did not appear in the PTA until December 1999.

The second section described the ways in which the practice of inflation targeting has – and has *not* – changed over the past 15 years. The basic features of most countries' IT frameworks have changed very little over the years. There has, however, been something of a trend towards the more comprehensive reporting of macroeconomic forecasts, perhaps reflective of efforts to increase transparency and the emphasis on forward-looking policy-making.

The third section discussed two critiques of inflation targeting: first, that it doesn't matter; and second, that it is too inflexible. On the latter, the paper presented some evidence indicating that ITers have, in practice, been relatively flexible, in the sense of taking real economic conditions into account in deciding how aggressively to react to inflation. Perusing ITers' published policy statements, however, it is very easy to come away with the impression that IT involves a more single-minded pursuit of price stability, suggesting something of a gap between the rhetoric and the reality of IT. This conclusion echoes Faust and Henderson's (2004) assessment that IT 'involves communication policy that is literally inconsistent with best practice, and in any case obfuscates some relatively simple issues'.

Inflation-targeting central banks' reluctance to talk directly about output stabilisation is in some ways understandable. After all, many countries adopted IT in less-than-ideal circumstances, such as after the abandonment of an exchange rate peg, or as part of a broader disinflation strategy. In these cases, it is perhaps not surprising that ITers should have played up the price stability message, at the expense of flexibility, in an effort to establish their anti-inflationary credentials. And in any case, there seems to be a deeply-ingrained central banking taboo against talking about any sort of short-term trade-off between output and inflation, and not only among ITers. (One need only recall the controversy surrounding Alan Blinder's 1994 statement that the 'central bank *does* have a role in reducing unemployment'.[35])

ITers have also been lucky. Aside from the occasional financial panic, the 1990s were a relatively quiescent decade, more or less free of supply-side disturbances such as the persistent oil price shocks and productivity slowdown of the 1970s. Moreover, to the extent that there *have* been supply shifts, they have generally been favourable, combining higher growth and lower inflation. Thus, a benign economic environment has allowed ITers to finesse the more difficult policy issues. Reality has obeyed Blanchard's 'divine coincidence', in other words. The good luck will inevitably run out, however, and adverse cost-push shocks are sure to appear at some point. Dealing sensibly with a more difficult economic environment may require further evolution in the practice of IT, towards even greater transparency in terms of communicating the relevant policy trade-offs. And that might not be such a bad thing.

35. Quoted in Woodward (2000, p 132).

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Discussion

1. John C Williams[1]

This paper studies three important questions. First, what distinguishes inflation targeting (IT) from the practices of other central banks? Second, how has IT practice evolved? And third, what is the empirical evidence on IT practice and performance? With regards to the third question, Ken Kuttner focuses particular attention on the issue of whether inflation-targeting central banks have been practicing a form of 'flexible inflation targeting', meaning that they have sought to stabilise fluctuations in *both* inflation and output.

Ken does an admirable job of describing the distinguishing characteristics of IT relative to other central bank practices and the evolution of inflation targeting, both in terms of changes made by early adopters and the increasing adoption of IT by emerging market economies. Table 2 provides a valuable summary of the characteristics of IT across countries. My one critique of this part of the paper is that it ignores some other important issues regarding the design of monetary policy regimes, including IT, such as institutional structure (independence, size and make-up of the policy-making committee) and accountability procedures.

The remainder of my comments focus on the third issue, that is, the empirical evidence on IT practice and performance. Although I am critical of some aspects of Ken's analysis, I applaud him for pushing the frontier in terms of formal quantitative research into the benefits of inflation targeting. This is an area of active research by Ken and others that I believe will have a high pay-off down the road in our understanding of alternative monetary policy regimes.

Ken notes that the evidence on the effects of IT on macroeconomic performance has been inconclusive. Although early IT adopters have experienced lower and more stable inflation than in their pre-IT period, the role of IT in this improvement remains controversial, since many non-IT countries also experienced a decline in the mean and variability of inflation over the past 15 years. Indeed, Ball and Sheridan (2003) claim that the improvement in performance among ITers reflects a 'regression to the mean' rather than evidence in favour of any benefits of an IT regime. Kuttner and Posen (1999) and Levin, Natalucci and Piger (2004) document that IT countries also have experienced lower inflation persistence than non-IT countries. However, the interpretation of this finding as evidence of a direct benefit of adopting IT is problematic. As stressed by Orphanides and Williams (2004), the persistence of inflation is a function of both the monetary policy regime and policy-maker preferences over inflation and output stabilisation. Thus, the lower inflation persistence observed in IT countries may reflect benefits particular to adopting IT, but may also result from IT central banks tending to place greater weight on inflation stabilisation relative to output stabilisation.

1. The opinions expressed are those of the author and do not necessarily reflect the views of the management of the Federal Reserve Bank of San Francisco.

It has long been argued that a key potential benefit of a successful IT strategy is the anchoring of inflation expectations on the part of the public and recent research has sought to identify the effects of IT by directly examining the behaviour of expectations. Orphanides and Williams (2003a, 2003b) illustrate the potential role played by an explicit inflation target in anchoring expectations using a model in which the public must otherwise infer the central bank's objectives from observations of inflation. In this model, successful communication of an explicit numerical inflation target reduces the sensitivity of inflation expectations to movements in actual inflation and thereby helps stabilise *both* inflation and output. In this regard, Kuttner and Posen (1999), Gurkaynak, Sack and Swanson (2003), and Levin *et al* (2004) find that longer-run inflation expectations are in fact less sensitive to economic developments in IT countries than in non-IT countries, thus providing compelling empirical support for the role of IT in anchoring inflation expectations.

In the final part of the paper, Ken examines the evidence for flexibility in stabilising inflation and output by IT countries. He uses two approaches. First, he estimates forecast-based monetary policy feedback rules for three IT countries and finds that the statistically significant coefficients on the output gap and/or forecasts of output growth are positive (Table 4). He interprets this finding as evidence in favour of flexible IT. Second, he examines how IT central banks have responded to apparent adverse supply shocks and again finds some informal evidence of flexibility. Unfortunately, he has few observations of adverse supply shocks over the period for which he has data, so this evidence should be viewed with considerable caution. For this reason, I will concentrate on the use of estimated policy rules to infer the degree of flexibility.

The basic premise of Ken's analysis is that a positive response to the output gap or expected output gap in an estimated policy rule is a sign of a policy-maker's concern for output stabilisation. One basis for this test is that in many empirical models, the optimised coefficient on the output gap and/or expected output growth in an instrument rule will be near zero if output stabilisation is not part of the policy objective, and positive if it is (see, for example, Levin, Wieland and Williams 2003). However, it is important to note that this is not a general result for all models; in particular, in backward-looking models the optimal coefficient on the output gap can be positive even if the policy-maker is unconcerned about output stabilisation.

In a recent paper in which he conducts the same policy rule analysis, Kuttner (2004) finds that his results are sensitive to the specification of the estimated policy rule. He finds that estimates of outcome-based specifications – rules in which policy is set according to the current output gap and observed past inflation, as opposed to the output gap and forecasts of output and inflation – provide no evidence of flexibility among the same three IT countries. This sensitivity to the specification of the policy rule is somewhat surprising to me based on an experiment I ran using a model where Kuttner's test is approximately valid. I solved the model assuming that the policy-maker is following a forecast-based rule using Kuttner's specification and then estimated a misspecified outcome-based policy rule on data generated from the model. I found that if the true output gap and growth coefficients are zero, then the estimated output gap coefficient based on the outcome-based specification is nearly zero, and if the true coefficients are positive, the estimated output gap coefficient is also positive.

Moreover, the test for flexibility is likely to be invalid if IT central banks are implementing optimal targeting policies as opposed to optimised instrument rules of the type estimated in the present paper and Ken's previous paper. If the central bank is acting optimally, then the policy rule that Ken estimates in this paper is likely to be misspecified and the coefficient estimates are biased. To examine the extent of this bias, I conducted experiments using standard empirical macro models in which the central bank is assumed to follow the optimal policy under commitment. Using the resulting solution to the model economy, I then computed the implied regression coefficients for Ken's specification of the policy rule. In some cases, the output gap and growth coefficients were positive even if the policy-maker places zero weight on output stabilisation; in others, the estimated coefficients are *negative* even though the policy-maker is acting optimally and places a substantial weight on output stabilisation!

Given the limitations of the test for flexibility used in this paper, a potentially better test of flexibility is to estimate the penalty on output gap variability in the objective function directly, as in Dennis (2003). For this approach, one needs to specify a macro model, an objective function, and estimate the model assuming that the monetary policy is set to maximise the objective (itself, a testable hypothesis). For early IT adopters, this approach may now be feasible given the availability of nearly 15 years of data.

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2. General Discussion

There was a general consensus among participants that the industrialised world had faced a relatively benign inflation environment over the past decade or so, which had contributed to the success of inflation targeting. A number of participants attributed this to the fact that most shocks of the past decade or so had been demand shocks, for which inflation and output stabilisation concerns were coincident. And while some participants noted that there had been supply shocks, these had generally been conducive to maintaining low inflation. In this respect, one participant highlighted the continued development of China and its production of low-cost manufactured products, the productivity pick-up in countries such as the US and Australia, and increases in global trade in response to a lowering of trade barriers.

This led to a discussion of the ability of inflation-targeting regimes to withstand any future adverse supply shocks. The majority of participants were confident that the inflation-targeting approach could successfully negotiate an adverse supply-side shock, with one participant arguing that it could stand up to these and other challenges as well as, if not better than, other monetary policy regimes. A key reason for this is the benefit of strongly anchored inflation expectations provided by inflation-targeting regimes. In the face of an adverse supply-side shock which pushed the inflation rate substantially above its target range, a central bank could credibly communicate to the public that inflation would return to its target value in time. The challenge of adverse supply shocks served to reinforce the advantages of a flexible approach to inflation targeting, and argued against the presentation of fixed horizons in monetary policy communication. While one participant acknowledged that a fixed horizon of two years, for example, is beneficial from the point of view of simplicity (particularly with regards to communication), it assumes that shocks are relatively small and so will not push inflation too far from the target. Beyond the issue of presentational simplicity, this participant said that a fixed horizon was not consistent with the theory of optimal monetary policy. Numerous participants were sympathetic to this point, arguing that to deal with a large adverse supply shock in the future, central banks may choose to extend the horizon over which they aim to return inflation to its target. In that regard, inflation targeting would continue to gradually evolve.

On the general theme of flexibility, there was a wide-ranging discussion of the experiences of various inflation targeters. One participant argued that inflation targeting in Sweden is not quite as flexible as portrayed by Ken Kuttner's paper, and that policy decisions could consistently be linked back to forecasts of inflation at two-year horizons. In contrast to this, another participant supported the flexibility of the Swedish approach embodied in the explicitly variable horizon of one to three years, depending on the nature and severity of shocks. In a number of cases, inflation targeters had initially talked tougher than they intended to act; hardly surprising given that inflation performance had been relatively poor prior to the adoption of inflation targeting. For Australia, it was thought that the flexible approach of the RBA – which had acknowledged its concerns about the variability of output – had initially given rise to some scepticism, given that other inflation targeters had adopted a less flexible approach with greater, if not sole, emphasis on inflation goals. Credibility was achieved in Australia nonetheless through a willingness to act tough when necessary. One participant supported Kuttner's view of the UK, agreeing that there is unrecognised flexibility in their system. There followed a brief discussion of the monetary policy framework for the US, including the extent of their commitment to keep inflation low, the role and imminent retirement of Federal Reserve Chairman Alan Greenspan, and the need to generate credibility through institutional frameworks rather than individuals. While one participant thought that the US framework should move closer to inflation targeting, another emphasised concerns still held in the US regarding the need to pick a particular number for the target and choose an appropriate horizon.

The challenges that adverse shocks would pose for central banks led one participant to discuss the different ways of assessing various policy regimes. One method was to consider the performance of a given regime over the particular historical period for which it was in place, such as the performance of inflation targeting over the past decade or so. An alternative approach, albeit significantly more complicated, was to consider how a policy regime would have performed in a different historical period. In other words, how would inflation targeting have performed if it had been in operation in the 1960s, 1970s and 1980s? Such analysis may provide insights as to how inflation targeters might best respond to possible future shocks.

Can Central Bank Transparency Go Too Far?

Frederic S Mishkin[1]

1. What Are the Issues?

Since the beginning of the 1990s we have seen a revolution in the way central banks communicate with the markets and the public. In the old days, central banks were generally very secretive institutions. Not only did they not clarify what their objectives and strategies were, but they even kept the markets guessing about what the actual settings of policy instruments were. Central banks were perfectly happy to cultivate a mystique as wise but mysterious institutions, prompting popular books about central banks to have titles like *The Secrets of the Temple* (Greider 1987).

The rationale for the secretive behaviour of central banks was that, as one former Fed official put it bluntly, 'secrecy is designed to shield the Fed from political oversight'.[2] Although central bank secrecy reflects the natural desire of a bureaucracy to maximise power and prestige by avoiding accountability, the theory of time-inconsistency of optimal policies articulated by Kydland and Prescott (1977) and Calvo (1978) suggests that there might be a rationale for central bank secrecy because, as this same Fed official stated, 'most politicians have a shorter time horizon than is optimal for monetary policy'. In order to avoid the pressures from politicians on central banks to pursue overly expansionary monetary policy to exploit the short-run trade-off between employment and inflation, central banks might want to obscure their actions and avoid the time-inconsistency problem by focusing on the long run and 'just doing it' as McCallum (1995) has proposed.[3] Another way to deal with the time-inconsistency problem is to appoint conservative central bankers, as suggested by Rogoff (1985), who put more weight on controlling inflation relative to output than does the general public and thus will resist inflationary policies. However, for this to work, conservative central bankers need to be independent of the political process, which is facilitated by central bank secrecy.

There are several problems with this secrecy approach to dealing with the time-inconsistency problem. First, having secretive central banks is inherently

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2. As quoted in 'Monetary zeal: how Federal Reserve under Volcker finally slowed down inflation', *Wall Street Journal*, 7 December, 1984, p 23.

3. The model of Barro and Gordon (1983) has the time-inconsistency problem residing inside the central bank. But as I have argued elsewhere in Mishkin (2000), the source of the time-inconsistency problem is in the political process because central bankers are very aware of the time-inconsistency problem and are indeed extremely averse to falling into a time-inconsistency trap.

undemocratic. Although it makes sense to insulate central banks from short-run pressures to pursue overly expansionary monetary policy, basic democratic principles require that the central bank be accountable for its actions: this requires that the public understands what the central bank is doing. In addition, democratic principles indicate that the preferences of policy-makers need to be aligned with those of the society at large. Furthermore, in the long run a central bank cannot operate without the support of the public. A secretive central bank may heighten suspicions that it is not acting in the public interest and so can eventually lead to curbs on its independence.

With the advent of inflation targeting in the early 1990s, central banks have been taking a different route to solving the time-inconsistency problem. They now recognise that transparency and improved communication with the public and the markets is the key to having a successful monetary policy. Inflation targeting has promoted a huge increase in transparency about inflation objectives and stresses regular communication with the public.[4] Inflation-targeting central banks now have frequent, periodic communications with the government, and central bank officials take every opportunity to make public speeches on their monetary policy strategy. These channels are also commonly now used by central banks that have not adopted inflation targeting, such as the Federal Reserve, but inflation-targeting central banks have taken public outreach a step further: not only have they engaged in extended public information campaigns, even engaging in the distribution of glossy brochures as in New Zealand, but they have engaged in the publication of inflation report-type documents. Inflation reports are far more user-friendly than previous central bank documents and explain the goals and limitations of monetary policy, including the rationale for inflation targets, the numerical values of the inflation targets and how they were determined, how the inflation targets are to be achieved, given current economic conditions, and reasons for any deviations from targets.

This emphasis on transparency and communication has produced several benefits for central banks. By explicitly announcing their objectives on the inflation front, central banks have been able to increase their credibility and anchor inflation expectations (Levin, Natalucci and Piger 2004). Not only has this helped them achieve low and stable inflation, but output volatility has, if anything, fallen. The strengthening of the nominal anchor apparently helps move the economy toward the efficient frontier of the trade-off between inflation and output gap variability, generating better performance on both the inflation and output fronts.[5]

Transparency and communication, especially when it has demonstrated the success in achieving a pre-announced and well-defined inflation target, has also helped build public support for a central bank's independence and for its policies. As documented in Mishkin and Posen (1997) and Bernanke *et al* (1999), the increased transparency of its inflation-targeting regime led to increased support for the Bank of Canada's policies, while it led to the granting of operational independence to the Bank of England in May 1997. Indeed, when announcing the decision, Gordon Brown, the Chancellor of the Exchequer indicated that a key factor behind granting

4. For example, see Bernanke *et al* (1999) and Mishkin (1999).

5. The so-called Taylor curve first outlined in Taylor (1979).

the Bank of England greater independence was that the increased transparency of the inflation-targeting regime enhanced political oversight. An important benefit of the transparency of an inflation-targeting regime, therefore, is that it makes it more palatable to have an independent central bank which focuses on long-run objectives, but which is consistent with a democratic society because it is accountable.

Although inflation targeting has increased transparency with substantial benefits, transparency is far from complete. As seen in Table 1, although almost all inflation-targeting central banks publish their inflation forecasts in their *Inflation Reports* (the Bank of Israel and Central Bank of the Republic of Turkey being the only exceptions),[6] a larger number do not publish output forecasts (the central banks of Australia, the Philippines, Poland, Romania, South Africa, South Korea and Turkey).[7] Furthermore, except for the Reserve Bank of New Zealand and most recently the central bank of Colombia, inflation-targeting central banks do not formally announce their forecasts of the future path for the interest-rate policy instrument.[8] No central bank describes their objective function for monetary policy, while almost all central banks are reluctant to discuss publicly their concerns about output fluctuations. This raises the question of whether central banks should increase transparency much further. Some monetary economists, with the most prominent example being Lars Svensson (2002), suggest that the answer is yes. Indeed, he advocates not only publication of output and inflation forecasts, but also announcement of projections of the future policy path and the central bank objective function. But can transparency go too far?

To answer this question, we need to keep the following basic question in mind: Does increased transparency help the central bank to do its job – that is, enable it to conduct monetary policy optimally with an appropriate focus on long-run objectives? The answer might well be no, particularly if the increase in transparency violates the KISS (Keep It Simple Stupid) principle. This paper uses this basic question as the lens through which it evaluates how far transparency should go. In the next three sections I look at the following three questions: (i) Should the central bank publish its forecasts, including projections of the future path of policy rates? (ii) Should the

6. The Bank of Israel publishes an inflation forecast based on a survey of private sector expectations, but not its own inflation forecast. The Central Bank of the Republic of Turkey (CBRT) does not officially call its framework inflation targeting but instead refers to it as 'implicit inflation targeting'. However, the end-of-year inflation target is agreed on by the government and the IMF. Like Israel, the CBRT does not publish its own forecasts, but does publish inflation forecasts based on a private sector survey. Note that although the European Central Bank (ECB) does not call itself an inflation targeter, it does have an explicit inflation objective and so has some elements of an inflation-targeting regime. The ECB does publish its inflation and output forecasts.

7. The central banks of Australia and South Korea do announce output forecasts in other settings, but the frequency of these forecasts is not as high as in *Inflation Reports*.

8. The central banks of Brazil, the Czech Republic, Hungary, Iceland, Norway, Poland and the United Kingdom do publish projections of the future policy-rate path, but it is based on market expectations and not their assessment of the expected policy-rate path. The central bank of Norway does have an extensive discussion of future monetary policy in their *Inflation Report*, but it is still quite qualitative. Other inflation-targeting central banks, such as the central banks of the Czech Republic, Iceland and Romania, have provided less formal discussions of their assessment of the future policy-rate path.

Table 1: Do Inflation-targeting Central Banks Publish their Forecasts?

Central bank	Policy rate projections?	Inflation forecasts?	Output growth forecasts?	Output gap forecasts?
Australia	No	Yes	No[(a)]	No
Brazil	No[†]	Yes	Yes	No
Canada	No	Yes	Yes	No[‡]
Chile	No	Yes	Yes	No
Colombia	Yes	Yes	Yes	Yes
Czech Republic	No[†]	Yes	Yes	Yes
Hungary	No[†]	Yes	Yes	Yes
Iceland	No[†]	Yes	Yes	Yes
Israel	No	No	No	No
Mexico	No	Yes	Yes	No
New Zealand	Yes	Yes	Yes	Yes
Norway	No[†]	Yes	Yes	Yes
Peru	No	Yes	Yes	No
Philippines	No	Yes	No	No
Poland	No[†]	Yes[(b)]	No	No
Romania	No	Yes	No	No
Slovakia[(c)]	No	Yes	Yes	No
South Africa	No	Yes	No	No
South Korea	No	Yes	Yes[(d)]	No
Sweden	No	Yes	Yes	No[‡]
Switzerland	No	Yes	Yes	No
Thailand	No	Yes	Yes	No
Turkey[(e)]	No	No	No	No
UK	No[†]	Yes	Yes	No

Notes: [†] Indicates central banks which publish the market expectations of future policy rates even though there is no official policy-rate forecast. The central banks of Hungary, Iceland and Poland publish macro forecasts based on a constant policy-rate path, the Czech Republic and Norway based on market expectations of the policy-rate path, and Brazil and the UK based on both a constant policy-rate path and market expectations of the policy-rate path.
[‡] The central banks of Canada and Sweden publish estimates of the current output gap.

(a) The Reserve Bank of Australia does not publish output growth forecasts in the *Statement on Monetary Policy*. However, GDP forecasts are given twice a year in the Governor's Opening Statement to the House of Representatives Standing Committee on Economics, Finance and Public Administration.

(b) The National Bank of Poland publishes extensive survey-based inflation expectations by market participants, but refrains from making an exact inflation forecast of its own. Instead, a commentary on the likelihood of fulfilling the inflation target is included in the *Inflation Report*.

(c) The National Bank of Slovakia does not refer to itself as an inflation targeter. However, the ECB defines it as an 'implicit inflation targeter'. (Source: 'The acceding countries' strategies towards ERM II and the adoption of the euro: an analytical review', ECB Occasional Paper No 10, February 2004)

(d) The Bank of Korea does not publish output growth forecasts in the *Inflation Report*. However, GDP forecasts for the year ahead are given twice a year in their publication *Economic Prospects*.

(e) The Central Bank of the Republic of Turkey does not call its framework 'inflation targeting' but rather 'implicit inflation targeting'. However, it follows an end-of-year inflation target, which is negotiated by the government and the IMF.

Sources: central bank websites as of August 2004 central bank announce its objective function? (iii) How should the central bank talk about output fluctuations? The final section contains some concluding remarks.

2. Should the Central Bank Publish its Forecasts Including Projections of the Future Path of Policy Rates?

Inflation-targeting theory, as illustrated in the simple model of Svensson (1997), shows that inflation forecasts are central to the conduct of monetary policy. His model comprises an aggregate supply curve in which the change in inflation is affected by the output gap with a one-period (one year) lag:

$$\pi_t = \pi_{t-1} + \gamma y_{t-1} + \varepsilon_t \tag{1}$$

and an aggregate demand curve in which the output gap is a function of the past output gap to reflect persistence, and of the real interest rate, again with a one-period (one year) lag:

$$y_t = \rho y_{t-1} - \varphi\left(i_{t-1} - \pi_{t-1}\right) + \eta_t \tag{2}$$

where $\pi_t = p_t - p_{t-1}$ is the inflation rate at time t (with p_t the log of the price level), y_t is the output gap (the log of the ratio of actual to potential output), i_t is the nominal interest rate, and ε_t and η_t are independently and identically distributed aggregate supply and demand shocks, respectively.

Optimal monetary policy involves setting the interest rate each period to minimise the intertemporal loss function:

$$E_t \sum_{\tau=t}^{\infty} \delta^{\tau-t} L_\tau \tag{3}$$

where $\delta < 1$ is the authorities' discount rate and where the period-by-period loss function is:

$$L_\tau = \left(\pi_\tau - \pi^*\right)^2 / 2 + \lambda y_\tau^{\,2} / 2 \tag{4}$$

given the inflation target π^*. In the case of $\lambda = 0$, where the central bank only cares about inflation fluctuations, Svensson (1997) has shown that the optimal setting of the interest rate is one in which the following target rule is followed:

$$E_t \pi_{t+2} = \pi^* \tag{5}$$

In other words, the monetary policy instrument is set so as to attain the inflation target over the horizon at which policy changes take effect, which in this model is two periods (years) ahead. If $\lambda > 0$, so that monetary policy-makers are also concerned about output fluctuations, then the interest rate instrument is set according to a target rule in which the approach to the inflation target is more gradual, that is:[9]

9. Models with more forward-looking behaviour such as the dynamic new Keynesian model in Clarida, Galí and Gertler (1999) would yield similar conclusions.

$$E_t\pi_{t+2} - \pi^* = c\left(E_t\pi_{t+1} - \pi^*\right) \qquad (6)$$

Svensson (1997) calls this type of policy reaction 'flexible inflation targeting', and the evidence discussed in Bernanke *et al* (1999) suggests that it is a more realistic approximation of what inflation-targeting countries do in practice.

Equations (5) and (6) illustrate that central bank decisions about monetary policy necessarily focus on the inflation forecast, and so inflation targeting is more precisely described as being 'inflation forecast targeting'. Clearly, if inflation forecasts are the key to the conduct of monetary policy in an inflation-targeting regime, then full transparency requires that the inflation forecasts of the central bank be revealed to the public. Because inflation forecasts are generated with forecasts of other variables, especially output, full transparency also requires that forecasts of these variables are published.[10] There are a number of advantages from publication of forecasts. First, publication of forecasts can help the public and the markets understand central bank actions, thus making it easier for them to assess whether the central bank is serious about achieving its inflation goal. Second, publication of forecasts enables the public to evaluate the quality of central bank forecasts which will enhance central bank credibility if these forecasts are viewed as constructed using best practice. Third, publication of forecasts increases the incentives for the central bank to produce good forecasts because a poor forecasting record would be embarrassing.

The three advantages above together point to the more general advantage from publication of forecasts, that it increases central bank accountability. Because of the long lags in the effects of monetary policy, which in the simple Svensson model is two periods (years), inflation outcomes are revealed only after a substantial lag. Thus without additional information, the inflation target by itself does not provide an immediate signal to both the public and the markets as to whether the current stance of monetary policy is appropriate. Because, as Equations (5) and (6) illustrate, optimal monetary policy involves 'inflation forecast targeting', publication of forecasts provides immediate information that helps the public to assess whether the central bank is taking the appropriate steps to meet its objectives. If the public and the markets think that the central bank's forecasts are not honest, or that the current policy stance is inconsistent with the inflation forecast, or that the inflation forecast differs too markedly from the stated target, they can immediately voice their criticisms of the central bank. Increased accountability of the central bank is then the result.

However, despite the obvious advantages of publishing forecasts, there are some thorny problems. The first is the tricky issue: What path of the policy interest rate should the forecast be conditioned on? There are three choices: (i) a constant interest rate path; (ii) market forecasts of future policy rates; or (iii) a central bank projection of the policy interest rate path. A constant interest path would almost surely never be optimal because future projected changes in interest rates will be necessary to keep inflation on the appropriate target path.[11] The second choice is

10. However, for reasons outlined in the next section, there are arguments against the publication of forecasts of output gaps.

11. See Svensson (2003a, 2003b) and Woodford (2003).

also problematic because, as Bernanke and Woodford (1997) have shown, there is a circularity problem if the central bank sets its policy rate on the basis of market forecasts. The markets' forecasts are just guesses of what the central bank will be doing, so if the central bank just does what the market expects, there is nothing that pins down the system and inflation outcomes will be indeterminate. Theory therefore tells us that the only appropriate and logically consistent choice is the third one, the central bank projection of the policy path. Clearly, an inflation forecast is meaningless without specifying what policy it is conditioned on, and this is why Svensson (2002) argues that in publishing its forecasts the central bank also needs to announce its projection of the policy-rate path used in producing its forecast, which will almost surely be time-varying.

Although Svensson's argument for announcing the projection of the policy path is theoretically sound, announcing the policy path is highly problematic. One objection to a central bank announcing its policy projection, raised by Charles Goodhart (2001), a former member of the Monetary Policy Committee of the Bank of England, is that it would complicate the decision-making process of the committee that makes monetary policy decisions. The current procedure of most central banks is to make decisions only about the current setting of the policy rate. Goodhart argues that 'a great advantage of restricting the choice of what to do now, this month, is that it makes the decision relatively simple, even stark'.[12] If a policy projection with time-varying rates is announced, this clearly requires that the monetary policy committee come to an agreement on this policy path. Svensson (2002) argues that this could be done by a 'simple' voting procedure, but this procedure is far from simple and I agree with Goodhart that this is unlikely to work. Forcing committee members to make a decision about the future path of rates and not just the rate today may complicate matters so much that the decision-making process could be impaired. Although committee members might have some idea of a future direction for policy rates, they are likely to have trouble thinking about a precise policy-rate path rather than just the setting of the rate today. Furthermore, getting committee members to agree on a future path of the policy rate might be very difficult and could end up being very contentious.[13]

I had a glimpse of the problems with projections of the policy-rate path when I sat in on Federal Open Market Committee (FOMC) meetings while I was the director of research at the Federal Reserve Bank of New York from 1994 to 1997. Upon my arrival at the Fed, the Green Book forecasts (prepared by the Board staff) were conditioned on a non-constant interest rate path. Several of the FOMC members objected to this procedure and this was probably for two reasons. First, having a staff projection of future interest rates might lead to some prejudgement of the committee's decision. Second, it is far easier to make a decision just on the rate today and not have to discuss the path for future policy rates at the same time. The

12. Goodhart (2001, p 173).

13. Kohn (2000) comes to a similar conclusion. He reports that members of the Bank of England's Monetary Policy Committee stressed the difficulty of getting agreement on a future path of interest rates.

objections eventually won the day: the procedure for generating the Green Book forecasts was changed so that they are now conditioned on a constant policy-rate path, at least in the short term. Thus, I side with Goodhart. Announcing a projection for the policy-rate path which would require agreement on this path by the committee deciding on monetary policy would be counterproductive.

The second problem with announcing a projection of the policy-rate path is that it might complicate communication with the public. Although economists understand that any policy path projected by the central bank is inherently conditional because changes in the state of the economy will require a change in the policy path, the public is far less likely to understand this. When new information comes in and the central bank changes the policy rate from its projected path, the public may see this as a reneging on its announced policy or an indication that the central bank's previous policy settings were a mistake. Thus even when the central bank is conducting its policy in an optimal manner, deviations from its projected policy path may be viewed as a central bank failure and could hurt the central bank's credibility. In addition, the deviations of the policy rate from its projected path might be seen as flip flops on the part of the central bank. As we often see in political campaigns, when a candidate changes his position, even if it reflects changes in circumstances and thus reflects sound judgement, the candidate is vulnerable to attacks by his or her opponents that he or she does not have leadership qualities. Wouldn't central banks be subject to the same criticism when changing circumstances would force them to change the policy rate from its previously projected path? The result might be a weakening of support for the central bank and its independence.

The recent Federal Reserve experience with the language of their post-FOMC statement illustrates the problem of the public not understanding that projected policy paths are conditional on the evolution of the data. In order to underscore its commitment to preventing a deflationary spiral from getting underway in the United States, the FOMC announced in August 2003 that it would maintain policy accommodation for a 'considerable period'. As Eggertsson and Woodford (2003) have shown, a commitment to keeping the policy rate unusually low beyond the time when the economy begins to recover is an important policy tool to deal with deflationary shocks. However, as is clear from Eggertsson and Woodford (2003), the length of the 'considerable period' is dependent on the actual evolution of the economy. The public may not fully understand this and so if the economy comes back far stronger than is anticipated, monetary policy may need to be tightened even when there has been a commitment to easy monetary policy for a 'considerable period'. We would then have the problems described above where the central bank's credibility might be tarnished. Thus the commitment to a policy path, even when it is needed, is not without its problems. As is indicated in Ito and Mishkin (2004), I still believe that deflationary environments, like the one we see in Japan, are sufficiently damaging that a commitment to the zero interest rate for an extended period is needed to reflate the economy. However, the cost of a commitment to a projected policy-rate path is trickier when the deflation risks are not as serious. This problem has been recognised by officials at the Fed, and explains why they have been seeking an exit strategy from their commitment to a policy-rate path by first changing the language, in January 2004, to say that the FOMC can be 'patient' in removing policy accommodation and then, in May 2004, to say that policy accommodation can be removed at a pace that is likely to be 'measured'.

The bottom line is that except in exceptional deflationary circumstances like the one Japan has experienced, announcement of a policy-rate path does not have much to recommend it. It is likely to complicate policy discussion within central banks which might impair the quality of monetary policy decisions, and it also may lead to a loss of credibility of the central bank and a weakening of the support for central bank policies. Thus announcement of its projection of the policy-rate path may make it harder for the central bank to conduct monetary policy optimally with an appropriate focus on long-run objectives.

The problem with announcing the projection of the future policy path creates a problem for publishing forecasts. Clearly, in order for a forecast to be evaluated, the central bank must reveal the policy path on which it is conditioned. But if it does not make sense for central banks to announce their projection of a time-varying, policy-rate path, then the forecasts that they publish cannot be based on such a projection. The alternative is for the central bank to publish forecasts that are either conditioned on the policy rate remaining unchanged or on market expectations of future policy rates. Indeed this is what almost all central banks that publish forecasts do. Only the central banks of New Zealand and Colombia publish their forecasts based on a projected policy-rate path which they intend to set in the future.[14]

If publishing forecasts based on a projected policy-rate path may do more harm than good, and yet this is the only logically consistent approach for producing these forecasts, then is publishing forecasts based on a constant policy rate or on market expectations of the policy rate truly transparent? After all, the central bank knows that neither of these interest rate paths is what it plans to do and the public and markets know this as well.[15] Publishing these logically inconsistent forecasts might even be viewed as non-transparent and so could potentially damage the central bank's credibility.[16] The case for publishing forecasts is thus no longer clear cut: there are costs and benefits. However, for central banks that have lower credibility, particularly those in emerging market economies, there may be a greater need for them to publish forecasts in order to provide more information to the public, even if the forecasts are not based on the central bank's projection of future policy rates.

14. The central banks of Brazil, the Czech Republic, Norway and the United Kingdom publish forecasts based on projections of the future policy-rate path that are *based on market expectations*. Norway does have an extensive section in its *Inflation Report* on the setting of future policy rates which is qualitative.

15. This criticism of the Bank of England's published forecasts has been raised by Martijn and Samiei (1999).

16. Although a forecast based on a constant-interest-rate path is logically inconsistent, it is internally consistent: that is, a forecast can be conditioned on any assumption about an interest-rate path. Indeed, Edey and Stone (this volume) argue that if a monetary policy committee makes decisions based on unchanged future policy then the publication of these forecasts is consistent with transparency.

3. Should the Central Bank Reveal its Objective Function?

In order for the public and the markets to fully understand what a central bank is doing they need to understand the central bank's objectives. As argued in the introduction, the announcement of an explicit, numerical objective for inflation is an important step in the right direction and has clear-cut benefits. However, central banks are not 'inflation nutters' (King 1997): they do care about output fluctuations as well as inflation fluctuations, and so λ is greater than 0 in the central bank objective function in Equation (4). Thus announcing an inflation target is not enough: full transparency requires that the central bank reveal its objective function (Svensson 2002).

Again, we need to ask the question whether revealing its objective function will help the central bank to do its job. I will argue that the answer is no because pushing transparency further in this direction violates the KISS (Keep It Simple Stupid) principle and is likely to hinder the communication process.

The first problem with announcing an objective function is that it might be quite hard for members of a monetary policy committee to specify an objective function. Having watched how members of a monetary policy committee operate, I can attest that members of monetary policy boards don't think in terms of objective functions and would have a very hard time in describing what theirs is. Indeed, I would suggest that most monetary economists, even brilliant ones, would have trouble specifying what their λ would be. A counter to this argument is that the λ could be backed out by revealed preference. Monetary policy committee members could be confronted with hypothetical choices about acceptable paths of inflation and output gaps and then their choices would reveal their λs. Although committee members would be able to do this when confronted with a real world situation, and this is effectively what was done in Brazil in early 2003, I think they would find this difficult to do when the choices are hypothetical – I know I would.

A second problem, raised by Goodhart (2001), is that it would be difficult for a committee to agree on its objective function. As mentioned above, committee members might have trouble defining their own objective function, but because the composition of the committee changes frequently and existing members may change their views on objectives depending on circumstances, they would also have to revisit the decision on the committee's objective function frequently. Deciding on the committee's objective function would thus substantially increase the complexity of the decision process and might also be quite contentious. This violation of the KISS principle would then have the potential to weaken the quality of monetary policy decisions.

A third problem is that it is far from clear who should decide on the objective function. If the members of the monetary policy board do so, isn't this a violation of the democratic principle that the objectives of bureaucracies should be set by the political process? An alternative would be for the government to do so. But if we think that it would be hard enough for a monetary policy committee to do this, it would clearly be even more difficult for politicians to decide on the objective function.

Even if it were easy for the monetary policy committee or the government to come to a decision on the objective function, would it be easy to communicate it to the public? If economists and members of a monetary policy committee have trouble quantifying their objective function, is it likely that the public would understand what the central bank was talking about when it announced it objective function? Announcement of the objective function would only be likely to complicate the communication process with the public and is another violation of the KISS principle.

The announcement of the central bank's objective function can add a further complication to the communication process that might have even more severe consequences for the ability of the central bank to do its job well. The KISS principle argues for articulation of monetary policy in as simple a way as possible. The beauty of inflation-target regimes is that by focusing on one objective – inflation – communication is fairly straightforward. On the other hand, with the announcement of the objective function, the central bank will be announcing that it has two objectives, minimising both output and inflation fluctuations. Discussion of output as well as inflation objectives can confuse the public and make it more likely that the public will see the mission of the central bank as elimination of short-run output fluctuations, thus worsening the time-inconsistency problem.

One outcome is that it may make it more likely that workers and firms will raise wages and prices because they know that the monetary authorities are likely to accommodate these rises by pursuing expansionary policy to prevent output gaps from developing. The result is that a self-fulfilling equilibrium can occur in which wages and prices rise, then monetary policy accommodates this rise, and this leads to further rises in wages and prices, and so on, thus leading to a new equilibrium with higher inflation but without a reduction in output fluctuations. Chari, Christiano and Eichenbaum (1998) have described this bad equilibrium as an 'expectation trap'. Discussing monetary policy objectives in terms of output fluctuations can thus lead to a loss of inflation-fighting credibility for the central bank, with the result that the trade-off between inflation and output fluctuations worsens.

Announcement of the objective function not only requires the announcement of λ and the inflation target, but it also requires the central bank to announce its estimates of the current and future output gaps and hence its estimate of potential output and its growth rate. The announcement of estimates of potential output, and particularly its growth rate, may increase the probability that the public sees them as a target for monetary policy and thus may increase political pressures on the central bank to eliminate output gaps and pursue high growth in the short run, with the resulting negative consequences mentioned above. This problem is likely to be even more damaging because potential output is very hard to measure.

One measurement problem for potential output occurs because the monetary policy authorities have to estimate it with real-time data, that is, data that are available at the time they set the policy instrument. GDP data are frequently revised substantially and this is one reason why output gaps are mismeasured in real time. Even more important: it is notoriously hard to know what potential GDP and its growth rate actually are without hindsight. For example, in the United States it was not until the 1980s that policy-makers recognised that potential GDP growth had slowed markedly after 1973: Orphanides (2001) has shown that the errors in measures of output gaps have been very large in the post-war period.

An even more severe measurement problem occurs because conceptually the y_t that belongs in the aggregate supply curve in Equation (1) is not at all clear and may be quite different from conventionally measured output gaps. Clarida *et al* (1999) point out that new Keynesian aggregate supply curves should have y_t specified as a marginal cost measure rather than an output gap and they find that the marginal cost measure has substantially different movements and timing than the conventionally measured output gap. McCallum and Nelson (2000) and McCallum (2001) argue that conventionally measured output gaps, which estimate the gap as deviations from a trend, differ substantially from more theoretically grounded measures based on the output level that would prevail in the absence of nominal price stickiness. It is true that there are measurement problems with inflation as well as output gaps, but both the conceptual and real-time measurement problems for inflation are of a far smaller magnitude.

The severe measurement problems for the output gap could interact with an increased focus on eliminating output gaps to produce serious policy mistakes as occurred in the United States in the 1970s. Orphanides (1998) shows that the use of real-time data on output gaps might lead to such inaccurate estimates that active monetary policy which reacts strongly to output gaps increases economic instability. Indeed, Orphanides (2002) argues that the reason for the Federal Reserve's poor performance during the 1970s was *not* that it was unconcerned with inflation, but rather that it focused too much on eliminating output gaps.

Given the objections raised here, it is not surprising that no central bank has revealed its objective function to the public. Furthermore, the discussion here suggests that even if the central bank does not announce its objective function, announcement of current and future potential output and output gap estimates still has the potential to worsen monetary policy performance. Thus the discussion also argues against the publication of central bank estimates and forecasts of potential output and the output gap even if publication of inflation and output forecasts is felt to be beneficial. Indeed, although the majority of inflation-targeting central banks publish output and inflation forecasts, only the central banks of Colombia, the Czech Republic, Hungary, Iceland, New Zealand and Norway publish their forecasts of potential output or output gaps, while the central banks of Canada and Sweden publish only current estimates of the output gap (Table 1).

4. How Should Central Banks Talk about Output Fluctuations?

One advantage of a central bank announcing its objective function is that it would make clear the central bank's views on how it will deal with output fluctuations. But since central banks do not announce their objective functions, and arguments against doing this are strong, they still have the problem of how to talk about output fluctuations. The reality is that central bankers, whether they target inflation or not, are extremely reluctant to discuss concerns about output fluctuations even though their actions show that they do care about them. This lack of transparency is the 'dirty little secret of central banking'. One remarkable manifestation of this occurred in August 1994 at the Federal Reserve Bank of Kansas City's Jackson Hole Conference, when Alan Blinder, then the vice-chairman of the FOMC, had the temerity to mention that a short-run trade-off between output and inflation exists and that, therefore, monetary policy should be concerned about minimising output as well as inflation fluctuations. Blinder was then pilloried by many central bankers and in the press, with a Newsweek columnist declaring that he was not qualified to be a central banker (Samuelson 1994). From an academic economist's perspective, this was quite amazing since Alan Blinder didn't say anything that was inconsistent with what our models tell us or what central bankers deep down believe. However, it does indicate the discomfort that central bankers as a group have with discussing the role of output fluctuations in the conduct of monetary policy.

The problems with revealing the objective function discussed in the previous section explain why central bankers have difficulty with being transparent about their concerns about output fluctuations. Central bankers fear that if they are explicit about the need to minimise output fluctuations as well as inflation fluctuations, politicians will use this to pressure the central bank to pursue a short-run strategy of overly expansionary policy that will lead to poor long-run outcomes. Furthermore, a focus on output gaps could lead to policy mistakes similar to those that occurred in the United States in the 1970s. The response to these problems is that central bankers engage in a 'don't ask, don't tell' strategy.

However, the unwillingness of central banks to talk about their concerns regarding reducing output fluctuations creates two very serious problems. First, a don't-ask-don't-tell strategy is just plain dishonest. Doing one thing but saying another is the height of non-transparency, and central banks not admitting that they care about output fluctuations can erode confidence in other elements of their transparency that are clearly beneficial. Second, if central bankers do not discuss their concerns about output fluctuations, they may end up being characterised as 'inflation nutters', and this can cause an erosion of support for a central bank's policies and independence because this set of preferences is clearly inconsistent with the public's.

The case for increasing transparency with regard to central banks' concerns about output fluctuations is quite strong. But how can central banks do this?

One answer is that a central bank can discuss the setting of its policy instruments in terms of the target rule in Equation (6). It can announce that it will not try to hit its inflation target over too short a horizon because this would result in unacceptably high output losses, especially when the economy gets hit by shocks that knock it substantially away from its long-run inflation goal. Inflation-targeting central banks have been moving in this direction: for example, the Reserve Bank of New Zealand has modified its inflation-targeting regime to lengthen the horizon over which it tries to achieve its inflation target.[17]

17. See Sherwin (1999), Drew and Orr (1999) and Reserve Bank of New Zealand (2000).

Although inflation-targeting central banks have lengthened the horizon for their targets to two years or so, with the Bank of England being a prominent example, this still does not solve the problem because it gives the impression that the horizon for inflation targets is fixed, which is not flexible enough.[18] Up to now, the use of a specific horizon like two years has not been a problem for inflation targeting in advanced countries like the United Kingdom; because inflation has not been subject to large shocks, it has remained close to the target level. In this case, having the horizon for the target equal to the two-year horizon at which policy changes take effect, as in Equation (5), is consistent with optimal policy. However, as we have seen in Equation (6), when there is a concern about output fluctuations and the inflation rate is shocked sufficiently away from its long-run target, the path for the medium-term inflation-target horizon needs to be modified.

A striking example of how large shocks to inflation can be handled occurred in Brazil recently (Fraga, Goldfajn and Minella 2003). Brazil experienced a major exchange rate shock in 2002 because of concerns that the likely winner in the presidential election would pursue populist policies that would lead to currency depreciation. The resulting depreciation then led to a substantial overshoot of the Brazilian inflation target. In January 2003, the Banco Central do Brasil announced a procedure for how it would modify its inflation targets. First, the central bank estimated the regulated-price shock to be 1.7 per cent. Then taking into account the nature and persistence of the shocks, it estimated the inertia from past shocks to be 4.2 per cent of which two-thirds was to be accepted, resulting in a further adjustment of 2.8 per cent. Then the central bank added these two numbers to the previously announced target of 4 per cent to get an adjusted target for 2003 of 8.5 per cent (= 4% + 1.7% + 2.8%). The central bank then announced the adjusted target in an open letter sent to the Minister of Finance in January 2003, which explained that getting to the non-adjusted target of 4 per cent too quickly would entail far too high a loss of output. Specifically, the announcement indicated that an attempt to achieve an inflation rate of 6.5 per cent in 2003 would be expected to entail a decline of 1.6 per cent of GDP, while trying to achieve the previous target of 4 per cent would be expected to lead to an even larger decline of GDP of 7.3 per cent.

The procedure followed by the Banco Central do Brasil had tremendous transparency, both in articulating why the inflation target was missed and also in explaining why the new target path for inflation was chosen. The discussion of alternative target paths, with the explanation that lower inflation paths would lead to large output losses, showed that the central bank did indeed care about output fluctuations, thus demonstrating that it was not an 'inflation nutter' and that its concern about output losses was aligned with similar concerns by the public.

Even though advanced economies have not yet had inflation shocks of the magnitude that Brazil has recently experienced, outlining the procedures that they

18. The fixed horizon is also problematic because it is inconsistent with optimal monetary policy: for example, see Woodford (forthcoming). Indeed, critics of inflation targeting, most notably Don Kohn (2004), who is a member of the Board of Governors of the Federal Reserve, have also worried that inflation targeting may be too rigid because inflation-targeting central banks in advanced economies have often adopted a fixed horizon for their inflation targets.

will use to to respond to future adverse shocks provides a vehicle for them to explain that they do indeed care about output fluctuations.[19] By announcing that they would do what the Brazilians did if a situation arose in which inflation shifted substantially away from the long-run goal, central bankers can get the dirty little secret out of the closet that they do have an appropriate concern about output fluctuations. Yet, they will still be able to assure the public that they continue to worry about the long run and the importance of achieving price stability. A procedure like the one followed by Brazil conveys the idea that the central bank cares about output fluctuations in a forward-looking context because it highlights decisions that the central bank will make about the future path of inflation and the horizon over which inflation will return to the target. It therefore continues to make clear that the central bank is focused on output fluctuations in a longer-run and not a short-run context, which is necessary for minimising the time-inconsistency problem.

Monetary authorities can further the public's understanding that they care about reducing output fluctuations in the long run by emphasising that monetary policy needs to be just as vigilant in preventing inflation from falling too low as it is in preventing it from being too high. They can do this (and some central banks have) by explaining that an explicit inflation target may help the monetary authorities stabilise the economy because they can be more aggressive in easing monetary policy in the face of negative demand shocks to the economy without being concerned that this will cause a blowout in inflation expectations. However, in order to keep the communication strategy clear, the explanation of a monetary policy easing in the face of negative demand shocks needs to indicate that it is consistent with the preservation of price stability.

In addition, central banks can also clarify that they care about reducing output fluctuations by indicating that when the economy is very far below any reasonable measure of potential output, they will take expansionary actions to stimulate economic recovery. In this case, measurement error of potential output is likely to be swamped by the size of the output gap. Thus, it is far clearer that expansionary policy is appropriate and that inflation is unlikely to rise from such actions. In this situation, the case for taking actions to close the output gap is much stronger and does not threaten the credibility of the central bank in its pursuit of price stability.

5. Concluding Remarks

Transparency is a virtue, but like all virtues it can go too far. The famous fashion designer Chanel came up with the marvelous dictum that 'You can never be too rich or too thin'. But you can be too thin – either anorexia or starvation is a killer. Similarly central banks can be too transparent. Central bank transparency must always be thought of as a means to an end. Transparency is beneficial when it serves

19. Central banks in advanced countries do have an awareness of the need to modify the inflation path if the economy is subjected to large shocks. For example, in the United Kingdom, the inflation-targeting regime stipulates that if inflation is knocked more than 1 percentage point away from the target (now 2 per cent), then the Bank of England will need to specify the path of inflation and the length of time that it will take to get back to the target.

to simplify communication with the public and helps generate support for central banks to conduct monetary policy optimally with an appropriate focus on long-run objectives. Some types of transparency may not do this.

This paper has argued that some suggestions for increased transparency, particularly a central bank announcement of its objective function or projections of the path of the policy interest rate, will complicate the communication process and weaken support for a central bank focus on long-run objectives. Transparency can indeed go too far.

However, there is one area in which the lack of central bank transparency does create problems: the unwillingness of many central banks to honestly discuss that they do care about reducing output fluctuations. Here transparency could be substantially improved. By describing procedures for how the path and horizon of inflation targets would be modified in the face of large shocks, by emphasising that monetary policy will be just as vigilant in preventing inflation from falling too low as it is in preventing it from being too high, and by indicating that expansionary policies will be pursued when output falls very far below potential, central banks can get the dirty little secret out of the closet that they do care about output fluctuations. These steps to improve transparency will increase support for the central bank's policies and independence, but avoid a focus on the short run that could interfere with the ability of the central bank to do its job effectively.

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Discussion

1. Warwick J McKibbin[1]

The paper by Rick Mishkin is a clear and timely overview of the state of the debate on the transparency of central banks. The paper asks three supplementary and related questions on the way to answering the main question – 'Can central bank transparency go too far?' The first question is whether central banks should publish forecasts of a range of variables and not just forecasts of inflation. In particular, the paper considers whether central banks should announce a forecast for real output and a 'no change interest rate' or a future path for interest rates. The second question is whether central banks should announce their objective function, so that the private sector understands how they will react to a variety of possible future events. The third question is how central banks should talk about output given that most have both output and inflation in their objective functions.

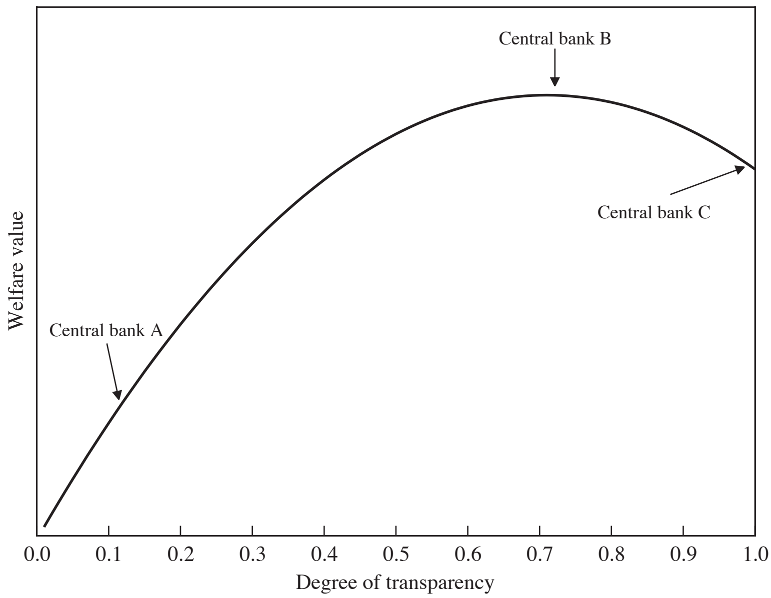
The paper gives a good overview of current practice, which varies substantially across countries. Almost all inflation-targeting central banks publish forecasts of inflation. Many central banks do not publish output forecasts. Most central banks do not publish forecasts of interest rates and no central banks publish their objective function.

The first practical issue that needs to be considered is what 'too far' means? Is the issue being 'too far' relative to the optimal amount of transparency, or is it relative to the current status quo? Figure 1 illustrates this point. It shows the extent of transparency of central banks expressed as an index which is zero when non-transparent and unity when completely transparent. The vertical axis shows the social welfare obtained from being transparent. The frontier in the figure shows the pay-offs to society of various degrees of transparency from none to full. Now suppose we pick three arbitrary central banks – central bank A, central bank B and central bank C. Clearly central bank B is at the optimal degree of transparency where any further revelation of information leads to a reduction in social welfare. Thus central bank C has gone too far relative to central bank B. However, it has not gone too far relative to central bank A, which generates lower social welfare because of low transparency. In reality most central banks are at point A and therefore even if they 'go too far' it could be welfare improving relative to the status quo.

This example is completely arbitrary because in fact the pay-off frontier may not have the shape in Figure 1, but it does illustrate the point that we need to be precise about going 'too far' in the context of how far central bank transparency has already moved. Most central banks are down near point A, in which case greater transparency from their current positions would be beneficial for the wider community, even though it might make life more difficult for central bankers.

1. The views in this note do not necessarily reflect the views of any of the institutions with which the author is affiliated. Useful comments and discussions with Renee Fry, David Gruen and Adrian Pagan are gratefully acknowledged.

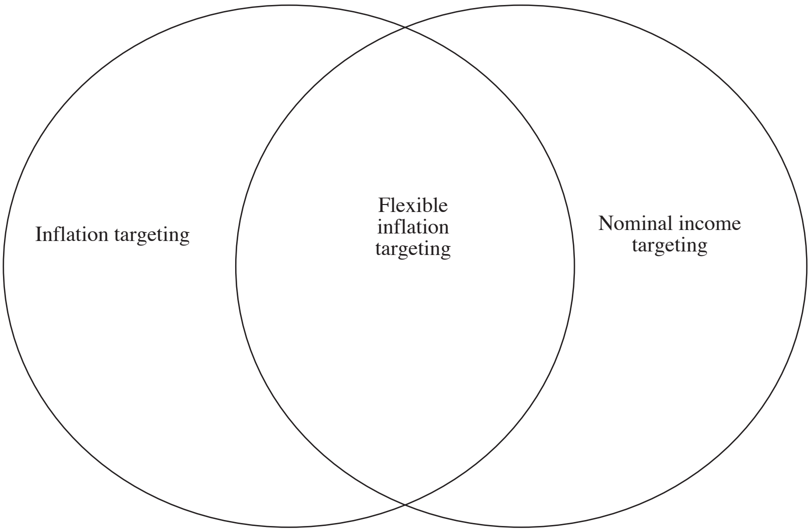
Figure 1: Potential Pay-offs to Transparency



A further issue which emerges from the paper is that there is a great deal of ambiguity about how actual central bank behaviour fits into the theoretical literature on monetary regimes. Much of the theoretical and empirical literature in the early 1990s (see Bryant, Hooper and Mann 1993 and the discussion in McKibbin 1997) focused on nominal income targeting, rather than inflation targeting, as a regime that handled the uncertainty of possible shocks the best. The emergence of the inflation-targeting literature in the mid 1990s was mainly generated by the desire of economists to better understand actual central bank behaviour in their inflation-targeting rhetoric, rather than a natural extension of the literature on evaluation of alternative regimes. The notion of flexible inflation targeting, which is now popular in the literature, is really closer to the concept of nominal income growth targeting in the sense that, as also pointed out by Rick, real output considerations enter into the decisions on how quickly central banks respond to inflation changes. In my opinion, the Reserve Bank of Australia's concept of 'inflation targeting over the cycle' is a form of flexible inflation targeting which is closer to a nominal income growth-targeting regime than a pure inflation-targeting regime. This ambiguity in the mapping of the theoretical to the actual regimes is illustrated in Figure 2.

As Rick points out, there are two parts to an inflation-targeting regime. The first is the central bank's objective function, which usually contains both inflation and output. The objective function is defined for all monetary regimes. The other part of the inflation-targeting regime is the policy rule in which the interest rate adjusts in response to either actual or expected inflation over some future period. The form of the interest rate rule determines whether the central bank is an inflation targeter or following some other regime.

Figure 2: Some Alternative Monetary Regimes



There are a number of streams of literature which bear on the theoretical aspects of Rick's paper. The analytical example in the paper of the role of transparency, which is adapted from the Svensson (1997) approach, assumes rational expectations. There is a new emerging literature, such as in Preston (2004), in which learning can change the nature of the interaction between central banks and the private sector in important ways. Indeed in a learning model, inflation targeting can be destabilising, depending on the forecasting process.

The other relevant literature is the evaluation of regimes based on the ability to offset shocks. There is a clear theoretical and strong empirical result that nominal income targeting dominates pure inflation targeting in the case of supply shocks or shocks to country risk (see Henderson and McKibbin 1993). This is particularly true for developing countries in which a majority of shocks are likely to be supply shocks due to events such as weather outcomes or underlying structural changes (see McKibbin and Singh 2003 for India).

Rick raises the dilemma of how central banks should reveal their concern over fluctuations in real output while maintaining an inflation target. Presumably by being more explicit about monetary policy responses to real output, a central bank provides a clear view to the private sector about how it will respond to certain shocks. This should enhance the credibility of the nominal anchor associated with an inflation target, even while the central bank responds to some shocks in a way that temporarily moves inflation away from the target. Perhaps the answer to this dilemma can be found in the early theoretical literature on the desirability of some form of explicit nominal income growth targeting. Rick argues that bringing greater transparency about output fluctuations into the monetary debate might violate the

KISS (Keep It Simple Stupid) principle, because talking about both inflation and output targets would be too complicated. However, an announced nominal income target is a single variable (although it does contain both inflation and real output growth as components). The general public could focus on the nominal income target and the central bank could announce the underlying inflation target for aficionados. The advantages of a nominal income growth target over a pure inflation target are many. Nominal income growth is as forecastable as inflation for the United States and more forecastable for some countries such as Korea (see Ponomareva 2004). The critical issue for forecastability is the covariance of forecast errors between real GDP and inflation, which Ponomareva (2004) finds is negative for Korea. Nominal income growth is a single variable as is inflation. It provides a nominal anchor through the inflation component of nominal income growth. Nominal income is easy to understand for the wider population (especially since it is not a complex price index but a measured variable). Nominal income targeting also requires less explicit exemptions than inflation targeting for a wide variety of shocks. How many times can a central bank make an exemption for a negative supply shock before the nominal anchor of inflation targeting is seriously undermined?

The key issue in the debate about transparency is not where central banks are relative to the extreme but where they are relative to the optimal. Surely, most central banks have not gone far enough when it comes to transparency – in terms of Figure 1 they are located closer to central bank A than central bank B. Inflation targeting has worked well in the 1990s. How much of this is good luck in terms of the types of shocks experienced, rather than good management, is an open question. There is a reasonable argument that the current form of inflation targeting will not necessarily survive the types of shocks that might buffet the world economy in the future. A case can even be made that in the event of large shocks, such as the Asian crisis, some inflation-targeting central banks outside those countries directly impacted were lucky with the way they adapted their inflation targets to deal with the shock while others were unlucky. Looking forward, there are a wide range of potential negative shocks – such as oil price shocks, terrorism, weather events and other unpredictable events – which may really test the forms of inflation targeting that some central banks have adopted. The extent to which a nominal anchor such as 'inflation targeting with exemptions' can withstand these shocks will inevitably be tested. A case can be made that it is better to improve a policy regime when it is not under stress rather than wait until the flaws are exposed during a period of serious systemic stress. Perhaps nominal income growth targeting in some form will be the monetary regime that evolves over the coming decade, when central banks become more transparent and Rick's revelation of the 'dirty little secret', that central banks also care about output, will be more clearly evident.

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2. General Discussion

There was general agreement with Mishkin's conclusion that central bank transparency can go 'too far'. One participant noted that this followed from the recognition of the limits of central bankers' knowledge. In other words, many of the arguments in Mishkin's paper against greater transparency reflected the complexities involved in determining the exact details of the extra information being provided, for example, with respect to central banks' objective functions or the future path of policy interest rates. In that context, one participant suggested that the Brazilian experience referred to by Mishkin was an example where central bank transparency had gone too far. A possible effect of the Banco Central do Brasil's decision to present alternative policy paths was an excessive focus on output stabilisation, which was an argument Mishkin had raised for why a central bank should not release its objective function.

A number of participants noted that, while McKibbin's Figure 1 did help to elucidate some of the issues involved with central bank transparency, it did not represent developments accurately enough. Echoing a wider sentiment, one participant suggested that, 10 to 15 years ago, all central banks were to the left of central bank 'A', with very low levels of transparency. Transparency had since increased significantly, bringing most central banks to a point somewhere in the vicinity of central bank 'B', at the optimal level of transparency. Furthermore, the curve was significantly flatter in this area than indicated by McKibbin's figure. As such, while earlier increases in transparency were of first-order importance for welfare, any further refinements were likely to be of second-order importance.

A number of participants noted that, when considering the desirable level of central bank transparency, one size does not fit all. The appropriate level of transparency was, to some extent, dependent on a country's institutional structure. For instance, one participant noted that the Reserve Bank of New Zealand's high level of transparency was common across the entire New Zealand government. The legislative environment, and the *Official Information Act* in particular, would make it difficult for the RBNZ to argue against releasing its interest rate projections. In a similar vein, one participant noted that the appropriate size and make-up of the central bank's policy committee will also reflect a country's structural characteristics. For example, a larger, geographically diverse committee is considered appropriate in the US, given the consolidation of financial power (in New York) and political power (in Washington DC). Similarly, a large committee of central bank governors was appropriate for the European Central Bank.

In terms of specific elements of central bank transparency, discussion focused on a number of matters. While some participants argued against the publication of any endogenous policy interest rate projections, others contended that financial markets had taken a reasonably sophisticated approach to the presentation of such projections in New Zealand. Opinion also diverged on the desirability of the central bank publishing inflation forecasts based on an endogenous interest rate or a constant interest rate. One participant questioned whether releasing forecasts based on an endogenous interest rate was necessarily the more transparent option; as such a forecast was less easily understood by the non-specialist than a forecast based on a constant interest rate. Another participant noted that the decision to increase transparency – including the release of detailed information regarding projections – was largely irreversible. This was especially relevant for emerging market economies, given the importance of establishing and then sustaining central bank credibility.

There was also some discussion about the desirability of publishing the minutes of the central bank's policy committee. A number of participants noted that the release of detailed minutes, which attributed comments to individual committee members, had the potential to substantially alter the operation of the policy-making body: the power of the chairperson may be enhanced and greater deliberation may occur outside the formal meeting. Both of these changes could compromise the integrity of the decision-making process. One participant suggested that the release of detailed minutes may stop committee members playing devil's advocate during policy deliberations, which can often advance the policy discussion.

Following McKibbin's comments, a number of participants raised the issue of nominal income targeting, with most rejecting the approach. Some participants noted the difficulties that nominal income targeting would pose for developing countries – and also countries such as Australia, Canada and New Zealand – as they can experience significant terms of trade shocks, both supply and demand induced. With a nominal income target, a positive terms of trade shock may lead the central bank to tighten policy, which might not be desirable. Other participants focused on the fact that nominal income targeting is more complicated to explain to the general public than inflation targeting. In that sense, the introduction of inflation targeting from the late 1980s, at a time when the academic literature was focused on nominal income targeting, was a reflection of Mishkin's 'KISS' principle. With an inflation target the central bank can also nail down inflation expectations with a specific number. This is not possible with a nominal income target unless the central bank is also explicit about a target for potential growth, which some participants believed to be fraught with difficulties. Finally, one participant pointed to the US economic performance in the second part of the 1990s – strong growth combined with low inflation – and contended that a nominal income target would have led the Federal Reserve to tighten monetary policy more than was necessary.

A Perspective on Monetary Policy Transparency and Communication

Malcolm Edey and Andrew Stone

1. Introduction

The subject of central bank communication has received growing attention in recent years, at the same time as central banks themselves have increased their efforts at communicating with the public. One reason for these trends has been the strengthening of central bank independence, which has brought with it a corresponding focus on public accountability. Another factor has been an increasing recognition of the broader importance of good communication for promoting confidence in the policy regime and creating a stable environment for expectations. This requires, among other things, that the thinking behind monetary policy decisions be clearly explained. The efforts made by central banks in that direction over the past decade or so can be summed up under the general heading of increased transparency.

Transparency, however, is not a one-dimensional concept. Central banks have available to them a number of different means of communication, including economic reports, media statements, forecasts, minutes and the like, and they have adopted a range of differing communication strategies, at least partly reflecting differences in their institutional structures and histories. The nature of these differences, their rationale, and whether existing communication strategies can be further improved, remain subjects of ongoing debate.

With that background, this paper aims to do three things. First, it looks at the economics of monetary policy communication, and attempts to draw out what the available evidence entitles us to say about the costs and benefits of particular forms of transparency. The purpose here is to provide a basis for distinguishing between good and bad arguments for changes to existing practices. Second, it reviews recent developments in the communication practices of central banks in order to bring out the similarities and differences in current approaches. Third, it looks in more detail at the role of inflation forecasts in the communication strategy, which seems to be at the heart of current differences of approach among inflation-targeting central banks.

2. The Economics of Transparency and Communication

We begin by addressing the question of what actually constitutes monetary policy transparency, before briefly reviewing the theoretical and empirical literature on the economic implications of central bank transparency, and discussing the interaction between accountability and transparency.

2.1 What is transparency?

A useful starting point for the discussion of transparency in monetary policy is the realisation that this is a concept with many dimensions. In a recent survey of the literature, Geraats (2001) classified the different aspects of transparency into five general categories: political, economic, procedural, policy and operational. Several subsequent papers, however, have argued that there is a degree of substitutability between various of Geraats's types of transparency and have therefore proposed an alternative subdivision into three categories. Hahn (2002) labels these three categories *goal*, *knowledge* and *operational* transparency.[1]

Goal transparency refers to transparency about the overall aims of the central bank, by which is meant broad policy objectives rather than day-to-day operational aims such as (say) maintaining the overnight cash rate at the desired target. These goals would include the specification of an inflation target, the statement of an output or employment objective, and, if both output and inflation are among the variables stated to be of concern, an indication of the relative weight typically placed upon each.

Two points are worth noting, in passing, about the concept of goal transparency. The first is that it may be difficult to retain a clear distinction between the transparency of a given policy goal and the precision with which that goal is formulated. An example of this is given by the contrasting specifications of inflation targets by the Bank of England and the Reserve Bank of Australia (RBA). Australia's target of 'consumer price inflation between 2 and 3 per cent, on average, over the cycle' (Second Statement on the Conduct of Monetary Policy, July 2003) is formulated much less sharply than that of the UK, where the Bank of England is charged with achieving 'an underlying inflation rate (measured by the 12-month increase in the CPI) of 2 per cent … at all times' (Remit for the Monetary Policy Committee, 10 December 2003).[2] This is sometimes interpreted as contributing to a lack of transparency about the RBA's objectives.[3] A counter view, however, would be that Australia's inflation target is no less transparent than the UK's, just more flexible.

1. Hahn (2002) notes that a rough correspondence between his own and Geraats's taxonomies of transparency is provided by matching her notion of political transparency with his own goal transparency, her concepts of economic and operational transparency with his knowledge transparency, and her notions of procedural and policy transparency with his operational transparency. In a similar vein, there is an approximate concordance between Hahn's three categories of transparency and those of Carpenter (2004); Carpenter's transparency with respect to instruments, goals and implementation broadly (though not exactly) correspond to Hahn's operational, goal and knowledge transparency.
2. The remit from the Chancellor does acknowledge that 'the actual inflation rate will on occasions depart from its target as a result of shocks and disturbances' and that 'attempts to keep inflation at the inflation target in these circumstances may cause undesirable volatility in output'. Nevertheless, it sets out a strict regime of accountability for deviations of inflation from target of more than 1 percentage point, and stresses that the resultant inflation thresholds of 1 and 3 per cent to trigger this regime 'do not define a target range'.
3. See, for example, the relative ratings given to the RBA and the Bank of England in Table 3.4 of Fracasso, Genberg and Wyplosz (2003).

The second point is that, even within the reduced, three-fold taxonomy of transparency considered here, there is clearly still some substitutability between the different categories of transparency. Hence, for example, a central bank which makes known both its forecasts for key economic variables and the policy actions it takes in light of these forecasts (forms of knowledge and operational transparency, respectively, discussed further below), reveals a good deal about its overall policy objectives (goal transparency), even if it does not explicitly state these objectives.

Knowledge transparency refers to the information provided by the central bank to the general public about: first, the data which the central bank relies upon in drawing up its strategy for achieving its overall objectives; and, secondly, how it uses that data to arrive at its ultimate strategy. This would be seen as including the periodic release of relevant forecasts of key variables by the central bank, as well as a description of the main factors driving these forecasts, the risks surrounding them, and how they influence the current stance of policy.

Operational transparency refers primarily to the openness of a central bank about the instruments it uses to try to achieve its policy objectives, and about how and when it uses these instruments. The obvious example is the announcement of decisions regarding the central bank's short-term interest rate target.[4] There is also a further bloc of issues which most naturally fall under this category, and these concern procedural aspects of the way in which monetary policy decisions are reached. The most prominent of these relate to the publication of minutes and voting records of the committee which decides the policy stance.

2.2 Theories of optimal transparency

To assess the economic case for or against particular aspects of transparency, the first point to note is that the overwhelming majority of the literature on these issues is theoretical rather than empirical. Within the theoretical literature, a recurring theme of the overview presented here is that many of the findings depend crucially upon the details of the modelling framework adopted, especially regarding: the treatment of uncertainty; the way in which monetary policy affects the real economy; and the precise nature of the central bank's objectives (whether revealed or not). As such, many of these findings do not, unfortunately, appear to be robust across a range of different analytical assumptions.

Beginning with the theoretical literature on goal transparency, two central themes of the modelling on this score are the issues of time-inconsistency, and of the impact of transparency on expectations formation. Eijffinger, Hoeberichts and

4. While it has become the norm for most central banks to use a short-term interest rate as their primary policy instrument, and to announce immediately any changes to the target level for this variable, it is surprising how recent a phenomenon this degree of transparency is. In the US, the Federal Reserve only commenced publishing its target for the Federal Funds Rate directly after board meetings in 1994, having successfully fought a case in the Supreme Court in the late 1970s to allow it to continue its then practise of only announcing this information with a 90-day lag. A similar opacity about the target for the overnight cash rate also characterised the RBA's behaviour until 1990.

Schaling (2000), for example, develop a model in which transparency, in the sense of reduced uncertainty about a central bank's relative preferences regarding inflation and output, is beneficial because it helps to fix inflation expectations, and so reduces both the mean and variance of inflation. Using a similar model, Canzoneri (1985) finds that increased central bank transparency should also help to overcome the time-inconsistency dilemma facing central banks – that is, the assumed temptation to seek superior economic outcomes by saying one thing and subsequently doing another. In a model in which such time-inconsistency can result in reputational damage, increased transparency will diminish the incentive to behave in this way.

A further strand of the literature on goal transparency concerns the implications of learning for monetary policy and central bank communication. In an important recent series of papers, Orphanides and Williams (2003a, 2003b) consider a model in which the general public, although aware of the broad structure of the economy, do not know the precise quantitative details of that structure. These details, embodied in the parameters of the model's equations, depend upon the objectives and preferences of the central bank, which are unstated, so that the public is assumed to have to infer them through observing the central bank's actions. As Bernanke (2004a) observes, in such a model, the behaviour of the economy 'can be quite different from that of the rational expectations analogue, in which the public is assumed to have full and symmetric information'. In particular, Orphanides and Williams (2003a) find that the public's process of adaptive learning, in the face of central bank opacity, can make the economy 'prone to episodes in which the public's expectations of inflation become uncoupled from the [central bank's] policy objective and stagflation results'. This leads them to argue that their results 'highlight the value of effective communication of a central bank's inflation objective and of continued vigilance against inflation in anchoring inflation expectations'.

Not all theoretical models, however, support the notion that greater goal transparency is necessarily economically beneficial. For example, Hahn (2004) develops a simple model in which the optimal trade-off between transparency and opacity in the central bank's objectives depends on society's relative preferences for output stabilisation versus low inflation. Also, Grüner (2002) presents an explicit model of the interaction between a central bank and a monopoly labour union under which greater secrecy by the central bank is economically preferable.[5] Finally, a variety of papers (Beetsma and Jensen 2003; Eijffinger and Hoeberichts 2002) bear on the possibility, bound up with the time-inconsistency issue, that 'high-credibility' central banks can afford to be opaque, whereas it may be optimal for 'low-credibility' institutions to be transparent.

As regards this latter point, it seems quite plausible that the potential benefits from increased goal transparency may be smaller for central banks which already have a good track record in achieving desired macroeconomic outcomes. Notwithstanding

5. This result, however, requires that the union become more cautious in its wage-setting demands when unsure about the relative weights which the central bank places on its output and inflation goals – lest the central bank turn out to be very hawkish, so that high wage demands would lead to high unemployment. The practical plausibility of such an assumption is open to question.

this caveat, however, Carpenter (2004) characterises the general finding that goal transparency can 'serve to create a long-term institutional incentive for low inflation' at central banks, and so in turn help to better anchor inflation expectations, as 'the most robust result of the literature'.

With regard to knowledge transparency, the theoretical literature is again inconclusive. A number of papers (Cukierman 2002; Gersbach 2003) suggest that disclosure of forecasts by central banks could undermine the effectiveness of monetary policy. However, these results rest upon a modelling assumption that only unanticipated monetary policy actions affect output. In a different vein, various papers outline a role for knowledge transparency to improve private sector information (Romer and Romer 2000), and thereby reduce aggregate economic volatility (Tarkka and Mayes 1999). Once again, however, this latter finding is model-dependent, since Morris and Shin (2001) present a model in which, even though central bank forecasts are superior to those of individual private agents, their publication could still lead to increased aggregate forecast errors. The mechanism here is that individuals, whose forecast errors previously tended to cancel out, might all shift their forecasts towards those of the central bank, resulting in the latter's forecast errors becoming aggregate errors.

A further set of papers (for example, Jensen 2002) focus on a potential trade-off between credibility gains for a central bank from increased transparency, on the one hand, and a possible loss of flexibility in its policy actions, on the other. The concern here is that a central bank which reveals both its goals and its forecasts may find itself undesirably constrained in its response to the range of different shocks which may strike the economy. However, rather than providing a case for central bank opacity, this could be argued to provide support for central banks casting their goals in a suitably flexible manner – acknowledging the fact that different shocks to the economy may call for different policy responses.

Overall, what lessons can we draw from this survey of the theoretical literature on the economic consequences of different forms of central bank transparency? Certainly, there are some findings which appear to be reasonably robust, such as the insight that goal transparency (principally, the announcement of an inflation target) can create a sustained institutional incentive for a central bank to pursue desirable macroeconomic goals, with associated benefits in terms of the anchoring of the public's expectations. Many of the theoretical results, however, appear to be very model-specific, and highlight that increased transparency can sometimes do more harm than good, depending upon subtle features of the monetary policy framework and the expectations formation process. As such, they suggest that, while a high degree of central bank transparency is likely to be desirable on economic grounds, it is certainly not automatically the case that more transparency will always be better.

2.3 Empirical evidence

By comparison with the theoretical literature, empirical evidence on the effects of transparency is relatively scarce. In large part, this reflects the problem that transparency is virtually impossible to quantify. As Carpenter (2004) observes, numerical measures of it will be 'at best imprecise and at worst incorrect', and for this reason 'the empirical evidence is not compelling and most likely never will be'.[6]

One study to attempt a quantification of monetary policy transparency is Eijffinger and Geraats (2002), who rate nine major central banks based on the authors' assessment of their performance in relation to a range of communication criteria. These include: clarity and precision about goals; the release of minutes and voting records from policy meetings; openness in relation to the data and models used to guide economic analysis; and forthrightness in *ex-post* examination of policy choices. Even leaving aside the unavoidable subjectivity of ratings on many of these criteria, a major issue with such an index concerns the arbitrariness of the combination of these different components into a single index, which Eijffinger and Geraats do using equal weights.

A similar index of the transparency of 20 inflation-targeting central banks, again based on an equal weighting of separate ratings of various aspects of each bank's inflation report, has also been produced by Fracasso *et al* (2003). An innovation of their approach is the use of a group of five graduate students in economics, 'familiar with broad principles but not necessarily central bank watchers', to rate each bank's report. This approach is aimed at avoiding any subconscious contamination of the results by the authors' own knowledge of the operations and performance of each central bank. Among a range of drawbacks identified by Lowe (2003), however, is that such a group may be quite unrepresentative of the intended audience of central banks' reports. Finally, an alternative index of the transparency of the central banks of 87 countries, focused on the quality of their published forecasts, has been produced by Chortareas, Stasavage and Sterne (2002).

Empirical applications of these indices have produced mixed results. Cecchetti and Krause (2002) find evidence that central bank transparency improves a measure of macroeconomic performance based on the variability of inflation and output – although not as strongly as does central bank credibility (quantified in terms of low past inflation outcomes). Demertzis and Hughes Hallett (2002) use the index of Eijffinger and Geraats (2002) to examine the impact of central bank transparency on economic outcomes, and interpret their results as suggesting that, for the nine OECD countries rated by Eijffinger and Geraats, increased transparency tends to reduce the variance of inflation but to increase the variance of output deviations from trend.[7] The mean levels of inflation and output are unaffected. Finally, by contrast with Demertzis and Hughes Hallett, Chortareas *et al* (2002) find that greater transparency, as measured by their own index, is associated with a lower average level of inflation. Carpenter (2004), however, is critical of both of these latter studies – and indeed of most of the econometric analysis of the effects of transparency – noting that 'given

6. We omit from this survey studies of the larger question of how the adoption of an inflation target itself affects economic performance. Examples include Kuttner and Posen (1999), Ball and Sheridan (2003) and Hyvonen (2004).

7. These findings, however, are based purely on simple nine-data-point regressions of the relevant variable on Eijffinger and Geraats's transparency measure.

the differing levels, types, and definitions of transparency, clear econometric results would be more surprising than convincing'.

What all of these studies have in common is that they seek to identify differences in economic performance across countries and to attribute them to the characteristics of the communication regime. Performance, in this context, is usually measured in terms of either the volatilities of, or shifts in, key variables like inflation, output growth and interest rates. To put these studies in perspective, therefore, it is worth looking at the gross facts that need to be explained. Some summary statistics of these variables for a group of industrial countries are shown in Table 1.

These summary statistics show, broadly, three things:

- over the past two decades, there has been a substantial reduction in average inflation levels in most of the selected countries, especially in those with initially high inflation rates, as well as a reduction in the variability of both inflation and output growth in most countries;
- there has been an even greater reduction in short-term interest rate volatility; and
- based on these summary measures, country performances have generally become much more similar than they were in the two previous decades.

Doubtless these trends are attributable to a number of factors that we cannot go into here, but which would have to include improved macroeconomic policies. The aspect of economic performance most likely to be directly related to monetary policy communication arrangements is the reduction in interest rate volatility. It is plausible to attribute this to the improvements in transparency that have occurred over the same period, and a number of more detailed studies have done so (Muller and Zelmer 1999; Haldane and Read 2000). But remaining cross-country differences in interest rate volatility are now small, and are swamped in any of these comparisons by the much larger historical movements. Given these gross facts, attempts to identify the economic effects of current differences in communication arrangements across countries seem unlikely to be convincing.[8]

2.4 Transparency and accountability

The technical literature on optimal communication, reviewed above, focuses on the objective of economic efficiency. It asks how a communication strategy can best promote efficiency by reducing uncertainty or by focusing the public's expectations in a desirable way. As noted at the outset, there is also a second objective of central bank communication, namely that of ensuring adequate accountability. To a large degree these two objectives can be viewed as complementary. Disclosure practices that produce clear explanations of policy decisions will generally be likely to promote efficiency, in the ways discussed above, as well as helping to satisfy the requirements of accountability. Even so, the two objectives are not identical. There

8. This is the conclusion of Coppel and Connolly (2003) in a study of the effects of transparency on financial market behaviour.

Table 1: Macroeconomic Summary Indicators

Annual CPI inflation[(a)]
Average, percentage points

	1984–1988	1989–1993	1994–1998	1999–2003
United States	3.5	3.9	2.4	2.4
Germany	1.1	3.9	1.6	1.4
United Kingdom	4.3	5.4	2.8	2.3
Canada	4.1	3.5	1.2	2.5
Australia	6.9	4.2	2.4	2.5
New Zealand	9.3	3.2	1.9	2.3

Year-ended CPI inflation[(a)]
Standard deviation, percentage points

	1984–1988	1989–1993	1994–1998	1999–2003
United States	1.0	1.1	0.5	0.8
Germany	1.1	1.2	0.6	0.6
United Kingdom	0.7	1.9	0.3	0.4
Canada	0.4	1.8	0.8	0.9
Australia	2.0	1.9	0.8	0.6
New Zealand	3.5	1.6	0.4	0.8

Year-ended real GDP growth
Standard deviation, percentage points

	1984–1988	1989–1993	1994–1998	1999–2003
United States	1.6	1.5	0.8	1.6
Germany	1.0	2.7	0.7	1.4
United Kingdom	1.1	1.5	0.7	0.8
Canada	1.5	1.8	1.4	1.7
Australia	1.9	2.0	0.9	1.0
New Zealand[(b)]	na	2.6	2.2	1.2

90-day bill yield
Average absolute daily change, basis points

	1984–1988	1989–1993	1994–1998	1999–2003
United States	4.5	3.5	1.9	1.7
Germany	4.1	4.2	2.8	2.4
United Kingdom	8.7	5.0	1.9	0.7
Canada	2.7	2.5	2.6	1.2
Australia	14.6	3.6	2.0	1.4
New Zealand[(c)]	22.5	6.2	7.9	1.9

(a) CPI excluding GST and mortgage interest payments for Australia; CPI excluding GST and credit services for New Zealand; RPIX for the United Kingdom; headline CPI elsewhere.
(b) Data for New Zealand: year-ended real GDP growth data only available on a quarterly basis from June quarter 1998.
(c) Data for New Zealand: daily 90-day bill yields available from January 1985.

will always be cases where demands for additional disclosure, based on right-to-know arguments, need to be weighed against questions of how that would affect the efficiency of the policy environment (including, as noted below, the decision-making process). Logically, the balance between these two sets of considerations must reflect both the economic cost-benefit calculus of any disclosure proposal, and the question of how highly the public values the disclosure of a given piece of information for its own sake.[9]

In practice, the area in which these issues most come to the fore is in the question of how a change in reporting practices might affect the decision-making process itself. For example, how might the fact of subsequent disclosure of minutes, transcripts and the like, influence the way debates are conducted on a policy committee and therefore the quality of its decisions? This is an issue not much focused upon in the formal optimisation literature, which is principally concerned with how the disclosure of information affects the perceptions of the public. However, it is a recurring theme of more practical discussions, as will be seen later.

3. Recent Developments and Issues

There is no doubt that central banks around the world have greatly increased the volume and quality of information they provide to the public. These changes, which have generally taken place over the period since the late 1980s, have gone hand in hand with the evolution of the policy framework itself.

In Australia, the key developments in this area have been:

- The commencement in 1990 of the practice of announcing changes in the operational interest rate (the cash rate). Associated with this, the RBA also began publishing detailed explanatory statements with the announcement of a policy change.[10]
- The adoption in 1993 of a medium-term inflation objective of 2–3 per cent in communicating the Bank's thinking about policy to the public.[11]
- Adoption of the Statement on the Conduct of Monetary Policy (1996) by the Treasurer and the Governor of the Reserve Bank. This recorded a formal joint understanding of the RBA's inflation-targeting framework, along with arrangements for reporting and accountability. The agreement also established a schedule of

9. Obviously there will be room for differences of opinion as to how the balance between these considerations should be struck. Blinder *et al* (2001) argue that communication practices should be assessed against a general presumption of disclosure, but with exceptions being made where the balance of economic costs and benefits can be clearly shown to be against doing so. Thornton (2002) gives a somewhat different perspective, arguing that efficiency should be the primary consideration.

10. While these features are now standard practice around the world, their adoption has been relatively recent in some countries, with the Fed, for example, not announcing its policy interest rate until 1994 and the RBNZ until 1999. See the comment on Australia in this regard by Blinder (1996, p 73).

11. Grenville (1997) provides an account of the background to this development.

semi-annual reporting by the Governor to the Federal Parliament through the House of Representatives Standing Committee on Economics, Finance and Public Administration.[12] This process now attracts considerable media attention, and an opening statement by the Governor covering the Bank's assessment of current conditions, including economic forecasts, is published in the RBA *Bulletin* and on the Bank's website.

- A more gradual process of upgrading the RBA's regular reports on the economy and monetary policy. In particular there has been a substantial upgrading of the quarterly *Statement on Monetary Policy* (*SMP*), which has now replaced the Bank's annual report as the main vehicle for formal reporting on monetary policy – in effect, generating a shift from an annual reporting cycle to a quarterly one.[13]

All of this means that there is now a much greater flow of information to the public about the RBA's thinking than was the case a decade or more ago. Other central banks have over the years made their own changes in a similar direction, which in some cases go beyond those made by the RBA, though not invariably so. Current reporting practices among a range of advanced-country central banks are compared in Table 2, reproduced from the 2004 *Annual Report* of the BIS.

A few general observations can be made about the comparisons in Table 2.

- In all cases these central banks publish regular reports on the economy and monetary policy, usually at quarterly frequency. While they differ somewhat in style and length, all give a fairly comprehensive review of the central bank's thinking about economic conditions and prospects.
- Similarly, all of the major central banks now publish economic forecasts, though some (Canada and the ECB) have begun to do so only quite recently. The majority present their forecasts at a quarterly frequency, though a significant minority (including the three largest) present them half-yearly. The forecasts generally focus on inflation and GDP growth, with a small number of additional macroeconomic variables also included in some cases.
- Practices on the release of minutes (and voting records) from the monetary policy decision-making committees differ from country to country. Australia is one of a number (along with Switzerland and the ECB) where minutes and voting records are not released. In Canada and New Zealand the question of minutes does not arise because monetary policy decisions in those countries are not taken by a committee; they are the responsibility of the Governor. In the other countries included in the table, minutes are released with lags ranging from around two to eight weeks.
- In all cases, these central banks make public announcements when a policy change is made. Even a casual perusal of these statements, however, indicates that

12. While such hearings had taken place previously, they had mainly covered banking matters and there had been no formal schedule.

13. One crude measure of the extent to which the quarterly *SMP* has been upgraded is the number of pages of analysis it contains – typically now around 60 pages, compared with 10–15 pages for its equivalent 10 years ago.

Table 2: Provision of Information by Central Banks

	G3			Inflation targeters					
	US	ECB	Japan	UK	Canada	NZ	Australia	Sweden	Switzerland
Accountability									
Quantitative inflation objectives	No	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes
Reports to legislature	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Policy decisions									
Decisions announced immediately	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Press conferences	No	Yes	Yes	No	No	Yes	No	Yes	Yes
Press releases	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Minutes published	Yes	No	Yes	Yes	–	–	No	Yes	No
Voting result published	Yes	No	Yes	Yes	–	–	No	Yes	No
Economic assessments									
Reports on monetary policy	H	M	M	Q	Q	Q	Q	Q	Q
Forecasts released	H	H	H	Q	Q	Q	Q	Q	H
Quantitative risk assessments	No	No	No	Yes	No	No	No	Yes	No

Notes: M = monthly; Q = quarterly; H = half-yearly

Source: BIS 74th *Annual Report*, June 2004, Basel

they differ quite markedly in format and content. The Fed and Bank of England announcements, for example, are typically brief and, in the Fed's case, make heavy use of standard verbal formulas to describe the current assessment. Those in Australia, New Zealand, and some other countries generally give a fuller and less formulaic account.

- In addition to the announcement of policy changes, most of these central banks also make announcements when a no-change decision is made. However, not all give an accompanying statement of reasons (included in this category are the RBA and the Bank of England).[14]

14. In the Bank of England's case, there is not generally a statement of reasons for a no-change announcement, but one is sometimes provided if it is judged to be needed.

These comparisons suggest three points on which significant variations in practices exist across the major central banks. Two of these – the frequency of communication and the release of minutes and voting records – are discussed further below, while the third, concerning the role of inflation forecasts as a communication tool, is considered in detail in Section 4.

The first point concerns the handling of no-policy-change announcements, and the particular issue of whether they are accompanied by detailed explanatory statements. In economic terms this is probably best viewed as part of the broader question as to the optimal frequency of communication. In Australia's case, as noted above, the explanatory statements that accompany changes in policy give a broad and somewhat fuller summary of the prevailing situation than is typical of the equivalent announcements of some of the larger central banks. A practice of issuing similar statements for no-policy-change decisions would mean issuing them at the same frequency as Board meetings: that is, effectively moving to a schedule of monthly commentaries in addition to the (much more detailed) quarterly reports already produced.

The economic issue here is whether the flow of genuine new information is sufficient to justify that sort of frequency. One possible response to this question would be simply to take the view: the more communication the better. This view would argue that, since information reduces uncertainty, additional communication is always either beneficial to the public (and to financial markets) or, at worst, redundant if there is nothing of substance to communicate. However, in addition to the theoretical caveats to this view, most participants in the debate would accept that there is some limit to this argument in practice. No-one argues for weekly, daily or continuous commentary from central banks, so in principle there is some optimal frequency of communication. One important reason for this is that communication is imperfect and, therefore, inevitably noisy. The shorter the interval between communications, the less genuine information there is likely to be. At some point, excessive frequency of announcements risks generating more noise than signal.

It is not hard to think of instances where central banks have had to grapple with this problem. The recent experience of the Fed, for example, saw some delicate manoeuvrering when the time came to move away from the 'considerable period' rhetoric adopted in 2003.[15] The communication challenge for the FOMC during the early part of the 'considerable-period' period was to convey, essentially, that the policy assessment was not materially changing between successive meetings: in other words, to convey a lack of new information. In general, one way to approach this task would be to come up with an entirely new statement each time, aiming to create broadly the same impression with different words. However, this approach has the drawback of attracting attention to the changes in wording and inviting markets to read more into them than is really there. Presumably, this is why the FOMC opted for the alternative approach of sticking to a fixed form of words, though at the cost

15. This refers to the series of FOMC statements commencing on 12 August 2003 and continuing until 28 January 2004 which stated that the accommodative stance of policy would be maintained for a considerable period.

of generating even greater speculation about when and how the formula would eventually be changed. No doubt this kind of awkward communication challenge can never be entirely avoided, but it is at least arguable that problems of this nature can be amplified by communicating too frequently.

In the context of this debate, there is also an interesting empirical question as to whether an increase in reporting frequency would be likely to generate significant economic benefits in the form of a reduction in financial market uncertainty. In the Australian situation, where monetary policy statements appear quarterly, a simple approach to this question would be to ask whether the build-up of information between quarterly statements was generally sufficiently large that those statements would be expected to have a material impact on financial markets when released. If so, a move to more frequent statements would presumably allow that information to be incorporated into financial prices more quickly than under current practices. This question has been examined by Coppel and Connolly (2003) who show that, for maturities out to about two years, the average movements in short-term market interest rates on the days when a quarterly *SMP* is released are not much larger than on ordinary (non-*SMP*) days. So this evidence is not consistent with a significant accumulation of pent-up information between successive quarterly reports. This result is likely to reflect the existence of other reporting vehicles such as governors' speeches, parliamentary hearings and media releases that become available in the intervening periods.

The second point concerns the varying practices with respect to the release of minutes. This has been a subject of some debate in Australia and elsewhere, most notably in relation to the ECB. The debate concerning disclosure of minutes by the ECB is illustrative of the broad lines of argument. Observers such as Buiter (1999) have argued forcefully for disclosure of minutes and voting records by the ECB's governing council, based on a general appeal to principles of accountability and the public's right to be kept informed. In effect, this form of disclosure would shift the ECB system from one of collective accountability (through the ECB President) to one where each member would be individually accountable for his or her vote, as is the case with the Monetary Policy Committee (MPC) of the Bank of England. The argument against this form of disclosure has hinged on the possible effects it might have on the decision-making process. The ECB (Issing 1999) defends its current practice on the basis that disclosure of voting records would expose individual members of the governing council to pressure to vote according to their national interests rather than the interests of the currency area as a whole. While not universally accepted, it is widely acknowledged that this argument has merit. For example, Blinder *et al* (2001), though supporting a general presumption of disclosure in their overall approach to central bank communication, do not recommend release of minutes and voting records in the ECB's case.

In Australia the argument is slightly different, since there is no Australian counterpart to the multi-national structure of the ECB's governing council. The RBA situation is, however, unusual in another respect, in that policy is decided by a non-executive Board where the majority of members are not technical experts on monetary policy or engaged on a full-time basis in the policy process. These points were raised at one of the RBA's recent parliamentary examinations, with the Governor noting that the Board members are chosen to reflect the broader sectors of the community and could be exposed to pressure to vote on the basis of sectoral interests if their votes were disclosed.[16] Thus, while the situations of these two central banks are not the same, the general point that has been made in both cases is that questions about accountability and disclosure practices cannot be looked at in isolation from the governance arrangements of each institution. A disclosure practice that makes sense for a technically-focused monetary policy committee might not be well suited to alternative board structures.

4. The Role of Inflation Forecasts in the Communication Strategy

The third general topic that emerges from the comparisons outlined in Section 3 concerns the use of forecasts as a communication device. Some key characteristics of the forecasts published by advanced-country central banks are summarised in Table 3.

In this section we focus on two aspects in particular: the monetary policy assumption embedded in the forecasts, and the broader question as to the degree of prominence given to inflation forecasts in a central bank's communication strategy.

4.1 The policy assumption

The question of what policy assumption is built into the published inflation forecast has been much debated and, as argued below, can have a significant bearing on the way forecasts are used in central bank communication. As can be seen from Table 3, the vast majority of central banks construct their forecasts on an assumption that monetary policy is unchanged. The main exception is the Reserve Bank of New Zealand, which uses the alternative approach of assuming endogenous monetary policy and therefore providing a forecast for the path of interest rates along with the other macroeconomic variables (including the exchange rate).[17]

The clear preference for the no-policy-change assumption among central bank forecasters has continued, notwithstanding some criticism of that approach in the academic literature. One criticism is that the assumption is unrealistic and therefore non-transparent, since central banks will, in fact, generally expect interest rates to change over time (Martijn and Samiei 1999). There are two problems with this type of claim. The first is that, as often occurs in these debates, it uses the word 'transparent' as a synonym for 'good' instead of looking at the particular question on its merits. Secondly, the use of a technical assumption is not the same thing as

16. See the exchange in Hansard, House of Representatives Committee on Economics, Finance and Public Administration, 8 December 2003 (EFPA 9).

17. The Bank of England also has a second set of forecasts that assume interest rates follow the path embodied in current market expectations. The Bank of Canada uses an endogenous interest rate but does not publish its forecast for the interest rate path.

Table 3: Provision of Forecasts by Central Banks

Central bank	Variables forecast	Frequency	Time horizon	Presentation	Policy assumption
Federal Reserve	Nominal GDP Real GDP Inflation	Semi-annual	12–18 months	Range	No change
European Central Bank	GDP Expenditure Inflation	Semi-annual (quarterly from June 2004)	12–18 months	Range	No change
Bank of Japan	GDP Inflation	Semi-annual	12–18 months	Range	No change
Bank of England	GDP Inflation	Quarterly	2 years	Fan chart	No change
Bank of Canada	GDP Expenditure Inflation	Quarterly	18–24 months	Point	Endogenous
Reserve Bank of Australia	Inflation GDP	Quarterly Semi-annual	1–2 years	Point	No change
Sveriges Riksbank	Inflation GDP	Quarterly	2 years	Point and fan chart	No change
Reserve Bank of New Zealand	GDP Expenditure Labour market Inflation Interest rates Exchange rate	Quarterly	2–3 years	Point	Endogenous

Sources: central banks

non-transparency. If a decision-making committee does in fact make use of forecasts constructed on an unchanged-policy basis, then the release of those forecasts to the public is a piece of transparency.

A more serious point is the technical criticism of the no-policy-change assumption. The issue here is that well-designed forecasting models are generally either unstable or indeterminate when interest rates are permanently fixed; this reflects the Wicksellian point that under fixed interest rates the economy itself will be unstable. But while this technical point is acknowledged, its importance should not be exaggerated. It is not inherently at odds with sensible theory to assume interest rates can be kept fixed for a temporary period, and most forecasting models have no trouble accommodating this kind of exercise. Certainly central bank forecasters have not generally found the problems associated with it to be insurmountable.

Assuming these technical difficulties can be overcome, it may be conjectured that in many forecasting frameworks it would be possible to map the forecasts from one approach to the other, at least over shortish forecast horizons. For example, given a set of short-term forecasts about how the economy would evolve with unchanged interest rates, one could deduce how interest rates would need to move in order to achieve a desired alternative outcome. That, presumably, is the type of mental exercise a policy-making committee might go through in using a no-policy-change forecast to inform its decisions. Viewed in this way, the two alternative forecasting approaches can be seen as two ways of summarising the same information. The information that a change in interest rates is needed could be expressed either through a forecast showing the inflation rate diverging from the target under unchanged interest rates, or by a forecast of the interest rate moves required to keep inflation on track. Why, then, have the majority of central banks so clearly opted for the unchanged-policy approach?

One reason, emphasised by Goodhart (2001), is likely to be the complexity of getting any forecasting process to agree on a projected time path for interest rates that can be adequately explained to the public. It is true that such forecasts can be routinely produced from economic models. But any attempt to debate the basis of the interest rate forecasts outside a modelling framework, and to explain them to the public, is still going to beg the question of why interest rates have to move as projected. This in turn is likely to require some assessment of what would happen if rates were kept unchanged. If so, the practice of using endogenous-policy forecasts just adds a layer of complexity to an exercise that would still have to be done; or, if that first step is by-passed, it renders the process of arriving at the forecasts opaque and excessively model-dependent.

Another reason is that, even if it is agreed that the two approaches can convey essentially the same information, there are important presentational differences between them. In particular they are likely to convey different senses of the central bank's propensity towards activism. The conventional approach presents the rationale for a policy decision in terms of the counterfactual question: what would happen if interest rates were kept unchanged? In an inflation-targeting context, for example, it might explain a policy decision on the basis that inflation is expected to go off track in the absence of corrective action. This approach has the effect of framing the public discussion in terms of a presumption that interest rates stay unchanged unless the assessment of the economic outlook makes a case to the contrary. Presentationally, this is very different from offering a forecast based on a presumption that interest rates change, which is likely to convey a stronger sense of activism in the central bank's policy approach. Since the evidence is that central banks are in fact quite gradualist relative to model predictions (Clarida, Galí and Gertler 2000; Judd and Rudebusch 1998), the conventional way of presenting forecasts is likely to be more in keeping with the way policy is actually conducted.

Finally, there is also a more general question as to the degree of precision that a central bank might wish to convey in its published forecasts. This applies also to the assumption concerning the exchange rate, a variable that is notoriously difficult to predict. The principal reason for releasing forecasts is to help convey a central bank's thinking about the policy decision. The use of standard simplifying assumptions, as is the practice of most central banks, may well serve the purpose better than an approach that could be seen as providing false precision about the future paths for the interest rate and exchange rate.

4.2 Degree of prominence of the inflation forecasts

Much of the debate in the theoretical literature assumes that, in some sense, all central banks (or at least those with an independent monetary policy) have an inflation target. That is, if central banks are modelled as optimisers (which, in formal theory, they must be) then they must have some view of the optimum inflation rate that they are aiming for. Given standard structural assumptions about long-run neutrality, this parameter of the central bank's objective function will tie down the inflation rate in the long run. The debate in the US, as typified in recent speeches by Fed Governors Bernanke and Kohn, has been about whether this particular parameter should be revealed to the public.[18] This would be achieved by the Fed providing a numerical value for what it means by satisfactory price stability. As a proponent of an inflation target for the US, Bernanke argues that a numerical target would reduce uncertainty about future inflation and confer economic benefits through reduced premiums for inflation risk. The opposing argument is that a numerical target would make the Fed's communication less effective, by oversimplifying what are in fact a more complex set of objectives and encouraging an excessive focus on short-term deviations of inflation forecasts from the target. In other words, it would give the inflation forecasts too much prominence. Embedded in all this discussion is the idea that there is an optimal degree of emphasis on inflation forecasts in a central bank's overall approach to communication. So the question arises, how much prominence is enough?

The most extreme response to this question is what might be termed the 'sufficient statistic' approach to communication. This approach would assert that the job of monetary policy is to set the interest rate at the unique level which, given current circumstances and expectations, brings the forecast of inflation to the target over a fixed period of time ahead (say, two years). The central bank would simply calculate a two-year ahead inflation forecast under the unchanged policy assumption and, using an estimate of the responsiveness of the forecast to a change in the interest rate, could then determine the interest rate that would bring inflation to the target. So the inflation forecast would be a sufficient statistic for determining today's required policy decision, and for explaining its rationale to the public.

Probably no major central bank nowadays would say that this is how monetary policy is, or should be, conducted. However, the early rhetoric of inflation targeters did come close to asserting this position. Goodhart's retrospective observation as a founding member of the MPC makes this clear:

18. For a convenient summary of this debate, see the panel discussion session of the October 2003 Annual Conference of the Federal Reserve Bank of St. Louis, on the topic 'Inflation Targeting: Prospects and Problems'. As part of this session, Bernanke (2004b) argued in favour of the adoption of a formal inflation target by the Fed, while Kohn (2004) argued for maintenance of the status quo.

> When I was a member of the MPC I thought that I was trying, at each forecast round, to set the level of interest rates so that, without the need for future rate changes, prospective (forecast) inflation would on average equal the target at the policy horizon. This was, I thought, what the exercise was supposed to be (Goodhart 2001, p 177).

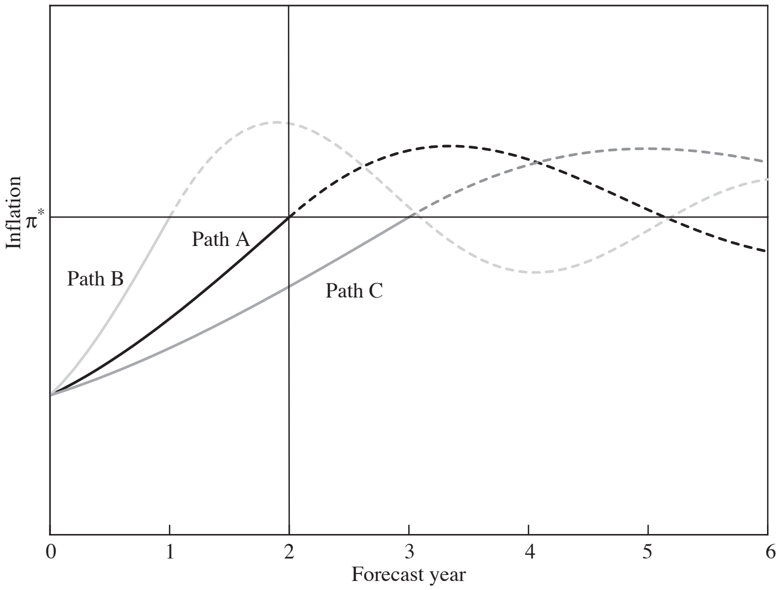
More recently, there has been greater awareness that this degree of conceptual simplification is too extreme. For one thing, there is nothing magical about a two-year forecast horizon. Central banks generally select a forecast horizon of about that length for pragmatic reasons – it reflects a view that this kind of horizon is long enough to allow for the lags in monetary policy, and is about as far ahead as forecasts can be made with any acceptable degree of confidence. Nonetheless, it is recognised (see, for example, Bean 2003) that a much longer horizon is potentially of interest to the policy-maker. Hence central banks need to develop ways of bringing into consideration factors that may be relevant to the policy decision but which would not fit into a conventional shorter-term inflation forecast.

A further point is that central bank mandates do not generally stipulate the attainment of inflation targets within a fixed time horizon. Generally they allow some degree of flexibility, though the degree of flexibility does vary. Australia's mandate (and also the revised RBNZ mandate) is at the flexible end of the spectrum, and specifies that monetary policy aims to achieve the inflation target on average over the medium term. The sufficient-statistic approach described above is clearly incompatible with this formulation. Since the target is expressed as an average, there will at any time be multiple paths for future inflation that would be consistent with it. This of course does not mean that policy is totally unconstrained, since only a course of action consistent with an expectation of achieving the target on average would be permissible.

The point can be illustrated using the following scenario. Figure 1 shows three hypothetical inflation forecasts associated with alternative (constant) settings of the policy interest rate, starting from a position where inflation is below the target. For the sake of argument it is assumed that the current level of interest rates is on the expansionary side of neutral, and generates path A, in which inflation is forecast to rise back to the target over a period of exactly two years. Thus the sufficient-statistic approach, applied using a two-year horizon, uniquely fixes the policy rate at its current level. An alternative forecast trajectory (path B), if interest rates were cut, would return inflation to the target more quickly (in, say, a year) while a small rise in interest rates would mean inflation taking longer than two years to reach the target (path C). Of course, all of these scenarios would eventually imply an unstable upward drift in inflation in the long run if interest rates were not changed further. Thus, there would have to be additional adjustments to policy over time that are not incorporated in the forecast assumption. But with appropriate corrective action in due course, any one of the alternative interest rates at the present point in time might be consistent with attainment of the inflation target on average in the medium term. The alternative longer-term paths might look something like those shown by the dashed lines in Figure 1.

How then should a central bank decide between these alternatives? In theory, an optimising central bank would need to take into account all available information

Figure 1: Alternative Forecast Paths for Inflation



affecting the probability distribution of the variables in its objective function (inflation and output) over the foreseeable future. So the aim would be to find the optimal path consistent with meeting the inflation objective on average. In practical terms this is likely to require taking several things into account. One is the trajectory of inflation at the end of the forecast period – is it rising, falling or stable? As noted by Stevens (2004), the interest rate that returns inflation to the target over some given horizon is not necessarily the one that keeps it there. So in some instances there might be a case for moving the policy rate now, even if the forecast end-point is at the target, to ensure that the inflation rate is not rising or falling too quickly when it gets there. Other considerations are those of macroeconomic stability, more broadly defined. Starting from a position where inflation is away from the target, the optimal speed of return will depend partly on what is happening to output, and also on the broader balance of risks to the economy, including those associated with asset and credit market developments. Elements of these considerations have entered into the policy decisions of the RBA in recent years, as documented in successive *Statements on Monetary Policy*. The general principle, which is recognised in the policy mandate, is that the inflation target is a medium-term constraint, not a deterministic formula that requires information outside the short-term inflation forecast to be ignored.

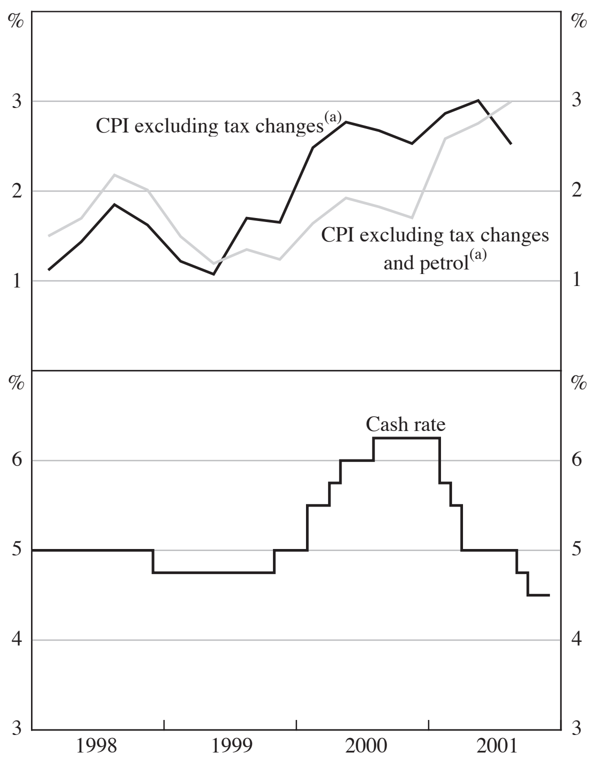
A specific point worth highlighting in this context is the relevance of the trajectory, in addition to the level, of inflation at the end of the forecast period. This is illustrated by two recent episodes in Australian monetary policy when the expected time path of inflation was being influenced by the temporary effects of large movements in the exchange rate.

The first episode was the period around the policy easing that occurred in late 2001. Some key features of this period are summarised in Figure 2, which shows data for inflation and the cash rate as they were presented in the November 2001 *SMP*. In the early months of 2001 the cash rate had been sharply reduced, by a total of 125 basis points. This occurred against the backdrop of global economic downturn and what was assessed in the first half of that year as a prospect of relatively low inflation in Australia, with underlying inflation expected to remain close to 2½ per cent (this was the forecast in the May 2001 *SMP*). By the second half of the year it had become apparent that the short-term outlook was for higher inflation than previously anticipated, reflecting a larger and more extended pass-through of the earlier exchange rate depreciation into consumer prices. The August *SMP* thus revised up the short-term inflation outlook to 3 per cent. The November *SMP* went slightly further, forecasting that underlying inflation would exceed 3 per cent for a brief period.

Clearly the decisions to lower the cash rate in September and October of that year were not the result of a purely mechanical response to short-run inflation forecasts.

Figure 2: Inflation and the Cash Rate

November 2001 *SMP*



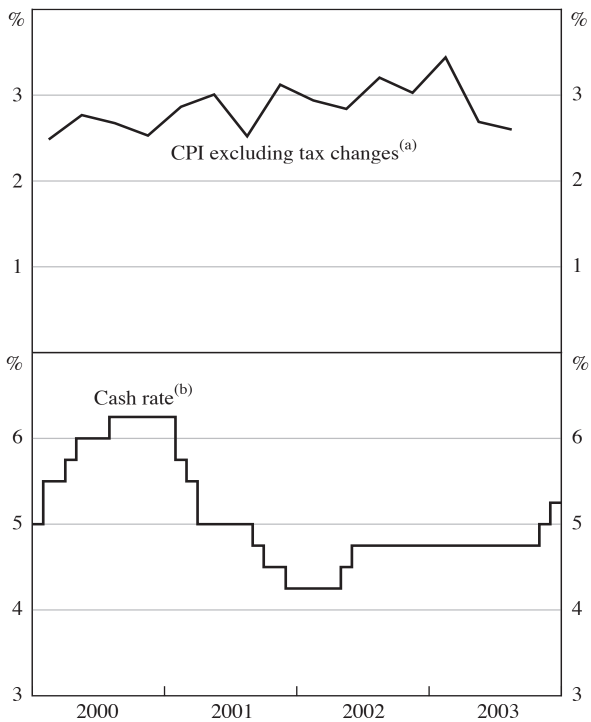
(a) Year-ended percentage change, excluding interest charges prior to September quarter 1998

Sources: ABS; RBA

While both the August and November *SMP*s forecast that inflation would decline from the expected near-term peak once the exchange rate effects faded, there was no suggestion that inflation would breach the target on the low side within a conventional forecast period. Rather, the rationale set out in the media statements accompanying the policy moves, and in the November *SMP*, was based on a combination of factors – the fact that inflation was expected to be declining in the latter part of the forecast period, and an assessment of more general risks to the economy, particularly those associated with the deteriorating economic situation abroad. In effect, a relatively benign inflation outlook beyond the near-term peak provided the flexibility for policy to respond to emerging risks to the wider economy.

The second episode, when monetary policy was tightened in late 2003, represents broadly the reverse of this situation. Some key features are summarised as before in Figure 3, using the data as presented in the November 2003 *SMP*. A feature of the second half of 2003 was that the short-term inflation forecasts were being revised downwards, as a consequence of the substantial appreciation of Australia's trade-weighted exchange rate over the previous year or so. The expected pass-through

Figure 3: Inflation and the Cash Rate
November 2003 *SMP*



(a) Year-ended percentage change
(b) Includes December 2003 change in the cash rate
Sources: ABS; RBA

of this effect into consumer prices produced a shallow U-shaped inflation forecast so that, in the forecast reported in November 2003, inflation was expected to dip to 2 per cent by mid 2004, subsequently rising to 2½ per cent by the end of the forecast period. Monetary policy, in the event, was tightened in two steps, by a total of 50 basis points in November and December.

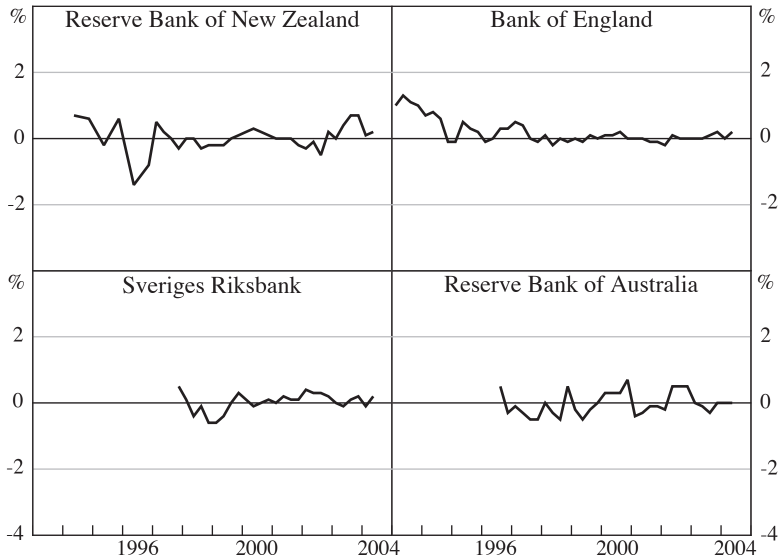
Once again, the rationale for these policy decisions was explained in terms of a broader set of factors than either the immediate (one or two quarters ahead) inflation outlook or the expected level of inflation at the end of the forecast period. First, the *trajectory* of inflation at the end of the forecast period was also clearly important. The explanatory announcements that accompanied the November and December decisions, and the subsequent discussion in the February 2004 *SMP,* emphasised that the immediate decline in inflation would be only temporary, and indicated that inflation would not only be back at the target midpoint, but also on a rising path, by the end of the forecast period. The second point was that prior to these decisions the policy stance had been highly expansionary. The implication of these two points was that, despite the expectation that it would decline in the short term, inflation would eventually exceed the target in the absence of corrective policy action. A third consideration presented in the Bank's policy statements was the run-up in house prices and credit. This situation risked becoming a significant destabilising influence on the economy, in ways that could not be readily incorporated in a conventional macroeconomic forecast. Finally, there was a strong global recovery underway by that time, improving the environment for growth of the Australian economy. These additional factors argued against persisting with a highly expansionary policy setting for too long, even though the expected movement in inflation above the target was still some way off.

The general observation suggested by these experiences is that it is unrealistic to expect an inflation forecast on its own to represent all of the information that policy needs to take into account, even though it is obviously an important component of it. The prominence given to inflation forecasts as a communication device is thus closely tied to questions about the specification of the policy framework itself. A heavy focus on inflation forecasts in the communication strategy is likely to be a more natural fit with regimes where the target is relatively tightly specified (that is, with narrow bands, relatively low tolerance of deviations from the target, and little emphasis on broader stability objectives). It will be less well suited to more flexible regimes which are more tolerant of short-run inflation variability and give greater weight to broader macroeconomic stability goals.

That said, it is at least open to question whether the different policy regimes are as different in practice as their rhetoric implies. The comparisons presented earlier in Table 1 show that macroeconomic performance across a range of advanced economies has become much more similar in recent years than it was in the two previous decades. This may well be partly a result of common structural changes or changes in the nature of the shocks now occurring. But it is also plausible that, notwithstanding differences in rhetoric, monetary policies have become more similar. Particularly noteworthy is the degree of similarity in inflation performances, a result which is suggestive of similar degrees of tolerance to variability of inflation around what are seen as desirable levels.

Finally, it is interesting to note that there is a high degree of similarity across countries in the inflation forecasts themselves. The statistical characteristics of published inflation forecasts for a group of inflation-targeting countries are summarised below in Figure 4 and Table 4. What this information shows is that the forecast deviations of inflation from target are generally very small. In all these countries, inflation is virtually always forecast to be inside the target range at the end of the forecast period, and there are only two instances (in a total of 142 forecasts) of central banks forecasting that inflation would be outside their targets at that horizon.

Figure 4: Central Bank Inflation Forecasts
Deviation from target, percentage points



Note: see Table 4 for notes

A pattern of inflation forecasts that closely hugs the target is open to several possible interpretations. One is that inflation itself is much more stable than it used to be, and inflation expectations much better anchored. This being the case, inflation forecasts should broadly reflect that characteristic: if inflation rarely breaches the target, it seems to make sense that it will rarely be forecast to do so. There is no doubt a degree of validity in this. The difficulty, however, is that in most countries, inflation is forecast on the basis of unchanged policy, and so the forecast will not include the stabilising influence of the future policy actions that help to keep inflation on track. So unless policy is close to its optimum when the forecast is made, a diverging inflation path should be expected. This suggests a second possible

Table 4: Statistical Characteristics of Central Bank Inflation Forecasts

	Period beginning[(a)]	Number of forecasts in sample	Average difference between farthest-horizon forecast and target (ppts)	Average absolute difference between farthest-horizon forecast and target (ppts)	Number of predicted breaches of target range	Number of predicted deviations from target midpoint greater than 0.5 ppts
UK	Aug 95	35	0.10	0.15	0	1
Canada	Jan 03	6	–0.08	0.08	0	0
Australia[(b)]	Aug 96	32	–0.02	0.27	1	1
Sweden	Dec 97	27	0.03	0.21	0	3
NZ	Feb 91	42	0.09	0.32	1	9

(a) For New Zealand, Sweden and Canada, the table covers the period since the central banks began publishing their inflation forecasts. For the UK, we commence in August 1995 when the revised reporting range for RPIX inflation was adopted. For Australia, the starting point is the RBA's first quarterly statement following adoption of the Statement on the Conduct of Monetary Policy (1996).

(b) Australian data in this table are calculated from unpublished point forecasts that underlie the inflation outlook presented in the RBA's quarterly *Statements*. The forecasts refer to underlying inflation excluding tax effects.

Sources: central banks

interpretation, namely that policy settings generally are, in fact, judged to be close to their conditional optimum at the time when forecasts are made. This would mean that with unchanged policy, inflation is usually not expected to deviate greatly from the centre of the target. Again, there is likely to be some validity in this. If a central bank was in a position where it could confidently forecast inflation to go seriously off track, policy would already have been changed. A third possible interpretation is just that inflation is hard to forecast and so, given limited information, it is hard to come up with a medium-term forecast of inflation too far away from its statistical mean. It may, indeed, be particularly difficult to do so if a strong policy signal is likely to be inferred from such a forecast.

The point of making these observations is not to argue against forecasts *per se,* but merely to comment on the weight given to them as a communication device. Inflation forecasts in practice are highly stable around their targeted values, as the preceding discussion shows. Whatever interpretation is put on this fact, it seems unrealistic to expect an inflation forecast to do the work of an all-encompassing summary statistic for monetary policy.

5. Conclusion

Much of the commentary in support of transparency as a general principle is just common sense. Monetary policy communication needs to be open and effective. And there is no doubt that central banks have taken big steps over the past decade or so to become more informative about their goals, their operations and the way they think. Notwithstanding these trends, ongoing differences in communication practices across central banks remain a subject of debate. These differences can be classified as relating to either the process of communication or the substance of what is communicated.

Empirical studies of the effects of central bank communication practices have focused to a large extent on matters of process (that is, on the type of reports produced, their frequency, the availability of committee minutes and the like) and have attempted to identify how these might affect economic outcomes. The most direct effects are likely to be those on interest rate uncertainty, and here the evidence suggests two things. First, the increases in transparency over the past 10–15 years have reduced interest rate volatility virtually everywhere. Second, despite remaining differences in communication processes across central banks, the differences in outcomes now are not large. For example, Australian interest rates are about as predictable as those in the UK, the US and a range of other countries. So it would be difficult to build a case on these grounds to say that currently existing differences in communication practices are having material economic consequences.

Regarding the substance of what is communicated, we argue that the key area of difference among central banks concerns the role given to inflation forecasts in the communication strategy. Economic theory has suggested that a heavy emphasis on inflation forecasts, in combination with other features that enforce a tight pre-commitment to inflation control, may be useful in building credibility for a newly established policy regime. But experience also shows that monetary policy in practice needs to take into account a broader range of information than can be summarised in an inflation forecast. If so, an excessive focus on inflation forecasts as a communication tool may be misleading or unhelpful in explaining the rationale for policy decisions, or may contribute to a costly loss of flexibility.

The balance between these considerations will depend on the extent to which the specific credibility-building features of the policy regime (namely, the heavy focus on inflation forecasts and pre-commitment devices) remain a priority once low inflation expectations have been established. It is not surprising that, after the ‘lost decades’ of the 1970s and 1980s, many central banks adopted these features to try to assist in the process of re-establishing their anti-inflation credibility. But with that battle largely won, central banks may find that they are now able to give greater weight to the broader stability objectives of monetary policy without compromising longer-term inflation control.

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Discussion

1. John Edwards

In reflecting on the theory and practice of central bank transparency and communication Malcolm Edey and Andrew Stone have come up with a subtle, interesting assessment which moves convincingly from issues of presentation to issues of substance. I want to focus my comments in two areas. The first is whether the current Reserve Bank of Australia (RBA) arrangements in respect of transparency and communication are the best that can possibly be devised, given the institutional framework. The implication of Malcolm and Andrew's treatment is that they are, and I am not sure this is so. The second is in the wider area which Malcolm and Andrew open up in the fourth part of their paper. This is the big question of how the Bank's inflation target should now be interpreted by the market. This is one of the central issues raised by the whole conference, and I think Malcolm and Andrew have much to contribute. In particular their description of the RBA's inflation target as a 'medium-term constraint' will, I think, be remembered, referenced and pondered for some time to come.

There is no doubt that the RBA is more transparent and communicates very much more effectively today than it did a decade ago. As the authors rightly remark, the introduction and gradual development of the quarterly *Statement on Monetary Policy*, the twice-yearly appearances by the Governor and other RBA officials before a parliamentary committee, the statements which accompany interest rate changes and – just as importantly – the greater candour and directness of speeches by RBA officials, have created a mass of material which now offers a good guide to the RBA's assessment of Australia's economic circumstances, the issues which it thinks will and won't be important, and the kind of data which might bear on monetary policy decisions. It does not of course reliably tell us what the RBA will do, but it does tell us how the RBA thinks economic circumstances will evolve, and how it might respond to some specified developments. In other words, it tells us as much about the future as the RBA itself knows. There are as yet no detailed forecasts. Except in the twice-yearly Parliamentary Committee appearances by the Governor, the RBA still seems wary of offering a numerical GDP forecast – partly perhaps because it might differ from that offered by Treasury. But it does now offer an explicit inflation forecast.

There are, as Malcolm and Andrew say, several purposes or rationales for communicating more material about the views of the RBA. One is that the RBA now has a conditional independence under which it exercises large powers. Accountability requires it to accept an obligation to be as transparent as possible and open to scrutiny, and is the necessary condition of the great powers it exercises. It is also highly likely that monetary policy will, over the long term, be more effective if other participants in the economy know the central bank's goals, time frame, style, and methods of work. It is not possible, for example, to anchor inflation expectations if there is widespread uncertainty about the real goals of the central bank. This is true of the inflation target, but it is also true of other issues pursued by the RBA – for example, its warnings about house price inflation. It is equally important to know what are *not* targets of the Bank – for example, the current account deficit, or temporary inflation 'blowouts' caused by oil price increases. I think it would be impossible to conduct policy now if the Bank was secretive or circumspect or misleading in respect of its goals, which is why the debate about the cleverness of conducting business through monetary policy 'surprises' is one for the journals and modellers alone. A third rationale for transparency is specific to financial markets. It is probably true that interest rates and currencies will be less volatile if the policy approach of the central bank is always well understood, and it is probably true that lower volatility is good for economic efficiency. Financial market deregulation has gone hand in hand with both the increasing authority of central banks, and with their increased transparency. It is difficult to imagine a secretive or deceptive central bank coexisting with very large and highly deregulated financial markets, though the European Central Bank is arguably testing the proposition.

These rationales are listed here to make the point that transparency is no longer discretionary, or voluntary. It is not a gift of the central bank. It is true that it is not a statutory requirement of the RBA, but it is an operational requirement. If this is so, then the more transparency the better, so long as the degree of transparency is consistent with the ability to make decisions effectively.

Is the current degree of transparency enough? I think not. It is not at all clear to me why the RBA cannot publish a summary of discussions at board meetings, and the material which is offered to the board to guide its decisions. At the very least, the RBA should be able to publish a résumé of the discussion, as the US Federal Reserve System now does in respect of the deliberations of the Federal Reserve Open Market Committee.

The RBA has an unusual institutional arrangement in that monetary policy decisions have to be approved by a board. The purpose of the Board has always been to make it harder for governments to exercise control over the money supply. The Board is not intended or required to be a group of monetary policy experts. It is not representative of the community nor is it meant to be. Nor is it representative of business. It does not, for example, include a representative from a media or telecommunications business. By law it cannot include a commercial banking representative. The Board members are selected by the government of the day, with no clear criteria. The function of the board these days is still to help protect the independence of the RBA from day-to-day influence by the government. Because of its composition, in practice it also works as a reality check on RBA recommendations, and a sounding board for the Governor. It does not value technical competence in monetary policy but experience in business leadership. My impression is that these days the ideal board member is someone who has long and successful experience of applying common sense to judgements about the future course of events, and who is not awed by the esoterica of monetary policy. The characteristics of the Board probably contribute quite a lot to the qualitative rather than quantitative style of the RBA, and its pronounced preference for commonsense, judgement, experience, balance and economic insight over econometric work and technical brilliance.

As it happens, there are quite a few excellent people on the Board who can make a contribution to an assessment of the state of the local and global economy. But if the Board is important, why are its deliberations shrouded in secrecy? It is not the board of a business which is in competition with others. It is the Board of what is effectively a monetary policy authority, and it is charged with making the decisions about monetary policy in Australia. Malcolm and Andrew suggest that if the Board's deliberations were published, members would be obliged to argue for the industries which they represent. I think it is very unlikely that board member and global shopping centre developer Frank Lowy, for example, would argue for the property industry if his role in the Board's deliberations was published, and not if it wasn't. Surely the same applies to all board members of substance. One might say that publication of this material would work the other way – board members whose contributions were exposed to view would be wary of peddling an industry line.

Publication of the minutes or a résumé of the minutes would serve several purposes. It would guide markets and the wider public to the nature of the monetary policy debate. This is often not as apparent as it could be. The RBA *Statements* and so forth, after all, offer only one viewpoint. Even where there are disagreements within its leadership, they are obscured or resolved in the process of drafting the material. But we know there will be different interpretations of the data, different views about the state of the local and global economies, different ideas about what is important and what is not at any particular time. It would be useful, therefore, to know the flavour of the discussion on the Board. It would mean fewer surprises for markets because markets would be more aware of the ranking of the probabilities of alternative policies, and the balance of opinion on the Board. It would enrich the economic debate.

But it would not only be useful to the markets and the public. It would also be useful to the Bank. It would impose a stronger discipline on board discussions. It would make it very difficult to introduce parochial concerns or irrelevant anecdote or political prejudice. It would elevate the discussion. It would better protect the independence of the Governor from the government by precluding political considerations or Treasury views from having too much influence.

What is really involved in releasing board minutes or a résumé of discussions is breaking the monopoly the RBA executive now exercises over the central bank's take on the economic debate. In the US, we not only have résumés released, we also have speeches by the FOMC members. Quite often those speeches will enlarge the debate, without contradicting the leadership of the Fed. In Australia, résumés are not released, and board members other than the Governor and Deputy Governor are discouraged from publicly offering economic views.

The minutes or a résumé of discussion would be very much more useful if published together with the material presented to guide the Board's decisions. This could include such forecasts as are used by the Board. Some of this material is now published in the *Statements* and some is in the publicly available chart pack, but the full range of material presented to the Board would also be interesting. The RBA should, by now, be quite unconcerned that on occasion its forecasts for GDP, for example, may sometimes be different to those of Treasury.

I have no doubt it would improve understanding of, and interest in, monetary policy, and that sooner or later it will happen. There is no push to further open up the RBA today because Australia is now in the 14th year of uninterrupted low-inflation expansion, and the RBA can claim some credit for that. Sooner or later there will be bad times, however, and that is when the pressure for changes will mount.

I think minutes or résumés of discussion could be useful and important. By contrast, I think detailed forecasts of GDP components and so forth are not important. What really matters in assessing the economy and the likely path of interest rates is the story rather than the projected numbers. Numbers without a story are quite useless. We know from our own experience that Treasury or RBA forecasts, or our own numerical forecasts, rarely pick up the big changes in investment, equity prices, capital flows, currencies, interest rates or the political framework which make a real difference. That is why most serious discussion is framed as risks to a forecast and why the medium-term story, with its risks and possibilities, is the heart of forecasting. Of course it is difficult to separate the story from the numbers. If one thinks it is highly likely, for example, that housing construction will fade in the coming year and that exports will increase, it is important to put some numbers around it. But the numbers are illustrating a view – they are not the view.

I turn now to the much bigger issue raised by Malcolm and Andrew, which is also the issue underlying this whole conference. How should we interpret the central bank's inflation target? We are reflecting on well over a decade of low inflation in most OECD economies. The excellent inflation outcome compared with earlier decades no doubt owes a good deal to the anchoring of inflation expectations by central banks, but it was also assisted by supply-side developments which have nothing to do with central banks. This is part of the 'divine coincidence' which Ken Kuttner referred to in his paper. In Australia, low inflation was brought about by the reforms of the eighties and the early nineties, and the unintended deep recession of 1991, which for Australia was the equivalent of the Volcker deflation of the late seventies and early eighties. There are also global influences. These include a halving of the real price of oil over the last decade, constant downward price pressure in manufacturing as the labour force of China engages in the world economy, the lower barriers resulting from the Uruguay Round and unilateral reductions in protection, cheap computing and telecommunication and all the technologies associated with them, and the upswing in productivity growth in the US, Australia and some other economies, which is probably related to cheap computing and telecommunications, as well as the more flexible labour market and other reforms in Australia. It is also the case that for the developed economies, most of the unfavourable shocks over the last decade have been on the demand side – the Asian financial crisis, the LTCM/Russian crisis, the crash in IT and telecommunications equities, September 11, and the Iraq war. In the developed economies, these crises posed the risk of lower output growth and lower inflation simultaneously. In each and every one of these the obvious and clear response was for central banks in Australia, the US, and Europe to lower interest rates.

In those sorts of circumstances it would at least have been possible to think of the inflation target the way in which Goodhart apparently did think of it, as quoted by

Malcolm and Andrew. In the early years of the Bank of England Monetary Policy Committee he saw it as a literal and sole target to be achieved within a definite and known time frame. Judgement was important, but only in estimating the path of the policy interest rate likely to see the target achieved at the date required.

We should assume that in coming decades central banks will sometimes be faced with the more typical unfavourable supply-side shocks, which threaten both lower output growth and higher inflation. In Australia, for example, one might see lower labour productivity growth. Globally, one might see sharply higher oil prices or gradually rising manufacturing costs as the value of labour in China rises. It is also true that inflation targeting has been complicated by asset-price bubbles. We have already seen that continued low inflation and low interest rates can give encouragement to inflation in equity or house prices which can become speculative and which can in various ways cause economic contractions when the bubble bursts.

In these circumstances, insistence on achieving an inflation target and only an inflation target, and achieving it only within a specific and defined time frame, would see the whole theory and practice of anti-inflation targeting and perhaps independent central banking collapse, after what would be a stormy period of debate. Malcolm and Andrew's paper is really important in laying out the ways central banks generally, and the RBA in particular, are redefining what the inflation target might be interpreted to mean. As they argue, 'central banks need to develop ways of bringing into consideration factors that may be relevant to the policy decision but which would not fit into a conventional shorter-term inflation forecast' (p 90). This might mean, for example, that inflation should return to target after some permitted deviation, and over a longer time frame. This is how one imagines the RBA would respond to a sharp and prolonged increase in the oil price. It may mean an understanding that there will be quite sharp changes in interest rates to deal with the growth of an asset bubble or its aftermath, even though forecast inflation through the period is within target. It may mean, in the case, for example, of a decline in labour productivity growth in Australia with perhaps some coincidental increase in wages growth, that the central bank departs entirely from the notion of an independent focus on inflation alone and proposes or accepts working within a framework which includes fiscal and incomes policy as well as monetary policy. All these outcomes are surely possible, and it will be no response at all for a central bank to say that inflation is its only responsibility. We have not even considered here the scope for even bigger events, such as some problem in the Australian banking system, which would require an immediate and massive response led by the RBA, but which would have to involve the Commonwealth Government and quite possibly other central banks and foreign governments as well.

Given these considerations, Malcolm and Andrew make two points, which I think are quite important statements. They are not entirely new but they are well expressed, and offered with authority. The first is that 'The general principle, which is recognised in the policy mandate, is that the inflation target is a medium-term constraint, not a deterministic formula that requires information outside the short-term inflation forecast to be ignored' (p 91). The second is that 'The general observation suggested by these experiences is that it is unrealistic to expect an inflation forecast on its own to represent all of the information that policy needs to take into account, even though it is obviously an important component of it' (p 94). These statements seem to me to helpfully clarify how we should think about the RBA interpretation of its mandate. To think about the inflation target as a constraint rather than as a goal, and a constraint that can, if necessary, be met within a flexible time frame, leaves plenty of room to pay attention to asset prices when necessary, growth and employment when necessary, to large discrepancies between headline and underlying inflation, and to other complicating issues which will no doubt come up from time to time in the decade to come. But in reinterpreting the inflation target in a broader and richer way we also need to recognise that the requirement for communication and transparency will increase. If asset prices are going to be important at various times we need to know how important, and in what circumstances. If the time frame for returning to the midpoint of the inflation target is to be extended, we need to know how far, and for what reasons, and how progress towards the other goals of policy are to be assessed. There is otherwise a danger of drifting back to a 'checklist' approach, in which the weight and priority and urgency of various goals is undefined. Since most of the new issues will not lend themselves to quantitative forecast, the nature of the monetary policy debate will be increasingly important – and that strengthens the case for publication of board discussions, and perhaps changes in the nature of the Board itself.

2. General Discussion

One participant argued that any review of the appropriate extent and form of transparency and communication should start with a recognition of the success of inflation targeting in Australia and elsewhere, especially when considered alongside the difficulties experienced with earlier monetary policy regimes (such as monetary targeting), and the initial uncertainty about the likely success of inflation targeting. While there had been an element of good luck, with the absence of significantly adverse supply shocks, some of the shocks experienced in recent years – such as the Asian financial crisis and the worldwide recession of 2001 – did not seem all that minor when they occurred. Looking ahead, another participant pointed to the challenge of embedding considerations of asset prices within the general inflation-targeting framework. This was important to avoid giving the impression that the central bank was abandoning the framework. This challenge was similar in some respects to earlier efforts of the RBA to communicate how movements in the exchange rate should be considered in the context of a flexible inflation target, rather than being mistakenly perceived as somehow being outside the framework.

As with Rick Mishkin's paper, there was some discussion about the implications of releasing the minutes of the central bank's policy committee. One participant noted that this decision could not be divorced from the exact role of the policy committee, or the composition of that committee. This was clearly related to the broader issue raised by a number of participants regarding the potential trade-off between greater disclosure of a central bank's internal discussion and the quality of that discussion.

On the same theme, one participant thought that an important factor in any decision to release minutes was whether it was desirable to encourage personal accountability or collective responsibility for decisions of the policy committee.

There was considerable discussion of Figure 4 in Edey and Stone's paper, which showed the (relatively small) deviations of inflation forecasts from the target for the central banks of Australia, New Zealand, Sweden and the United Kingdom. As a number of participants noted, these results were surprising given that only the Reserve Bank of New Zealand presented its inflation forecasts on the basis of an endogenous projection for interest rates. One participant suggested that this general result might be explained by the actual publication of forecasts, which may tend to constrain forecast values to be close to the target, while another participant suggested that it implied that central banks' forecasts were being made from a position where the interest rate was already close to its neutral level. In either case, the proximity of inflation forecasts two years out to the target had implications for any lengthening of the inflation-targeting horizon. While it is important, conceptually, to think further than two years out, if the central bank believes it will hit the target in two years it is difficult to comprehend how it should take longer-term events into consideration when deciding the appropriate stance of monetary policy today.

There was also some discussion about the implications for inflation-targeting regimes of the establishment of inflation expectations at low levels. In Australia's case, one participant suggested that this had given the RBA the flexibility to deal with the shocks it had faced in recent years, such as the Asian financial crisis. Another participant argued that inflation targeting was akin to a policy approach of constrained discretion. It was suggested that constraining mechanisms are important for building credibility when the central bank was trying to signal a clear regime change and to lock in low inflation expectations. Once that was firmly in place, the wider objectives of monetary policy could become a larger part of the emphasis. In other words, there was scope for more discretion.

News and Interest Rate Expectations: A Study of Six Central Banks

Ellis Connolly and Marion Kohler[1]

1. Introduction

Central banks around the world have become considerably more transparent over the past decade. An important part of this has been the increased efforts by central banks to communicate their views about the economic outlook and its implications for monetary policy. On an abstract level, if a central bank was operating a fully transparent monetary policy rule, market participants would only require macroeconomic news to anticipate future changes in monetary policy. However, in practice, policy-makers must deal with uncertainty and structural change, which requires them to use some discretion in formulating policy. No policy framework can specify how the policy-maker should respond to every possible contingency. Therefore, there is a role for central banks to regularly articulate their thinking to help market participants filter macroeconomic news.

There is a substantial body of academic work on the theoretical and empirical aspects of monetary policy transparency. In a recent study, Coppel and Connolly (2003) found that the predictability of monetary policy is very similar across a panel of central banks in developed economies, possibly reflecting similarities in central bank communication strategies. Our study expands their results by asking which channels of communication influence expectations of future policy. One approach to address this question is to examine empirically the effect of different channels of central bank communication on financial market expectations of future interest rates. Of course, the impact of monetary policy communication has to be judged in the light of other news events, which can have a much larger effect on the market, such as international developments, domestic macroeconomic data releases and monetary policy decisions themselves. In this paper we therefore estimate the impact of four types of news on interest rate expectations: domestic macroeconomic news, foreign news, monetary policy surprises and central bank communication.

The effect of macroeconomic news and policy decisions on interest rate expectations has been the subject of a number of event studies that investigate what moves interest rate futures, in which interest rate expectations are embedded. The widely used approach in this literature is to estimate the daily change in interest rate futures as a function of macroeconomic and policy surprises. However, it is more difficult to measure the impact of monetary policy communication on interest rate futures. The main reason is the difficulty of quantifying the information content of,

1. We would like to thank Christopher Kent, Mark Lauer, Anthony Richards and seminar participants at the Reserve Bank of Australia for valuable comments. Of course, all remaining errors are ours.

for example, a speech in a one-dimensional measure. It is even sometimes difficult to establish the direction in which a certain communication event should influence interest rate expectations. One way of measuring the impact of policy news, irrespective of the direction of movement, is to examine its effect on the variance of interest rate futures on the day. Both elements – the effect of macroeconomic and monetary policy surprises on the change in interest rate futures and the effect of central bank communication on the variance of interest rate futures – are combined in the GARCH-type model applied in this paper.

A few papers have empirically examined this issue for individual economies, such as a recent study for the United States by Kohn and Sack (2003), and for Australia by Campbell and Lewis (1998). In this paper we apply a framework similar to that suggested by Kohn and Sack to a panel of economies (Australia, Canada, the euro area, New Zealand, the United Kingdom and the United States), which allows us to compare central bank communication channels across different institutional frameworks.

Our results suggest that central bank communication is not a large contributor to overall movements in interest rate futures. We find that the important channels of communication add only a few basis points to the standard deviation of rates on the days on which these communication events occur, which is a small minority of trading days. In comparison, across all trading days, the standard deviation of daily changes in the futures rates averages around 6 basis points for our panel of economies. Domestic and foreign macroeconomic news events that we examine occur on a majority of trading days and make a much larger contribution to the variance of changes in interest rate futures. This pattern holds across all economies.

While the effects of central bank communication are generally small, we find that they increase the standard deviation of interest rates on the day on which the communication occurs, as a result of providing new information to the markets. Among the different types of communication, commentaries following rate decisions, monetary policy reports and parliamentary hearings are found to have the greatest influence on expectations for future policy in the economies examined. Speeches, on the other hand, have typically much less of an impact.

The remainder of the paper is structured as follows. The next section reviews some conceptual considerations on how news affects interest rate expectations of financial markets. Section 3 discusses the data and some preliminary empirical evidence of the link between news and interest rate futures, followed by the estimation of a full-scale model in Section 4. Section 5 concludes.

2. News and Interest Rate Expectations: Some Conceptual Issues

Many asset prices incorporate, among other factors, expectations about the future path of monetary policy. The most direct measure of expected future policy rates are interest rate futures, since these incorporate expectations of market interest rates, which are closely linked to the policy rate over the short to medium horizon. Over this horizon, movements in interest rate futures mainly reflect revisions in market expectations regarding the future path of monetary policy.[2]

The efficient market hypothesis suggests that interest rate futures incorporate all relevant information about future interest rates that is available at any point in time. As a consequence, a variable that can be forecast perfectly will have no measurable effect on changes in interest rate futures. This, however, does not mean that the variable is unimportant for monetary policy setting, but it means that expectations will not significantly change following the release of news on such a variable. As a result, the literature on the movement of financial markets in response to news releases usually focuses on the surprise element in the data (see, for example, Fleming and Remolona 1997).

Potentially, any type of news event that can convey information on the future path of monetary policy can affect interest rate expectations. For example, the yield curve should be influenced by both policy-related events such as meetings of the committee or board that sets policy rates and by the release of macroeconomic news. Central bank communication more generally can provide new information to the extent that it helps the markets to interpret the relevance of macroeconomic developments for the decision-making process. Consequently, in this paper we look at four types of news:

- domestic macroeconomic news, comprising domestic macroeconomic data releases;
- foreign news, comprising data releases and policy decisions in important international markets;
- monetary policy news, that is (domestic) monetary policy decisions; and
- central bank communication, including regular reports, parliamentary hearings, press releases, minutes of meetings and speeches.

Estimating the effect of macroeconomic news on interest rates is relatively straightforward. The widely used approach in the event-study literature is to estimate the daily change in the interest rate futures as a function of macroeconomic surprises (see, for example, Jansen and de Haan 2003, and Kohn and Sack 2003). The surprise element is measured by taking the difference between the actual outcome of macroeconomic news releases and the outcome expected in a survey of market economists.[3]

2. In principle, a change in interest rate expectations can reflect two different channels: revisions of expectations about monetary policy settings, or revisions of expectations about the monetary policy framework, which in turn affects expectations about long-run inflation. We would expect the former to affect interest rate futures at the short to medium end of the yield curve, while the latter is more relevant for expectations of longer-term nominal interest rates. In this paper, we concentrate on the short- to medium-term expectations of interest rates, and, therefore, on news that is relevant for an assessment of monetary policy conditions over that period.

3. Many financial time-series studies use tick-by-tick data to examine the impact of a specific event, instead of daily data. This has the advantage of being able to more easily identify the source of interest rate movements if more than one news event occurs on the day. However, this was difficult in our study for several reasons. First, a number of our communication variables, such as parliamentary hearings or speeches, have no specific time when the information content is released. Second, interest rate futures markets are not always liquid enough to examine tick-by-tick data. Finally, given the scope of our dataset, with a large number of news releases across six economies, establishing the exact timing of all data releases and communication events was not feasible.

Developments in important foreign markets, especially the US, appear to have a major impact on all asset classes in other economies. Consequently, in a number of studies foreign news has been identified as an important determinant of domestic interest rate futures. Some of these studies account for foreign news by explicitly considering the effect on domestic interest rate futures of foreign policy decisions and a number of selected foreign data releases (see, for example, Campbell and Lewis 1998, and Gravelle and Moessner 2001). Others have modelled domestic and foreign interest rate futures jointly, thus accounting for linkages between economies (for example, Ehrmann and Fratzscher 2002, and Kim and Sheen 2000). In this paper, we assume that any important development in the foreign market must be reflected in a change of the foreign interest rate futures. These changes in foreign interest rate futures can therefore be seen as a proxy for both foreign macroeconomic data releases and foreign policy surprises.

Estimating the effect of monetary policy surprises on interest rates has been the subject of numerous studies on the predictability of monetary policy (see, for example, Bomfim and Reinhart 2000, Haldane and Read 2000, Kuttner 2001, Lange, Sack and Whitesell 2001, Muller and Zelmer 1999, and Ross 2002). In these studies, monetary policy surprises are typically defined as the change in the 30-day interest rate on the day of announcement, which is shown to be very closely related to the change in the expected policy rate over the following month. In a recent study, Coppel and Connolly (2003) compare the predictability of monetary policy across a panel of central banks. Table 1 replicates their results, updated to June 2004, the endpoint of the dataset used in our study. The coefficients reported measure the response of the 30-day interest rate to monetary policy moves. A coefficient of zero implies that monetary policy is, on average, fully predictable, and there are no policy surprises. A non-zero coefficient measures the size of the surprise element per basis point increase in the policy rate, on average.

The results confirm Coppel and Connolly's conclusion: the predictability of monetary policy is very similar across these central banks. This suggests that, despite differences in the communication framework, central banks in these economies convey information to financial markets to a very similar degree. Our study expands on these results by looking in more detail at the different communication channels that influence financial markets' expectations of future monetary policy.

Table 1: Market Response to Monetary Policy Moves

Same-day change in 30-day interest rates, January 1999–June 2004

	Australia	Canada	Euro area	NZ	UK	US
Change in market	0.16^{***}	0.18^{***}	0.25^{***}	0.21^{***}	0.32^{***}	0.19^{*}
interest rate	(0.06)	(0.05)	(0.09)	(0.07)	(0.08)	(0.11)

Notes: Updated results from Table 2, Coppel and Connolly (2003). The coefficients are based on a regression of the daily change in the 30-day interest rate on the changes in the policy rate. Numbers in brackets are the standard deviations. *** and * denote coefficients that are significant at the 1 and 10 per cent level, respectively.

Estimating the effect of central bank communication on expectations of monetary policy has been the subject of only a few studies. While there is a substantial body of theoretical literature (for recent reviews of the literature, see Geraats 2002 and Hahn 2002), the empirical literature on this topic is relatively recent, partly because it is difficult to measure the impact of monetary policy communication on interest rate expectations. To determine the effect of communication on interest rate futures directly would require a measure that can summarise and quantify the information contained in a communication event. However, sometimes it might even be difficult to establish the direction in which a certain communication event should influence interest rate expectations. One way of measuring the impact of policy news, irrespective of the direction of movement, is to examine the variance of interest rate futures on the day, since any change in the mean will also affect the variance on the same day. A specific type of communication can then be associated with a dummy variable that can take the value of one on days where such a communication event happens and zero otherwise.[4] This approach is consistent with Kohn and Sack (2003), who look at the effect of communication on expectations in the US, Chadha and Nolan (2001) who examine the UK, and Campbell and Lewis (1998) who include an 'RBA commentary' variable in their study of changes in Australian interest rate futures.

An interesting question is whether increased variance on the day of central bank communication should be viewed as good or bad. While Chadha and Nolan characterise higher variance as bad, Kohn and Sack assume that increased variance is evidence that central bank communication conveys important information to market participants. We take the view that if central bank communication is to have any influence on expectations, this must show up as an increase in the daily standard deviation on days of communication. However, it is possible for some communication to be poorly worded or misinterpreted, which could be viewed as causing unnecessary volatility in financial markets. Therefore, since we cannot compare the intention of the central bank with the markets' reaction to the communication, we are only measuring whether a channel of communication has the effect of providing information to market participants, irrespective of whether that information is necessary or accurate.

Our study shares a number of features with earlier studies that estimate the effect on interest rate expectations of different types of news relevant to the future path of monetary policy. We examine daily changes in interest rate futures, though concentrate on the futures one to eight quarters ahead (Campbell and Lewis 1998 and Fleming and Remolona 1997 also analyse the long end of the yield curve). Similar to Kohn and Sack (2003) and Chadha and Nolan (2001), we estimate a model that

4. Alternatively, some studies, such as Jansen and de Haan (2003) and Andersson, Dillén and Sellin (2001), address this problem by reading each communication and making a subjective determination of whether it should have a positive or negative effect. However, it is likely to be difficult to make a judgement on the 'intention' of a speech on a consistent basis, especially in a cross-country study such as ours. Moreover, some communication events such as speeches can include a question and answer session, which may convey important information. Unfortunately, transcripts of such sessions are usually not available on central banks' websites.

allows us to judge the effect on both the mean and the standard deviation of the daily changes in expected interest rates. Unlike these studies, however, we estimate our results across a panel of economies. This may allow us to gain some insight into whether different types of central bank communication convey information 'universally'.

3. Does News Matter?

As outlined in the previous section, in this paper we model the various influences – domestic and foreign – on interest rate expectations in six different economies. We concentrate on influences that change expectations for the future path of monetary policy: domestic macroeconomic data surprises, changes in foreign news reflected in changes in foreign interest rate futures, domestic monetary policy surprises and central bank communication. The next section summarises the data underlying our analysis, followed by a preliminary analysis. This analysis investigates the contribution of surprises in the four news categories to daily changes in interest rate futures, before a formal model of the effect of individual news events is estimated in Section 4.

3.1 Data

At the core of our empirical analysis are changes in interest rate expectations. We measure these using changes in daily implied interest rates from 90-day interest rate futures, Δf_t , at maturities from one to eight quarters, based on the last trade available for each day. Our data for individual economies start in January 1997 for Australia, Canada, the United Kingdom and the United States, and in 1999 for the euro area and New Zealand.[5] Our panel results therefore start in 1999. The last data point included is 17 June 2004.

Domestic macroeconomic surprises, $news_{b,t}$, related to a release of data on b (for example, GDP, CPI or employment releases), are measured by taking the difference between the actual outcome of data released and the outcome expected in a survey of market economists. Consulting Bloomberg yielded a large number of surveys of expected macroeconomic news outcomes for constructing surprise variables (Table 2).

Foreign news surprises can be approximated by the contemporaneous change in the interest rate futures of equivalent maturity in an important foreign market, Δf_t^{OS}, and its lags. These should capture both the macroeconomic surprises for these foreign economies and monetary policy surprises. A number of studies have found that developments in US financial markets have an important effect on other

5. A number of the news releases and market expectations were readily available only since 1997. Moreover, by then all inflation targeters included in the samples had put in place most elements of their current communication frameworks. The Bank of Canada changed elements of their communication strategy up until December 2000 (see, for example, Siklos 2003), but our results for Canada were qualitatively unchanged when estimated over the shorter time period starting in 2001.

Table 2: Number of Observations
1 January 1997–17 June 2004

	Australia	Canada	Euro area	NZ	UK	US	Panel
Observations	1 947	1 947	1 425	1 372	1 947	1 947	8 550
Policy decisions	84	45	100	44	92	63	357
News releases	801	1 384	3 246	354	1 731	3 857	9 804
Release variables	16	24	74	16	26	61	217

Notes: The data for the euro area start on 1 January 1999 and for NZ start on 17 March 1999; the panel includes data for all six economies from 1 January 1999.

economies' financial markets. We therefore include changes in US interest rate futures in the equations for all other economies, and also changes in Australian interest rate futures in the model for New Zealand.[6]

Monetary policy surprises, ps_t, are measured by taking the change in 30-day interest rates on the day of monetary policy decisions, consistent with Campbell and Lewis (1998) and Kohn and Sack (2003). This 30-day interest rate, a market interest rate, should reflect market participants' expectation of the actual policy rate for the following month. Since central banks in our sample have regular policy meetings in a monthly or 6-weekly cycle, the expected policy rate should be very similar, if not the same, over this month. Consequently, any change of the 30-day interest rate can be attributed to a change in the (expected) policy rate which is set on the first day of the 30-day paper.

The information or news content of central bank communication cannot be collapsed into one empirical measure, making it difficult to measure the surprise element or even the direction. Therefore, we measure different types of communication, w, by the central bank through a communication dummy, $com_{w,t}$, that takes the value one if a certain communication event has happened on a day, and zero otherwise. These communication events include policy rate decisions with and without commentary, monetary policy reports, parliamentary hearings, minutes of meetings (and voting records) and speeches. The data were available on the websites of the six central banks.

A number of variables control for time-specific and other events, $Other_{d,t}$, where d denotes the different variables. These include four dummies for day-of-the-week effects, $Other_{1\text{-}4,t}$, a dummy for public holidays, $Other_{5,t}$, and a dummy for 11 September 2001, $Other_{6,t}$.[7] We also include a measure for the *days to rollover* for each futures contract, $Other_{7,t}$. Every three months on a pre-set date, the 1st futures

6. Ehrmann and Fratzscher (2002) find that US developments seem to be more important for euro interest rates than vice versa. They argue that one reason for this may be that US data are typically released earlier than euro area data, and thus might provide a leading indicator function. For our sample of economies, US macroeconomic data are typically released earlier than domestic data in a similar category.

7. Day-of-the-week effects can be expected to proxy for news events that we have omitted from our study. Since releases of a specific category of news are often scheduled for the same day of the week, this can show up as additional variance on that weekday.

contract is settled and the remaining futures contracts are rolled over to the next contract. Since volatility may be expected to vary as a contract approaches expiry, we include this variable to capture this effect.

3.2 A preliminary analysis

In Section 2 we have noted a number of theoretical reasons why macroeconomic and monetary policy news should affect interest rate expectations. However, many other factors can affect the variance of daily financial data. One simple way to assess whether different types of news affect interest rate expectations is, therefore, to ask whether interest rate futures have a higher variance on days of news releases than on other days.

Table 3 is based on the 100 largest daily changes in interest rate futures for each of the six economies in our study. For illustrative purposes, we only present the results for the 4th futures contract in the tables, which measures expectations for one year in the future, roughly the middle of the horizon of our futures data. For each economy the first column shows the proportion of the top 100 daily changes that fall on days with foreign market movements, macroeconomic data surprises, monetary policy surprises and central bank communication. The second column shows the corresponding proportion of news days in the entire sample, which – except for the euro area and New Zealand – comprises 1 947 observations. If economic announcements or monetary policy news did not affect markets, the proportion of large changes in interest rate futures occurring on news days should not be significantly different to the proportion of news days in the entire sample.

Table 3: 100 Largest Changes in Interest Rate Futures
4th contract, 1 January 1997–17 June 2004
Proportion of days, per cent

	Australia		Canada		Euro area(a)		NZ(a)		UK		US	
	Top 100	All	Top 100	All	Top 100	All	Top 100	All	Top 100	All	Top 100	All
Foreign market movements(b)	57	24	72	24	49	27	80	27	47	24	–	–
Macro news surprises	38	29	50	45	77	79	25	16	43	38	86	72
Policy surprises	9	3	6	2	9	4	19	2	14	3	7	2
Other communication(c)	10	6	5	5	24	28	6	4	20	15	29	25
Other days	13	49	10	40	5	12	3	59	18	39	9	22

(a) The data for the euro area start on 1 January 1999 and for NZ on 17 March 1999.
(b) Foreign interest rate futures move almost on a daily basis. For this analysis we therefore concentrate on ‘large’ or ‘important’ moves which we define to be any moves that are larger than one standard deviation of the series over the entire sample period.
(c) ‘Other communication’ excludes any communication released jointly with a policy decision.

We can make two observations from these results. First, all four news categories are over-represented on the days with the largest 100 changes in interest rate futures, compared with their overall share in the sample. Second, most of the days with large changes are also days when foreign interest futures changed significantly or when domestic macroeconomic data surprises occurred. However, the methodology used in Table 3 has an obvious drawback. Different types of news can arrive on the same day, and therefore changes in interest rate expectations can be attributable to either or both. In fact, in large economies such as the United States, barely a day passes without the release of new data. To disentangle – and possibly quantify – the effect of different news, an econometric model needs to be estimated. In the remainder of this section we estimate two very simple equations with the aim of disentangling the contributions of the different news categories.

The simple model of Equation (1) explains the change in 90-day interest rate futures Δf_t with a range of factors, such as monetary policy surprises ps_t, domestic macroeconomic data surprises $news_{b,t}$, foreign data surprises Δf^{OS}, and different types of communication by the central bank $com_{w,t}$. As mentioned above, a number of variables, $Other_{d,t}$, control for time-specific events. We also include lags of futures rates to control for autoregressive behaviour in the futures markets.

$$\Delta f_t = \alpha_0 + \sum_{a=1}^{j} \alpha_a \Delta f_{t-a} + \beta_0 ps_t + \sum_{b=1}^{k} \beta_b news_{b,t} + \sum_{c=0}^{m} \gamma_c \Delta f_{t-c}^{os} + \sum_{w=1}^{n} \phi_w com_{w,t} + \sum_{d=1}^{7} \delta_d Other_{d,t} + \varepsilon_t \quad (1)$$

From this model the relative contributions of the different types of news in explaining changes in interest rate expectations can be calculated based on an ANOVA analysis.[8] Columns (1) in Table 4 show the results for each economy. An initial observation is that the unexplained residual is by far the largest component. This means that a large share of the variation in daily interest rate futures cannot be explained by simple regression on unexpected macroeconomic and monetary policy news, domestic or foreign. However, some conclusions can be drawn from the part that can be explained by the model. The pattern for Australia is illustrative for all economies: foreign market movements[9] and domestic macroeconomic news are the largest source of variation. Their effect is prominent for interest rate futures

8. The contributions based on an ANOVA analysis can be thought of as the differences in (unadjusted) R-squared from a regression with and without the variable (or set of variables) in question. Since this measures only the marginal contribution of this variable, the order in which the contributions are calculated can matter if the variable is correlated with the variables already contained in the model. In our model, we have included the communication variable last, thereby assuming that any change in interest rate futures that could be attributed to either communication or another news event, is attributed to the latter. While this might explain the low contribution of communication in all regressions, an ordering in which communication was included first, yielded similar results, with a contribution from communication of around 1 to 2 per cent in most cases.

9. Foreign market movements are modelled for all economies, except for the US, as changes in US interest rate futures. For New Zealand, changes in Australian interest rate futures are also included.

over the entire time horizon considered (Table 4 contains only the results for the 4th contract, but the results for all contracts are consistent with those in Section 4.2 and are available from the authors). In contrast, monetary policy surprises appear to affect interest rate expectations mainly in the very short term.

Finally, communication by the central bank explains changes in interest rate expectations only to a small degree. This might suggest that central bank communication provides some information to markets, but interest rate expectations mostly get revised after macroeconomic data surprises or unexpected monetary policy decisions. This conclusion is, however, partly complicated by our measure of communication events as a dummy. As it is difficult to quantify the information contained in central bank communication, we have identified each type of communication event only by whether or not it happens on a specific day. The estimated coefficient underlying the ANOVA analysis in Table 4, on the other hand, measures the average impact of all communication events of a specific type. If this type of communication has, on average, equally often 'upward' and 'downward' impacts, we would expect to estimate a zero impact of a communication dummy in this analysis.

Table 4: Contributions of Different Types of News – ANOVA Results
4th contract, 1 January 1997–17 June 2004
Per cent of total variation in daily interest rate futures

	Australia		**Canada**		**Euro**		**NZ**		**UK**		**US**	
Regression	(1)[(a)]	(2)[(b)]	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)	(1)	(2)
Explained	35.9	22.4	62.4	46.6	44.2	26.2	55.8	44.8	31.3	18.4	18.1	22.9
Due to news from:												
Foreign market movements	27.8	11.8	52.8	33.4	36.3	14.3	48.0	28.0	20.3	6.8	–	–
Unexpected macroeconomic news	4.6	2.1	3.1	1.4	4.5	4.1	1.9	1.3	6.6	3.3	16.6	10.5
Monetary policy surprises	2.1	2.0	5.0	4.4	0.6	0.8	2.7	3.8	2.9	2.9	0.1	0.5
Central bank communication	0.3	0.4	0.3	0.2	1.3	1.3	0.5	3.9	0.1	0.7	0.5	2.9
Other variables	1.1	6.1	1.2	7.2	1.5	5.7	2.7	7.8	1.4	4.7	0.9	9.0
Unexplained residual	64.1	77.6	37.6	53.4	55.8	73.8	44.2	55.2	68.7	81.6	81.9	77.1

(a) Based on Equation (1), a regression of changes in interest rate futures on news in the four categories and some time-specific controls.
(b) Based on Equation (2), which uses absolute values for the model estimated in Equation (1).
(c) ANOVA contributions are marginal contributions, that is they depend on the ordering. Alternative orderings, however, did not materially affect these results. Data for the euro area start on 1 January 1999 and for NZ start on 17 March 1999.

An alternative is to estimate a model that uses absolute values only, such as Campbell and Lewis (1998). Taking absolute values of the impact would avoid the 'averaging out' of upward and downward impacts. We consequently estimated Equation (1) in absolute value form, as follows:

$$\begin{aligned} \left|\Delta f_t\right| &= \alpha_0 + \sum_{a=1}^{j} \alpha_a \left|\Delta f_{t-a}\right| + \\ &\beta_0 \left|ps_t\right| + \sum_{b=1}^{k} \beta_b \left|news_{b,t}\right| + \sum_{c=0}^{m} \gamma_c \left|\Delta f_{t-c}^{os}\right| + \sum_{w=1}^{n} \phi_w com_{w,t} + \sum_{d=1}^{7} \delta_d Other_{d,t} + \varepsilon_t \end{aligned} \tag{2}$$

Columns (2) in Table 4 show the ANOVA contributions from this regression. The results confirm our earlier findings: domestic macroeconomic news and especially foreign market movements explain a much larger share of changes in interest rate futures than monetary policy surprises and central bank communication. The contribution of central bank communication remains relatively low, suggesting that the 'averaging' effect is not very strong. However, compared with the results for Equation (1) the contribution of foreign market movements is much lower, which may be due to the loss of information in the absolute value equation (as indicated by the lower R-squared of Equation 2). Many foreign market movements happen on the same day as monetary policy decisions or macroeconomic news. The econometric estimation has difficulties attributing these correctly as we have given up the information on 'direction' of all news variables.

Taken together, these results indicate that movements in foreign markets and domestic macroeconomic data surprises affect interest rate expectations to a much larger degree than central bank communication. Of course, the latter can still affect the standard deviation of the interest rate futures on the day of the communication event. Due to the nature of the communication variables (neither direction nor strength is modelled) compared with the other 'news variables', a different approach is needed to assess the effect of individual types of news events on interest rate expectations. The econometric model employed in Section 4 provides such an estimation technique, modelling the mean and the standard deviation of the change in interest rate futures jointly.

4. Measuring the Impact of News on Interest Rates: A Cross-country Study

Empirical modelling of financial time-series data usually needs to take account of changing asset return variance, whereby periods of low and high volatility tend to be clustered. This phenomenon can be captured by employing models of conditional heteroskedasticity such as the ARCH (autoregressive conditional heteroskedasticity) and GARCH (generalised ARCH) models suggested by Engle (1982) and Bollerslev (1986). As mentioned above, such an approach allows us to deal with the different nature of the central bank communication variable compared with macroeconomic and monetary policy surprises. It does so by simultaneously estimating the mean equation for interest rate futures and the variance of the residuals from the mean equation.

The next section briefly describes the specific model estimated, using the data described in Section 3.1. In Section 4.2 and Section 4.3 we present the empirical results for the effect of different types of news: domestic macroeconomic data releases, foreign market movements, monetary policy surprises, and different channels of central bank communication. Comparing the results across different economies also allows us to assess the effectiveness of these channels across different monetary policy frameworks.

4.1 The econometric model

The econometric model underlying our analysis of interest rate futures is an EGARCH (exponential generalised autoregressive conditional heteroskedasticity) model suggested by Nelson (1991). The exponential form allows for asymmetry in the response of interest rate futures following positive or negative shocks. It has the added advantage of guaranteeing that the estimated daily conditional variance is always positive.[10]

4.1.1 The mean equation

The mean equation for changes in 90-day bank bill futures rates, Δf_t, is specified for each economy as in Equation (1), but we exclude central bank communication events:

$$\Delta f_t = \alpha_0 + \sum_{a=1}^{j} \alpha_a \Delta f_{t-a} + \beta_0 ps_t + \sum_{b=1}^{k} \beta_b news_{b,t} + \sum_{c=0}^{m} \gamma_c \Delta f_{t-c}^{os} + \sum_{d=1}^{6} \delta_d Other_{d,t} + \varepsilon_t \quad (3)$$

4.1.2 The variance equation

To explicitly model ARCH effects, we assume that the residuals from the mean Equation (3) can be modelled as a function of the standard deviation of the residuals h_t, and an independently and identically distributed term v_t:

$$\varepsilon_t = v_t h_t \sim \left(0, h_t^2\right) \quad (4)$$

v_t are also known as the standardised residuals:

$$v_t = \frac{\varepsilon_t}{h_t} \sim iid\left(0,1\right) \quad (5)$$

The variance of the residuals, h^2_t, is modelled as a function of its own past values, past errors from the mean equation and other factors which may be influencing the conditional variance.[11] In our EGARCH(x,y) framework, we assume that the logged variance $\ln(h^2_t)$ of the residuals can be modelled as:

10. For an accessible exposition of ARCH and GARCH models, see McKenzie and Brooks (1999).

11. GARCH models of short rates often require the inclusion of the *level* of the interest rate in the variance equation (we would like to thank Adrian Pagan for drawing our attention to this). In our model we find that this term is insignificant (or negative) over almost all horizons for all the countries studied. One possible explanation is that this term serves to model differences in the magnitude of policy changes under high and low inflation, but for the period we studied inflation was always low.

$$\ln h_t^2 = \phi_0 + \sum_{w=1}^{q} \phi_w com_{w,t} + \sum_{x=1}^{n} \left(\varpi_x v_{t-x} + \theta_x \left| v_{t-x} \right| \right) + \sum_{y=1}^{p} \lambda_y \ln h_{t-y}^2 + \sum_{z=1}^{7} \varphi_z Other_{z,t} \quad (6)$$

where $com_{w,t}$ denotes a dummy for monetary policy communication channel w.[12] ARCH in the residuals is addressed by including lags of the absolute value standardised residuals $|v_{t-x}|$, and lags of the logged conditional variance terms $\ln(h^2_{t-y})$. Asymmetric responses to shocks can be addressed by including lags of the standardised residuals v_{t-x}. Days to rollover for each futures contract are captured by the variable $Other_{7,t}$. Finally, as in the mean equation, we include time-specific dummies. Identifying the effect of the economic commentary on days of monetary policy decisions is a particular challenge, since there can also be a policy rate surprise on these days. We attempt to do this by controlling for the surprise in the mean equation. Therefore, the communication dummies in the variance equation should only reflect effects not captured by the interest rate surprises modelled in the mean equation.[13]

We estimate the model in Equations (3) and (6) for Australia, Canada, the euro area, New Zealand, the UK and the US, and for a panel of these economies, using fixed effects in both the mean and variance equations.[14] The equations are estimated for each of the first eight 90-day futures contracts, which measure interest rate expectations from the 3-month to 2-year horizon. We first estimated Equation (3) for each economy with all the available explanatory variables using OLS to obtain a more parsimonious model by excluding insignificant macroeconomic releases. GARCH models are estimated by the method of maximum likelihood using an iterative algorithm, since the conditional variance appears in a non-linear way in the likelihood function. We estimated the EGARCH model using a general-to-specific modelling approach, by excluding insignificant variables in a number of iterations. Similarly, we tested the appropriate dimensions of the EGARCH model for each economy separately. Interestingly, the lagged conditional variance terms in the variance equation were insignificant, except for the US, thus reducing our models to an ARCH specification. Economically, this implies that an increase in the conditional variance of interest rate futures as a result of communication does not lead to increased variance on subsequent days. Table 5 summarises the specifications and diagnostics of the final models. The overall fit of the equations are reasonable, with R-squared values of between 0.14 and 0.61.[15]

12. As suggested by the results in Section 3, if the communication events are included in the mean equation their average effect is insignificant. This result, however, may be due to the measurement of these variables, which does not include ‘direction’ of the information and therefore ‘upward’ and ‘downward’ movements may be netted out. Changes in the mean also affect the variance on the day of the news event, but the effect on the variance abstracts from the direction of the effect. Therefore, in our framework, the coefficient in the variance equation captures both (non-directional) changes in the mean and possible additional effects on the variance.

13. In principle, macroeconomic and monetary policy surprises could affect both mean and variance. However, the inclusion of these variables in the variance equation yields mostly insignificant effects, suggesting that most of their effect has been absorbed by the mean equation.

14. We estimated our GARCH model with EViews, version 3.1. The panel regression with GARCH followed the example in Grier and Cermeño (2001).

15. A significant portion of this explanatory power comes from the ‘foreign rates’ variable, which helps to explain why the fit is lowest for the US.

Table 5: Specification and Diagnostics for EGARCH Model
4th contract, January 1997–June 2004

	Australia	Canada	Euro	NZ	UK	US	Panel
EGARCH (*x*,*y*)	(3,0)	(5,0)	(4,0)	(5,0)	(4,0)	(5,1)	(5,0)
Overseas effects	US	US	US	US, Aus	US	–	US
Diagnostics							
R^2	0.34	0.61	0.40	0.54	0.30	0.14	0.35
ARCH LM (5)	{0.79}	{0.81}	{0.65}	{0.58}	{0.92}	{0.86}	{0.62}
Excess kurtosis	2.24	2.25	0.71	2.88	1.04	1.59	1.52

Notes: Numbers in braces are *p*-values. Estimates for the euro area and the panel start from 1 January 1999, and for NZ from 17 March 1999. In the variance equation, *x* is the number of lagged standardised residuals and *y* is the number of lags of the logged conditional variance (see Equation 6).

The variance equations for each economy include an EGARCH specification sufficient to account for any ARCH remaining in the standardised residuals. This is confirmed using ARCH LM tests. While the excess kurtosis of the interest rate futures has been greatly reduced by the EGARCH model, there is still some evidence of excess kurtosis, indicating non-normality of the standardised residuals. Therefore, Bollerslev and Wooldridge (1992) heteroskedasticity consistent standard errors are reported.[16] We now turn to specific results these estimations yielded. For brevity, we will only show the results for the 4th contract for interest rate futures in the tables, however, the figures show the results across all eight contracts. More detailed results can be found in Connolly and Kohler (forthcoming).

4.2 The effect of macroeconomic news and monetary policy surprises

The results of the mean equation can tell us which macroeconomic news releases are most important for interest rate expectations. As mentioned above, we included a large number of macroeconomic surprise variables. For instance, there were 801 Australian news releases during the period, made up of 16 different types of releases, of which half significantly influenced interest rate expectations. Table 6 shows which economic releases were found to be significant in the mean equation for the change in interest rate futures (4th contract).

For Australia, activity indicators such as retail sales, building approvals and GDP are significant along with prices and labour market indicators such as the CPI and employment. These results are consistent with those found by Campbell and Lewis (1998) and Silvapulle, Pereira and Lee (1997). While not included in Table 6, US data surprises – measured through their impact on US interest rate

16. This approach, which uses quasi-maximum likelihood estimation, is standard in the literature; see McKenzie and Brooks (1999, p 24) and Jansen and de Haan (2003).

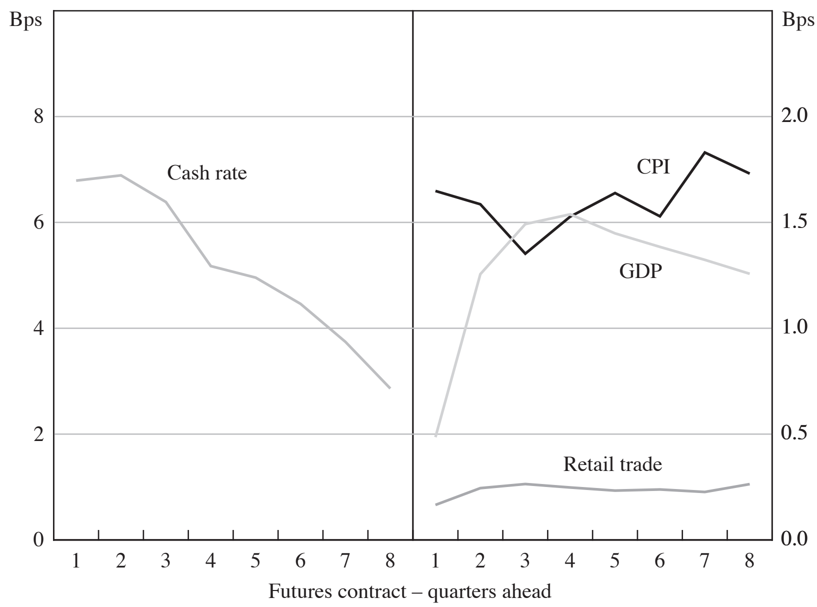
Table 6: Economic Releases which Significantly Influence Interest Rate Expectations (Mean Equation)

	Australia	Canada	Euro area	NZ	UK	US
Prices	CPI	CPI	PPI (euro area)	CPI	Input PPI	CPI
			CPI (France)	Core CPI	Output PPI	GDP deflator
			Core CPI (Spain)	Input PPI	RPIX	
Labour market	Employment	Employment	Unemployment (France)	Unemployment rate	Average earnings	Average hourly earnings
	Unemployment rate	Unemployment rate				Non-farm payrolls
						Employment cost
						Initial jobless claims
Activity	GDP	GDP	GDP (euro area)	GDP	GDP	Advance retail sales
	Building approvals	Industrial production	Industrial production (euro area)	Retail sales	Industrial production	Capacity utilisation
	Trade balance	Manufacturing shipments	Consumer spending (France)		Consumer credit	Chicago purchasing managers' business barometer
	Inventories	Retail sales excl autos	GDP (France)		Retail sales	Consumer confidence
	Investment		Production outlook (France)		Trade balance	Durable goods excl transport
	Retail sales		IFO (Germany)			Empire manufacturing
			Industrial output (Germany)			Existing home sales
			GDP (Italy)			ISM manufacturing
			GDP (Spain)			ISM non-manufacturing
						Philadelphia Fed Outlook Survey
						Michigan confidence
						Wholesale inventories

futures – explain a large share of movements in Australian interest rate futures. This result has been confirmed by earlier studies, such as Kim and Sheen (2000). The results for other economies are also in line with those found by previous country-specific studies, where available. For example, for the US, Kohn and Sack (2003) find that announcements of 13 economic data releases affect the Federal funds futures significantly; almost all of these are included in our list of 18 significant macroeconomic releases for the US. For Canada, Gravelle and Moessner (2001) single out surprises in the PPI, employment and US data, comparable to our results. Across economies, a number of similar releases can consistently be found to be significant. These are not surprising: CPI in the category of important price releases, unemployment in the labour market category and GDP and retail sales in the economic activity category.

The results for the mean equations can also show whether market participants view surprises in monetary policy decisions as shocks to the short-term or medium-term outlook. For Australia, interest rate futures which expire within three months (the 1st contract) respond quite strongly to monetary policy surprises, rising by around 6 basis points in response to an *unexpected* cash rate increase of 10 basis points (Figure 1). This response falls steadily as the settlement date becomes more distant. This suggests that market participants view monetary policy surprises as containing more short-run than medium-run information. In contrast, macroeconomic surprises such as GDP, the CPI or retail trade have a relatively consistent effect on interest rate expectations out to the two-year horizon. This suggests that they are viewed as relevant to the medium-term outlook. This is consistent with the findings of Campbell and Lewis, who report that monetary policy news has more

Figure 1: Macroeconomic and Policy Surprises – Australia
Same-day response of 90-day interest rate futures to 10 basis points surprise



often been associated with a large move in bill yields (that is, the short end of the futures market) while macroeconomic surprises also affected bond yields (that is, the long end of the market).

Overall, the profile for the interest rate futures response to monetary policy surprises for Australia is reasonably representative for those of the other economies, with an impact of between 5 and 8 basis points on the 1st contract, which steadily declines for the contracts further ahead. We do not report these results in more detail, since they are in line with those found by a number of other studies (see, for example, Kohn and Sack 2003 for the US, Gravelle and Moessner 2001 for Canada, and Chadha and Nolan 2001 for the UK). It is worth noting, however, that the results for New Zealand seem to have a less smooth profile, possibly because of the lower liquidity of the New Zealand futures market, especially for the longer-dated contracts.

4.3 The effect of monetary policy communication

One of the motivations of our study is to estimate the effectiveness of different channels of central bank communication, and to analyse whether we can detect consistent patterns across different economies. For this, we now turn our attention to the results from the variance equation. As stressed earlier, due to the nature of our communication variables (it is difficult to objectively measure news contained in communication events), we interpret a positive statistically significant result as 'effective' since it appears to have provided information to the markets.[17] We cannot, however, measure whether the information extracted by the markets is the information the central bank intended to convey.

In Table 7, the communication results from the variance equation are presented for each economy and the panel. Some types of communication, such as publishing minutes of meetings, are used only by some central banks and therefore some values are missing from this table. Other events do not occur often (such as unscheduled rate moves). We would expect such events to have a significant effect on markets precisely because they are rare. However, estimated coefficients for these events should be treated with caution since they are based on very few observations. Any coefficient based on 10 or less events is reported in braces. Again, the results are presented for the 4th futures contracts.

Across all economies – given the size and significance of the coefficients – the most important channels of monetary policy communication are the economic commentary accompanying rate moves, parliamentary hearings and monetary policy reports; minutes of meetings and speeches are much less important. As discussed in Section 4.1, identifying the effect of the economic commentary on days of monetary policy decisions is a particular challenge, due to the concurrent policy decision. In this respect, the results in Table 7 are comforting, since policy decisions without commentary are insignificant for almost all conditional variance regressions. This

17. Significant, but negative coefficients in the variance equation imply that on the day of the event the variance of the interest rate future is typically lower than on days without such events. Therefore, we are primarily interested in results when the coefficient is significantly positive.

Table 7: Effect of Central Bank Communication on Interest Rate Futures (Variance Equation)
4^{th} contract, January 1997–June 2004

	Australia	Canada	Euro area	NZ	UK	US	Panel
Commentary with rate decisions							
Scheduled rate moves	0.46	1.09^{***}	1.42^{***}	0.32	1.34^{***}	1.03^{***}	1.09^{***}
	(0.36)	(0.30)	(0.29)	(0.31)	(0.25)	(0.26)	(0.13)
Unscheduled rate moves	$\{1.87^{***}\}$	0.76	$\{3.75^{***}\}$		{–18.81}	$\{1.21^{**}\}$	1.38
	(0.33)	(0.69)	(0.25)		(0.99)	(0.53)	(1.38)
‘No move’ decisions		0.25	0.71^{***}	1.43^{***}	{–1.28}	1.18^{***}	0.93^{***}
		(0.31)	(0.25)	(0.50)	(0.59)	(0.34)	(0.16)
Rate decisions without commentary							
Rate moves					$\{0.98^{***}\}$		$\{1.28^{***}\}$
					(0.35)		(0.37)
‘No move’ decisions	–0.47		–0.18	{–1.30}	0.49^{***}	–1.20	-0.03
	(0.26)		(0.21)	(0.49)	(0.18)	(0.24)	(0.12)
Reports	0.80^{***}	0.63^{*}	0.00	1.58^{***}	0.18	1.88^{***}	0.47^{***}
	(0.27)	(0.39)	(0.17)	(0.53)	(0.22)	(0.21)	(0.12)
Parliamentary hearings							
Post-reports	1.25^{**}	0.33		1.40^{**}	1.15^{*}	1.88^{***}	1.15^{***}
	(0.53)	(0.45)		(0.66)	(0.68)	(0.21)	(0.29)
Other			0.08			0.59^{*}	–0.08
			(0.23)			(0.32)	(0.17)
Minutes of meetings					0.56^{***}	0.04	0.37^{***}
					(0.15)	(0.18)	(0.14)
Speeches	0.46^{**}	0.40	–0.24	0.18	0.01	0.13	0.07
	(0.22)	(0.33)	(0.10)	(0.19)	(0.12)	(0.10)	(0.06)

Notes: Numbers in brackets are Bollerslev-Wooldridge (1992) heteroskedasticity consistent standard errors. ***, **, * indicate positive coefficients are significant at the 1, 5 and 10 per cent levels, respectively. Estimates in braces { } are based on 10 or less events and should therefore be treated with caution. The model for the euro area and the panel was estimated from 1 January 1999 and for NZ from 17 March 1999. The US Fed’s monetary policy report and testimony occur simultaneously, so the same coefficient is reported for both.

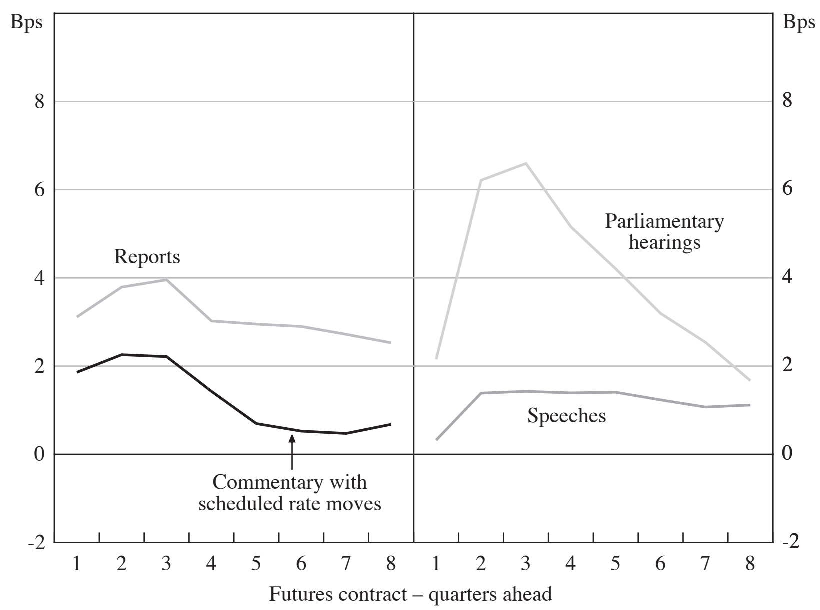
suggests that the policy surprise effect is well captured by the mean equation, allowing us to identify the communication effect through the variance equation.

It is not straightforward to interpret the magnitude of the coefficients and compare them across economies, since the dependent variable of the variance equation is the logged conditional variance. To make interpretation easier, in the following figures we have transformed the coefficients in Table 7 such that they represent the average effect in basis points on the standard deviation of policy expectations for all horizons.[18] These transformed coefficients measure the change, in basis points, of the standard deviation of the interest rate futures on average on the day when a specific communication event occurs.

Figure 2 shows these transformed coefficients for Australia over all eight futures contracts. The results indicate that parliamentary hearings have the largest impact on interest rate expectations among the various communication channels. On average, parliamentary hearings shifted the standard deviation of interest rate expectations by around 2 to 6 basis points, with the largest effect on expectations of rates in two to three quarters' time. Other channels of communication that also have an effect are the quarterly *Statement on Monetary Policy* (reports), the commentary accompanying scheduled rate moves and speeches. Each of these has an average

Figure 2: Communication – Australia

Same-day increase in standard deviation – variance equation



18. We take the average difference between the standard deviation of the errors in our regressions and those that would result if we assumed (in turn) that each channel of communication did not exist, where n is the number of communication events in the sample:

$$\frac{1}{n}\sum_{g=1}^{n}\left(h_g - \frac{h_g}{\sqrt{e^{\phi_{w,g}com_{w,g}}}}\right)$$

effect of around 1 to 4 basis points on rates, with the largest response at the two- to three-quarter horizon.

The channels of communication which have the greatest effect on Australian interest rate expectations are also among the most important for the other central banks in our sample. We will discuss these specific results in more detail in the remainder of the section.

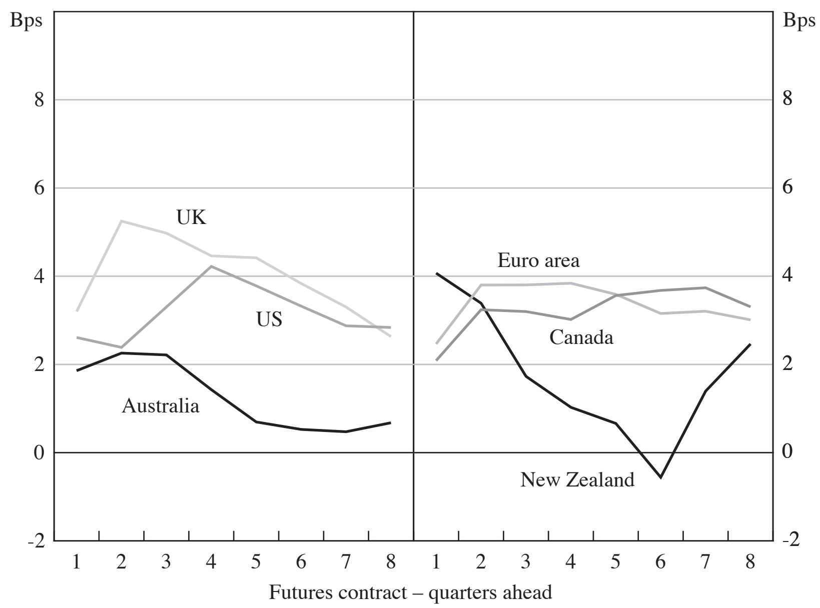
4.3.1 Commentary with monetary policy decisions

The commentary accompanying rate moves influences policy expectations significantly in all economies for the first year ahead (Table 7 and Figure 3), while 'no move' decisions with commentary are positive and significant in the euro area, New Zealand and the US. In contrast, 'no move' decisions without commentary are positive and significant only for the UK, with the panel result showing insignificance.

These results suggest that markets' interest rate expectations are influenced by the commentary accompanying rate decisions, and not just the decision itself. This is consistent with the results of Kohn and Sack (2003) for the US, and the close scrutiny given to press releases and press conferences by market participants and the media.

As noted earlier, these results cannot be used to determine whether the response of the markets was consistent with the intentions of the central bank. In the US in particular, there has been debate over whether the FOMC policy statements should

Figure 3: Commentary with Scheduled Rate Moves
Same-day increase in standard deviation – variance equation



be signalling future policy intentions. For instance, in August 2003, William Poole, President of the St. Louis Fed, argued that narrower language should have been used in the FOMC statement in May 2003 that warned of deflation, thereby contributing to a decline in bond rates (see Poole 2003).

4.3.2 Monetary policy reports and parliamentary hearings

Policy reports and post-report parliamentary hearings appear to be the most important channels of communication outside of rate decisions (Figures 4 and 5). The magnitude of response is largest in the US, Australia and New Zealand, where the average effect on the standard deviation of expectations is around 4–10 basis points.

Parliamentary hearings in Australia, New Zealand, the UK and the US significantly affect the markets. Notably, the US post-report hearing, the Humphrey-Hawkins testimony, has a much larger effect than other US testimonies. Two factors are likely to play a role in this: the Humphrey-Hawkins testimony coincides with the release of the monetary policy report – so we cannot disentangle the two effects – and it occurs less frequently than the other testimonies. The results for New Zealand are also significant, but since parliamentary hearings, monetary policy reports and rate decisions often happen on the same day, the magnitudes of individual effects are harder to disentangle. Moreover, the futures market in New Zealand is less liquid than in the other economies considered here, which might explain why most of the results for New Zealand appear less 'smooth' across the different futures contracts.

Figure 4: Parliamentary Hearing
Same-day increase in standard deviation – variance equation

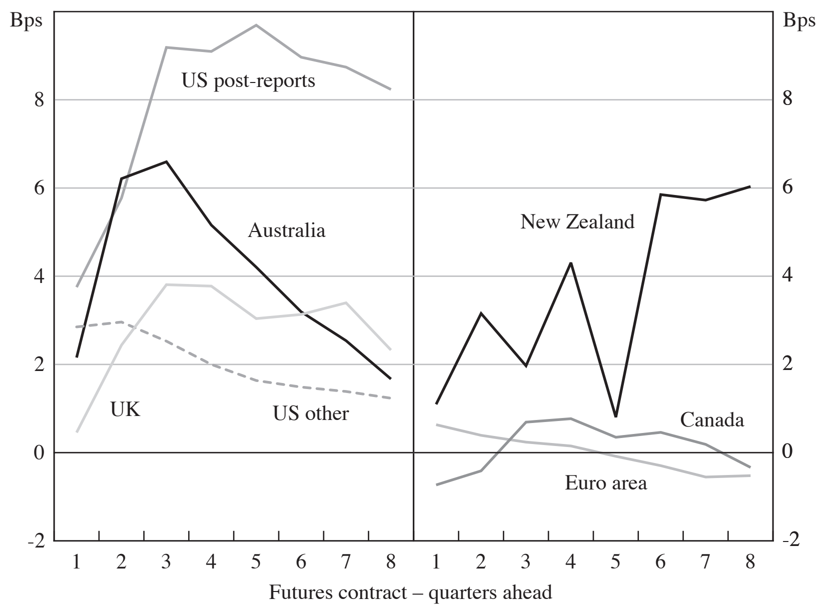
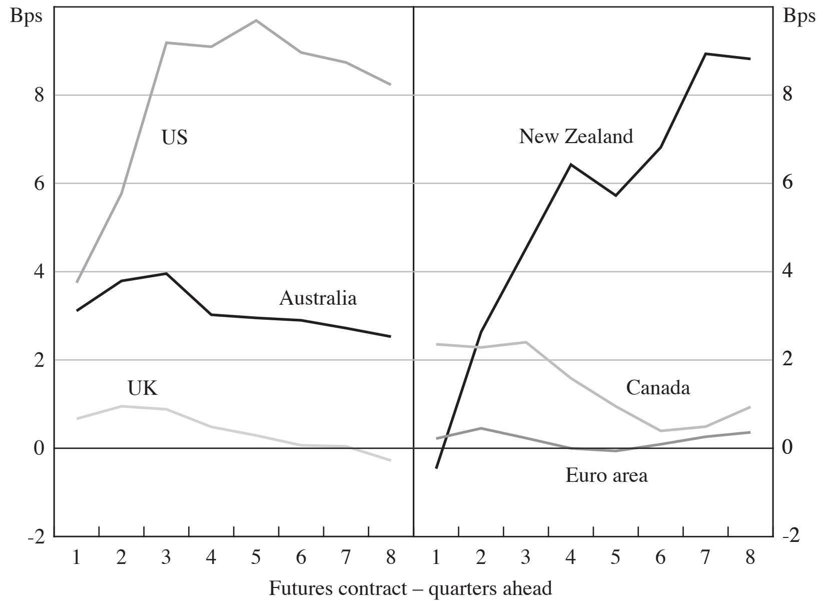


Figure 5: Monetary Policy Report
Same-day increase in standard deviation – variance equation



The monetary policy reports in Australia, Canada, New Zealand and the US provide information that significantly affects the markets. For the US, this effect also incorporates any effects of the parliamentary testimony that coincides with the report, which might explain the relatively large effect. The Bank of England's *Inflation Report* did not significantly influence market expectations of future rates. This result is consistent with Chadha and Nolan (2001), who also found that the *Inflation Report* did not significantly influence interest rates. The ECB's analysis of 'Economic and Monetary Developments' is also insignificant. The ECB's report is published more frequently, as part of the monthly *Bulletin*, while most other central banks' reports are published on a quarterly or semi-annual basis. The high frequency of these reports might be one reason why the effect of an individual monetary policy report for the euro area is relatively small.

4.3.3 Minutes of meetings and voting records

Only two economies in our sample (the UK and the US) release minutes of their monetary policy committee meetings (and voting records). Only the coefficient for the UK is significant, while that for the US is insignificant and close to zero for all futures contracts. The UK minutes are significant at all horizons, in contrast with the results by Chadha and Nolan (2001) who find an insignificant effect for the UK. Given that the UK minutes are released monthly, two weeks after policy decisions, this may help to explain why the Bank of England's quarterly *Inflation Report* has little effect on expectations.

There are several explanations for the relative unimportance of the US minutes. First, the minutes are released with a lag of 6–8 weeks by the Fed on the day after the *following* FOMC meeting, which reduces their relevance for forward-looking analysis. It is also unclear whether the Fed is intending to influence expectations with the minutes. In 1997, the FOMC was concerned that the minutes were not receiving enough press, and shifted the timing of the release to try to maximise reporting in the Friday papers.The associated debate regarding the target audience of the minutes – whether it is the media, the markets or Congress – suggests that the FOMC was more concerned about how the minutes were viewed by the press and Congress than whether they are a tool to influence markets' expectations (see FOMC 1997).

These results highlight another aspect of our study. 'Having' a certain channel of communication is not necessarily the decisive factor. Markets will attach importance to a specific channel only if new information is conveyed. However, the same information can, in principle, be conveyed through other communication events. Consequently, the difference in results for specific communication channels across economies can often be explained by looking at the entire communication structure. For instance, minutes for the UK are released two weeks after the meeting, and are therefore likely to be one of the first communication events that convey the views of the central bank after a meeting of the Monetary Policy Committee. In contrast, the minutes of the Federal Reserve are not released until after the next meeting has taken place. In the meantime, a number of different communication events will have happened which allows the central bank to explain its views on current conditions for monetary policy.

4.3.4 Speeches

While we find that speeches have a significant positive coefficient for Australia and – at an 80 per cent significance level – also for the US, this effect is not systematic across all the central banks in our sample. One explanation could be that speeches occur relatively frequently and, therefore, information tends to be conveyed more gradually. However, this result may also be a reflection of our methodology, rather than a general statement on whether speeches are used to convey important information in these other economies. We do not subjectively choose speeches that are more likely to influence expectations. Instead, all speeches published on the websites of the central banks are included in our sample. Some of these may be speaking engagements dealing with other central bank responsibilities unrelated to monetary policy. For the economies with an insignificant overall effect, the inclusion of these speeches is likely to hide the effect of speeches that are deliberately designed to influence expectations.[19] Even if we were able to single out these speeches, we

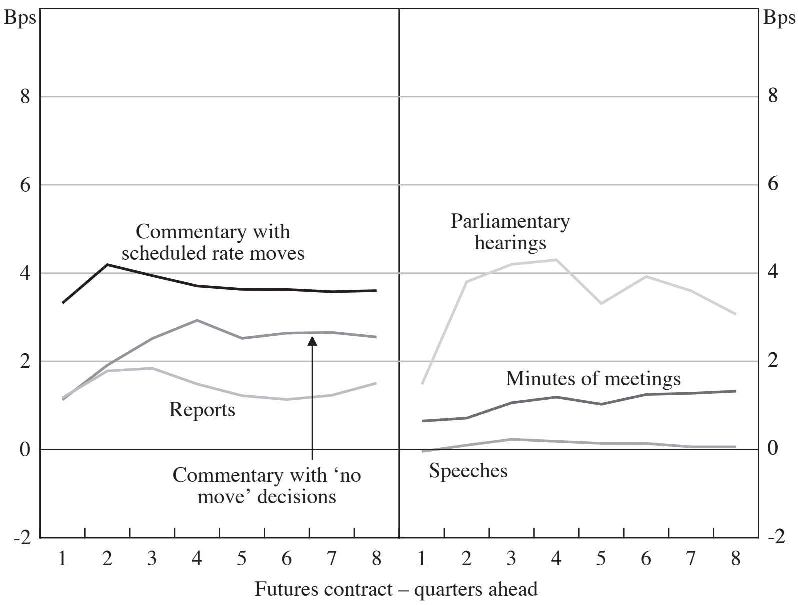
19. Some evidence that this factor plays a role is provided by a robustness test where we decided whether a speech dealt with monetary policy based on its title. Using this split in our regressions, we find that speeches in the 'Monetary policy' category are significant for the euro area, the US and – for horizons up to one year – New Zealand, while those in the 'Other' category tend to be insignificant.

would still be left with the problem that in some instances information may be conveyed during a question and answer session following a speech.

4.3.5 Panel results

Our panel, which estimates the effect across all central banks, can provide some insights into the common factors of the communication strategies of the six central banks (Figure 6). The results suggest that across the six economies, central banks have used parliamentary hearings, commentaries with policy decisions and monetary policy reports to influence interest rate expectations. These channels of communication affect the outlook for policy in both the short and medium term. Minutes of meetings are significant, but are entirely driven by the results for the UK, while speeches do not have a significant effect.

Figure 6: Communication – Panel of Central Banks
Same-day increase in standard deviation – variance equation



5. Conclusions

In this paper we have analysed the effect of news relating to the expected path of monetary policy on interest rate futures. We consider four types of news: domestic macroeconomic news, foreign news, monetary policy surprises and central bank communication. The effect of these types of news on daily changes in interest rate futures was estimated using an EGARCH model for a panel of economies. We find that interest rate expectations respond to both macroeconomic (domestic and foreign) and policy news, although the response to macroeconomic news is larger, especially once we include foreign news. Overall, the results suggest that the impact of the RBA's communication policy is in line with other major central banks, and significantly influences (and informs) expectations of future monetary policy.

Previous work has found that the predictability of monetary policy is very similar for major central banks including the RBA, despite differences in the communication frameworks (see Coppel and Connolly 2003). This implies that central banks provide information on the future path of monetary policy to a very similar extent. Our study could shed light on some factors underlying this similarity.

The channels of communication that are found to most influence expectations – commentary with rate decisions, monetary policy reports and parliamentary hearings – tend to be used by all the central banks in our study. Interestingly, communication events that occur more frequently tend to have less effect on expectations of future policy. However, this is consistent with the view that more frequent channels allow the central bank to convey information gradually, at the same time as it learns about changes in current and expected future conditions for monetary policy.

The individual economy results reflect small differences in the structures of central bank communication policies. Some channels, such as minutes of meetings, have significant effects in some economies but not in others. However, these results do not imply that some central banks convey 'more' information than others. They merely suggest that central banks can use different channels to convey the same information.

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Discussion

1. Stefan Palmqvist

The paper by Ellis Connolly and Marion Kohler is one of the first to analyse and evaluate what types of news drive interest rate futures in a panel of countries, and I credit them for putting together a very interesting data set. Regarding the relative importance of the different driving forces, their main findings can be summarised as:

- domestic and foreign news are the most important driving forces;
- policy surprises play a small role; and
- central bank communication explains almost nothing, and this is true, in particular, for speeches.

While I find the paper interesting, the results provide somewhat of a puzzle. If central bank communication does not affect the predictability of interest rates, why do central banks talk so much? As an example, since 1999 the six members of the Executive Board of Sveriges Riksbank (the central bank of Sweden) gave in combination an average of about 35 speeches per year. On top of that, some speeches are published as press releases, and since 1999 the Riksbank has published about 80 press releases per year on average. Taken together, the speeches and press releases amount to more than two pieces of central bank communication every week of the year. In other words, in reality central banks communicate quite frequently, which seems puzzling in light of the findings by Ellis and Marion. In my discussion I will focus on some methodological issues that may at least partly explain this.

What horizon should we look at?

Ellis and Marion use interest rate futures of different maturities as the dependent variable in their analysis. The benchmark result in the paper is for the interest rate futures four quarters ahead. They note that the results are robust to different contracts, where the longest contract is two years and the shortest contract is one quarter. However, market participants are typically most interested in the very next monetary policy decision. As most countries have monetary policy meetings about 10 times a year, the next decision is typically only 2–4 weeks ahead. If a central bank communicates its views about the next decision, some 2–4 weeks ahead, a one quarter contract may not adequately pick up the effects of the communication.

For central bank communication to be effective, a speech should, of course, also affect interest rate futures with longer maturities than 2–4 weeks. On the other hand, communication may not have any effects at all on the very long horizon, say five years ahead. This is because the best five-year forecast probably is that the economy is back at its steady state. I would, therefore, expect a speech to have a greater impact on interest rate futures with a shorter maturity than on interest rate futures with longer maturities. Thus, to evaluate the importance of a speech it may be necessary to look at an even shorter horizon than one quarter.

While speeches predominantly are concerned with the very next policy decision, other pieces of central bank communication may regard a somewhat longer period. As an example, inflation reports typically lay out the central bank's view about the outlook for the next 1–2 years. Therefore, an inflation report may affect interest rate futures with longer maturities. However, this is only partially confirmed by the results presented in Figure 5. Monetary policy reports in the US and New Zealand have a greater impact on the longer horizon futures, whereas the effects are more evenly distributed across different horizons in Australia, and in the other three economies the effects decrease with the horizon. There are some institutional differences between the economies that could help explain why monetary policy reports have different effects in the economies studied, and I think it is unfortunate that these institutional differences are not discussed in the paper (more on this below).

When it comes to the speeches, the effects of speeches are only shown for Australia and the panel consisting of all six economies. Thus, further study of the horizon at which different pieces of central bank communication affect the market should be an important area for future research.

Endogeneity

Another methodological issue is the potential endogeneity of central bank communication, especially with regards to speeches. In Sweden, the Executive Board members are constantly informed about what the market expects them to do with the policy rate at the next monetary policy meeting. If their own views differ from what the market expects, they can schedule a speech and 'correct' the market. I am aware of a few instances where this has happened in Sweden, and I suspect that the central banks that Ellis and Marion study follow similar procedures regarding the scheduling of speeches. In other words, the number of speeches may respond to developments in the interest rate futures markets, which can cause problems in the estimations that are conducted in the paper.

Identification

Much of a central bank's communication is about the economic outlook, including what the central bank expects the next CPI or GDP figure to be. Hence, the question is whether the effects of speeches and macroeconomic news can be identified separately. Suppose that a central bank was a 'black box' that did not communicate anything. If nobody knew the objectives of monetary policy or the central bank's framework for setting interest rates, interest rates would be completely unpredictable and no macroeconomic news would enter significantly in Ellis and Marion's estimations. I would argue that it is because central banks are transparent about their objectives, their framework for setting interest rates, and the outlook that the market can interpret what the outcome of a particular CPI or GDP figure implies for future interest rates.

This suggests that it may not be possible to separate the effects of macroeconomic news from the effects of central bank communication.

As all economies studied in the paper have central banks that, to some extent, can be thought of as targeting inflation, it would also be interesting to include some other countries that are not as transparent about their objectives. Does macroeconomic news affect interest futures in a country where the central bank does not communicate its outlook, or is it the combination of communication and macroeconomic news that alter the markets' expectations? I would encourage the use of a broader set of countries to shed some light on this issue.

Measurement errors

In the empirical implementation, the authors incorporate speeches as an explanatory variable measured as a dummy variable. However, as the authors mention, not all speeches are designed to affect market expectations. In other words, speeches that are designed to affect market expectations are measured with errors.

How big of a problem is this? In a standard OLS framework, measurement errors in the explanatory variable do not pose a big problem, as they basically only add more noise to the equation. However, there are reasons to expect that they pose a greater problem in the EGARCH-framework that the authors use. Not only do the measurement errors add variance to the variance equation – the only equation where central bank communication enters – there is also reason to believe that these measurement errors could be serially correlated. As an example, while the total number of speeches by the Riksbank's Executive Board members decreased during 2001–03, the number of speeches on the topic of EMU/euro increased. That EMU/euro became a more frequent topic of speeches was a natural consequence of the Swedish referendum on whether Sweden should join the EMU and adopt the Euro that was held in September 2003. Given the outcome of the referendum, where a strong majority of the Swedish population voted against joining the EMU, there were almost no speeches held on the topic of EMU/euro after the referendum. In this particular example, any speech on the topic of the EMU/euro during this period is an example of a measurement error in the dummy variable for speeches and the gradual increase and sudden stop of speeches on this topic is a clear example of serial correlation.

While the example above refers to the case of Sweden, I suspect that similar examples can be found in the economies studied in the paper. Serially-correlated measurement errors may harm the results in the EGARCH model. One way of fixing the problem is of course to read all speeches and determine which ones have monetary policy content. As the number of speeches in the data set is quite large, reading all speeches to determine which ones have monetary policy content may not be feasible. A simpler way to check the robustness of the results is, therefore, to let a search engine look for certain phrases that may indicate whether the speech is intended to affect market expectations and only use those speeches in the estimations.

In summary, all these methodological issues could very well explain why Ellis and Marion find that central bank communication does not have a significant effect on the markets' expectation of future policy. I think these issues must be addressed before we can conclude that central bank communication does not add to transparency, as measured by the predictability of interest rates. That said, I would also strongly recommend that the authors pursue this line of research and explore further the interplay between the institutional framework and the effectiveness of different channels of communication. As an example, the forecasts in the inflation reports of the different countries are based on different conditioning assumptions. Some are based on a constant interest rate, some are based on the markets' expectations and some are measures of 'optimal policy'. A casual inspection of Table 7 seems to indicate that reports with unconditional forecasts have a greater impact on the longer-horizon futures than reports with constant interest rate forecasts. Another institutional difference is the size of the monetary policy committee. Do speeches have a greater effect if they are given by the single decision-maker than if a speech is given by one of the many members of a committee? These types of institutional differences deserve further exploration in the future.

2. General Discussion

A common theme in the discussion was how the results of the paper should be interpreted, with a number of participants questioning whether a finding of significance implied that central bank communication had been successful or unsuccessful. The authors responded that the framework used in the paper implied that the results could not distinguish between a central bank that communicates with perfect clarity and a central bank whose communication provides no useful information. Presumably, the strategy and thinking of the former is so well understood that their communication regarding economic developments will have no measurable effect on financial markets; the same would be true, however, of a central bank that says a lot without providing any real sense of its policy framework or how it interprets economic developments. The authors added that the central banks examined in the paper were all construed as having 'best-practice' communication strategies and, as such, if communication had an effect on financial markets, this was likely to be the deliberate intention of the central bank.

There was some discussion of how financial markets perceive central bank communication. One participant suggested that markets generally understand that central banks faced an output and inflation trade-off and, like the markets, have difficulties forecasting inflation and output. The nuances in central bank communication thus become quite important, as market participants might ascertain new insights as to the likely direction of policy. Another participant suggested that one reason why central bank communication seems to have a limited impact could be that markets have developed a good understanding of the central bank's policy reaction function. Hence, when macroeconomic data are released, the interest rate outlook is evident and there is not much additional information that a central bank, on most occasions, can convey about that outlook.

The role of central bank speeches was also discussed. A number of participants suggested that it was not surprising that speeches had such a limited effect on interest rate volatility. A possible reason for this, stressed by the authors, was that all speeches were contained in the data set, not only speeches that focused on monetary policy considerations. One participant suggested that many speeches were not intended to convey new information to financial markets or to foreshadow the decisions that will be taken by the policy committee. Instead, speeches are often made to reinforce the overall logic or framework of policy to the public and to address their concerns. In a similar vein, another participant suggested that because central banks' speeches were designed to help clarify the monetary policy framework, much of the effect of clear communication will be captured by the response of the markets to macroeconomic news. Another participant suggested that there were difficulties comparing the impact of speeches across countries because of differences in the content and length of speeches and their relationship to other forms of communication. This consideration was also clearly relevant for other forms of central bank communication.

Some participants queried the results for particular countries. One participant noted that markets pay relatively limited attention to the Federal Reserve's report to Congress, given that Chairman Alan Greenspan's testimony to Congress is held on the same day. It was also suggested that there was a case for splitting the speeches by US Federal Reserve officials into speeches by Greenspan and speeches by others, given that Greenspan was the dominant decision-maker. The authors suggested that distinguishing speeches according to their likely importance is a subjective exercise and, in any case, can amount to 'picking the winner', thus making a statistically significant result for speeches not very meaningful. A number of participants questioned the results for New Zealand in Figures 4 and 5, which show the increase in interest rate volatility following parliamentary hearings and the release of monetary policy reports. The authors responded that these results needed to be treated cautiously, as liquidity in NZ markets was relatively low at longer horizons, and there were estimation difficulties as different forms of communication often occur on the same day. The comparatively smaller impact of euro area macroeconomic news on financial markets might reflect the relatively long lag for the release of data and the apparent leaking of official data. Finally, one participant suggested that there was a marked change in the formation of market expectations in Canada following the adoption of fixed action dates for monetary policy decisions in December 2000. The finding that the largest sensitivity is to US news and domestic monetary policy action may thus be affected by the period when interest rate moves were basically unscheduled.

Inflation Measurement for Central Bankers

Robert J Hill

1. Introduction

Interest in the measurement of inflation has increased significantly in recent years for a number of reasons. First, inflation rates have fallen significantly since the early 1980s. Second, many central banks have adopted inflation targets. The combination of these two factors has increased the importance of accurate measurement. Third, rapid quality improvements, particularly in the information technology and health sectors, have made accurate measurement more difficult. The final impetus was provided by the Boskin *et al* (1996) report which claimed that the US consumer price index (CPI) has an upward bias in excess of 1 percentage point per year, while at the same time pointing out the dramatic budgetary implications of this bias, which arises from the fact that about one-third of federal expenditure in the US is indexed to the CPI.

Most central banks that have adopted inflation targets have been very successful in getting their inflation rates down to historically low levels. It is important to remember, nevertheless, that inflation is a surprisingly slippery concept. It is not clear exactly what concept of inflation is most relevant in a central banking context, or how it can best be measured. For example, should we focus on consumer, producer and/or asset prices? Even if we agree on consumer prices, should some volatile or hard-to-measure categories such as food, energy or owner-occupied housing be excluded? Also, in a consumer context, a distinction can be drawn between a cost of goods (and services) index (COGI) and a cost of living index (COLI). Adjustments must be made for quality change and new goods and services, which the Boskin *et al* (1996) report identifies as the main source of bias in the US CPI. Such adjustments require econometric estimation of hedonic models. It is important to factor in estimates of possible biases when setting an inflation target, and for central banks to account for new statistical innovations introduced by national statistical offices to reduce these biases. It is not clear how frequently the index should be computed or how often it should be rebased. The increased availability of scanner data has the potential to revolutionise the construction of consumer price indices, allowing them to be computed more frequently using expenditure weights at a much finer level of aggregation than is currently possible. However, the use of scanner data may also increase the volatility of the CPI, an eventuality that might not be welcome in central banking circles.

This paper surveys these issues. My objective is not so much to provide answers as it is to alert users of inflation targets to the underlying complexities of the inflation concept itself. These issues bear directly on the choice of the inflation target and on how a central bank should respond to changes in the observed rate of inflation.

2. The Choice of Target

Most central banks target the CPI. However, it is not the only readily available measure of inflation in an economy. In particular, two notable alternatives are the producer price index (PPI) and gross domestic product (GDP) deflator. To decide which concept provides the most appropriate inflation target, it is useful to step back and consider why inflation is a problem in the first place. One significant cost of inflation is that it distorts the scarcity signals in relative price movements. This is, at least partly, attributable to the fact that, by trying to reduce menu costs, firms do not continuously adjust their prices. This leads to relative price movements with no information content that become more pronounced as the inflation rate rises. Empirically, a number of authors have demonstrated the positive correlation between the inflation rate and relative price variability (see, for example, Silver and Ioannidis 2001). This noise in relative price movements can lead to a misallocation of investment funds as well as discouraging investment by causing uncertainty. In addition, Feldstein (1997) argues that inflation reduces the after-tax real rate of interest and affects the after-tax return on some assets more strongly than others, thus further distorting investment and savings decisions. Given the emphasis in these arguments on investment, which is excluded from the domain of the CPI, this suggests that it may be better for a central bank to target the PPI or GDP deflator. However, the coverage of the PPI is quite narrow, focusing mainly on the manufacturing sector (see the International Monetary Fund's *PPI manual*, 2004). Hence, it is probably not a suitable target. Likewise, Kohli (1983) and Diewert (2002) note how the fact that import quantities have negative weights in the GDP deflator implies that a rise in import prices acts directly to reduce the GDP deflator. Hence, the GDP deflator is also unsuitable as an inflation target. Diewert goes on to consider a number of variants on the GDP deflator, such as deflators for $C+I+G+X$, $C+I+G$ and $C+G$. TP Hill (1996), Woolford (1999) and Bloem, Armknecht and Zieschang (2002) advocate deflators for either $C+I+G+X$ or $C+I+G$, while Diewert (1996) advocates the deflator for $C+G$ on the grounds that prices for capital expenditure are not relevant to the deflation of current period household expenditures. He then argues that G should also be deleted due to the difficulty of obtaining meaningful prices for items of government expenditure. Hence, he concludes that the CPI is perhaps the best measure of inflation.

An additional argument in favour of the CPI as an inflation target is that it is the standard benchmark used by employees and employers in wage negotiations and is used to index public sector wages and pensions. To the extent that inflation is of the wage cost-push variety, a central bank should, therefore, target the CPI since this will directly impact inflationary expectations and hence wages. In fact, in most countries the CPI was developed as a benchmark against which public sector wages and pensions could be indexed. It was only subsequently that the CPI was adopted by central banks as an inflation target. In some countries, this has led to changes in the CPI, for example the exclusion of mortgage interest payments from the Australian CPI. One important exception from this general pattern is the European Union's Harmonised Index of Consumer Prices (HICP), which has been constructed specifically as an inflation target (for the European Central Bank). The HICP is discussed in greater detail later in the paper (also see Diewert 2002).

There has been much debate recently over whether asset prices should be included in an inflation target (see, for example, Goodhart 2001 and Tatom 2002). The current target, the CPI, includes one of the most important assets, that is, owner-occupied housing, although in Australia and New Zealand only the cost of the building materials and labour are included (this point is discussed in more detail later in the paper). It also includes consumer durables, such as cars. However, it excludes most financial assets (e.g. stocks), as do all other currently available measures of inflation. The treatment of asset prices tends to attract most attention during periods when asset and consumer price movements diverge from each other, as happened in Japan in the late 1980s and the US in the late 1990s. The concern is that when asset prices rise faster than consumer prices, this will ultimately feed back into consumer prices. It does not follow, however, that asset prices should necessarily be included in the target index. Rather, the more natural implication is that central banks should plan ahead and engage in inflation forecasting as part of their inflation-targeting strategy. Asset prices are an important input into this process.

It is sometimes argued that food and energy prices should be excluded from the inflation target. There are two main justifications for this argument. First, Blinder (1997) argues that in the US, food and energy prices are largely beyond the control of the Federal Reserve. I find this argument surprising. Even if food and energy prices are beyond the control of the Federal Reserve, it does not follow that they should be ignored. It may still be desirable to try and make adjustments elsewhere in the economy so as to keep the CPI in an acceptable range. Second, it is generally believed that the inclusion of certain food items, such as fresh fruit and vegetables, and energy items, such as petrol, makes the CPI more volatile. Cecchetti (1997) casts some doubt on this claim. Again, even if this is true, it does not follow that these very important components of consumer expenditure should be excluded from the inflation target. What it suggests is that a central bank should be allowed to take a reasonably long-term view with regard to meeting its inflation target. A central bank should not be expected to respond aggressively to every short-run fluctuation in the CPI. Clearly, there is a role for core inflation measures to help determine the direction of the underlying inflation rate by separating transitory shocks from long-run trends (see Cecchetti 1997). However, this does not mean that a core inflation measure should become the target itself.

3. The COGI versus COLI Debate

Even if it is agreed that the focus of attention is consumer expenditure, this does not resolve all conceptual ambiguities. The CPI could be defined as measuring the cost of buying a particular basket of goods and services or as the cost of achieving a given level of utility. A distinction has, therefore, been drawn in the consumer price index literature between a cost of goods index (COGI) and a cost of living index (COLI).

The main issue for a COGI is the choice of reference basket. Let p_t denote the price vector of period t (the base period), and p_{t+k} the price vector of period $t+k$ (the current period). If the base period's basket (that is, q_t) is used, we obtain a Laspeyres price index. If the current period's basket is used (that is, q_{t+k}), we obtain a Paasche price index. Let n = 1,..., N index the goods and services included in the reference basket. It is assumed here that the goods and services under consideration do not change between periods t and $t+k$. The treatment of new goods and quality change are discussed later in the paper. The price of good n in period t is denoted by $p_{t,n}$ while the quantity of good n in the reference basket of period t is denoted by $q_{t,n}$. The Laspeyres and Paasche indices are defined as follows:

$$\text{Laspeyres: } P^L_{t,t+k} = \frac{\Sigma^N_{n=1} p_{t+k,n} q_{t,n}}{\Sigma^N_{n=1} p_{t,n} q_{t,n}} \tag{1}$$

$$\text{Paasche: } P^P_{t,t+k} = \frac{\Sigma^N_{n=1} p_{t+k,n} q_{t+k,n}}{\Sigma^N_{n=1} p_{t,n} q_{t+k,n}} \tag{2}$$

The problem with both of these indices is that they suffer from representativity bias (see TP Hill 1998). That is, to correctly measure the change in the price level, the reference basket should be representative of the two periods being compared. This problem can be dealt with by using a reference basket that is an average of the baskets of the two periods being compared. Two such indices have received attention in the price index literature.

$$\text{Marshall-Edgeworth: } P^{ME}_{t,t+k} = \frac{\Sigma^N_{n=1} p_{t+k,n} \left(q_{t,n} + q_{t+k,n}\right)}{\Sigma^N_{n=1} p_{t,n} \left(q_{t,n} + q_{t+k,n}\right)} \tag{3}$$

$$\text{Walsh: } P^W_{t,t+k} = \frac{\Sigma^N_{n=1} p_{t+k,n} \sqrt{q_{t,n} q_{t+k,n}}}{\Sigma^N_{n=1} p_{t,n} \sqrt{q_{t,n} q_{t+k,n}}} \tag{4}$$

Alternatively, instead of constructing an average basket, we could take an average of Laspeyres and Paasche indices. This is the approach followed by the Fisher index, which is a geometric mean of Laspeyres and Paasche indices.

$$\text{Fisher: } P^F_{t,t+k} = \sqrt{P^L_{t,t+k} P^P_{t,t+k}} \tag{5}$$

A price index can also be constructed by taking a geometric mean of price ratios. The geometric Laspeyres index weights each price ratio by its expenditure share in the base period, while the geometric Paasche index weights each price ratio by its expenditure share in the current period. By taking a geometric mean of geometric Laspeyres and geometric Paasche indices we obtain the Törnqvist index.

$$\text{Geometric Laspeyres: } P^{GL}_{t,t+k} = \prod_{n=1}^{N} \left(\frac{p_{t+k,n}}{p_{t,n}} \right)^{s_{t,n}} \tag{6}$$

$$\text{Geometric Paasche: } P^{GP}_{t,t+k} = \prod_{n=1}^{N} \left(\frac{p_{t+k,n}}{p_{t,n}} \right)^{s_{t+k,n}} \tag{7}$$

$$\text{Törnqvist: } P^T_{t,t+k} = \prod_{n=1}^{N}\left(\frac{p_{t+k,n}}{p_{t,n}}\right)^{\frac{(s_{t,n}+s_{t+k,n})}{2}} \tag{8}$$

The term $s_{t,n}$ denotes the expenditure share of good n in period t:

$$s_{t,n} = p_{t,n}q_{t,n}\Big/\left(\sum_{i=1}^{N} p_{t,i}q_{t,i}\right) \tag{9}$$

To avoid representativity bias, one out of the Marshall-Edgeworth, Walsh, Fisher and Törnqvist indices should be used. These indices will tend to approximate each other quite closely, so the choice between them is of limited practical significance. If required, the axiomatic approach to index numbers can be used to discriminate between them. Usually the formula that emerges as best from an axiomatic perspective is the Fisher index. In particular, it is the only one of these formulae that satisfies the factor reversal test (see Balk 1995). Nevertheless, in some circles these four indices are viewed with suspicion. Von der Lippe (2001), in particular, strongly advocates the Laspeyres index on the grounds that it is easier to interpret since it has a fixed reference basket. Among academic researchers, his is a minority position.

A COLI (see Konüs 1939) takes the following form:

$$COLI_{t,t+k} = \frac{e(p_{t+k},u)}{e(p_t,u)} \tag{10}$$

where $e(p, u)$ is an expenditure function which measures the minimum expenditure required to reach the utility level u given prices p. There are three main problems with the concept of a COLI. First, it depends on the reference utility level. Second, it assumes the existence of a representative agent. Last, but not least, it is not directly observable. We will consider each of these problems in turn.

The COLI is independent of the reference utility level only if preferences are homothetic. Clearly, in practice, preferences are not homothetic. This suggests that rich and poor people face different rates of inflation. Intuitively, this is not surprising since they buy different baskets of goods and services. For example, the price of a yacht may be a matter of concern to a rich person, but it is of complete irrelevance to a poor person. People also have different tastes. Part of this difference can be attributed to age differences. For example, the price of a hip replacement matters more to a retiree than to someone in their twenties. This brings into question the assumption of a representative agent. Attempts have been made to broaden the concept of a COLI to groups (see Pollak 1981). However, it is hard to see how this concept could be implemented in practice (see Deaton 1998).

Although the COLI is not directly observable, it is bounded from below given the reference price vector p_{t+k} by Paasche, and from above given the reference price vector p_t by Laspeyres. Paasche and Laspeyres bound the COLI because they fail to take account of the fact that consumers change their consumption patterns when relative prices change, switching from goods that have become relatively more expensive to goods that have become relatively cheaper. In other words, Paasche and

Laspeyres indices are both subject (in opposite directions) to substitution bias. The substitution bias of Paasche and Laspeyres indices in a COLI context is analogous to the representativity bias of Paasche and Laspeyres indices in a COGI context.

When preferences are homothetic, Paasche and Laspeyres indices provide lower and upper bounds, respectively, on the same COLI. It can be argued, therefore, that the geometric mean of Laspeyres and Paasche (that is, Fisher) should approximate reasonably closely the underlying COLI. Alternatively, under the assumption of utility maximising behaviour, once a functional form has been specified for the expenditure function, the COLI reduces to a function of observable prices and quantities. In fact, each price index formula is exact (that is, equals the COLI) for a particular expenditure function. For example, the Törnqvist index is exact for the translog expenditure function, while the Fisher index is exact for the normalised quadratic expenditure function. Diewert (1976) argued that we should prefer price index formulae that are exact for flexible expenditure functions (that is, expenditure functions that are twice continuously differentiable and can approximate an arbitrary linearly homogeneous function to the second order). He referred to price indices that satisfy this condition as *superlative*. Diewert went on to identify a family of superlative formulae of the following form:[1]

$$P^r_{t,t+k} = \frac{\left(\sum_{n=1}^{N} s_{t,n}\left(p_{t+k,n}/p_{t,n}\right)^{r/2}\right)^{1/r}}{\left(\sum_{n=1}^{N} s_{t+k,n}\left(p_{t+k,n}/p_{t,n}\right)^{-r/2}\right)^{1/r}} \quad r \neq 0, \quad P^0_{t,t+k} = \prod_{n=1}^{N}\left[\left(\frac{p_{t+k,n}}{p_{t,n}}\right)^{\frac{s_{t,n}+s_{t+k,n}}{2}}\right] \tag{11}$$

where $s_{t,n}$ denotes the expenditure share of product n in time period t as defined in Equation (9). A second class of superlative price indices is derived implicitly as follows:

$$\tilde{P}^r_{t,t+k} = \frac{1}{Q^r_{t,t+k}} \frac{\Sigma_{n=1}^{N} p_{t+k,n} q_{t+k,n}}{\Sigma_{n=1}^{N} p_{t,n} q_{t,n}} \tag{12}$$

where $Q^r_{t,t+k}$ denotes the corresponding family of superlative quantity indices defined below.

$$Q^r_{t,t+k} = \frac{\left(\sum_{n=1}^{N} s_{t,n}\left(q_{t+k,n}/q_{t,n}\right)^{r/2}\right)^{1/r}}{\left(\sum_{n=1}^{N} s_{t+k,n}\left(q_{t+k,n}/q_{t,n}\right)^{-r/2}\right)^{1/r}} \quad r \neq 0, \quad Q^0_{t,t+k} = \prod_{n=1}^{N}\left[\left(\frac{q_{t+k,n}}{q_{t,n}}\right)^{\frac{s_{t,n}+s_{t+k,n}}{2}}\right] \tag{13}$$

Although there are an infinite number of superlative price indices, since the parameter r can take any finite positive or negative value, only three simplify in an intuitively appealing manner: $P^0_{t,t+k}$ is the Törnqvist price index, $\tilde{P}^1_{t,t+k}$ is the Walsh price index, and $P^2_{t,t+k}$ is the Fisher price index. It should be noted that none of Laspeyres, Paasche, Marshall-Edgeworth, geometric Laspeyres and geometric

1. The limit of the superlative formula as r tends to zero is the Törnqvist price index. If Equation (11) is defined for $r = 0$ as in the Törnqvist price index, the function is continuous on the real line.

Paasche indices are superlative. It is interesting that these same three formulae (Fisher, Walsh and Törnqvist) are the three that usually emerge as best from an axiomatic perspective. Furthermore, for most data sets, the Fisher, Walsh and Törnqvist indices approximate each other closely (although it is not true that all superlative indices approximate each other closely; see RJ Hill forthcoming). Whatever the starting point, therefore, the outcome is similar.

This seems to imply that the choice between a COGI and COLI is of merely academic interest. While this is true with regard to the choice of formula, it is not true more generally, since the COGI versus COLI stance taken by a national statistical office is a signal of intent with regard to imputations. A statistical office that favours the COLI concept is likely to quality-adjust its CPI more than a statistical office that favours the COGI concept. The stance taken in the COGI versus COLI debate may also impact on the treatment of owner-occupied housing. These issues are discussed later in the paper.

The analysis thus far ignores environmental variables that affect utility such as climate, air quality, the crime rate and the divorce rate. If these are allowed to vary when computing the COLI, this drives a wedge between the COGI and COLI concepts. This is because, by construction, a COGI does not respond to such environmental variables. At this point a distinction must be drawn between a conditional and unconditional COLI (see Pollak 1989). To illustrate this distinction, an extra term z denoting environmental variables must be added to the definition of a COLI in Equation (10). An unconditional COLI, denoted here by $COLI^U$, allows z to vary over time.

$$COLI^U_{t,t+k} = \frac{e\left(p_{t+k}, z_{t+k}, u\right)}{e\left(p_t, z_t, u\right)} \tag{14}$$

By contrast, a conditional COLI, denoted here by $COLI^C$, holds z fixed.

$$COLI^C_{t,t+k} = \frac{e\left((p_{t+k}, z, u\right)}{e\left(p_t, z, u\right)} \tag{15}$$

For a conditional COLI this then raises the question of whether z_t or z_{t+k} as well as u_t or u_{t+k} should be used as the reference. This decision is analogous to the one faced by a COGI with regard to the choice of reference basket (q_t or q_{t+k}). Both a COGI and a conditional COLI should only respond to movements in the quality-adjusted prices of goods and services (appropriately weighted by expenditure shares). An unconditional COLI, by contrast, will respond to changes in environmental variables even if the prices of all goods and services remain fixed. It would make no sense, therefore, for a central bank to target an unconditional COLI. For example, suppose the divorce rate rises. This, other things equal, will increase an unconditional COLI. As a result, a central bank targeting an unconditional COLI might have to respond to this by raising interest rates. Clearly, monetary policy should only respond to changes in the prices of goods and services. Furthermore, the use of an unconditional COLI would introduce a huge number of dubious imputations into the CPI (such as placing a dollar value on the change in the divorce rate).

Which concept out of a COGI and a conditional COLI provides the most appropriate inflation target for a central bank? The Statistical Office of the European Union (Eurostat) has stated clearly that the HICP is not a COLI (see Astin 1999 and Diewert 2002), as has the Australian Bureau of Statistics (ABS) with regard to the Australian CPI (see ABS 2000). In contrast, the Bureau of Labor Statistics (BLS) has adopted the COLI concept for the US CPI (see Triplett 2001). Triplett (2001) emphatically argues that the CPI should be based on the COLI concept. However, he is unduly harsh in his criticism of the COGI since he seems to equate a COGI with a Laspeyres index. This is not necessarily the case. In a COGI setting, a Laspeyres index is still subject to representativity bias. Also, the axiomatic approach can be equally well applied to the COGI concept as to the COLI concept. Nevertheless, I agree with Triplett that a central bank should not be targeting a Laspeyres index. The target should be calculated using one of the Fisher, Walsh or Törnqvist formulae. This conclusion, however, can be reached from either the COGI or constrained COLI perspective.

Even statistical offices that advocate the COLI concept are more or less forced to use a Laspeyres index due to the fact that expenditure weights for the current period are typically not available when the CPI is released. In fact, to be more precise, the index actually used typically is not even Laspeyres. This is because the expenditure weights in the CPI are drawn from one or more years, while the CPI is computed monthly or quarterly (depending on the country). The formula actually used is a Lowe index, which is defined below.

$$\text{Lowe: } P_{t,t+k}^{Low} = \frac{\Sigma_{n=1}^{N} p_{t+k,n} q_{X,n}}{\Sigma_{n=1}^{N} p_{t,n} q_{X,n}} \tag{16}$$

The important thing to note about a Lowe index is that the quantity vector q_X does not belong to either of the periods in the comparison (see the International Labour Organization's *CPI manual*, 2004, Chapters 9 and 15).

The BLS has responded to the problem of not having up-to-date expenditure weights by releasing a retrospective chained Törnqvist version of the CPI one year after the 'Laspeyres' CPI (see Cage, Greenlees and Jackman 2003). Shapiro and Wilcox (1997) suggest an alternative approach that makes use of the Lloyd (1975)-Moulton (1996) price index, defined below.

$$\text{Lloyd-Moulton: } P_{t,t+k}^{LM} = \sum_{n=1}^{N} \left[s_{t,n} \left(\frac{p_{t+k,n}}{p_{t,n}} \right)^{1-\sigma} \right]^{1/(1-\sigma)} \tag{17}$$

Lloyd-Moulton reduces to a Laspeyres index when σ is equal to zero. The parameter σ can be interpreted as the elasticity of substitution between pairs of commodities in the basket. The substitution bias of a Laspeyres index is a direct consequence of the fact that it sets σ equal to zero. One important feature of the Lloyd-Moulton index that it shares with the Laspeyres index is that, given a value of σ, it can be computed without the expenditure data of the current period. Shapiro and Wilcox experiment with different values of σ, and find that when set to 0.7, the Lloyd-Moulton index approximates quite closely a Törnqvist index for their data set. It is unrealistic, however, to assume that the elasticity of substitution does not vary across pairs of commodities. Nevertheless, short of estimating a whole demand system, the Lloyd-Moulton index provides a useful alternative to Laspeyres for computing the headline CPI.

4. Fixed-base versus Chained Price Indices

All the index number formulae considered above (including all the superlatives) are intransitive. For example, consider the following three ways of making a comparison between 2000 and 2002, using the Fisher formula:

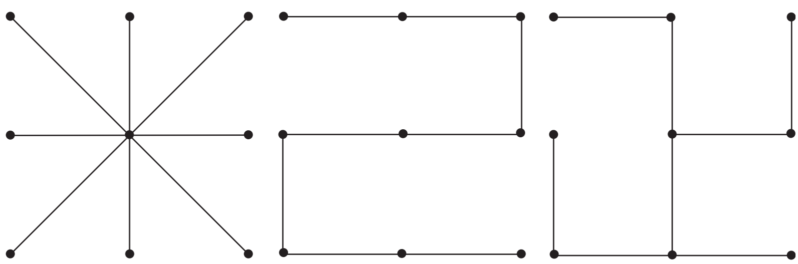
$P^F_{00,02}$ – a direct comparison

$P^F_{00,01} \times P^F_{01,02}$ – a chained comparison through 2001

$P^F_{00,95} \times P^F_{95,02}$ – a chained comparison through 1995

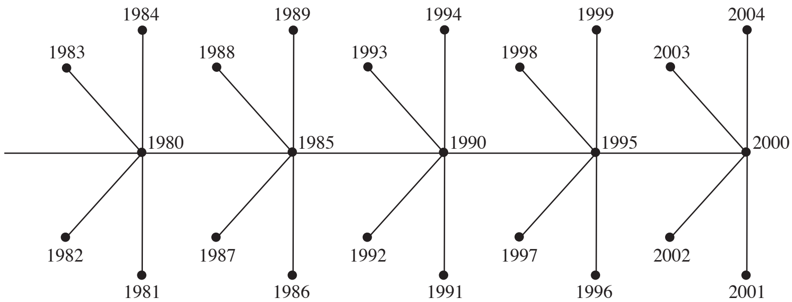
The fact that bilateral price indices are intransitive implies that each price index chain is path-dependent, and hence will generate a different answer. This has important implications for the measurement of inflation. It implies that the resulting price index series will depend both on the choice of index formula and on the way the time periods are linked together. To avoid internal inconsistencies, there should be one, and only one, path between each pair of time periods. This means that the time periods, when linked together, should form a *spanning tree* (see RJ Hill 2001). Three examples of spanning trees are shown in Figure 1. Each vertex in a spanning tree here denotes one of the time periods in the comparison. Each edge denotes a bilateral comparison between a pair of time periods.

Figure 1: Examples of Spanning Trees



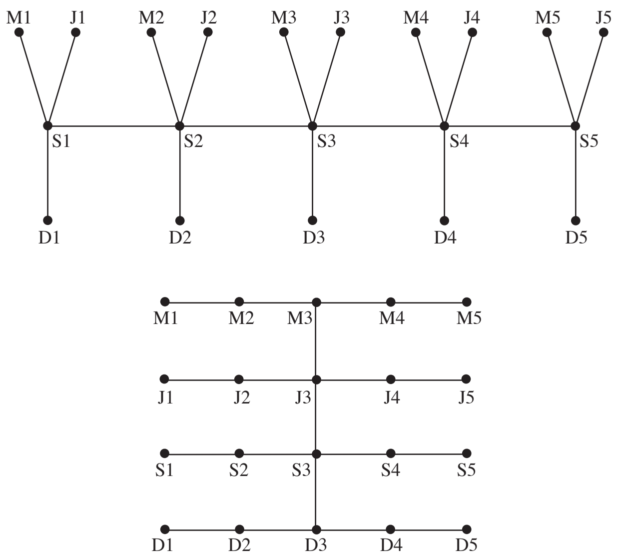
A fixed-base price index compares every period directly with the base period. This implies using a star spanning tree with the fixed base at the centre of the star (the tree on the left in Figure 1). A chained price index compares each period directly with the period chronologically preceding it. This implies using a spanning tree like the middle one in Figure 1, with the vertices ordered chronologically. Hence, it can be seen that the debate over fixed-base versus chained price indices is really a debate over the choice of spanning tree. A number of intermediate scenarios are also possible where, for example, the price index could be rebased, say, every five years. This spanning tree is depicted in Figure 2.

Figure 2: A Hybrid of the Star and Chain Spanning Trees: A Price Index that Rebases Every Five Years



Something resembling a consensus has emerged in the index-number literature that price indices should be rebased every year. This tends to minimise the sensitivity of the results to the choice of price index formula. This sensitivity can be measured by the spread between Laspeyres and Paasche indices. Generally, the closer the two time periods being compared, the smaller is the substitution or representativity bias of Laspeyres and Paasche indices and hence the closer they are together. However, for quarterly non-seasonally adjusted data the case for chronological chaining is less clear cut. In this case it is not clear whether March 2002 will be more similar to June 2002 or to March 2003 (see RJ Hill 2001). Two examples of spanning trees that annually chain quarterly data are depicted in Figure 3.

Figure 3: Examples of Spanning Trees that Annually Chain Quarterly Data



Note: M, J, S and D denote March, June, September and December.

Von der Lippe (2001) has criticised chaining on the grounds that it does not compare like with like. For example, a comparison between 2000 and 2003 is made by chaining together comparisons between 2000 and 2001, 2001 and 2002, and between 2002 and 2003. This means that, irrespective of the choice of formula, the comparison cannot be reduced to the pricing of a reference basket over two time periods. Von der Lippe forgets, however, that even a fixed-base comparison uses chaining, unless we are only interested in comparisons that involve the base year. Suppose, for example, that we wish to compare 2002 and 2003, when the fixed base is 1995. This implies chaining together comparisons between 2002 and 1995, and between 1995 and 2003. In general, it makes more sense if the intermediate links in the chain lie chronologically in between the two end points. This, by construction, is always true for a chronological chain, but is not true for a fixed-base price index when the two periods being compared lie on the same side of the fixed base.

5. Quality Change and New Goods

The two biggest sources of bias in the CPI identified by the Boskin *et al* (1996) report are new goods and quality change. New goods introduce an upward bias into the CPI (relative to a measure of the COLI) for two reasons. First, when a new good appears on the market, this in itself represents a price fall. Hicks (1940) argued that we should view the price in the period before a new good is introduced as the minimum price at which demand is zero. He referred to this price as the reservation price. Therefore, when a new good first appears, we can interpret its price as falling from the reservation price to its initial selling price. This reservation price can be estimated econometrically. For example, Hausman (1997) estimates that the reservation price of Apple Cinnamon Cheerios was about double the actual price when they first appeared on the market. Second, it typically takes a number of years for new goods to find their way into the CPI basket. This causes an upward bias since new goods tend to fall significantly in price after they are first introduced. Hausman (1999), for example, observes how mobile phones were included for the first time in the US CPI in 1998, even though they first appeared in 1983. By the end of 1997, there were 55 million mobile phones in use in the US. This second source of new goods bias in general will exceed the first, since the initial level of expenditure on new goods is typically small and hence the initial fall in price (from the reservation level) when the new good first appears should get a small weight in the CPI.

Quality change arises when a firm produces/provides a new improved version of a product/service. Frequently there is no overlap between the two versions. That is, the old version is discontinued as soon as the new version appears. Nevertheless, statistical agencies try to splice the two price series together often without making any adjustment for improved quality. Even when the old and new versions overlap the splicing process is not straightforward. Suppose, for example, that the new and old versions overlap for a single period (say period 2). Then the price index comparing periods 1 and 2 depends only on price movements in the old version, while the price index comparing periods 2 and 3 depends only on price movements in the new version. This situation can be illustrated with a simple numerical example.

Old version: $p_1 = 10, p_2 = 9$.

New version: $p_2 = 12, p_3 = 8$.

These price series can be spliced together as follows:

$p_1 = 10, p_2 = 9, p_3 = 6$.

The problem is that nowhere in this approach is the superior quality of the new model captured, thus creating an upward bias in the price index (see Nordhaus 1998, p 61).

Recently there has been a huge upsurge of interest in hedonic regression methods, as a way of capturing these quality improvements (see, for example, Silver 1999, Hulten 2003, and Pakes 2003). A hedonic model regresses the price of a product on its characteristics, some of which may take the form of dummy variables. For example, consider the case of personal computers (PCs). Three characteristics that affect the quality of a PC are its speed (MH), RAM and hard drive (GB). If we have information on the price at which computer i is sold in period t (p_{ti}) and the characteristics of each computer (that is, speed, RAM and hard drive), we can then run the following regression:

$$\ln p_{ti} = \alpha + \beta_{MH} \ln MH_{ti} + \beta_{RAM} \ln RAM_{ti} + \beta_{GB} \ln GB_{ti} + \sum_{k=1}^{T} \delta_k d_{kti} + \varepsilon_{ti} \qquad (18)$$

The d_{kti} terms are dummy variables. That is $d_{kti} = 1$ if $t = k$ and $d_{kti} = 0$ otherwise. Once the parameters α, β_{MH}, β_{RAM}, β_{GB}, $\delta_1 ... \delta_T$ have been estimated, it is then possible to specify any combination of the characteristics, and obtain an estimate of the quality-adjusted price, even if no computer in that particular period had exactly this combination of characteristics. Our main focus of interest, however, is in the δ_k parameters since these are equal to the logarithms of the quality-adjusted price indices for each period k. There are a number of technical issues that arise in the construction of hedonic price indices, such as the weighting of different models, and the choice of characteristics and functional form (for example, semi-log versus log-log). Nevertheless, it has clearly emerged in recent years as the method of choice for quality-adjusting price indices.

The BLS started applying hedonic methods to the US CPI for the apparel category in the early 1990s. Since 1999, hedonic adjustments have also been made to computers and televisions (see Fixler *et al* 1999). Hedonic adjustments are now also being made for microwave ovens, refrigerators, camcorders, VCRs, DVDs, audio products, college textbooks, and washing machines (see Schultze and Mackie 2002). The BLS has probably gone further than any other statistical office in the extent of its quality adjustments. It is no coincidence that it is also one of the strongest advocates of the COLI.

There has been some debate as to whether some hedonic adjustments used by the BLS could have gone too far (see Triplett 1999, Harper 2003, and Feenstra and Knittel 2004). Harper, in particular, argues that insufficient attention may have been paid to the role of obsolescence. Returning to the example of an old and new version of a product that overlap for a single period, the price of the old version may fall in its final period on the market. Buyers will only buy at a discount since they now have a better outside option (the new version), and sellers are trying to unload their stock. To the extent that the price fall is caused by obsolescence, this means that part of the quality improvement will be captured by the spliced price index. Failure to account for this obsolescence effect could result in price indices being over-adjusted for quality change. It remains to be seen how big an issue this is in practice.

The most intractable quality-adjustment issues arise in the health sector. At present, what is measured in the CPI is the price of inputs such as a consultation with a doctor, or of a hospital stay rather than the price of outputs such as a treatment or attaining a certain health outcome. The reservation price of a health outcome that was previously unattainable may be very high, and hence a quality-adjusted medical price index could be significantly lower than the current index included in the CPI (see Cutler *et al* 1998).

One important implication for central banks of the more rapid introduction of new goods into the CPI and the widespread adoption of hedonic adjustment methods by national statistical offices is that it may cause an implicit change in the rate of measured inflation. The adoption of hedonic quality-adjustment methods could cause significant downward adjustments to CPI inflation. If there is no corresponding adjustment to the central bank's inflation target, this will imply a loosening of monetary policy. For this reason it is important that central banks keep abreast of statistical innovations that are introduced at their respective national statistical offices.

6. The Treatment of Owner-occupied Housing in the CPI

Owner-occupied housing is the biggest single component of the CPI in most countries. It is also one of the most contentious components. Two main approaches are in use. Australia and New Zealand use the acquisitions approach. The European Union will probably soon also adopt the acquisitions approach in its HICP (at present owner-occupied housing is excluded from the HICP). Most other countries use the rental-equivalence approach. A third approach, referred to as the user-cost approach, is used by Iceland (see Diewert 2002).

The acquisitions approach is perhaps the easiest to explain. It measures the cost of constructing new dwellings. Two features of this approach warrant further discussion. First, the focus on new dwellings is standard in a CPI context. The CPI does not attempt to track the prices of second-hand goods that are traded between households. Such transactions can be viewed as transfers between households and not a net cost incurred by the household sector. It is for this reason that sales of second-hand cars are also excluded from the domain of the CPI. Far more contentious is the fact that the acquisitions approach only measures the cost of *constructing* a new dwelling. That is, changes in land prices are ignored. Again, this approach can be justified on the grounds that the land is not new.

The rental-equivalence approach, by contrast, attempts to impute the rent that an owner occupier would earn if she rented out her house rather than live in it. The total value of this imputed rent across all home-owning households is then included in the CPI. In practice, these imputed rents must be estimated from data obtained from the actual rental market. This can be problematic if the rental market is thin or if the characteristics of owner-occupied and rental properties do not match (see Kurz and Hoffman 2004). To get round these problems, in the US home owners are surveyed directly and asked to estimate the rent they could receive for their homes (see Ewing, Ha and Mai 2004).

This same issue arises for all consumer durables, of which housing is just one example (although admittedly a very important one). The CPI could track the price of a new consumer durable (that is, the acquisitions approach) or the cost of the services it provides each period (that is, the rental-equivalence approach). These two approaches will give different answers. In the case of housing, the difference can be large. This is because land prices are, to some extent, implicitly included under the rental-equivalence approach. The exact interaction depends on how rents react to changes in land prices. Irrespective of the exact nature of this interaction, the total expenditure share of owner-occupied housing is larger under a rental-equivalence approach than under an acquisitions approach, and the housing price index itself is much more responsive to changes in land prices. The impact of the choice of approach on the observed expenditure share of owner-occupied housing can be observed to some extent from comparisons across countries. The US and Canada use the rental-equivalence approach. The expenditure share of owner-occupied housing in the US and Canada is about 23 per cent and 18 per cent, respectively. The corresponding expenditure shares for Australia and New Zealand (based on the acquisitions approach) are about 11 per cent and 14 per cent, respectively (see Ewing *et al* 2004).

The case of owner-occupied housing again illustrates two important points. First, a national statistical office's stance on the COGI versus COLI debate is a good predictor of its treatment of owner-occupied housing. Statistical offices that prefer the COGI concept tend to use the acquisitions approach, while those that prefer the COLI tend to use the rental-equivalence approach. It must be emphasised, however, that the rental-equivalence approach is in no way inconsistent with the COGI concept which, it must be remembered, tracks the prices of services as well as goods. Second, the behaviour of the CPI over time can be highly sensitive to the underlying methodologies used in its construction. These can differ from one country to the next, and can change in each country over time. For an inflation-targeting regime to function effectively, it is necessary that central banks keep abreast of these methodological issues.

7. Inflation Targeting in the European Union

The creation of the European Central Bank (ECB) necessitated the construction of a harmonised index of consumer prices (HICP) for the member countries of the European Union. This was something of a logistical nightmare given the significant differences in the methodologies used by the member countries to construct their own CPIs. The treatment of owner-occupied housing is a case in point. It ended up being put in the 'too hard' category and at present is completely excluded, although in the next few years it will probably be included on an acquisitions basis (see Astin 1999).

Given its large share in total consumer expenditure (even on an acquisitions basis) this could cause a structural break in the HICP, particularly given that house prices are rising faster than the HICP in many EU countries.

The adoption of an inflation target for the euro area has been made more difficult by the widely differing inflation rates across the member countries. Differing inflation rates within the euro area means that monetary policy may be too stimulative in some countries and too restrictive in others. This problem could become more severe when the euro area is widened to include relatively low-price countries in Eastern Europe. This problem is probably an inevitable consequence of the creation of a single market with a common currency, since it is causing a convergence of price levels across countries (see Rogers 2001, RJ Hill 2004). That is, poorer, more labour-intensive countries (for example, Greece, Portugal and Spain) generally have lower price levels since non-tradables, in general, are more labour intensive and hence relatively cheaper (see Kravis and Lipsey 1983, and Bhagwati 1984). Increased labour and firm mobility is acting to reduce these differences, thus causing higher rates of inflation in these countries. Lower-inflation countries (such as Germany) are therefore burdened with higher interest rates than might otherwise be deemed desirable.

8. Scanner Data

It was stated earlier that ideally the CPI should be constructed using the Fisher, Törnqvist or Walsh formulae. One drawback of each of these formulae is that it requires expenditure data for the current period. At present such data are not generally available. The expenditure shares are typically obtained from household expenditure surveys, that in some countries are only undertaken at five- or even ten-year intervals. National statistical offices in most countries are more or less forced to use the Laspeyres formula, with the base year updated whenever the results of a new household expenditure survey become available. Furthermore, the expenditure data are only available at an aggregated level. For example, the Australian CPI only has expenditure data on 89 headings (see ABS 2000). Examples of these headings include milk, cheese, bread, and breakfast cereals.

This situation could change dramatically in the next few years due to the increased availability of scanner data. AC Nielson collects records of transactions at supermarkets, department stores and other shops. This has the potential to revolutionise the CPI in two ways. First, expenditure data will be available at the level of individual commodities. Second, both the price and expenditure data will be available almost continuously. Admittedly, this is only true for certain parts of the CPI, particularly food, beverages and clothing. It means, however, that at least for these components, the CPI can be computed weekly (or even daily) using a superlative formula such as Fisher. Third, scanner data can also be used in hedonic regressions to obtain more accurate estimates of quality change and better matching of characteristics and of products across geographical locations.

With these benefits also come problems. More disaggregated data tend to exhibit a stronger substitution effect. For example, a consumer is much more likely to substitute between two different brands of beer when relative prices change, than between beer and wine. A stronger substitution effect implies that the resulting price index will be more sensitive to the choice of formula. Reinsdorf (1999) and Feenstra and Shapiro (2003) document evidence of huge shifts in expenditure driven by sales on coffee and canned tuna, respectively. This is particularly troubling for chained price indices. For example, consider the case of a weekly chained Laspeyres price index for a particular supermarket. Suppose further that one brand of coffee is put on sale for one week (in week 2), and that this results in a huge increase in expenditure on this brand for the duration of the sale. The weekly chained Laspeyres index will give too little weight to the fall in the price in the coffee brand in week 2, and too much weight to its increase in price in week 3, both of which will create an upward bias. A fixed-base Laspeyres index, by contrast, will only be affected by the first of these biases and hence will have a smaller overall bias. By similar reasoning it follows that a weekly chained Paasche index could have a stronger downward bias than a fixed-base Paasche index. Although chained Fisher should be free of substitution bias, the large biases in chained Laspeyres and Paasche indices (remembering that Fisher is the geometric mean of Laspeyres and Paasche) may cause it to be somewhat erratic. Reinsdorf indeed finds evidence of erratic movements in chained Fisher indices for the case of coffee. The findings of Feenstra and Shapiro (2003) are even more surprising. For the case of canned tuna, they find that even the chained Törnqvist index has an upward bias. This is surprising since like all other superlative indices it satisfies the time-reversal test (see Balk 1995). They attribute the bias to the fact that sales are only advertised towards the end of the period, and hence there is a large spike in expenditure just before the sale ends. This means that the rise in the price of tuna when the sale ends has a much bigger effect on the index than the fall in price when the sale begins.

A number of national statistical offices have started experimenting with scanner data with the intention of eventually incorporating them into their CPIs. The experiences of Statistics Netherlands and the ABS are discussed in van Mulligen and Oei (forthcoming) and Jain and Caddy (2001), respectively. The paper by Reinsdorf (1999) is part of a broader project on the properties of scanner data at the BLS in the US.

From a central banking perspective, scanner data raise two main issues. First, there is the question of how frequently the CPI should be computed. The frequency varies across countries from monthly to quarterly. Scanner data, however, open up the possibility of computing a weekly CPI. It is not clear whether a central bank should be in favour of such a development, particularly if in the process, the CPI becomes more volatile. The increased volatility of the CPI at existing frequencies is the second issue. The use of scanner data will almost certainly increase volatility since it captures the strong substitution effects that occur at the level of individual commodities. More research is required to determine the best ways of handling scanner data. As was noted above, it is already clear that such indices should not be chained weekly. Nevertheless, it is only a matter of time until national statistical offices start using scanner data in their CPIs. Central banks, therefore, should start thinking about the implications of scanner data for inflation targeting.

9. Conclusion

Inflation targeting has been remarkably successful at bringing down inflationary expectations in most countries that have adopted it. There has been much debate regarding what rate of inflation a central bank should be targeting, and on methods for forecasting the rate of inflation so that a central bank can anticipate future trends and better meet its target. One aspect of the inflation-targeting regime, however, that has perhaps been somewhat neglected in the literature is the choice of the target price index itself. It is by no means clear that the CPI is the ideal target. The CPI in most countries was designed as a benchmark for adjusting public and private sector wages rather than as a monetary policy benchmark. Some researchers have argued that, in an inflation-targeting context, the focus of the CPI is too narrow since it ignores prices of a range of items, such as investment goods, public-sector goods and services, exports, and assets such as land and equities. In contrast, other researchers have argued that its focus is too broad, and that volatile elements such as some, or all, food and energy prices should be excluded.

Even supposing that we agree on the CPI as the inflation target, a national statistical office must still make a number of decisions that can significantly affect the index. First, there is the matter of whether the statistical office views the CPI as a COGI or COLI. This decision need not, in and of itself, necessarily have a major impact. However, in practice, it usually does, since it sets the tone with regard to the number of imputations included in the index. Two key types of imputations are made in the CPI. The first type are quality-adjustments, particularly to computers, televisions, microwave ovens, refrigerators, VCRs, DVDs, washing machines, cars and in the health sector. These adjustments are usually made using hedonic regression methods. The second type of imputation is the treatment of owner-occupied housing. Statistical offices that adopt the COLI concept tend to make more quality adjustments (potentially making the CPI lower than it would otherwise be, by as much as 1 percentage point, using the Boskin report as a rough guide), and tend to use the rental-equivalence approach for owner-occupied housing. When house prices are rising faster than the CPI excluding housing, then the use of the rental-equivalence approach will tend to make the CPI rise faster than if the acquisitions approach (generally preferred by advocates of the COGI) is used. It is important, therefore, that each central bank keeps abreast of the imputations its statistical office is including in the CPI, and in particular of any changes in methodology that might affect the index. Failure to do so could result in inadvertent changes in the stance of monetary policy. For example, if a statistical office suddenly expands its quality-adjustment program, this may require a central bank to lower its inflation target to avoid a loosening of monetary policy.

Looking forward, scanner data have the potential to revolutionise the construction of the CPI by providing far more detailed expenditure weights at far greater frequency than are currently available. The incorporation of scanner data into the CPI may make the index more volatile as well as allowing it to be computed more frequently (for example, on a weekly basis). It might be prudent for central banks also to start considering how the use of scanner data in the CPI might affect the operation of an inflation-targeting regime.

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Discussion

Christopher Kent

Robert Hill has made a valuable contribution to the conference in a number of respects. First, he has provided a succinct and thought-provoking discussion of the broad range of issues relevant to measuring inflation. Second, he has highlighted a number of developments that could potentially alter the way in which we measure inflation. For example, as Robert has explained, a reduction in the measurement bias would, by itself, reduce average CPI inflation, while a shift to more frequent updating of expenditure weights could increase the short-term volatility of CPI inflation. And third, he has issued a challenge for inflation-targeting central banks to consider the likely impact of these potential changes in inflation measurement on monetary policy. It is this third area on which I will focus my attention.

The relevant discussion for policy-makers can be framed around two related questions: (i) how should inflation targeters deal with changes in the measurement of inflation; and, (ii) should inflation targeters care about the potential for mismeasurement of inflation? The short answers are first, that a flexible inflation-targeting regime can deal quite effectively with changes that affect the measurement of inflation, and second, we should be concerned about mismeasurement, but perhaps not as much as one might think. Ensuring that the measurement bias is as modest as possible is important to enhance the credibility of an inflation-targeting regime, and like all central banks, inflation targeters need to play a role in the decision processes leading to possible changes in the way that statistical agencies measure inflation. But as long as the bias is not too large, the key question for inflation targeters is whether the bias is changing over time in a systematic fashion.

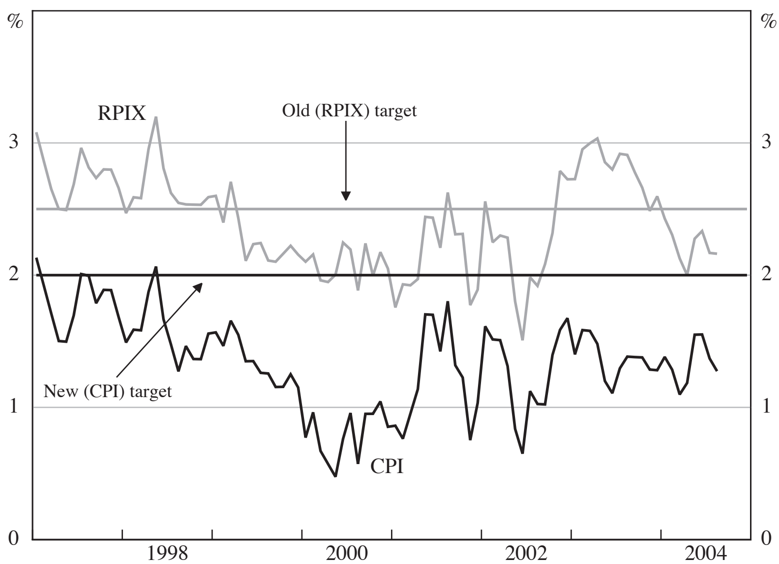
How to deal with changes in the measurement of inflation

The response to changes in the measurement of inflation depends crucially on the nature of the change. Consider a large change in the average rate of measured inflation. Perhaps surprisingly, the larger the change in the mean, the more obvious the solution: namely, it will likely force an adjustment in the inflation target itself. *A priori*, the adjustment process should not be a costly one so long as the central bank can leverage off its existing credibility to help reset the medium to long-term inflation expectations of the general public and financial markets around the new target.[1] The transition could be problematic, however, if the change leads current inflation to be further from target than had been the case under the old system. In this case, a flexible inflation-targeting regime will reduce the output cost of transition compared to a targeting regime that is required to return inflation to target in a relatively short time.

1. A more complete analysis would acknowledge the possible distinction between expectations regarding measured inflation and actual inflation, but this is beyond the scope of these brief comments.

In the UK in late 2003, the Bank of England (BOE) switched from targeting the retail prices index (excluding mortgage costs, RPIX) to the harmonised consumer prices index (CPI). The difference between the annual rates of inflation across the two measures was in the order of ¾ of a percentage point on average over the past 15 years, though it has been higher more recently (Figure 1; King 2004). The Governor of the BOE, Mervyn King, described the changeover as being akin to switching from Fahrenheit to Centigrade – the numbers change but the temperature stays the same. The problem is, however, that this assumes that the thermostat is also adjusted proportionately. The targeted level of inflation was indeed lowered, from 2½ per cent under the old RPIX regime to 2 per cent for the new CPI regime. At the time of the changeover, the RPIX measure was close to its target; it has since come down some way. The CPI, however, was well below its target at the time of the switch. Perhaps even more importantly, the CPI has been below 2 per cent for a considerable time. The RPIX had been above the CPI by more than ½ a percentage point in large part due to the rapid growth in housing-related prices, and when these pressures dissipate the two measures of inflation will likely move closer together. While this may be true, reducing the rate of inflationary pressures stemming from the housing market will not raise the rate of CPI inflation. The trend rate of CPI inflation will need to rise significantly relative to its recent history in order to bring it to the 2 per cent target.

Figure 1: United Kingdom – Inflation
Year-ended



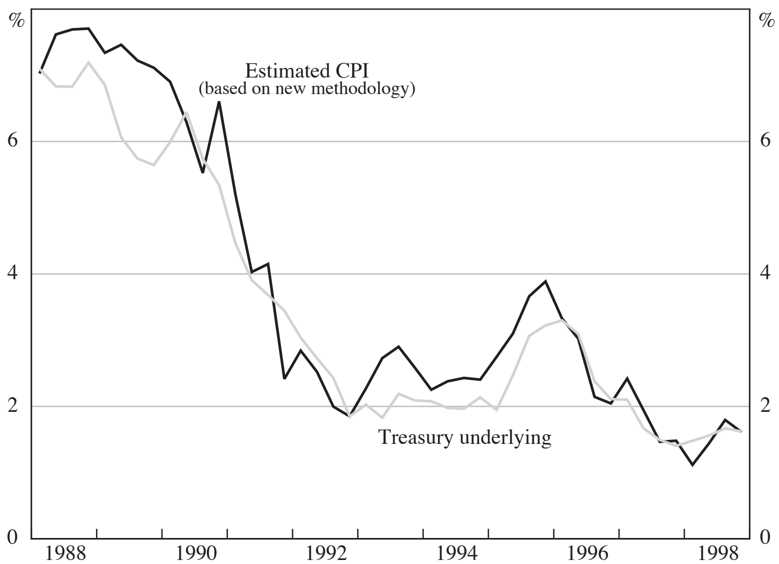
Source: Thomson Financial

In contrast to the UK case, adjusting the inflation target may not make sense for changes in the inflation measure that lead to only relatively small changes in average inflation. For example, it would be impractical to switch from a target of between 2 and 3 per cent to a target of, say, between 2.2 and 3.2 per cent on average over the course of the cycle. This type of change would, therefore, require a transition that brings actual inflation according to the new measure into line with an unchanged inflation target. This transition will be less costly (in terms of output fluctuations) if: the central bank's commitment to the target is credible enough to anchor expectations around the unchanged target; and the targeting regime is relatively flexible.

In late 1998, the RBA decided to switch the measure of inflation it targeted from an underlying measure of CPI inflation (labeled in Figure 2 as 'Treasury underlying') to the headline CPI measure. This followed a modification to the CPI which meant that, among other changes, mortgage and consumer interest charges were replaced by house purchasing costs (RBA 1998). Inflation based on the Treasury underlying measure averaged 2.2 per cent from 1993 to 1998, compared with 2.4 per cent based on estimates of the CPI over the same period derived from the new acquisitions-based methodology. The switch was advantageous in at least three respects. First, it allowed the target to be defined in terms of the headline consumer price inflation measure published by the ABS, which was likely to have wider acceptance in the community. Second, the new measure actually had an average inflation rate closer

Figure 2: Australia – Consumer Price Measures

Year-ended percentage change



Sources: ABS; RBA

to the mid point of the 2 to 3 per cent range. And third, it occurred at a time when the old and new targeted measures were estimated to be relatively close to each other. This would not have been true had the switch taken place, for example, during 1996 when estimates suggest that the new CPI methodology would have resulted in a measure of inflation that was somewhat higher than the underlying measure. The new measure was not without disadvantages, however. In particular, it tended to display greater short-term volatility. To help address this, the Bank emphasised the need to use underlying measures of inflation to help assess inflationary trends, even though the target is expressed in headline terms. Also, the flexibility of the targeting regime helped to deal with higher short-term volatility by allowing the Bank to look through temporary deviations from the target.

In summary, credibility allows a low-cost transition if a new measure of inflation is used for the target. In the case where the measure of inflation that is targeted is altered but the level of the target itself is not, adjustment to the target is less costly if wage and price setters believe that the central bank will act to move the economy to that target in a timely manner. In the case where the target is adjusted along with the inflation measure that is targeted, central bank credibility will help to ensure rapid adjustment of people's expectations to the new anchor. A flexible targeting regime is likely to help in both cases; luck also matters, but it matters less if the timing of the changeover is suitably chosen. Finally, it seems obvious that central banks should play some role in the decision process leading to changes in the targeted measure of inflation.

Should inflation targeters care about the potential for mismeasurement?

Inflation targeters should care about inflation mismeasurement if the bias is especially large, since this would reduce the extent to which the targeted measure is accepted among the general population, thereby reducing the credibility of the targeting regime. However, so long as the bias is small, then switching to an even less biased measure of inflation is not necessarily optimal from the perspective of an inflation-targeting central bank. This is because other characteristics of the targeted measure matter besides just mismeasurement.

It is desirable for the targeted measure of inflation to satisfy at least four general characteristics. It should be: (i) widely understood and accepted; (ii) a broad measure of prices; (iii) timely; and, (iv) have a high signal-to-noise ratio. Acceptance helps to establish credibility for the targeting regime. The desirability of a broad measure follows from the first and helps to ensure that policies to reach the target also impart stability across the economy as a whole. Timeliness will aid public acceptance of the measure and is relevant to the operational concerns of the central bank, that is, by helping to signal recent inflationary trends. And a high signal-to-noise ratio will also enhance acceptance, since the public will loose faith in a measure that moves around too much in the short term relative to its medium-term trends. It will also help to satisfy operational concerns regarding accurate assessment of current and likely near-term trends.

It is not clear that a measure that captures the true changes in the cost of living or the cost of goods and services is necessarily optimal when judged against all of these four characteristics. For example, any such measures are likely to be less well understood and less timely than a measure such as the standard Laspeyres measure of the CPI. And, as Robert has suggested, they are unlikely to be available on a timely basis and may display a lot of short-term volatility. Even in the case where this volatility reflects true movements in short-term prices facing consumers, if this is at a frequency over which policy can have very limited influence (for example, less than a couple of quarters), then it may be preferable to target a less volatile, albeit less than perfect, measure of true prices.

A biased measure such as the Laspeyres CPI may better satisfy many of these characteristics, including being well understood, already widely accepted and available on a timely basis. Relative to a measure such as the Fisher Ideal index suggested by Robert, the Laspeyres index does suffer from measurement bias. However, this does not create sizeable problems for an inflation-targeting central bank, so long as the bias is not too large and is not subject to significant variation over time. Also, the inflation target must obviously be set high enough to account for the bias. Statistical agencies can do much to help minimise the size of the bias, including, for example, regularly updating the weights used in the Laspeyres index. The Australian Bureau of Statistics updates the expenditure weights at the level of the 89 expenditure classes only infrequently – typically every five years – but does make adjustments to weights within categories more frequently according to new products and services. Even variation in the measurement bias over time, however, is not a significant problem, so long as it is small relative to other factors affecting inflation and the targeting regime is sufficiently flexible.

The US Federal Reserve tends to focus on the measure of consumer price inflation based on the core chain price index for personal consumption expenditures from the Bureau of Economic Analysis (Federal Reserve Board 2000, 2004). While this has the advantage of a smaller bias than the headline CPI (Laspeyres) measure of inflation published by the Bureau of Labor Statistics, it is not as well understood nor widely accepted by wage and price setters. Also, it is subject to revisions, which can at times be quite substantial and, therefore, problematic for an inflation targeter (for estimates of these revisions, see Clark 1999).

In summary, central banks care about a range of characteristics with respect to the inflation measure targeted. Accurately measuring the change in a broad measure of prices is important, but not the only consideration. Moderate mismeasurement of the true change in the cost of living is not a problem *per se*. The more important question is whether mismeasurement is changing over an extended period of time. I suspect that this is difficult to test accurately, but it is not clear why the extent of the bias in the CPI in Australia has changed over time in a systematic way. Finally, problems of mismeasurement matter less for a central bank with a credible and flexible inflation-targeting regime.

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Inflation in Australia: Measurement and Modelling

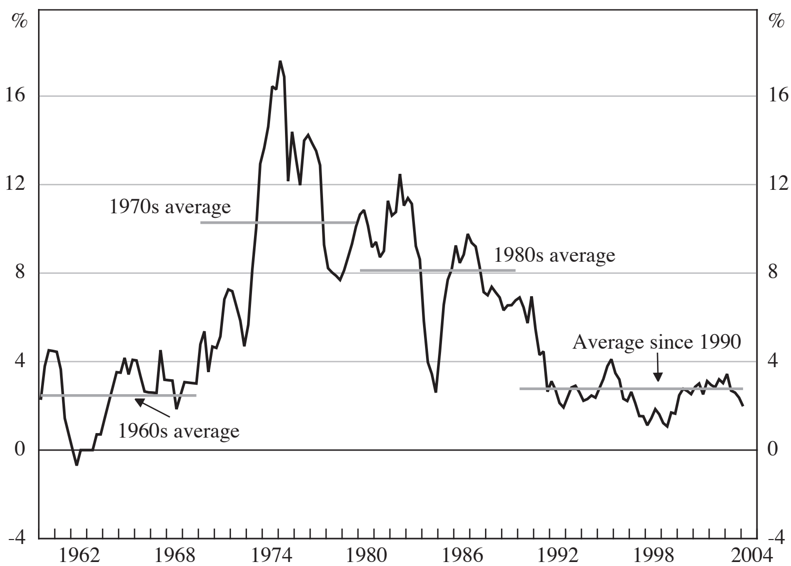
Alexandra Heath, Ivan Roberts and Tim Bulman[1]

1. Introduction

Since 1993, monetary policy in Australia has targeted CPI inflation of between 2 and 3 per cent, on average, over the course of the cycle. Over this period, the average of CPI inflation has fallen markedly to 2½ per cent, the lowest it has been for a sustained period since the 1960s (Figure 1). This paper examines two topics that are important for understanding and interpreting the behaviour of inflation: the measurement of underlying inflation and exchange rate pass-through. These topics are of particular interest in the current context because effective implementation of

Figure 1: Inflation in Australia

Year-ended



Note: RBA estimates, excluding interest charges prior to September quarter 1998 and adjusted for the tax changes of 1999/2000

Sources: ABS; RBA

1. We have benefited from discussions with many colleagues on the topics covered by this paper, but we especially wish to thank Adrian Pagan, Anthony Richards and Malcolm Edey for helpful comments. We are also grateful to Kylie Smith for preparing Appendix E of this paper. Any errors are ours alone.

an inflation target requires a good sense of current inflationary pressures and good short- to medium-run forecasts for inflation.

CPI inflation can be affected by non-trivial relative price movements which monetary policy may wish to look through to the extent that they are temporary and do not get built into inflation expectations. To this end, it is important to have good measures of underlying inflation that abstract from temporary volatility in relative prices and should thereby improve our ability to assess current inflationary pressures and to forecast inflation. We begin Section 2 of the paper by surveying the recent literature on the properties that a measure of underlying inflation should have to be useful in an inflation-targeting context, and present a minimum set of statistical criteria it should satisfy. We then assess an array of underlying inflation measures according to these criteria. We find that the weighted median and trimmed mean measures published by the Reserve Bank of Australia (RBA), as well as a number of other measures, fulfil the criteria. It is apparent, however, that the utility of the various underlying inflation measures considered has declined since the transition to low inflation in the early 1990s.

The second part of the paper looks at the issue of exchange rate pass-through. As Australia is a small open economy subject to significant external shocks, understanding the pass-through relationship between exchange rate movements and consumer prices is important for obtaining good forecasts of inflation. This issue has received considerable attention of late because anecdotal evidence suggests that there has been surprisingly little pass-through of large exchange rate movements to import prices and final prices in a number of countries over the past decade or so.

We start Section 3 by surveying the literature on why this may have occurred. Perhaps of most interest are explanations that link the fall in pass-through over the short to medium run to changes in inflation expectations arising from changes in the monetary policy regime. We then review the cross-country evidence for a change in the pass-through of exchange rate movements into import prices and consumer prices in the 1990s. While the slowing in pass-though to final prices appears to be a pervasive phenomenon, the cross-country evidence is not conclusive as to why this has occurred. We also update earlier research for Australia. This shows that while there is no evidence of a change in import prices' responsiveness to movements in the exchange rate, it appears that the pass-through of import price movements to consumer price inflation has slowed. In Section 4 we summarise our findings and make some concluding comments. In short, we find that CPI inflation in Australia responds to shocks more slowly, and as a consequence is more stable, than it was prior to the adoption of inflation targeting.

2. Underlying Inflation

As already discussed, good measures of underlying CPI inflation are important in the context of an inflation-targeting regime because they allow policy-makers to look through the effects of short-term movements in CPI inflation stemming from relative price movements. The literature has produced a number of specific criteria by which to judge different underlying inflation measures within the operational context of an inflation-targeting regime. Roger (1998) argues that an appropriate measure of underlying (also referred to as core) inflation should be timely, credible (verifiable by agents independent of the central bank), easily understood by the public, and not significantly biased with respect to the targeted measure of inflation. Roger (1998) also regards the identification of a relatively transparent measure of underlying inflation as highly conducive to the credibility of the central bank, irrespective of the actual inflation target. Wynne (1999) suggests such a measure should also be computable in real time, have some predictive power relative to future inflation, be familiar to the public, and not be subject to revisions. As Wynne (1999) emphasises, these features are only important to the extent that the central bank seeks to use a measure of underlying inflation as an important part of its routine communications with the public to explain policy decisions. As the RBA publishes some measures of underlying inflation on a routine basis, such considerations are relevant in the Australian context.

As noted by Marques, Neves and da Silva (2002), while many of the above criteria are sensible, they are somewhat vague, and do little to clarify exactly what statistical conditions a suitable underlying inflation indicator should satisfy. One approach to resolving this issue, due to Bryan and Cecchetti (1994) and Bryan, Cecchetti and Wiggins (1997), makes the case that the optimal indicator is the one that best approximates a 'reference' measure of core inflation (such as a 36-month-centred moving average), as indicated by root mean squared error (RMSE) or mean absolute deviation (MAD) statistics. While it is plausible that a moving average of inflation may capture 'trend' inflation as well as any other measure of underlying inflation, it is not necessarily an appropriate benchmark against which other possible measures ought to be assessed. Moreover, as Aucremanne (2000) observes, the optimal measure may not be robust to different reference measures calculated over alternative horizon windows, and this is the case for Australian data. In view of this ambiguity, it can be argued that rather than focus on a single optimal measure of underlying inflation, a central bank should consider a collection of underlying measures. However, the measures considered should comply, at a minimum, with two properties that are desirable in an inflation-forecasting context.

To understand these properties, we start with the following decomposition of CPI inflation, along the same lines as that provided by Bryan and Cecchetti (1994):

$$\pi_t = \pi_t^* + v_t \tag{1}$$

where π_t is CPI inflation, π_t^* is underlying (or trend) inflation and v_t is a temporary disturbance, in any period *t*. The disturbance term can be interpreted as a relative price shock. We would expect higher relative price volatility to increase the measured discrepancy between CPI inflation and underlying or trend inflation temporarily over a given period. Also, in the absence of relative price shocks, there should be no difference between CPI and underlying inflation.[2] Therefore, Equation (1) implies that a good proxy for underlying inflation should be unbiased with respect to CPI

2. As expected, CPI inflation is more volatile than any of the underlying inflation measures discussed in this paper (see Section 2.2.1 for details).

inflation. This property is particularly important if the underlying measure of inflation is expected to provide an accurate forecast of the path of CPI inflation.

We test for the unbiasedness of a given underlying inflation measure with respect to CPI inflation by estimating Equation (2) and testing the joint null hypothesis that $\alpha_0 = 0$ and $\beta_0 = 1$. It bears noting that this test only assesses whether or not the bias is statistically significant.

$$\pi_t = \alpha_0 + \beta_0 \pi_t^* + \nu_t \tag{2}$$

The second property a good measure of underlying inflation should have is that it contains information about future trends in CPI inflation over and above the information that the CPI itself provides about its future path. Intuitively, if a deviation between CPI and underlying inflation arises because of a temporary relative price shock, we would expect that CPI inflation would revert to underlying inflation and, more generally, we would expect that a good measure of underlying inflation would not 'depend' on movements in CPI inflation. This condition can be formalised by stipulating that underlying inflation should Granger cause CPI inflation and that Granger causality should not run in the opposite direction (Bryan and Cecchetti 1994). To do this, we estimate Equations (3) and (4):

$$\pi_t = \alpha_{10} + \sum_{j=1}^{n} \alpha_{1j} \pi_{t-j} + \sum_{j=1}^{n} \beta_{1j} \pi_{t-j}^* + \eta_{1t} \tag{3}$$

$$\pi_t^* = \alpha_{20} + \sum_{j=1}^{n} \alpha_{2j} \pi_{t-j} + \sum_{j=1}^{n} \beta_{2j} \pi_{t-j}^* + \eta_{2t} \tag{4}$$

Since inflation is assumed to be stationary, these equations can be estimated separately by ordinary least squares. We then conduct Wald tests for the joint hypotheses that $\beta_{1j} \neq 0$ for all *j* and that $\alpha_{2j} = 0$ for all *j*. The lag order *n* is determined by a general-to-specific approach using the Schwarz Bayesian Criterion. We do not include the contemporaneous level of underlying inflation in Equation (3), as we are interested in the predictive ability of underlying inflation with respect to the *future* path of CPI inflation.

The literature has examined additional methods that could be used to assess measures of underlying inflation. If CPI and underlying inflation are both shown to be I(1) processes, Marques, Neves and Saramento (2000) and Marques *et al* (2002) suggest that CPI and underlying inflation should also be cointegrated and that only CPI inflation should respond to deviations from this cointegrating relationship. Dixon and Lim (forthcoming) apply this assessment procedure to Australian data on the basis that four-quarter-ended CPI inflation and the 'true' underlying inflation (calculated by compounding quarterly observations) are, in their view, both empirically I(1). In Section 2.2.2, we argue that, in contrast, the quarterly data support the interpretation that the inflation rate is stationary. This result is reassuring insofar as the assumption that inflation is I(1) is inconsistent with the idea of an effective inflation-targeting regime with a constant target range.

In Section 2.1 we examine a range of potential underlying inflation measures. We assess these for unbiasedness and Granger causality in Section 2.2, noting that these properties can only be considered a minimum set of characteristics that a suitable measure of underlying inflation should have. The assessment of different measures based on their contribution to the accuracy of reduced-form forecasting equations would be a worthwhile area for future research.[3]

2.1 Measures of underlying inflation

There are three main methods of estimating underlying inflation in common practice. The first is to use a dynamic smoothing technique or linear filter, such as a centred moving average or a Hodrick-Prescott filter. These filters are relatively straightforward, and have been used as benchmark measures of underlying inflation in a number of studies.[4] However, there are a number of reasons why they may be of limited use in a policy context. Most importantly, linear filters are subject to the end-point problem; that is, as new data are added to the end of a series, the extracted trend can change, in some cases substantially. Another constraint is that they are generally atheoretical in the sense that no economic intuition has been called upon to define how a trend should behave. Thus, it is unclear how many periods should be included in the moving average, what weighting scheme should be used, or, in the case of the Hodrick-Prescott filter, what smoothness penalty should be applied. Consequently we do not consider underlying inflation measures produced using smoothing techniques further in what follows.

The second method is to exclude specific items whose price movements are more likely to reflect policy changes or temporary relative price movements, rather than movements in the general price level. The third method is to use statistical approaches, such as calculating the median, which are robust to some of the relative price movements that do not represent the underlying inflation process, without explicitly removing any specific information. We deal with these two methods in more detail below.

2.1.1 Exclusion-based measures

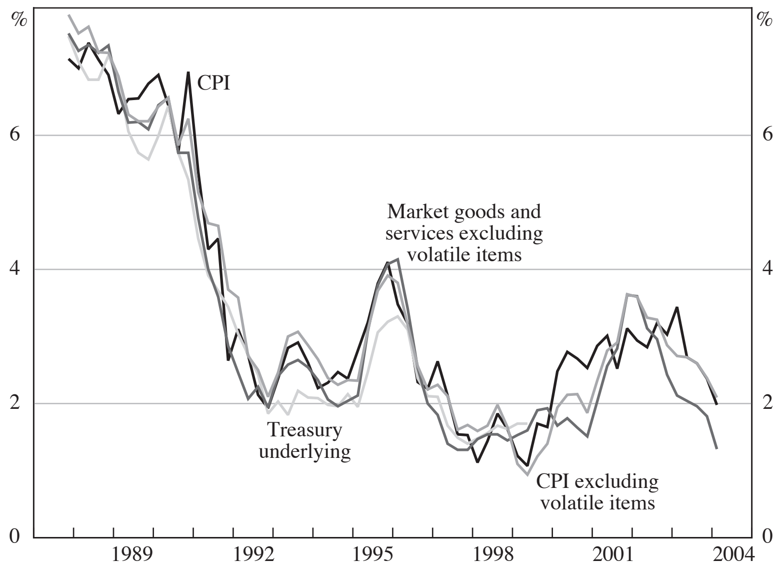
These measures exclude price movements of items that are thought most likely to influence aggregate inflation for reasons that are not related to underlying inflationary forces. Examples include prices that are set in the public sector independently of supply and demand movements, or prices that are strongly influenced by temporary supply factors – such as weather conditions – that are likely to be reversed. In Australia, there have been three main exclusion-based measures that have gained some prominence during the inflation-targeting period: the Treasury underlying series, the CPI excluding volatile items, and the price of market goods and services excluding volatile items (Figure 2).

3. Smith (2004) assesses measures of underlying inflation by examining the performance of underlying inflation measures in richer forecasting specifications than the elementary models described above.

4. Dixon and Lim (forthcoming) obtain an estimate of underlying inflation using an unobserved components model, another linear filtration method.

Figure 2: Exclusion-based Measures of Underlying Inflation

Year-ended



Note: RBA estimates, excluding interest charges prior to September quarter 1998 and adjusted for the tax changes of 1999/2000

Sources: ABS; RBA

The Treasury underlying inflation series removed a number of items including the prices of fresh food and clothing, government-owned dwelling rents, property rates and charges, and the costs of utilities, health services, pharmaceuticals, and education. Another important item that was excluded was interest rate charges, which was used in the CPI to proxy the cost of housing. From a policy point of view, the inclusion of this variable in the CPI is problematic, as a tightening of monetary policy would automatically lead to an increase in the CPI. For this reason, the RBA initially phrased its inflation target in terms of the Treasury underlying series of inflation. Subsequently, the ABS introduced a new basket for the CPI that replaced interest rate charges with new project home prices, resulting in what is known as the acquisitions-based CPI. The RBA restated its inflation target in terms of CPI inflation, and publication of the Treasury underlying series was ceased after June 1999.

The ABS currently publishes two exclusion-based measures of inflation: CPI excluding volatile items and market goods and services excluding volatile items. The volatile items that are excluded are fruit and vegetables, which experience large temporary price movements, chiefly reflecting domestic supply conditions; and petrol, which is affected by world oil prices and the exchange rate. The market prices excluding volatile items measure excludes these items as well as those whose prices are set by the public sector and/or are not driven by ongoing supply and demand constraints, such as pharmaceuticals and urban transport.

These series are less volatile than the published CPI series. However, the excluded items are removed in all time periods, not just those in which their prices are clearly uncharacteristic of the underlying trend. There are also instances, such as observed recently in Australia, in which items that are not excluded experience significant relative price movements that should be excluded. This can result in a misleading portrayal of underlying inflationary pressures in the exclusion-based numbers. For example, various levies introduced by the Government in late 2001 had the effect of rapidly boosting airline ticket prices, which contributed strongly, but temporarily, to CPI inflation in both quarterly and year-ended terms.

2.1.2 Statistical measures – trimmed means and weighted medians

CPI inflation is calculated as the weighted mean of the distribution of price changes. This makes it sensitive to large relative price movements that do not represent underlying price movements. If, for example, the distribution of price changes is positively skewed, because there is a tendency for large relative price changes to be positive, the weighted mean of the distribution will lie above other measures of central tendency such as the median.[5] In Australia, the quarterly distribution of price changes has tended to be positively skewed more often than it has been negatively skewed (Kearns 1998). Even if there is no excess skewness, but there are large relative price movements and the distribution of prices changes displays excess kurtosis (fat tails), the weighted mean will be more sensitive to these movements and probably harder to forecast (Bryan and Cecchetti 1994). Statistical measures of underlying inflation are designed to be more robust to large relative price movements that lead to deviations of the distribution of price changes from the normal distribution.

The trimmed mean is calculated by removing a certain proportion of the weight from each tail of the distribution of price changes, rescaling the remaining weights to sum to one, and calculating the weighted mean of the remaining distribution. The weighted median is calculated as the price change in the middle of the distribution, which can be thought of as a trimmed mean calculated such that 50 per cent of the distribution above and below the observation is excluded (that is, 'trimmed'). Appendix B provides formal definitions.

Although the weighted median is theoretically the measure least affected by outlying relative prices movements, it is unlikely to be the most efficient as it gives potentially informative observations a zero weight. Thus, there exists a trade-off between robustness and efficiency that may be exploited by varying the proportion of the distribution of price changes which is trimmed. Bryan and Cecchetti (1994) propose that the optimal trim can be found by searching across different trims and choosing the time-invariant trim that minimises the RMSE when the underlying measure is compared to a 'benchmark' underlying series. The benchmark that is often chosen is a moving average.[6]

5. For a normal distribution, the mean and median are equivalent, which makes it easy to determine the central tendency of the distribution.

6. Using this methodology for Australia, Kearns (1998) showed that there could be significant gains from trimming even a small proportion of the distribution of price changes, and that these benefits typically increased with the size of the trim. These results led him to recommend the weighted median as the best measure of underlying inflation.

The choice of any given benchmark series is, however, somewhat arbitrary. Following the Bryan and Cecchetti (1994) procedure, we have found that the optimal trim chosen when using Australian data can be very sensitive to the smoothness of the benchmark series chosen as well as the sample periods used in the calculation of the RMSE and MAD statistics, suggesting that few firm conclusions can be drawn from this procedure in the Australian context.[7]

An alternative approach to estimating underlying inflation is to choose the least amount of trim necessary to accept the hypothesis that the remaining distribution has skewness and kurtosis properties of a normal distribution. This approach has been followed by Aucremanne (2000), using the Jarque-Bera statistic to test normality in the cross-section distribution corresponding to each time period. This procedure allows the degree of trim to vary for each cross-section distribution being considered, and thus has the potential to exploit the trade-off between robustness and efficiency more effectively than standard trimmed means.

The usefulness of a trimmed mean or weighted median measure may be called into question if the average inflation over time implied by that measure is significantly different from that implied by the weighted mean (CPI). This would suggest that the underlying inflation measure being used is biased, and shows a long-run tendency to diverge from the target variable. As indicated in Kearns (1998) and Roger (1997), *inter alia*, one way to correct for this bias is not to centre the trim on the 50th percentile, but to centre it on the percentile that ensures the average of quarterly changes in the underlying variable lines up with that corresponding to the target variable. This issue has proved particularly problematic in New Zealand, where strong and persistent right-hand skewness in the distribution of price changes results in a large difference between the weighted mean and weighted median, and it has been shown that the 57th percentile is a more appropriate centre (Roger 1997). In the Australian context, Kearns (1998) found that centres between the 51st and 53rd percentiles were most appropriate. In an analysis of European inflation data, Aucremanne (2000) optimises the central trimming percentile by choosing the percentile that minimises the average absolute difference between observed and expected inflation.

An extension to Aucremanne's (2000) Jarque-Bera optimisation procedure is to relax the implicit assumption that the central trimming percentage remains constant over time and allow it to vary in line with the characteristics of the cross-section.[8] Such an approach would retain the key advantage of a trimmed mean by being robust to excess kurtosis, while correcting for a key disadvantage – namely, bias resulting from excess skewness. While this approach, in principle, does not guarantee that the bias creating a wedge between the underlying measure and the published CPI will be eliminated, we find that empirically it does at least as good a job of eliminating the bias as, say, the symmetric 30 per cent trimmed mean, and tends to reduce the amount trimmed from quarter to quarter.

7. More details of this analysis are available from the authors on request.

8. For details, see Appendix B.

2.1.3 Volatility-weighted measures

Exclusion-based measures restrict volatility in the CPI by removing components that are presumed to make a consistent contribution to that volatility, whereas the statistical measures considered above attempt to trim volatility according to characteristics of the distribution of price changes in each time period. A further means of restricting the volatility in published inflation is to weight the components in the CPI by the inverse of their volatility, giving rise to the 'neo-Edgeworthian' index (see Appendix B). To calculate this index we weight each component of the CPI by the inverse of the standard deviation of the quarterly change in that component. In addition we calculate the 'double-weighted' measure described by Laflèche (1997), which creates effective weights for each inflation component by multiplying the published effective weight by the inverse of the standard deviation of quarterly inflation in that component. This method has the convenient property of keeping the original expenditure-weighting scheme partially intact, while correcting for excessive volatility in particular items.[9]

A practical issue that arises in the context of the Australian CPI, owing to its frequent re-weightings, is the horizon over which the volatility is calculated. We look at three cases for the purpose of this exercise. In the first case, the standard deviation of quarterly price changes for the entire sample is calculated; in the second, the standard deviation of prices changes in each 'series' of the CPI (for which the same basic weights are retained) is used for the duration of each series; and in the third, a rolling four-year standard deviation of price changes is used. Clearly, these measures are subject to revision in line with changes in the volatility of CPI components, although the extent of revision is likely to be limited in any given quarter, with adjustments occurring only gradually over time.

2.1.4 Statistical measures based on the year-ended distribution

The discussion so far has been solely concerned with inflation measures calculated using the distribution of *quarterly* price changes. In the case of the aggregate CPI and the exclusion-based measures, the four-quarter-ended price change is the same whether it is calculated directly or from compounding the quarterly movements, because the weighted mean calculation is linear. However, the weighted median and trimmed mean calculations can be quite different depending on differences in the properties of the distributions of quarterly and four-quarter-ended price changes.[10]

In the Australian context, the statistical properties of the distribution of four-quarter-ended price changes are, in fact, different to those of the quarterly distribution of price changes. These properties are shown in Table 1; median statistics are used owing to large outliers in certain quarters.

9. A similar alternative to volatility-weighted measures is the persistence-weighted measure, which weights each component of the CPI by its past persistence. While we do not examine these measures here, they are explored in depth by Cutler (2001).

10. Volatility-weighted measures will only differ for year-ended inflation data if the weights are recalculated on a four-quarter-ended basis.

Table 1: Higher Moments of the Distribution of Price Changes[(a)]

	Skewness (median)		Kurtosis (median)		Jarque-Bera statistic (median)	
Indicator	1987:Q1–2003:Q4	1993:Q1–2003:Q4	1987:Q1–2003:Q4	1993:Q1–2003:Q4	1987:Q1–2003:Q4	1993:Q1–2003:Q4
Quarterly percentage changes	0.64	0.64	11.7	10.9	375.8**	304.3**
Year-ended percentage changes	0.26	0.37	9.0	8.4	176.8**	140.4**

Note: ** Significantly different from a normal distribution at the 1 per cent level.

(a) Based on CPI excluding interest charges and tax effects.

In general, the skewness and kurtosis in the distribution of four-quarter-ended price changes are lower because a reasonable proportion of large quarterly price movements are typically reversed within the space of four quarters, and prices that are adjusted only annually also create lower skewness and kurtosis in the four-quarter-ended series.[11] Items that experience reasonably strong price movements in the same direction over a number of quarters are more likely to create skewness and kurtosis in the four-quarter-ended distribution. Given the lower skewness and kurtosis in the annual distribution of price changes, one would expect that the optimal trim and the optimal central percentile of the trimmed distribution would also be somewhat lower. Indeed, an application of the Bryan and Cecchetti (1994) method to Australian data suggests that this expectation is borne out in practice, although the optimal trim is still sensitive to the benchmark chosen and the time period used.

Although there is no strong *a priori* reason to prefer measures calculated using the distribution of quarterly rather than the four-quarter-ended changes, the way in which the CPI is constructed creates practical problems for utilising the latter. In particular, changes to the CPI basket, which occur roughly at five-year intervals, but which have been slightly more frequent in the past ten years, mean that while a continuous set of distributions of quarterly price changes can be obtained, there are gaps in the set of distributions of four-quarter-ended changes. This prevents a four-quarter-ended weighted median and trimmed mean from being calculated in a transition period, or from being used in analysis that benefits from a lengthy run of continuous time-series data.

11. Preliminary estimates of the weighted median and 30 per cent trimmed mean for the quarterly distribution of seasonally adjusted price changes appear to be quite similar to the weighted median and 30 per cent trimmed mean estimates of underlying inflation based on the four-quarter-ended distribution of price changes over the past few years. This suggests that recently, seasonal price changes may be responsible for differences in the skewness of the quarterly and four-quarter-ended distributions of price changes.

While it is technically possible to estimate time-series equations with missing data (at a cost of losing degrees of freedom), without interpolating year-ended price changes, it is not possible to compute a series for quarterly price changes that would be appropriate for estimating forecasting equations on a quarter-to-quarter basis. As we do not currently have a suitable interpolation method for year-ended price changes, we do not attempt to use econometric criteria to assess measures based on the distribution of year-ended price changes in what follows. This would be a profitable area for further research.

2.2 An assessment of underlying inflation measures

By ignoring those measures calculated via smoothing techniques we reduce the field of measures for assessment to exclusion-based measures (CPI excluding volatile items and market prices excluding volatile items), the full range of trimmed means and weighted medians (with trims ranging from 0 to 100 and central percentiles ranging from 40 to 60), the Jarque-Bera optimised time-varying trims (with both constant and time-varying central percentiles), the neo-Edgeworthian measures and the double-weighted measures.

2.2.1 General properties of the data

Table 2 shows summary statistics for key examples from this selection of underlying measures. For the sake of brevity, only four of the available trimmed means (corresponding to different combinations of trimming percentages and central percentiles) are presented, and only two of the volatility-weighted measures are shown – namely, double-weighted measures with fixed weights and weights that vary with each CPI re-weighting. For the purpose of analysis, we focused on two alternative sample periods: 1987:Q1 to 2003:Q4 and 1993:Q1 to 2003:Q4. The first is the longest period over which we have data for all measures, while the inflation-targeting period initiated in 1993 is particularly appealing for analysis, given that it is regarded by most observers as, structurally, fairly stable owing to the presence of a single monetary policy regime.

A few preliminary points are worth noting. First, it is apparent that the weighted median, trimmed mean and exclusion-based measures used by the RBA have all had a small average bias with respect to CPI inflation. The Jarque-Bera trim measures have also displayed a downward bias. Whether or not these biases are statistically significant is assessed in the next section. It turns out that, on average, Jarque-Bera trim measures exclude a substantially lower percentage of the distribution of price changes to achieve this result (around 8 per cent for the Jarque-Bera optimal trimmed mean and around 13 per cent for the symmetric Jarque-Bera trimmed mean), in addition to being more robust to departures from normality of the original distribution of price changes. Finally, it bears noting that the volatility-weighted measures do not necessarily display significantly lower volatility than the other underlying inflation measures. Indeed, some trimmed means with large trims give substantial weight to the least volatile components and give a zero weight to the most volatile components. So it is unsurprising that the volatility-weighted

Table 2: Summary Statistics for Quarterly Inflation Series[(a)]

Indicator	Average		Standard deviation	
	1987:Q1–2003:Q4	1993:Q1–2003:Q4	1987:Q1–2003:Q4	1993:Q1–2003:Q4
Consumer price index	**0.86**	**0.61**	**0.58**	**0.31**
Weighted median (symmetric)	0.82	0.56	0.50	0.19
Weighted median (51st percentile)	0.83	0.58	0.49	0.19
Weighted median (52nd percentile)	0.86	0.61	0.50	0.19
30 per cent symmetric trimmed mean	0.80	0.56	0.47	0.18
30 per cent trimmed mean (51st percentile)	0.85	0.61	0.47	0.18
45 per cent symmetric trimmed mean	0.81	0.57	0.47	0.17
60 per cent symmetric trimmed mean	0.81	0.56	0.48	0.17
Market prices excluding volatile items	0.81	0.56	0.53	0.26
CPI excluding volatile items	0.87	0.60	0.53	0.25
Optimal Jarque-Bera trim	0.80	0.56	0.47	0.19
Jarque-Bera trim (symmetric)	0.82	0.58	0.48	0.20
Double-weighted (varying weights)	0.85	0.61	0.50	0.20
Double-weighted (fixed weights)	0.85	0.60	0.50	0.19

(a) All series exclude interest charges and tax effects.

measures (which give all components a non-zero weight) have not proved the least volatile of all the series.

2.2.2 Results

To begin with, we excluded measures that were clearly biased from the full set of trimmed means, as these were unlikely to pass the unbiasedness criterion discussed above.[12] Excluding the neo-Edgeworthian measures, which were also biased, we were left with a collection of 102 measures to which the criteria could be applied.

Visual inspection of the inflation data suggests that over the inflation-targeting period these data are stationary, although the picture is less clear over the full sample, which is influenced by the transition to a low-inflation environment. Augmented Dickey-Fuller (ADF) and Phillips-Perron tests for the presence of unit roots in all of the series, including CPI inflation, generally suggest that these data are stationary in both samples, although results for the ADF tests are quite sensitive to specification in the full sample. Appendix C contains results for the Phillips-Perron tests. In view of these results and conclusions drawn from visual inspection of the data, we

12. We retained measures whose average quarterly percentage change was within 0.1 percentage points of the quarterly CPI inflation rate, and focused on trimming percentages between 20 and 80, apart from weighted medians. In general, very low trims are rejected by our assessment criteria. This is not necessarily the case for very large trims but we believe these are adequately represented by weighted medians, which are a natural subject for assessment owing to their use by the RBA.

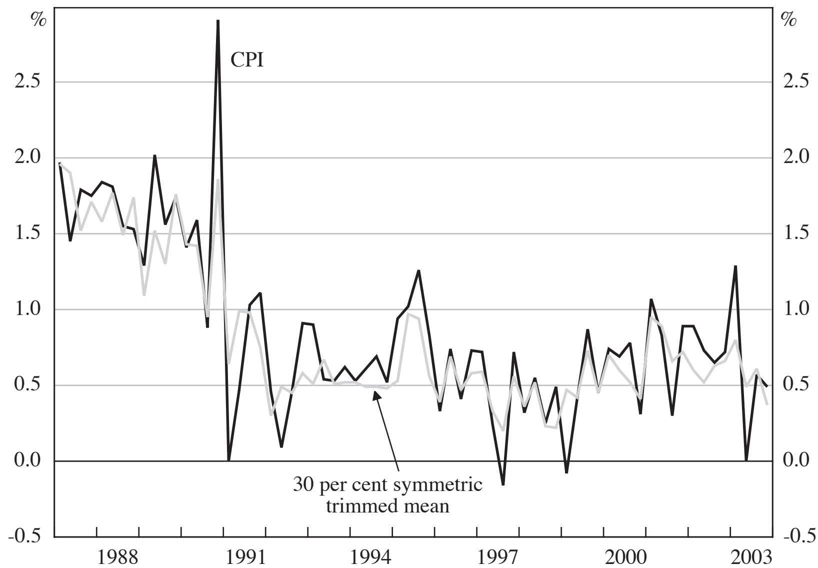
maintain the assumption that the inflation process is stationary, but characterised by a possible structural break over this period.

Figure 3 plots the quarterly movements in CPI inflation and the 30 per cent trimmed mean measure of inflation published by the RBA. It is apparent that over the inflation-targeting period the series have similar means and tend to move together. The same story can be told for most of the other underlying inflation measures selected for assessment. Of particular note is the fact that the measures obtained using the Jarque-Bera optimisation procedure appear very similar to better-known alternatives, suggesting that the latter are probably reasonable approximations to estimators that are more robust to departures from normality (Figure 4).

Turning to the statistical tests, we find that over the full sample period, all the measures assessed pass the test for unbiasedness with respect to CPI inflation (Table 3).[13] With the exception of the measure of market prices excluding volatile items, all of the measures assessed also pass the test for unbiasedness in the inflation-targeting sample.

Figure 3: CPI and Underlying Inflation

Quarterly

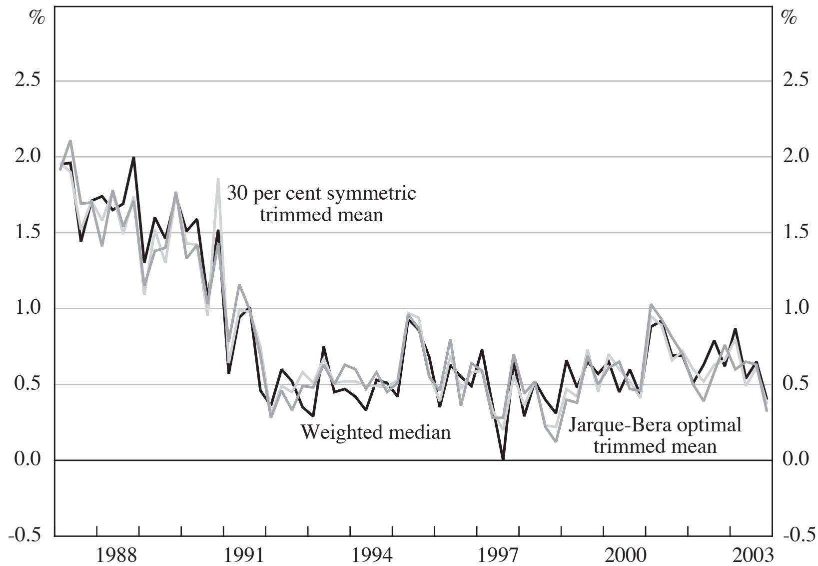


Note: RBA estimates, excluding interest charges prior to September quarter 1998 and adjusted for the tax changes of 1999/2000

Sources: ABS; RBA

13. Using an alternative test for unbiasedness, proposed by Holden and Peel (1990), yields very similar results.

Figure 4: Underlying Inflation
Quarterly



Note: RBA estimates, excluding interest charges prior to September quarter 1998 and adjusted for the tax changes of 1999/2000
Sources: ABS; RBA

Table 3: Test for Unbiasedness

Indicator	$H_0 : \pi_t = \pi_t^* + v_t$ *p*-value 1987:Q1–2003:Q4	1993:Q1–2003:Q4
Weighted median (symmetric)	0.497	0.422
Weighted median (51st percentile)	0.707	0.715
Weighted median (52nd percentile)	0.944	0.986
30 per cent symmetric trimmed mean	0.110	0.072
30 per cent trimmed mean (51st percentile)	0.388	0.158
45 per cent symmetric trimmed mean	0.280	0.145
60 per cent symmetric trimmed mean	0.384	0.259
Market prices excluding volatile items	0.266	0.045*
CPI excluding volatile items	0.954	0.914
Optimal Jarque-Bera trim	0.390	0.399
Jarque-Bera trim (symmetric)	0.194	0.141
Double-weighted (varying weights)	0.879	0.819
Double-weighted (fixed weights)	0.696	0.778

Note: * denotes significance at the 5 per cent confidence level

In the second stage of our analysis, we estimated Equations (3) and (4) to test for Granger causality. For all the hypothesis tests conducted we adhered to the 5 per cent significance level when deciding which measures passed or failed this criterion.

Table 4 shows results for the full sample. It is clear that most of the measures shown pass our basic test for predictive ability. However, the asymmetric 30 per cent trimmed mean, the symmetric Jarque-Bera trimmed mean and the double-weighted measure with fixed weights all have the property that they may be predicted using past values of CPI inflation.

These results are typical of the broader sample of measures. In total, we find that 89 of the 102 measures assessed pass the Granger causality tests, and thus satisfy the minimum criteria required for forecasting CPI inflation. The main failures are trimmed means with less than 40 per cent of the weighted distribution of price changes trimmed (although the symmetric 30 per cent trimmed mean is a notable exception), the Jarque-Bera trims with fixed central percentiles and a couple of the volatility-weighted measures. These measures all fail our test because CPI inflation is found to predict future values of the underlying inflation measure.

It is encouraging to note that the two statistical underlying inflation measures regularly monitored by the RBA, the symmetric weighted median and the 30 per cent symmetric trimmed mean, pass the criteria in the full sample. A number of weighted medians with centres arbitrarily close to the published weighted median also satisfy the criteria, suggesting that the properties of this estimator are relatively robust. It is apparent from Table 4 that the exclusion-based measures satisfy the criteria in the full sample, suggesting that, despite our misgivings about these

Table 4: Granger Causality Tests (1987:Q1 – 2003:Q4)
p-values

Indicator	$H_0 : \pi_t^*$ does not Granger cause π_t	$H_0 : \pi_t$ does not Granger cause π_t^*
Weighted median (symmetric)	$3.52 \times 10^{-6**}$	0.487
Weighted median (51st percentile)	$2.57 \times 10^{-7**}$	0.132
Weighted median (52nd percentile)	$1.53 \times 10^{-7**}$	0.078
30 per cent symmetric trimmed mean	$1.70 \times 10^{-4**}$	0.586
30 per cent trimmed mean (51st percentile)	$7.70 \times 10^{-6**}$	0.022^{*}
45 per cent symmetric trimmed mean	$1.20 \times 10^{-4**}$	0.449
60 per cent symmetric trimmed mean	$9.62 \times 10^{-5**}$	0.212
Market prices excluding volatile items	$2.68 \times 10^{-5**}$	0.685
CPI excluding volatile items	0.010^{*}	0.788
Optimal Jarque-Bera trim	$5.14 \times 10^{-7**}$	0.331
Jarque-Bera trim (symmetric)	$2.18 \times 10^{-6**}$	0.005^{**}
Double-weighted (varying weights)	$7.79 \times 10^{-4**}$	0.618
Double-weighted (fixed weights)	$5.26 \times 10^{-6**}$	0.008^{**}

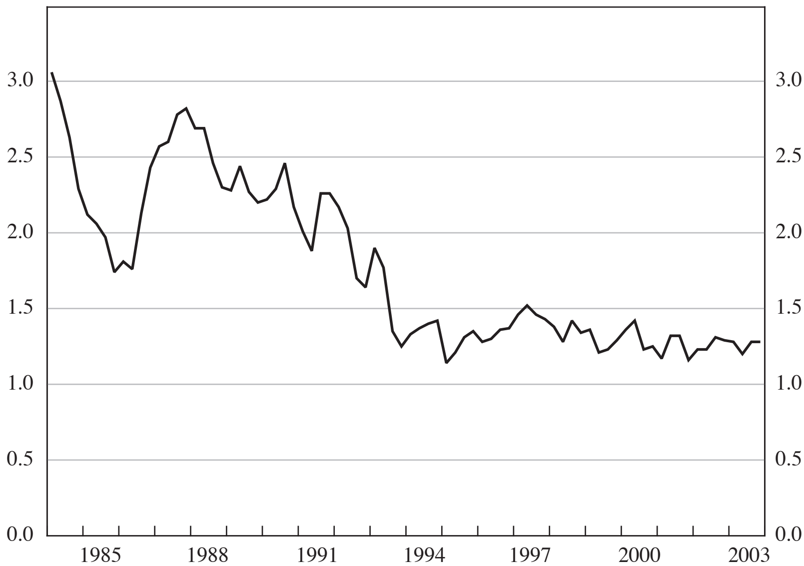
Note: *,** denote significance at the 5 and 1 per cent confidence levels measures (discussed above), they still have some predictive ability with respect to future CPI inflation. Finally, the optimal Jarque-Bera trimmed mean with a time-varying central percentile also satisfies the criteria, and in this respect is comparable to standard trimmed means.

In contrast, over the 1993:Q1 to 2003:Q4 period, none of our measures pass the Granger causality criterion. In particular, while CPI inflation does not Granger cause any of the underlying inflation measures, so too, none of the underlying measures Granger cause CPI inflation. CPI inflation is better described by a constant average inflation rate over this period than by lagged values of either underlying inflation or CPI inflation.[14] In annualised terms, the constant is around 2½ per cent, consistent with the RBA's target range of 2–3 per cent.

How do we interpret this result? Since the implementation of an inflation-targeting regime, inflation has been comparatively stable. As Figure 5 demonstrates, relative price volatility (as measured by rolling weighted variances of the cross-section distribution of price changes) declined over the period 1987:Q1 to 1993:Q1, and has been relatively stable since then. It is therefore not altogether surprising that

Figure 5: Relative Price Volatility in the CPI

Two-year rolling cross-sectional weighted variances



Note: RBA estimates, excluding interest charges prior to September quarter 1998 and adjusted for the tax changes of 1999/2000

Sources: ABS; RBA

14. If we regressed CPI inflation on the contemporaneous level of underlying inflation over this period, the latter would have a highly significant coefficient. Yet this strong contemporaneous correlation is of limited value from a forecasting point of view.

measures of underlying inflation do not seem to provide much information about future trends in CPI inflation.

Although we are cautious about placing too much emphasis on results that have been produced using such a short run of data, one implication of our analysis is that underlying inflation indicators are potentially less useful for gauging future trends in CPI inflation than they used to be. Put simply, none of the underlying inflation measures we have assessed appear to have any systematic predictive ability with respect to CPI inflation over the inflation-targeting period. By corollary, in the context of an inflation-targeting regime, policy-makers may become less inclined to regard the distinction between underlying and CPI inflation as important, and conclude that it does not matter which variable is used for the purposes of forecasting and routine analysis.

However, our results should not be used to draw this conclusion. In periods when there is a resurgence of relative price volatility for one reason or another, measures of underlying inflation will continue to help policy-makers disentangle signals from the noise and, in some cases, make more accurate assessments of the current trend. As individual measures may be inaccurate guides to the underlying inflation trend in any given quarter, there is justification for using a 'suite' of different underlying inflation measures.[15] This approach has particular relevance given our finding for the full sample that a large number of measures satisfy our minimum criteria. Routine surveillance of the various shocks likely to move CPI inflation away from its underlying trend will help policy-makers to decide when an examination of this suite of underlying inflation measures is likely to be of value for forecasting and analysis. Finally, it seems plausible that the exclusion of key sources of relative price volatility – particularly supply shocks – from the CPI on a quarter-by-quarter basis will improve the forecasting performance of an underlying inflation equation relative to that of a CPI inflation equation.

As we cannot draw solid conclusions regarding which underlying inflation indicators have suitable properties over the inflation-targeting period, we are compelled to use the conclusions drawn for the longer sample to discriminate among the various measures. The results for the 1987:Q1 to 2003:Q4 period suggest that, generally, trimmed means that trim 40 per cent or more of the distribution of price changes tend to pass our minimum criteria, as does the symmetric 30 per cent trimmed mean currently monitored by the RBA. The optimal Jarque-Bera trimmed mean also passes our tests but is unlikely to be easily communicable to the public, despite being designed to exploit the trade-off between robustness and efficiency more effectively than standard trimmed means. Simple exclusion-based measures of underlying inflation also pass our criteria, but the fact that they cannot be relied upon to exclude the more volatile components from the CPI on a regular basis suggests that they should be used with caution.

15. Similar conclusions have been drawn for the UK (Mankikar and Paisley 2002) and Canada (Hogan, Johnson and Laflèche 2001). The benefits of an approach that combines the information provided by a variety of measures has long been recognised by the RBA (see, for example, Reserve Bank of Australia 1994).

3. Exchange Rate Pass-through

Anecdotal evidence suggests that the pass-through of exchange rate movements to import prices and final consumer prices was lower, or at least slower, in the 1990s than had been expected. There are several explanations for why this might have been so. At the aggregate level, the relationship between import prices and consumer prices would be weaker if there was a lower proportion of imports in the consumer price basket or in the proportion of imported inputs to the production process. However, this is an unlikely explanation in the Australian case as the imported component of the CPI was roughly constant, while imports relative to GDP grew substantially. This suggests, if anything, that pass-through should have increased. Another explanation is that observed changes in pass-through may be the result of microeconomic changes, such as changes in the composition of trade (Campa and Goldberg 2002) or reform that increases competition in the retail sector (Laflèche 1996).

The apparent decline or slowing of pass-through has occurred simultaneously across a number of countries and has coincided with significant falls in the level of inflation. This has led the literature to explore a possible link between changes in exchange rate pass-through, the inflation environment and the monetary policy regime. In general, the models used to articulate this explanation start with the assumption that with more credible monetary policy, inflation expectations become anchored to a lower rate of inflation. Combined with nominal rigidities such as overlapping contracts or menu-cost pricing, this results in slower pass-through of exchange rate movements, and other cost shocks, to final price movements.

One of the first articulations of this linkage was made by Taylor (2000). He argued that lower levels of inflation have been historically accompanied by lower persistence of inflation and that the persistence of cost movements will be correlated with aggregate inflation persistence. Using a model with staggered price setting, he then showed that pass-through of changes in costs, including those related to exchange rate movements, falls as the expected persistence of cost changes falls. Choudhri and Hakura (2001) provide a more formal model of these linkages in a new open-economy macro framework. Devereux and Yetman (2003) also use a new open-economy macro framework, but rely on different linkages. In their model, the important consequences of a 'tighter' monetary policy regime are lower levels of inflation and less volatile nominal exchange rates. Combined with menu-cost pricing, rather than staggered pricing, this implies less frequent price changes and slower pass-through. This model has the advantage of not relying on the levels and persistence of inflation being correlated, which Cecchetti and Debelle (2004) argue may not hold as strongly as previously thought due to misspecification of the tests.

There are several ways of testing the implications of these models. Some empirical papers, reviewed below, estimate exchange rate pass-through for a range of countries. They then test whether these estimates (or changes in these estimates over time) are correlated with macroeconomic variables (or changes in these variables) which the theory suggests are important. Taylor's (2000) explanation implies that pass-through in the short to medium run should be related to the level and persistence of inflation. The Devereux and Yetman (2003) model has the testable implication that both exchange rate movements and the level of inflation have non-linear relationships with pass-through in the short to medium run. Campa and Goldberg (2002) argue that the pass-through of exchange rates into import prices could also be affected by exchange rate volatility if this volatility encourages producers to keep the domestic currency price of imports fixed to maintain market share. In Section 3.2.2, we use time-series data for Australia to update previous RBA research to examine whether exchange rate pass-through fell and/or became slower in the 1990s.

3.1 Pass-through to import prices

At the first stage of pass-through, exchange rate movements are translated into domestic currency import prices. First-stage pass-through will be complete if world prices are taken as given for the importing country, so that all exchange rate changes are fully reflected in the domestic currency price of imports. This is referred to as producer currency pricing, and is most likely to characterise small open economies such as Australia. At the other end of the spectrum are large economies, such as the US, where foreign producers are more likely to keep the import price in the destination currency fixed to maintain market share against domestic producers. This is known as local currency pricing or pricing to market.

Campa and Goldberg (2002) estimate the first-stage pass-through relationship for 25 OECD countries, and show that most countries exhibit pass-through that lies somewhere between these two extremes. Their estimates of the elasticities of import prices to exchange rate movements for Australia are 0.55 in the first quarter and 0.69 in the long run.[16] Both these elasticities are statistically different from unity. In contrast, previous RBA research suggests that the long-run elasticity is not statistically different from unity and that this complete pass-through is achieved within two quarters (Beechey *et al* 2000, Dwyer and Leong 2001). Recent RBA research suggests that differences in the model specification and data used can have a significant effect on the estimated pass-through coefficients. While Campa and Goldberg (2002) used a model specified in differences – they could not find cointegration across all countries considered – RBA estimates explicitly model the long run in an error-correction specification (Appendix E).

While the extent and speed of pass-through is important, we are also interested in the way that the pass-through relationship may have changed in the past decade or so. Campa and Goldberg's results suggest that although first-stage pass-through has fallen in 15 of 24 countries between the 1980s and the 1990s, the fall is only statistically significant in 4 cases. For Australia, Campa and Goldberg find that there has been a statistically insignificant increase in the long-run elasticity over this period and no change in the short-run elasticity. Qualitatively similar results

16. The long-run estimate is the cumulated effect of a 1 per cent change in the exchange rate on import price inflation over four quarters.

for the changes in the estimated elasticities are obtained using an error-correction model (Appendix E).

In contrast, Bailliu and Fujii (2004) find a statistically significant fall in first-stage pass-through in the 1990s for a panel of 11 industrialised countries. They begin by testing for appropriate breakpoints in the consumer price inflation series, and argue that in most cases, the breakpoints can be associated with changes to the monetary policy regime.[17] These breakpoints are used to define dummy variables that are interacted with the contemporaneous change in the exchange rate. The test for a significant change in the short-run relationship between exchange rates and import prices is then a test for the significance of the coefficients on these interaction terms.[18] Using this methodology, they show that there is a statistically significant fall in the 1990s, but not in the 1980s, and use this as evidence to argue that changes in pass-through can be identified with recent changes in monetary policy regime rather than changes to monetary policy regimes in general.

Although Campa and Goldberg do not find such convincing evidence of a change in first-stage pass-through, they proceed to investigate whether changes in first stage pass-through are associated with changes in macroeconomic performance. They test the hypothesis that pass-through is slower in a lower inflation environment by regressing changes in estimated pass-through on changes in average inflation across countries. While they find that there is a statistically significant relationship, the size of the effect is economically insignificant. They also test whether pass-through is slower in the presence of higher exchange rate volatility, and reject this hypothesis. In contrast, McCarthy (2000) finds that differences in the response of import prices to exchange rate shocks across the nine countries in his sample are negatively related to exchange rate volatility.

Campa and Goldberg's preferred explanation for the estimated fall in first-stage pass-through is based on the observations that pass-through differs across industries, is relatively stable within industries over time, and that trade has shifted in favour of higher pass-through industries such as manufacturing over lower pass-through industries such as energy. A closer examination of more disaggregated trade data shows that for Australia, changes in pass-through within industries over time dominate the effects of composition changes across industries on the aggregate estimates (Appendix E).

In summary, there is some mixed evidence for a fall in first-stage pass-through across countries and tentative, circumstantial evidence that this coincided with a change in the monetary policy regime at the beginning of the 1990s. A specific examination of the time-series evidence for Australia suggests that long-run first-stage pass-through has remained effectively complete over the 1990s, and is relatively rapid. This will be maintained as an assumption in Section 3.2.2.

17. The estimated breakpoints for Australia are 1982:Q3 and 1990:Q3.

18. Bailliu and Fujii (2004) use annual data, and so their estimate of short-run pass-through refers to the same period as the long-run estimate in Campa and Goldberg (2002).

3.2 Pass-through to final prices

3.2.1 Cross-country evidence

As mentioned earlier, several papers have looked at the pass-through of exchange rates into final prices and/or the pass-through of import price changes to final price changes using cross-country data. Choudhri and Hakura (2001), Gagnon and Ihrig (2002) and Devereux and Yetman (2003) all estimate simple relationships between inflation and exchange rate or import price movements using time-series data for different samples of countries (Table 5).[19] In a second stage, these estimates are related to the macroeconomic variables which theory suggests are important using the cross-country dimension of the data.

All three papers find a significant relationship between the inflation environment and their estimates of pass-through. Gagnon and Ihrig's results show that roughly one-third of the variation in pass-through across countries can be attributed to differences in the inflation environment.[20] Choudhri and Hakura (2001) find that the level of inflation dominates the volatility of inflation and the exchange rate as an explanator of cross-country differences in pass-through. Devereux and Yetman (2003) find

Table 5: Panel Estimates of Pass-through to Final Prices

	Choudhri & Hakura (2001)	Gagnon & Ihrig (2002)	Devereux & Yetman (2003)
Equation	$\Delta p_t = \delta_0 + \delta_1 \Delta p_{t-1} + \delta_2 \left(\Delta e_t + \Delta p_t^*\right)$	$\Delta p_t = \delta_0 + \delta_1 \Delta p_{t-1} + \delta_2 \left(\Delta e_t + \Delta p_t^*\right)$	$\Delta p_t = \delta_3 \Delta e_{t-1} + \delta_4 \Delta p^*_{t-1}$
Point estimate of pass-through for Australia	0.14	0.12	0.10
Macroeconomic variables	Δp, sd(Δp), sd(Δe)	Δp, sd(Δp)	Δp, $(\Delta p)^2$, sd(Δp), Δe, $(\Delta e)^2$, sd(Δe)
Sample	71 countries; 1979–2000 (annual)	20 industrial countries; 1972:Q2–2000:Q4	81 countries; 1970–2001 (annual)

Notes: p is the domestic final price level, p^* is the foreign price level and e is the nominal exchange rate, and $\mathrm{sd}(\circ)$ means standard deviation of the relevant variable.

19. Choudhri and Hakura (2001) look at the effect of exchange rate movements on inflation after 1, 2, 4 and 20 quarters. In line with the notation used in Table 5, Gagnon and Ihrig (2002) use the long-run estimate of pass-through, $\delta_2 / (1 - \delta_1)$, whereas Devereux and Yetman (2003) use the estimate of δ_3, which could be interpreted either as a short- or long-run estimate.

20. Given that Gagnon and Ihrig's estimate of long-run pass-through uses an estimate of inflation persistence, it can be argued that there is a positive relationship between pass-through and the inflation environment by construction.

that there is a statistically significant non-linear relationship between pass-through, inflation and exchange rate movements.

Goldfajn and Werlang (2000) estimate pass-through for the same sample used by Choudhri and Hakura (2001). By interacting exchange rate movements with other macroeconomic variables, they indirectly show that the pass-through of exchange rate movements to final prices is affected by the extent of real exchange rate misalignment for the developing country sub-group. They also show that the initial inflation rate has some relationship with estimated pass-through coefficients in Europe, and that openness affects pass-through in the Oceania region.

Another test of the hypothesis that pass-through is related to the credibility of the monetary policy regime and the anchoring of inflation expectations is to examine whether changes in pass-through are related to changes in macroeconomic variables related to the credibility of monetary policy, such as the level of inflation. Gagnon and Ihrig (2002) look at changes over time by breaking the sample for each country at a point between the early 1980s and early 1990s that they argue is a time of regime shift or structural change. This explicitly allows the relationship between exchange rate movements and inflation to be linked with changes in the inflation environment and the monetary policy regime. In the case of Australia, the break is chosen to be 1993:Q2, to coincide with the shift to inflation targeting. The results indicate that there has been a fall in pass-through in most countries and that the average change is roughly three times larger than the change estimated by Campa and Goldberg. This suggests that most of the change is occurring in the relationship between import prices and consumer prices. Long-run pass-through is estimated to fall from 0.09 to –0.01 for Australia, but in each sub-period is insignificantly different from zero.

Bailliu and Fujii (2004) do a similar analysis but test for the timing of breaks, as discussed above, and exploit the full panel nature of the data. Their results suggest that there has been a significant fall in short-run pass-through that has coincided with a fall in inflation and the most recent change in monetary policy regime.[21]

Although they do not consider the relationship between changes in pass-through estimates and changes in possible causes, Goldfajn and Werlang do consider whether there may have been changes in the pass-through relationship by looking at out-of-sample performance for several countries following various crises. In general, inflation is over-predicted, suggesting that pass-through fell significantly following these events and that pass-through can be regime-dependent. Event studies, such as those presented by Cunningham and Haldane (2002) for Brazil, the UK and Sweden, also suggest that the pass-through of exchange rate movements into final prices following currency crises in the past 15 years or so has been significantly lower than expected.

In summary, cross-country panel data and event studies suggest that there has been a general fall or at least slowing in the pass-through of exchange rate movements into final consumer prices in the late 1980s or early 1990s, and that this has been

21. As Bailliu and Fujii (2004) are using annual data, short-run pass-through is the pass-through occurring over one year.

significantly larger than the estimated falls in the pass-through of exchange rate movements into import prices. There is also some evidence that the fall has been related to a change in the inflation environment, which in turn is roughly coincident with changes in monetary policy regimes.

3.2.2 Time-series evidence for Australia

In this section, we examine whether there has been a fall in the pass-through of import price movements into final prices using time-series data for Australia. There are several reasons for focusing on this second stage of pass-through. First, the time-series evidence suggests that pass-through of exchange rate movements to import prices has been complete and rapid in Australia and that there does not appear to have been a significant change in this relationship over the 1990s. Second, the cross-country literature indicated that the most economically significant changes in price-setting behaviour have occurred at the second stage. Finally, it increases the comparability of our analysis with earlier studies. The pass-through of import price movements to final consumer prices in Australia has been analysed in recent years by Dwyer and Leong (2001), Andersen and Wascher (2001), and Debelle and Wilkinson (2002).

Dwyer and Leong (2001) estimate a model in which consumer prices are considered to be a mark-up on labour costs and the cost of other inputs, approximated by import prices (Figure 6).[22] This formulation lends itself to an error-correction framework in which the price level terms form the error-correction term, and the dynamics are captured by current and lagged import price inflation, unit labour cost inflation, measures of the output gap and lags of consumer price inflation (de Brouwer and Ericsson 1998). The mark-up model has been used extensively in RBA analysis and has several advantages. First, it focuses on price-setting behaviour, albeit at an aggregate level. Second, it allows us to look at how inflation is influenced by a variety of factors, including movements in import prices, unit labour costs and price-setters' margins. Finally, it makes the distinction between short- and long-run pass-through explicit in a way that is not done in the international literature reviewed above.

Debelle and Wilkinson (2002) examine changes in the inflation process by estimating an import price-augmented Phillips curve. This model contains no price level terms or dynamics from unit labour cost movements, but it does focus on the role played by inflation expectations.[23] Andersen and Wascher (2001) estimate a hybrid model that adds a mark-up of prices over unit labour costs to the import-price augmented Phillips curve, but do not find a statistically significant role for this variable.

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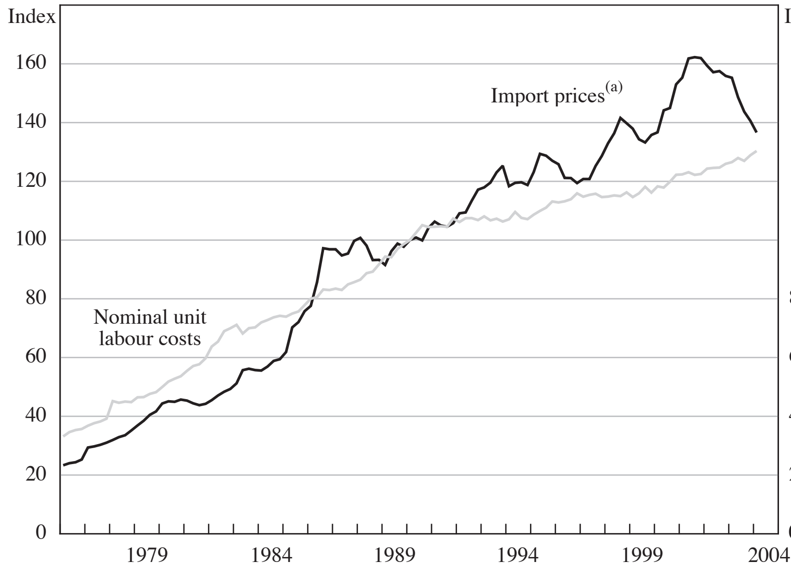
22. Import prices have been adjusted for productivity differences between the traded and non-traded sectors of the economy and the fact that unit labour costs are not measured for the non-traded sector only. For details of this adjustment see Beechey *et al* (2000) and Appendix A.

23. As the Phillips curve model is a differences model, it will also be robust to any mismeasurement problems that may be affecting the levels relationship, such as a mismeasurement of the size of the productivity-differential adjustment to import prices.

Figure 6: Mark-up Model Components
Index, 1990:Q1 = 100



(a) Adjusted for tariffs and for the productivity differential between the traded and non-traded sectors

Sources: ABS; RBA

To address the question of whether pass-through has changed, we start by estimating a mark-up model in two sub-samples: a pre-1990s sample that runs from 1976:Q3 to 1989:Q4; and a sample which runs from 1990:Q1 to 2003:Q4. This sample break divides the available data in half and corresponds with the sharp break in the mean of inflation, which Cecchetti and Debelle (2004) argue is important to control for when estimating models of inflation. This date is also very close to a break point identified by Bailliu and Fujii (2004).

We estimate the mark-up model in two stages using the Dynamic Ordinary Least Squares (DOLS) methodology of Stock and Watson (1993) because the price level variables are non-stationary. The long-run parameters are estimated by regressing the level of the weighted median consumer price series on the level of unit labour costs and import prices, as well as leads, lags and contemporaneous terms of unit labour cost and import price growth. The dynamic terms are used to correct for simultaneity and misspecification bias that are present in small samples.

Following the literature, the results presented here use two leads and two lags of each of the variables, although it should be noted that the estimates do not change significantly for small variations in the lead/lag structure. Using these long-run estimates, a mark-up term, $\hat{z}$, is constructed and included in the second-stage regression of inflation as follows:

$$\hat{z}_t = p_t - \hat{B}pm_t - \hat{\Gamma}ulc_t$$

$$\pi_t = \alpha_0 + \sigma\hat{z}_{t-1} + \sum_{k=1}^{K}\alpha_k\pi_{t-k} + \sum_{k=0}^{K}\beta_k\Delta pm_{t-k} + \sum_{k=0}^{K}\gamma_k\Delta ulc_{t-k} + \sum_{k=0}^{K}\delta_k gap_{t-k} + \omega_t$$

where p is the level of consumer prices, pm is the level of import prices, ulc is the level of unit labour costs, π is consumer price inflation, and gap is a measure of the output gap. Lower case variables (other than π) are expressed in logarithms; the data definitions are provided in Appendix A.

Table 6 presents the results of estimating this mark-up model of inflation in the two sub-periods discussed above. A more detailed set of results and diagnostic information is presented in Appendix D.

Table 6: Pass-through Elasticities – Mark-up Model

Sample	Long-run estimates: Import prices	Long-run estimates: Unit labour costs	Short-run estimates: Speed of adjustment	Lagged inflation	Changes in import prices	Changes in unit labour costs	Output gap
1976:Q3–1989:Q4	0.35** (0.05)	0.50** (0.09)	–0.03* (0.02)	0.50** (0.13)	0.02 (0.01)	0.04 (0.02)	0.05* (0.02)
1990:Q1–2004:Q1	0.17** (0.05)	1.03** (0.06)	–0.03 (0.03)	0.46** (0.10)	0.01 (0.01)	0.05 (0.03)	0.04* (0.01)

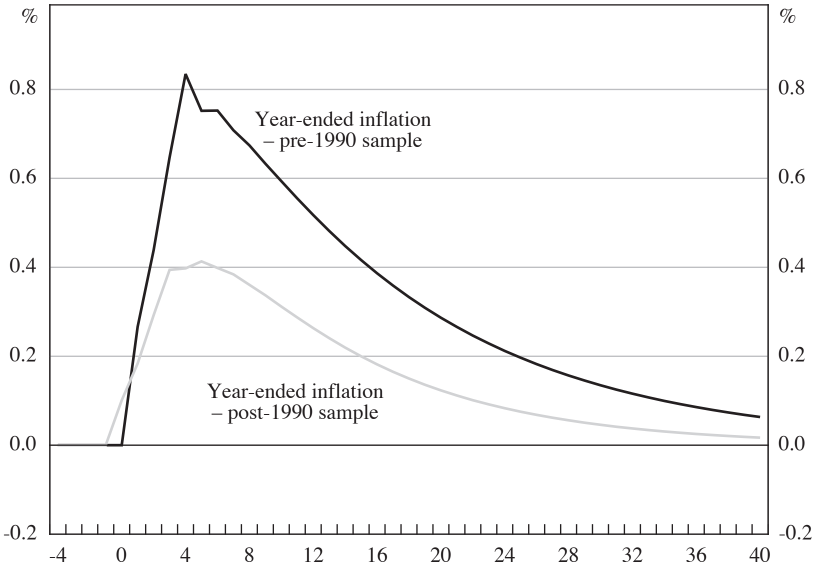
Notes: Standard errors reported in parentheses. *, ** denote significance at the 5 and 1 per cent confidence levels, respectively. Where the reported elasticity is the sum of several coefficients, the p-value on the F-test of the coefficients being jointly equal to 0 is reported. Full details of these models are provided in Appendix D.

Figure 7 presents the response of inflation to a 10 per cent increase in import prices in the two sample periods. This confirms that second-stage pass-through is substantially lower in the second period, with the two impulse response functions remaining divergent in an economically meaningful way for four or five years. This difference between the impulse response functions is driven almost entirely by the decline in the long-run elasticity of consumer prices with respect to import prices (Table 6).[24] It is compounded by a small fall in the speed with which inflation adjusts to the long-run equilibrium, although it should be noted that the estimated speed of adjustment is statistically insignicant in the second sample.

There are several reasons why the results from the mark-up model should be treated with caution. The first is that in the second sample period, the insignificance

24. The response of inflation to changes in import prices in the very short run is statistically insignificant in both samples and economically small. Also, while the estimates of inflation persistence, which are captured by the sum of the coefficients on lagged inflation, are statistically significant, they are not significantly different between the two sample periods. This is consistent with the estimates presented in Cecchetti and Debelle (2004).

Figure 7: Effects of a 10 per cent Increase in Import Prices
Mark-up model



of the mark-up term suggests that there is no longer a cointegrating relationship among the price level series, and yet most of the difference between the two periods is being driven by this long-run relationship. The second is that if pass-through has slowed, and possibly fallen, it will become increasingly difficult to precisely estimate long-run parameters, especially with the relatively short samples being used here. This suggests that it is important to check the robustness of the short-run import price and inflation persistence estimates to the inclusion of the mark-up term. To do this, we need a model specified in differences, and following Debelle and Wilkinson (2002) we estimate an import-price augmented Phillips curve model of inflation (Table 7).

Table 7: Pass-through Elasticities – Phillips Curve Model

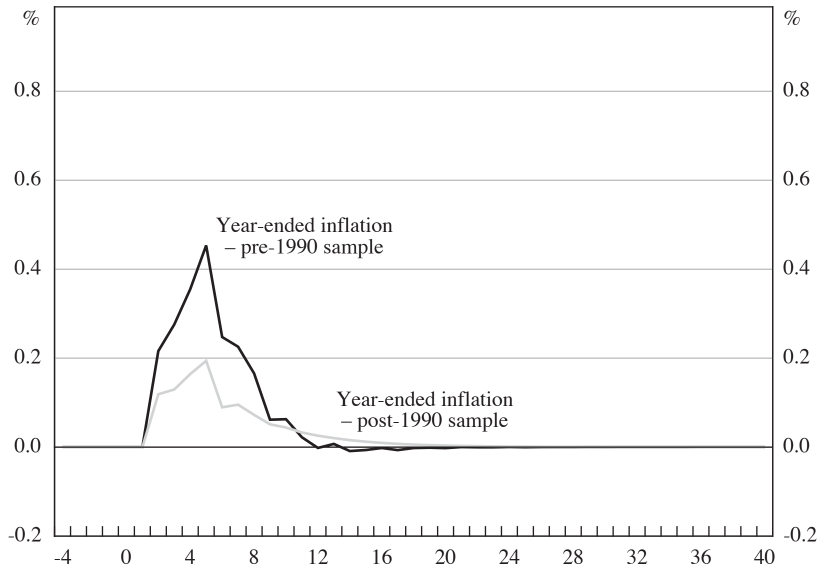
Sample	Constant	Lagged inflation	Output gap	Changes in import prices
1976:Q3–	–0.19	0.58**	0.04	0.02
1989:Q4	(0.10)	(0.14)	(0.02)	(0.01)
1990:Q1–	–0.15*	0.57**	0.03*	0.01
2004:Q1	(0.07)	(0.10)	(0.02)	(0.01)

Notes: Standard errors reported in parentheses. *, ** denote significance at the 5 and 1 per cent confidence levels, respectively. Where the reported elasticity is the sum of several coefficients, the p-value on the F-test of the coefficients being jointly equal to 0 is reported. Full details of these models are provided in Appendix D.

Although there are differences in the size of the impulse responses compared with those derived from the mark-up model, there is still an economically meaningful slowing of pass-through across the two samples (Figure 8). While the response of consumer price inflation to a change in import prices appears to be slower in the second sample period, this difference is not statistically significant. However, the point estimates are comparable to those presented in Debelle and Wilkinson (2002). It is worth noting that the estimates of inflation persistence are higher than those from the mark-up model, and this is likely to be because these estimates are picking up some of the role played by the mark-up term in the previous model.

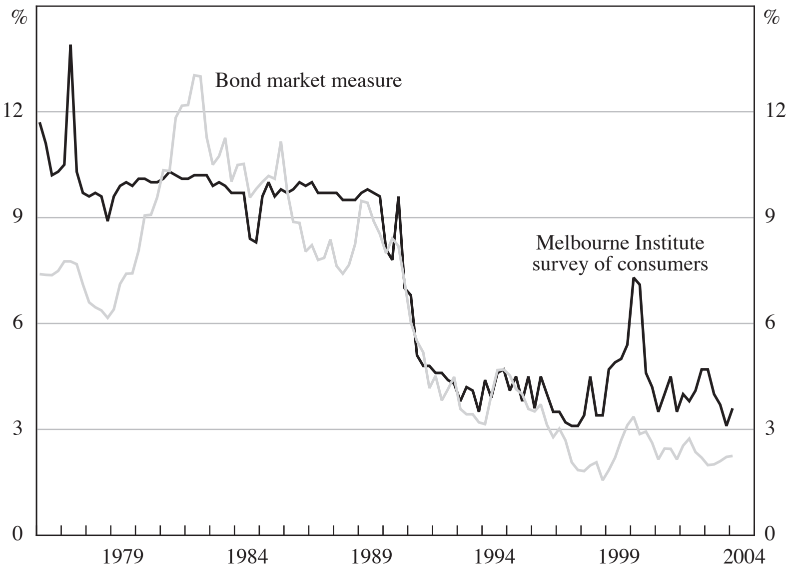
Figure 8: Effects of a 10 per cent Increase in Import Prices

Phillips curve model



The evidence for pass-through in Australia slowing over the 1990s is consistent with the hypothesis that changes in pass-through are related to changes in the extent to which inflation expectations became anchored at low levels. Indeed, the direct evidence suggests that this has occurred in Australia in the 1990s (Figure 9). Another testable implication of this link is that inflation should respond less quickly to all shocks, not just shocks from external sources. Although there is some evidence of economically and statistically small falls in the response of inflation to the output gap, and to its own history, results from the mark-up model suggest that inflation has become more responsive to unit labour cost shocks. While this is not consistent with the proposed explanation, it is possible that there have been offsetting developments in the labour market. For example, rough calculations suggest that the persistence of unit labour cost shocks has increased over the 1990s, whereas the import price shocks have become, if anything, less persistent over this period. Indeed there is direct evidence that inflation expectations have led to a change in wage-setting behaviour as the duration of enterprise bargaining agreements has increased on average over the 1990s (Dwyer and Leong 2001).

Figure 9: Australian Inflation Expectations Indicators



Sources: Melbourne Institute; RBA

A further implication of inflation expectations becoming anchored at a lower level and shocks transmitting to inflation more slowly is that inflation should become more stable, and it should become more difficult to estimate meaningful inflation equations. We know from evidence presented in Section 2, that CPI inflation has become more stable and that the volatility of relative price shocks has declined markedly over the 1990s. This is consistent with a deterioration in the performance of models estimated using data from 1993 onwards (Appendix D).

In summary, these results add weight to the body of evidence surveyed above that inflation has become less responsive to exchange rate movements in the short to medium run across a large number of countries in the 1990s. There is also some evidence that this has been associated with an anchoring of inflation expectations at low levels, although it cannot be described as definitive at this stage. Further research that directly examines the formation of inflation expectations and its linkages with pricing behaviour would be useful.

4. Conclusions

This paper looks at two areas that are important for understanding inflation, particularly in the context of an inflation target. In the first half of the paper we discuss a set of criteria that a measure of underlying inflation should satisfy at a minimum to be useful as an operational guide within the inflation-targeting framework. Using Australian data from 1987, we find that a large number of measures satisfy these criteria, including the 30 per cent trimmed mean and weighted median measures that are monitored by the RBA. Exclusion-based measures published by the ABS also satisfy these criteria, but concerns about the construction of these measures suggest that they should be used with caution. It appears, however, that over the inflation-targeting period a constant inflation rate is a better predictor of future CPI inflation than any satisfactory measure of current underlying inflation or current CPI inflation. This is the result of the fall in the volatility of relative price movements, and increased stability of CPI inflation. Having said that, measures of underlying inflation are likely to remain important for understanding quarterly movements in the CPI on occasions when particularly large relative price shifts do occur.

In the second half of the paper, we address the question of whether the pass-through of exchange rate movements to final prices has slowed, or even perhaps fallen, over the 1990s. The cross-country evidence and time-series evidence for Australia indicate that there has been a widespread slowing in the pass-through of exchange rate movements into final prices. There is some evidence that this has been correlated with the global trend towards relatively low and stable inflation. The consequence of this for our analysis of Australian data is that it has become more difficult to estimate meaningful inflation equations using data for this period.

Appendix A: Data

Inflation: Consumer Price Index, ABS Cat No 6401.0. The statistical measures of underlying inflation use the expenditure item data in this publication.

Import prices: 1975:Q1 to 1981:Q2 – Import Price Index, ABS Cat No 6457.0, RBA *Bulletin*, mineral fuels and lubricants excluded. 1981:Q3 to 1985:Q2 – Import Price Index, mineral fuels and lubricants and other related items excluded. 1985:Q3 to 2004:Q1 – Implicit price deflator for imports, ABS Cat No 5206.0, fuels and lubricants, lumpy items, automatic data processing (ADP) equipment, and RBA imports of gold excluded. For Appendix E, ADP equipment are not excluded. Apart from the import price series analysed in Appendix E, these series are adjusted for tariffs (customs and excise data provided by the Australian Customs Service). They are also adjusted for the productivity difference between the traded and non-traded sectors of the economy given that unit labour costs are measured only in aggregate, and not for the non-traded sector only. Following Beechey *et al* (2000), we add a quarterly, linear time trend multiplied by 0.005 to the tariff-adjusted import price series.

Nominal unit labour costs: Non-farm labour costs divided by non-farm productivity, ABS Cat No 5206.0.

Output gap: Potential output series constructed using a multivariate filtering technique akin to that described in Gruen, Robinson and Stone (2002).

Inflation expectations: Consumers' median expected change in prices four quarters ahead, Melbourne Institute. Implied bond market inflation expectations are calculated by the RBA. Data prior to July 1986 are calculated and published in Gruen *et al* (2002).

Exchange rate: Nominal G7 GDP-weighted exchange rate index calculated by the RBA.

Foreign export prices: Nominal GDP-weighted average of G7 export price indices. Export price indices sourced from Datastream.

Appendix B: Formal Definitions of Statistical Underlying Inflation Measures

The trimmed (weighted) mean is formally defined for discrete data as:

$$TM = \frac{1}{1-\alpha/100} \sum_{i \in I_\alpha} w_i \pi_i \tag{B1}$$

where α is the proportion trimmed, and w_i are the effective weights corresponding to the cross-section of component price changes (π_i). The weighted median may be conceived of as the limiting case of the trimmed mean when α tends to 100.

Aucremanne's (2000) Jarque-Bera optimisation procedure for trimmed means (described in Section 2.1.2) can be extended such that the central percentile, in addition to the trimming percentage, varies in line with the characteristics of the cross-section. This entails a slight variation on the original approach. First, all trimming percentages between 0 and 100 per cent and all central percentiles between, say, 40 and 60 per cent are considered; second, the least trimming percentage corresponding to each central percentile for which the Jarque-Bera statistic does not reject non-normality is chosen; and finally, the estimator characterised by a central percentile for which the optimal trim rejects the least number of observations is selected as the optimum. In the event that there exist two or more central percentiles corresponding to the same optimal trimming percentage the percentile that yields the lowest Jarque-Bera statistic is selected.

The neo-Edgeworthian index is defined as:

$$NE_t = \frac{\sum_{i=1}^{p} \frac{1}{Vol(\pi_i)} \pi_{i,t}}{\sum_{i=1}^{p} \frac{1}{Vol(\pi_i)}} \tag{B2}$$

where $Vol(\pi_i)$ is the variance (or standard deviation) of the component *i*.

The 'double-weighted' index is defined as:

$$DW_t = \frac{\sum_{i=1}^{p} \frac{w_{i,t}}{Vol(\pi_i)} \pi_{i,t}}{\sum_{i=1}^{p} \frac{w_{i,t}}{Vol(\pi_i)}} \tag{B3}$$

Appendix C: Times-series Properties of CPI Inflation and Underlying Inflation

Table C1: Stationarity of Quarterly Inflation Series[(a)]

	Phillips-Perron test for presence of a unit root	
Indicator	1987:Q1–2003:Q4	1993:Q1–2003:Q4
Consumer price index	–5.35**	–6.06**
Weighted median (symmetric)	–3.13*	–5.62**
Weighted median (51st percentile)	–3.01*	–5.27**
Weighted median (52nd percentile)	–2.96*	–5.16**
30 per cent symmetric trimmed mean	–3.90*	–4.53**
30 per cent trimmed mean (51st percentile)	–3.77**	–4.70**
45 per cent symmetric trimmed mean	–3.32*	–4.86**
60 per cent symmetric trimmed mean	–3.08*	–5.01**
Market prices excluding volatile items	–3.46*	–3.74**
CPI excluding volatile items	–3.64**	–3.71**
Optimal Jarque-Bera trim	–3.40*	–4.50**
Jarque-Bera trim (symmetric)	–3.31*	–4.97**
Double-weighted (varying weights)[(b)]	–3.22*	–4.09**
Double-weighted (fixed weights)	–3.25*	–3.88**

Notes: *,** denote significance at the 5 and 1 per cent levels, respectively. Significance of the Phillips-Perron test statistic is assessed using Mackinnon (1991) small sample critical values.

(a) All series exclude interest charges prior to the September quarter 1998 and are adjusted for the tax changes of 1999/2000.

(b) In this table we refer only to the double-weighted measure using base-period weights that change with each official re-weighting of the CPI.

Appendix D: Model Specifications

We estimate two inflation models in Section 3.2.2, an error-correction model (ECM) and a Phillips curve, both of which are estimated over two periods, from 1976:Q3 to 1989:Q4 and 1990:Q1 to 2004:Q1.

The ECM is estimated in two stages (Tables D1 and D2). The long-run relationship between consumer prices, import prices and unit labour costs is estimated using the Dynamic Ordinary Least Squares (DOLS) methodology of Stock and Watson (1993). Serial correlation is accounted for with the Newey-West correction to the standard errors. Static homogeneity, the property that the long-run elasticities of unit labour costs and import prices sum to one, is not accepted in either sub-sample, even at a 10 per cent confidence level.

In the second-stage, dynamic specifications are found using a general to specific approach. The specification search begins with up to three lags of inflation, and zero to three lags of the output gap and changes in import prices and unit labour costs. For expositional purposes, changes of unit labour costs and import prices are retained regardless of their significance. The specification also includes the long-run residual from the first stage, $\hat{z}$:

$$\hat{z}_t = p_t - \hat{B}pm_t - \hat{\Gamma}ulc_t \tag{D1}$$

Table D1: Mark-up Model Specification – First Stage

	1976:Q3–1989:Q4	1990:Q1–2004:Q1	1993:Q1–2004:Q1
Long-run specification	$p_t = \alpha + Bpm_t + \Gamma ulc_t + \text{leads} + \text{lags} + \varepsilon_t$	$p_t = \alpha + Bpm_t + \Gamma ulc_t + \text{leads} + \text{lags} + \varepsilon_t$	$p_t = \alpha + Bpm_t + \Gamma ulc_t + \text{leads} + \text{lags} + \varepsilon_t$
B	0.35**	0.17**	0.12**
	(0.05)	(0.05)	(0.05)
Γ	0.50**	1.03**	1.07**
	(0.09)	(0.06)	(0.07)
$B+\Gamma$	0.85	1.19	1.20
F-statistic that $B+\Gamma=1$	7.56**	38.58**	39.59**
T	54	55	43
Adjusted R^2	0.99	0.99	0.99

Notes: Newey-West adjusted standard errors reported in parentheses. ** denotes significance at the 1 per cent confidence level. Variable names in lower case are expressed in logs.

Table D2: Mark-up Model Specifications – Second Stage

	1976:Q3–1989:Q4	1990:Q1–2004:Q1	1993:Q1–2004:Q1
Short-run specification	$\pi_t = \alpha_0 + \sigma\hat{z}_{t-1} + \alpha_1\pi_{t-1} + \alpha_2\pi_{t-2} + \beta_1\Delta pm_{t-1} + \gamma_3\Delta ulc_{t-3} + \delta_1 gap_{t-1} + \omega_t$	$\pi_t = \alpha_0 + \sigma\hat{z}_{t-1} + \alpha_2\pi_{t-2} + \alpha_3\pi_{t-3} + \beta_0\Delta pm_t + \gamma_2\Delta ulc_{t-2} + \delta_2 gap_{t-2} + \omega_t$	$\pi_t = \alpha_0 + \sigma\hat{z}_{t-1} + \alpha_1\pi_{t-1} + \alpha_2\pi_{t-2} + \beta_1\Delta pm_{t-1} + \gamma_1\Delta ulc_{t-1} + \gamma_2\Delta ulc_{t-2} + \delta_3 gap_{t-3} + \omega_t$
α_0	–0.12 (0.10)	–0.01 (0.12)	–0.09 (0.06)
σ	–0.03* (0.02)	–0.03 (0.03)	–0.03 (0.02)
α_1	0.25* (0.13)	–	–0.05 (0.15)
α_2	0.24 (0.13)	0.30** (0.11)	0.03 (0.14)
α_3	–	0.15 (0.11)	–
β_0	–	0.01 (0.01)	–
β_1	0.02 (0.01)	–	0.00 (0.01)
γ_1	–	–	0.06* (0.03)
γ_2	–	0.05 (0.03)	0.05 (0.03)
γ_3	0.04 (0.02)	–	–
δ_1	0.05* (0.02)	–	–
δ_2	–	0.04* (0.01)	–
δ_3	–	–	0.04* (0.02)
T	51	57	45
Adjusted R^2	0.39	0.51	0.25
LM AR(4): $T \bullet R^2$ (*p*-values)	7.02 (0.13)	6.67 (0.15)	5.44 (0.25)

Notes: Standard errors reported in parentheses. *, ** denote significance at the 5 and 1 per cent confidence levels. Variable names in lower case are expressed in logs.

The second type of model we estimate is a simple Phillips curve (Table D3). Again, the final structures are arrived at following a general to specific specification search, beginning with three lags of inflation, and zero to three lags of the output gap and changes in import prices. At least one change in import prices term is retained.

Table D3: Phillips Curve Model Specifications

	1976:Q3–1989:Q4	1990:Q1–2004:Q1	1993:Q1–2004:Q1
Specification	$\pi_t = \lambda_0 + \lambda_1\pi_{t-1} + \lambda_2\pi_{t-2} + \lambda_3\pi_{t-3} + \lambda_4\pi_{t-4} + \lambda_5 gap_{t-2} + \lambda_6\Delta pm_{t-2} + \varepsilon_t$	$\pi_t = \lambda_0 + \lambda_1\pi_{t-1} + \lambda_2\pi_{t-2} + \lambda_3\pi_{t-3} + \lambda_5 gap_{t-3} + \lambda_6\Delta pm_{t-2} + \varepsilon_t$	$\pi_t = \lambda_0 + \lambda_2\pi_{t-2} + \lambda_5 gap_{t-3} + \lambda_6\Delta pm_{t-1} + \varepsilon_t$
λ_0	–0.19 (0.10)	–0.15* (0.07)	–0.15* (0.06)
λ_1	0.28* (0.13)	0.09 (0.13)	–
λ_2	0.29* (0.13)	0.28* (0.12)	0.10 (0.15)
λ_3	0.27* (0.13)	0.20 (0.12)	–
λ_4	–0.26 (0.13)	–	–
λ_5	0.04 (0.02)	0.03* (0.02)	0.03* (0.01)
λ_6	0.02 (0.01)	0.01 (0.01)	0.01 (0.01)
T	49	57	45
Adjusted R^2	0.44	0.47	0.10
LM AR(4): $T \bullet R^2$ (*p*-values)	5.25 (0.82)	1.54 (0.26)	4.40 (0.36)

Notes: Standard errors reported in parentheses. * denotes significance at the 5 per cent confidence level. Variable names in lower case are expressed in logs.

Appendix E: Recent Australian Analysis of First-stage Exchange Rate Pass-through[25]

In a study of 25 OECD countries, Campa and Goldberg (2002) find partial first-stage pass-through, which has increased for Australia, though it has decreased for a number of other countries. They further suggest that observed changes in pass-through rates across OECD countries is driven by changes in the composition of imports. Their results rely on a model of first differences, which is appropriate in the context of their cross-country study. However, in the case of Australia, an error-correction model is shown to be more appropriate. As shown below, use of this model implies that there is, in fact, full first-stage pass-through. Further, while pass-through has risen over time, this change is not statistically significant and largely results from changes in the pass-through for different categories of imports, rather than compositional changes.

E1. Aggregate First-stage Pass-through

An error-correction model is appropriate for Australian import prices given that they can be shown to be non-stationary and that they form a co-integrating relationship with measures of world prices and the exchange rate. This model takes the form:

$$\begin{aligned}\Delta pm_t = \alpha + \beta_1 pm_{t-1} + \beta_2 p^{*x}_{t-1} + \beta_3 e_{t-1} + \\ \sum_{i=0}^{1} \beta_4 \Delta p^{*x}_{t-1} + \sum_{i=0}^{1} \beta_5 \Delta e_{t-1} + \beta_6 D_t + \beta_7 t + v_t\end{aligned} \tag{E1}$$

where pm is the local currency import price, p^{*x} is the foreign export price, and e is the exchange rate (G7 GDP-weighted). Theses variables are all expressed in logarithms and the data definitions are provided in Appendix A. Also, D is a dummy variable ($D_t = 0$, $t < 1998$:Q2; $D_t = 1$, $t \geq 1998$:Q2) and t is a linear time trend. The trend is included to capture the gradual shift in Australia's imports toward lower-priced goods from non-G7 countries and the dummy is included to capture a lowering of prices by Asian exporters following the Asian crisis (Beechey *et al* 2000).

Campa and Goldberg examine exchange rate pass-through into import prices using the following first difference equation. The justification for the model specification in first differences is that they could not find evidence of co-integration in a number of their series and their study required a single model to fit all 25 OECD countries considered:

$$\begin{aligned}\Delta pm^j_t = \alpha + \sum_{i=0}^{4} a^j_i \Delta e^j_{t-1} + \sum_{i=0}^{4} b^j_i \Delta w^j_{t-i} + c^j \Delta gdp^j_t + \vartheta^j_t \\ \textit{for} \;\; j = 1,\ldots,25 \;\; \textit{countries}\end{aligned} \tag{E2}$$

where w is a proxy for export partner costs[26], and gdp is real domestic GDP (both in logarithmic form).

25. Kylie Smith prepared this Appendix.

26. This proxy is a weighted measure of country j's trading partner CPIs (see Campa and Goldberg 2002 for further details). For the purpose of estimating this equation for Australia, in this paper the proxy was a G7 GDP-weighted CPI.

Both the error-correction model and the Campa and Goldberg model are estimated for the sample period 1986:Q1–2004:Q1 as well as for the two sub-samples 1986:Q1–1994:Q4 and 1995:Q1–2004:Q1. The estimates for the long-run and short-run pass-through of both models, along with the change in elasticities between the two sub-samples, are shown in Table E1. The estimates for Equation (E2) imply that first-stage pass-through is only partial (consistent with Campa and Goldberg), but has remained fairly constant over time (in contrast to Campa and Goldberg).[27] The estimates from Equation (E1) – the model appropriate for Australian import prices – imply that there is full first-stage pass-through, and if anything, it has increased somewhat over time (by 0.13 percentage points), although this change in pass-through was not found to be statistically significant.

Table E1: Aggregate Exchange Rate Pass-through

	Full sample[(a)]		Change in elasticity[(b)]	
Model	Short run	Long run	Short run	Long run
Campa & Goldberg dynamic model	0.60*+	0.64*+	0.13	–0.003
Error-correction model	0.67*+	0.95*	–0.02	0.13

Note: * significantly different from zero and + significantly different from one, both at the 5 per cent significance level

(a) Full sample estimation 1986:Q1–2002:Q1

(b) Difference between first sub-sample (1986:Q1–1994:Q4) and second sub-sample (1995:Q1–2004:Q1)

E2. Exchange Rate Pass-through into Disaggregated Imports

Campa and Goldberg propose that a change in aggregate pass-through can be explained by a change in the industry composition of imports. This requires that pass-through differs across different industry groups, and also, that there has been a consistent shift in the composition of imports. Even though there has been no significant change in pass-through over time at the aggregate level, this does not preclude the possibility that there may have been changes in pass-through across different categories of imports and that the impact of this on aggregate pass-through has been offset by compositional change. While it is shown below that first-stage pass-through does vary across different categories of imports in Australia, compositional change is shown to be relatively minor in terms of its effect on aggregate pass-through.

Import prices can be disaggregated into 25 categories to investigate whether the movement in pass-through for the components is similar to that for the aggregate

27. The results using Equation (2) are different from those found in Campa and Goldberg largely due to differences in the data, in particular the different weights used in the exchange rate and world price series.

(6 consumer, 6 capital and 13 intermediate components were examined). Table E2 presents the pass-through estimates obtained using the error-correction model for a selection of the more sizeable import categories. In sum, these represent around 70 per cent of imports over the estimation period.

Table E2: Exchange Rate Pass-through for Selected Import Categories

	Full sample[(a)]		Change in elasticity[(b)]	
Component	Short run	Long run	Short run	Long run
Processed industrial supplies	0.68*+	1.18*	0.11	–0.16
Machinery & industrial equipment	0.76*+	1.09*	–0.06	–0.44
Other consumption goods	0.58*+	0.73*	–0.27	–0.27
Parts for capital goods	0.76*+	1.52*	0.20	0.09
Motor vehicles	0.70*+	1.25*	–0.38	–0.66
Fuels & lubricants	0.98*	1.14*	0.58	–0.06
Parts for transport equipment	0.66*	1.79*	0.29	–0.40
ADP equipment	0.91*	0.89	0.06	0.19
Food & beverages for consumption	0.34*+	0.30*+	0.17	–0.13
Textiles, clothing & footwear	0.56*+	0.96*	0.15	1.48
Other capital goods	0.65*+	1.01*	–0.01	–0.11
Toys, books & leisure goods	0.59*+	0.96	0.12	0.81

Note: * significantly different from zero and + significantly different from one, both at the 5 per cent significance level

(a) Full sample estimation 1986:Q1–2004:Q1

(b) Difference between first sub-sample (1986:Q1–1994:Q4) and second sub-sample (1995:Q1–2004:Q1)

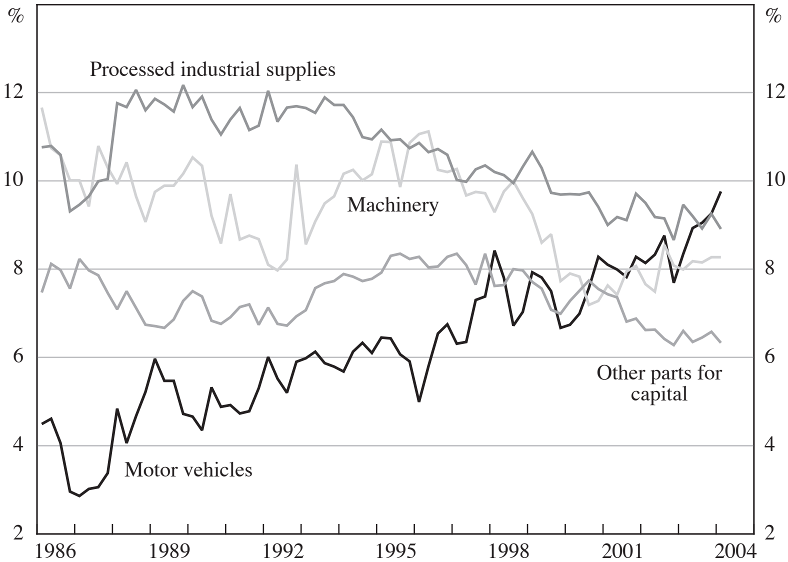
Between sub-samples, pass-through increased in 12 out of the 25 import categories, 4 of which are reported in Table E2. Most of the estimated increases are greater than 0.2 percentage points.

For the full sample period, in the long run there is a range from partial to full pass-through across the disaggregated components. There were a surprising number of components (13) in which the pass-through over the entire sample was full or greater than one, and one component for which pass-through was negative (food and beverages for industry). This may reflect specification error insofar as one model was used to estimate all 25 series, in addition to potential measurement error – a problem Campa and Goldberg also encountered.

Figure E1 shows that there have been some substantial shifts in the shares of larger import categories. The role of compositional change in explaining the change in aggregate pass-through was examined by constructing a hypothetical measure of the change in aggregate pass-through that would have occurred if the exchange rate elasticity of each category had been constant but the shares of each category were allowed to change between the two sub-samples. The results suggest that compositional change can account for an increase in the elasticity of long-run pass-through of, at most, 0.023 percentage points.

Figure E1: Composition of Imports

Share of total value



Source: ABS

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Discussion

Gordon de Brouwer[1]

There are few analytical areas more basic and important for a central bank than measuring and modelling inflation. The Heath-Roberts-Bulman paper makes an important contribution to understanding the complexity in measuring and modelling inflation, with particular reference to Australia. On the measurement issue, Alex, Ivan and Tim set out two criteria to determine the usefulness of measures of underlying inflation, and they apply them to the Australian data. On the modelling issue, they estimate mark-up and Phillips curve models for their preferred measure of underlying inflation. They show that the effect of the exchange rate on consumer price inflation has moderated substantially over the past decade and that inflation has become increasingly harder to model; it behaves like a 'constant', although it is subject to demand pressures. They argue that this is an outcome of low inflation.

The paper raises a raft of issues, some technical and some policy-based. Alex, Ivan and Tim have provided a clean and rigorous technical analysis. I would like to discuss issues that arise from both parts of the paper in turn, and look at some of the policy implications that arise from the analysis in the paper. On the issue of inflation measurement, my main point is that other criteria are also relevant in selecting underlying measures of inflation. On the modelling side, I don't think that the failure of inflation modelling is as overwhelming as the authors suggest: statistical work using other definitions of underlying inflation, imperfect as they are, does not seem to suffer the extent of instability exhibited with their preferred definition of underlying inflation. And the decline in the pass-through of exchange rate changes apparent in statistical work may be, at least to some extent, because relatively more adjustment has been occurring through quality changes than price changes, due to broader structural change in the Australian economy.

The use of underlying measures of inflation

Alex, Ivan and Tim look at 102 measures of underlying inflation, although they only report some test results for 13. These measures include a mix of exclusion-based measures (dropping volatile components) and statistically-adjusted measures. They argue that a good measure of underlying inflation is one which is unbiased with respect to the actual CPI and one which predicts the actual CPI but is not predicted by it. The results don't stack up all that well in general across different time periods. And they look to be a bit worse for exclusion-based measures (which is a bit disappointing from a policy perspective because I suspect that exclusion-

1. Principal Adviser (Macroeconomic), The Australian Treasury, and Professor, Asia Pacific School of Economics and Government, Australian National University. I am grateful for comments from Laurie Brown, David Gruen, Adrian Pagan, Tony Richards, Nick Stoney and Martin Parkinson. Comments welcome to gdebrouwer@treasury.gov.au. The views expressed here are those of the author alone and should not be represented as the views of the Australian Treasury, the Australian Government, or the Australian National University.

based measures are easier to explain to non-economists). Nevertheless, the authors make a judgement call that pragmatic use of the underlying measures is important in understanding what is going on with inflation at particular points in time.

That judgement looks right. The rationale for looking at underlying measures of inflation is that the headline CPI inflation statistic can be a distorted indicator of the true inflation impulse in an economy. Focusing on the ‘underlying’ bit is an attempt to ‘wash out’ the misleading signal in the statistics. Accordingly, this sort of exercise is, and remains, a necessary one for serious analysis of inflation.

But, while it is necessary, it has probably become less important, at least for that part of the debate which is in the ordinary public domain. One reason is pointed out by the authors themselves. For the past 13 years or so of low and less variable inflation, the noise in the inflation statistics has, not surprisingly, become smaller. With less noise, the inflationary impulse is easier to identify and the need for underlying measures is less than it was. The authors seem attached to the measures of underlying inflation – indeed, they explicitly refer to the full sample results to support their assessment that underlying measures still matter a lot. But if Australia is now in a low-inflation world, then the experience of the past decade, not of their full sample, is what matters. And in this period the evidence of the usefulness of underlying measures is much weaker.

Another reason why underlying measures are less important now is that headline CPI inflation has been calculated on an acquisitions basis since 1998, and the inflation target agreed between the Treasurer and the Governor is now headline CPI inflation, not underlying inflation. The target is a medium-term one. This is important since the medium term itself tends to wash out the noise in headline inflation. The authors refer to how the authorities can use measures of underlying inflation to communicate with the public about the inflationary impulse in the economy. To my mind, discussion of inflation is now best done in the main with reference to the targeted measure itself, and not underlying measures, especially since these measures are biased indicators of headline CPI inflation in the low-inflation environment (albeit mostly insignificant). When there is noise that distorts the information content of the inflation statistic, then that should be explained as such.

Of course, this does not mean that analysis of underlying inflation is unnecessary. Measures of underlying inflation have lost their policy prominence but they still have to be assessed in the engine rooms of economic analysis in order to inform policy-makers’ judgement of whether the inflation statistics at any point in time are a reliable guide to the inflationary impulse. It is helpful for economists elsewhere to know the substance of the work being done in the central bank on this; the paper is particularly useful in this respect.

The choice of which underlying measure to use is also, I suspect, broader than the two technical criteria that the authors set out and test. Other aspects matter. Depending on the target audience, it helps if the underlying measure used can be readily understood. Economists can surely understand the logic of the statistically-derived measures but the general public might understand the exclusion-based measures better.

And the choice of underlying measure for modelling, forecasting or policy analysis will be determined by the extent to which that particular measure is useful for that task. The measure which best meets the criteria set out by the authors might not in fact be the best for modelling, forecasting or policy analysis. One possible limitation of statistically-based measures of underlying inflation, for example, is that they may exclude valuable economic information. If the price changes or volatility are purely random, then no economic information is lost. But if the volatility is systematic, reflecting a common 'shock', then some economic information is lost. One such shock is a substantial movement in the exchange rate, which leads to the second part of the paper: inflation modelling.

Modelling inflation

The second part of the paper is concerned with modelling inflation, especially with pass-through of the exchange rate to prices. The economic story that the authors tell is that first-stage pass-through (from the exchange rate to import prices in Australian dollars) is full and quick, but that second-stage pass-through (from import prices to consumer prices) basically halved from the 1980s to the 1990s, a result they attribute to the success of inflation targeting in Australia.

But they temper this result by reporting that the performance of standard inflation equations has deteriorated significantly over this period. It is clear from the paper that the equations estimated over the 1990s are basically a mess. With respect to the mark-up model of inflation, the explanatory power halves (the adjusted R-squared falling from 0.51 to 0.25) when data from the early 1990s are excluded, and in the 1990s the error-correction term becomes insignificant and the rejection of linear homogeneity of consumer prices with respect to import prices and unit labour costs becomes quite spectacular. With respect to the import-price augmented Phillips curve, the import price variables in the equation are not statistically significant (which begs the whole question of why that model is used in the first place) and the explanatory power of the equation basically disappears when the sample is restricted to the past decade.

The authors argue that it is harder to estimate equations under low and stable inflation. But it is not clear that this is a *necessary* consequence of low inflation; low and stable inflation could be the result of low and stable growth in the driving variables. There could be other things going on which cause the results that the authors report. There are three other possibilities that I would like to canvas here. The problems with estimation might be caused by the particular measure of underlying inflation being used. There could be new divergences in the statistical measure of labour costs or import prices used from 'true' labour costs or import prices. Or it might be a quirk of a particular econometric methodology.

To explore this, Table 1 presents two sets of indicative results. Columns (1) to (3) show results estimated from a dynamic single equation error-correction model – along the lines of de Brouwer and Ericsson (1998) – for the weighted median

Table 1: Mark-up Models of Inflation with Different Definitions of Inflation

	Inflation as weighted median			Inflation as Treasury underlying		
	1990:Q1– 2004:Q1 (1)	1993:Q1– 2004:Q1 (2)	1990:Q1– 2002:Q2 (3)	1990:Q1– 2004:Q1 (4)	1993:Q1– 2004:Q1 (5)	1990:Q1– 2002:Q2 (6)
Constant	**0.06** **[0.00]**	0.04 [0.24]	**0.06** **[0.00]**	**0.05** **[0.00]**	**0.10** **[0.04]**	**0.05** **[0.01]**
Adjustment parameter	**–0.07** **[0.00]**	–0.05 [0.16]	**–0.08** **[0.00]**	**–0.07** **[0.00]**	**–0.12** **[0.01]**	**0.06]** **[0.00]**
Long-run coefficient on import prices	0.11 [0.13]	0.19 [0.24]	**0.17** **[0.04]**	**0.31** **[0.00]**	**0.20** **[0.01]**	**0.30** **[0.01]**
Implied long-run coefficient on unit labour costs	**0.84**	0.73	**0.79**	**0.64**	**0.76**	**0.65**
Long-run coefficient on oil prices	**0.05** **[0.00]**	**0.08** **[0.07]**	**0.04** **[0.00]**	**0.05** **[0.00]**	**0.04** **[0.00]**	**0.05** **[0.01]**
GST dummy	**0.027** **[0.00]**	**0.027** **[0.00]**	**0.027** **[0.00]**	**0.021** **[0.00]**	**0.021** **[0.00]**	**0.021** **[0.00]**
Change in ulc (t)	**0.08** **[0.01]**	0.06 [0.14]	**0.07** **[0.03]**	**0.07** **[0.03]**	**0.09** **[0.04]**	**0.07** **[0.02]**
Change in ulc (t–5)	l0.05 [0.11]	0.04 [0.25]	**0.06** **[0.06]**	**0.05** **[0.07]**	0.05 [0.16]	**0.06** **[0.09]**
Output gap (t)	**0.10** **[0.00]**	**0.09** **[0.04]**	**0.11** **[0.00]**	**0.09** **[0.00]**	**0.15** **[0.00]**	**0.09** **[0.00]**
Adjusted R-squared	0.83	0.86	0.85	0.80	0.83	0.80
Homogeneity restriction	[0.42]	[0.54]	[0.87]	[0.52]	[0.45]	[0.62]

Notes: The number in square brackets is the marginal significance; bold numbers indicate null hypothesis rejected at the 10 per cent level; linear homogeneity is imposed and tested.

measure of inflation over three sample periods: March quarter 1990 to March quarter 2004, March quarter 1993 to March quarter 2004, and March quarter 1990 to June quarter 2002. Columns (4) to (6) show the results over the same sample periods respectively for an exclusion-based measure of underlying inflation – actual CPI less interest rate charges, selected volatile items (like fresh food and energy) and a number of non-market items (such as health and education), which is equivalent to the Australian Bureau of Statistics' old measure of Treasury underlying inflation.[2] Linear homogeneity is imposed in these estimations – that is, the coefficients on unit labour costs, import prices, and oil prices are required to sum to one. The bottom row in Table 1 reports the marginal significance of the Wald statistic: a number equal to or less than 0.05, for example, indicates rejection of the null hypothesis of linear homogeneity at the 5 per cent level of significance.

There are four results of note:

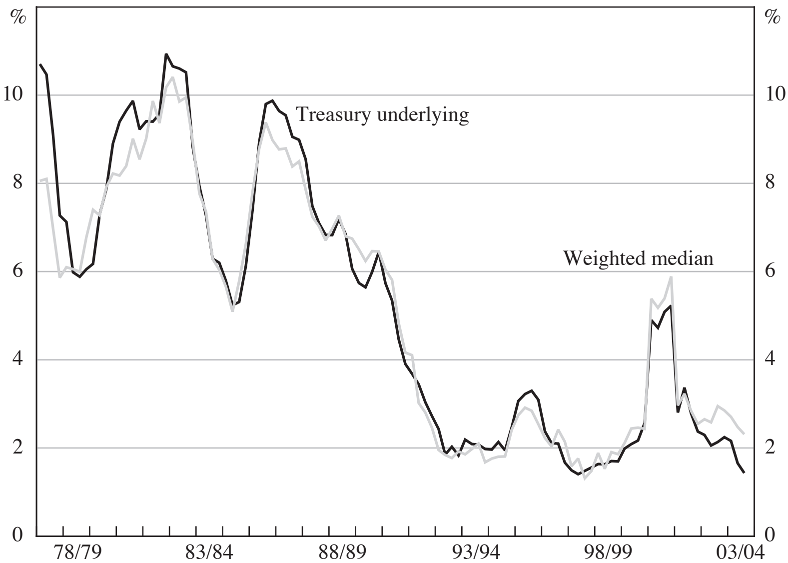
- The import price variable becomes insignificant in the weighted median underlying inflation equation in the 1990s when the endpoint is 2004. But import prices are still significant when the endpoint in this specification is 2002 (Column 3), implying that observations from the last few years might be the problem.
- The equation breaks down, along the lines outlined by Alex, Ivan and Tim, when underlying inflation is defined as the weighted median but it does not appear to do so when underlying inflation is defined on an exclusion basis as the Treasury underlying series. How underlying inflation is defined seems to matter.
- Linear homogeneity is not rejected in this estimation, either for the weighted median or the Treasury underlying series. This is not consistent with the results of Alex, Ivan and Tim. The puzzle is that different econometric methodologies seem to yield different outcomes with respect to linear homogeneity for the weighted median. (Linear homogeneity is not rejected for the Treasury underlying series in estimations, but it is in the estimations which include the early 1990s.) Economists tend to be uncomfortable with an overwhelming rejection of linear homogeneity – the trends in costs and prices cannot diverge in the long run for, if they do, the economic system explodes or implodes. Spectacular rejection of homogeneity might be a signal that something is wrong with the data or estimation.
- The degree of exchange rate pass-through does appear to have lessened somewhat over the past decade or so. When the early 1990s are excluded from the sample, for example, the long-run coefficient on import prices declines from 0.3 to 0.2 for the Treasury underlying series.

One obvious difference between the results presented in the paper and those outlined above is the measure of underlying inflation. The weighted median and the Treasury underlying inflation measure have moved much the same way over the past few decades, except in the past few years. The Treasury underlying measure has fallen in the past year or so but the weighted median has not; as shown in Figure 1, the Treasury underlying measure was about 1.4 per cent in the March quarter 2004, compared to 2.3 per cent for the weighted median.

It is not surprising that a mark-up model using the Treasury underlying series will tend to perform better because that measure has fallen much more at a time of sharp currency appreciation – about 45 per cent over the past two years. The puzzle is why the gap has emerged between the weighted median and this particular exclusion-based measure.

2. In these estimations, a GST dummy is included for the four quarters starting September 2000. The dummy enters in both the long run and short run.

Figure 1: Measures of Underlying Annual Inflation



One conjecture is that the prices which have changed the most are those on imported goods. Against a background of low overall price volatility, imported prices have been the ones that have moved most, and so they are likely to have been the ones cut out of the statistically-based measure.[3] By contrast, these goods and services are not the ones excluded from the Treasury underlying measure. Pass-through is less apparent in statistical work based on the weighted median measure which only partially reflects the impact of falling import prices over the more recent period. The collapse of the weighted median inflation equation in the past few years is consistent with this explanation.

It appears that systematic influences are being removed from the statistically-based measures of inflation. Given that the overall noise in inflation is now lower, the risk of removing systematic effects is now greater. If this is the case, then the statistically-based measures of underlying inflation might need to be used with caution for *economic* modelling, particularly when inflation is low and stable. In this instance, the systematic influence is the effect of exchange rate movement, but it could also apply to other systematic influences.

To the extent that statistically-based measures remove systematic influences of the exchange rate on inflation, the estimated pass-through parameter will be biased downwards, underestimating the 'true' extent of pass-through. This might explain why the pass-through parameter is notably lower for the weighted median (an average of about 0.15) than the Treasury underlying measure (an average of about 0.25).

3. I am grateful to Laurie Brown and Nick Stoney for this analysis.

This does not mean that the Treasury underlying measure is necessarily the best measure of underlying inflation; it too has its faults, not least the apparent arbitrariness of exclusion. But what it does suggest is that forecasters should not just rely on their preferred definitions of variables. In terms of econometric work, it would seem to be important not just to use a number of analytic frameworks to motivate empirical work (like mark-up or Phillips curve frameworks), but also to experiment with a number of definitions of the dependent variable.

Another explanation for the falling power of inflation equations reported by Alex, Ivan and Tim might be that the data on unit labour costs and import prices may not be fully capturing the reality; data are, after all, just constructs, and not the reality itself. The results in the paper show a big shift in homogeneity over the past decade: the joint trends in unit labour costs and import prices grow faster than the trend in consumer prices in the 1980s and then substantially less than the trend in consumer prices in the 1990s.

The data might be a problem in a number of ways.[4] The unit labour cost measure used in the estimation is the economy-wide series, but in the mark-up model it is supposed to be non-traded unit labour costs. It is possible that productivity growth has shifted up, or wages growth has shifted down a notch in the traded sector relative to the non-traded sector over the past decade. This would mean that the cost series used in the econometric work will have been progressively underestimating actual non-traded unit labour costs and causing instability in the parameter estimates. The authors are aware of this issue and accordingly make an adjustment to the import-price measure (as described in their Appendix A). While for estimation purposes this is equivalent to making the adjustment to unit labour costs, it is perhaps not as appealing intuitively.

There are also complications with the measurement of import prices. The growth in ICT imports and greater flexibility in production chains mean that it is harder to accurately identify quality changes in imported goods; to the extent that these are not properly reflected in the import price statistic, there is scope for the statistic to diverge from what it is meant to capture.

These data problems are relevant to the measurement of pass-through as well. In a competitive and much more flexible corporate environment, importers in Australia can respond to movements in the Australian dollar by changing the quality of the goods they sell. To preserve margins as much as possible, for example, clothing retailers shift between single- and double-stitched shirts, electronics firms change the disc-stacking capacity in their CD players, and car retailers shift the airbag, air conditioning, paint and rust-proofing standards for each model.[5] These changes in the quality of the good represent hedonic price changes, but they can be hard to identify and track and so are only incompletely captured in the statistics.

The ability of firms to respond to exchange rate changes by altering the quality and cost of the good rather than shifting the final price of the good has probably

4. I am grateful to David Gruen for discussions on this.
5. I am grateful to Nick Stoney for these examples which have come from Treasury's business liaison program.

increased over the past decade or so. This is likely given the sharp rise in import penetration, the rapid fragmentation of the production chain, the greater frugality in holding stocks, and strengthening links between retailing and manufacturing groups. Pass-through is still occurring, but the form it takes is different and may have become more so. The decline in pass-through in these equations may be, in part, due to these structural and market changes in the economy. The upshot is clear: we have to check that the statistics are measuring the reality.

The results in the paper suggest that inflation in the past decade is best modelled by a constant and the output gap. I think that it would be incorrect for readers of the paper to infer that drivers like unit labour costs or the exchange rate are no longer relevant to the inflation process. (I should emphasise that the authors don't fall into this trap themselves.) Technical problems with inflation forecasting and statistics should not mean that we throw out the theoretical frameworks of inflation underpinning the empirical work (in this case, either the mark-up model or the Phillips curve model). A striking feature of Figure 6 in the paper is just how benign growth in nominal unit labour costs has been, which is in turn due to stable inflation, high productivity growth, a stable economy, and increased competition and contestability in domestic goods, services and labour markets. This can't be taken for granted.

And it has certainly been easier for firms to absorb changes in costs due to exchange rate movements, or perhaps to smooth price adjustment over a longer time period, when overall profitability in the economy has been high and even rising modestly, as it has been for the corporate sector over the past decade. While we don't know the counterfactual, exchange rate pass-through may not have slowed (as much) if profit margins had been squeezed from the mid 1990s. (I wonder whether scaling pass-through by a measure of the strength of profits would add anything to this analysis?)

The horizon for monetary policy

I would like to explore a broader monetary policy issue on which the analysis in the paper by Alex, Ivan and Tim may have some bearing. That is the desirable forecast horizon for setting monetary policy. The rule of thumb that I use from empirical analysis of Australian monetary policy is that the most efficient forecast horizon for Australia is basically one year ahead. This is based on two bits of technical work.

In 1998, Luci Ellis and I used the Bank's system of forecasting equations for inflation, output, the real exchange rate, import prices and wages to ask what sets of weights in a forward-looking Taylor-type rule produce the lowest combination of variability in inflation and variability in output, given the variance-covariance matrix of shocks in these equations.[6] Taking account of feedback loops, we also looked at which forecast horizon produces the most efficient of these policy frontiers. We found that four-quarter-ahead forecasts performed best. Given the lags in the transmission of shocks through the economy, a policy horizon of less than four quarters is inefficient because it would ignore valuable current information about the likely

6. See de Brouwer and Ellis (1998).

course of the economy. And basing policy on forecasts beyond four quarters was less efficient because forecast errors became bigger the longer the forecast profile; if policy looks too far into the future, it risks responding to phantoms.

In 2002, James Gilbert and I fitted a variety of forward-looking Taylor-type rules (including real-time data estimates of the output gap), and we found that the policy interest rate in Australia in recent decades is best explained as being set on the basis of the four-quarter-ahead inflation forecast, among other things.[7] Given how well monetary policy has been set in the past decade, we took this as an indication that the four-quarter-ahead rule works very well. This profile is also similar to the fitted 12-month forward-looking interest rate rules for the G7 economies estimated by Clarida, Galí and Gertler (1998).

This may be technical work but it makes intuitive sense. Given what we know about what is happening now in the economy, most forecasters are generally more comfortable in saying what they think will happen over the coming 12 or possibly 18 months than over the next 2, 3 or 4 years. Technical analysis confirms the gut view. While there is an obvious appeal in policy-makers thinking carefully about the economic process beyond the standard one-to-two year forecast period, the inherent limitations of forecasting suggest that it is hard to operationalise an extension of the policy horizon.

The paper by Alex, Ivan and Tim highlights the structural instability in inflation equations, which makes it harder to use the inflation equations as tools for forecasting. Their claim is that the speed of pass-through has changed. But the impulse responses do not suggest that the lags themselves have changed all that much; the location of the peaks and the rates of decay are pretty similar across sample periods. This suggests that we may have to conditionally wind back the effect we expect exchange rate movements to have on consumer price inflation (at least when profits are strong). But it does not change the working rule of thumb that the efficient forecast profile for monetary policy is about a year ahead.

Final comment

Let me sum up. This paper is useful in a number of ways.

It provides some detailed analysis on measures of underlying inflation. These measures are now less important in the public debate about monetary policy, but they remain necessary tools in the engine room of economic analysis. It is valuable to put this work in the public domain; it may be a bit too esoteric for the average punter, but it is especially helpful to other economists.

The paper also presents evidence on the reduction in exchange rate pass-through to consumer price inflation. I don't think we really understand this. How different would the outcome have been, for example, if profits had not been as strong as they have been? How well are the statistics capturing what is going on in the economy? How dependent are the results on the particular measure of underlying inflation used,

7. See de Brouwer and Gilbert (2002).

especially a measure which may remove systematic economic information? The paper is honest in showing how hard econometric analysis can be in a policy environment. One tool in the forecaster's kit might not be working so well at the moment. But it is not the end of the world. We do have better measures of expectations than we had a decade ago. It does not shake views on other aspects of policy analysis, such as the preferred forecast horizon. And nor does it necessarily follow that the analytical frameworks which underpin this particular technical work have failed.

I would like to thank the authors for a stimulating paper and the Reserve Bank for the invitation to discuss the paper. Having spent a number of years in the mid 1990s modelling inflation at the Bank, I feel a welcome sense of coming home and nostalgia in discussing these issues today.

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General Discussion

The discussion of the two papers ranged over a variety of issues, a number of which were common to both. Considerable attention was given to the impact of administered prices – such as those for education, child care, heath care and pharmaceuticals – on the CPI. One participant noted that, until the last few years, the traditional method of forecasting inflation using unit labour costs and import prices (as discussed in the Heath, Roberts and Bulman paper) had worked reasonably well. In the last couple of years, however, this approach has led to a considerable underprediction of inflation. The difference could be explained by administered prices, which comprise 14 per cent of the CPI by weight and have recently been growing at 5–6 per cent a year. It was suggested that this might better explain the low inflation implied by the Treasury underlying measure of inflation relative to other underlying measures over the past year or so. As a number of participants noted, this phenomenon has wider implications: monetary policy has to press harder on non-administered prices to maintain inflation within the target band; it has become more difficulty to estimate inflation using a mark-up model; and, as administered prices are changed infrequently, say every four quarters, trimmed measures of the CPI calculated at a greater frequency will tend to be biased downwards.

Following Kent's comments, there was some discussion of the implications of possible biases in the CPI. One participant agreed that, while it was technically true that inflation mismeasurement did not pose problems for the monetary policy process, it was important for central bankers to be involved with CPI formulation and measurement issues. Another participant questioned whether it mattered for the central bank if the magnitude of the measurement bias was unknown, but thought to be relatively stable. In this respect it was noted that greater quality adjustment would potentially lead to greater instability in the measurement bias. One participant suggested that in addition to the need for a low bias in order to gain wide community acceptance of the measure of inflation that the central bank is targeting, accurate measurement of prices is important for contracts that include indexation clauses, and for the measurement of real income.

In terms of other measurement issues, one participant noted that the use of expenditure weights in the CPI meant that the CPI was likely to better represent wealthier households, who have a higher absolute value of expenditure. To overcome this, it was possible to construct 'democratic' CPIs, using expenditure weights for individual households (from household expenditure surveys), rather than the average of all households. Encouragingly, preliminary work at the Reserve Bank suggested that the average CPI measured across households is roughly similar to the expenditure-weighted CPI, although there was wide variation in the inflation experience across households. The use of democratic CPIs may help to shed light on experiences such as the introduction of euro notes and coins, when segments of the population thought that inflation was quite high. This may have reflected relative expenditure patterns, with some people not benefiting by much from the prices that had come down, but were focusing instead on items they purchased frequently whose prices had increased.

There was also considerable discussion of the slowdown in import price pass-through in recent years. There was general agreement that this was a common phenomenon across the industrialised world and thus seems to be a feature of low and stable inflation, independent of any variation in the structural characteristics of countries, including economic size. The econometric difficulties of measuring changes in pass-through were covered at some length. A number of participants accepted that the significant fall in inflation variability over the past decade or so made estimating the relationships in an inflation equation considerably more problematic. A number of participants also noted that with the fall in pass-through, the unit labour costs component of the inflation equation assumed greater importance. One participant contended that the estimation problems highlighted by the Heath *et al* paper were not encountered if the equation was estimated before and after the float of the Australian dollar in 1983. More specifically, the import price pass-through coefficient had changed between these two periods, but in the post-float period pass-through had not changed between the period of high inflation and the period of low inflation. These results further illustrated the sensitivity of the estimate to the choice of sample period. Finally, one participant noted that, while a lot of work had been undertaken examining the statistical properties of the dependent variable in the inflation equation, there had been relatively limited work trying to better understand the independent variables – most notably unit labour costs. Better measures here may lead to an improved mark-up model.

Inflation Targeting and Japan: Why has the Bank of Japan not Adopted Inflation Targeting?

Takatoshi Ito[1]

1. Introduction

By any historical or cross-sectional standard, the Japanese economic slump from 1992 to 2004 has been quite unusual. The economy that was once regarded as 'number one' fell into a state of low growth, falling prices, and chronic banking crises for more than a decade.[2] The average growth rate from 1993 to 2003 was just above 1 per cent, in contrast to the average growth rate of 4 per cent between 1975 and 1992. Slow growth was accompanied by disinflation in the first half of the 1990s and, eventually, deflation since the mid 1990s. The deflation in prices was associated with a shrinking of the Japanese economy – a rare phenomenon among advanced economies. From 1997 to 2002, Japanese nominal GDP (in yen) shrank by 4 per cent, while the nominal GDP of the United States (in US dollars) increased by 25 per cent.

Many factors have contributed to the stagnation of the Japanese economy since 1992. The long stagnation reflects the adverse combination of the negative wealth effects from the crash in asset prices, external shocks like the Asian currency crisis, and policy errors in bank supervision, fiscal policy, and monetary policy. In the early to mid 1990s, the burst bubble – a decline of stock prices by 50 to 60 per cent and the beginning of a long slide in real estate prices – meant that many corporations and households suffered from capital losses, and consumption and investment spending were curtailed. The most severely affected companies stopped interest and principal payments to banks. Non-performing loans became a serious policy problem by 1995. Large fiscal stimulus packages were implemented in the mid 1990s, and the call interest rate was lowered to an unprecedented level of 0.5 per cent in the fall of 1995. The stagnation of the Japanese economy from 1990 to 1995 can be largely explained by the extraordinary negative shocks to asset markets and the subsequent damage to the balance sheets of households and corporations.

After the mid 1990s, policy errors prevented the Japanese economy from returning to a firm recovery track. The two opportunities for recovery in 1996 and in 2000 were followed by negative growth and a (near) banking crisis. After a long stagnation, the Japanese economy began to recover in 1996, partly due to

1. The author is grateful for comments by Governor Ian Macfarlane, Robert McCauley, Frederic Mishkin, Warwick McKibbin, and other participants of the conference.

2. *Japan as No.1: lessons from America* was the title of a book written by Ezra Vogel (1979). A comprehensive description and analysis of the Japanese economy up to 1990 is available in Ito (1992).

the large fiscal stimulus in 1995, and partly because of an increase in exports. As part of the 1995 'tax-reduction-now, tax-increase-later' package, an increase in the consumption tax in April 1997 had been planned. The expected increase in the consumption tax rate stimulated consumption in the second half of 1996 and the first quarter of 1997. It was difficult to see how much of the growth was due to a genuine recovery and how much was due to the intertemporal substitution of consumption. The planned tax rate increase was carried out and consumption decreased in the second quarter of 1997.

The consumption tax rate increase and the repeal of the income tax cut in April 1997 are often regarded as a mistake, in that fiscal tightening was applied to an economy in a nascent recovery. But, in evaluating the cause of the sharp decline in Japanese economic growth in 1998, it is difficult to separate the effects of the fiscal tightening of April 1997 from those of the Asian currency crisis, from July 1997 to the spring of 1998, and the banking crisis of 1997–1998. The financial markets suddenly shrank due to the failure of one large bank and two securities companies (one large and one medium-sized) in November 1997. As a result of these incidents, the government undertook a capital injection for the major banks in March 1998. However, the additional capital proved insufficient, and two large banks failed in 1998. The second round of fiscal support in March 1999 put an end to the undercapitalisation and fragility of Japanese banks, but only for a few years, as it later turned out.[3]

From 1995 to 2000, the US economy grew strongly without inflation. The 'new economy' was believed to be supported by the widespread use of information and communication technology (ICT), as well as growth in the ICT sector itself. This was not happening in Japan (or Europe), and one reason, I believe, is that regulatory barriers and the protection of jobs prevented the widespread use of ICT. Even without strong economic growth, ICT stock prices soared worldwide. The Japanese economy was partly helped by the stock price boom and in 2000 the economy expanded by 3 per cent. However, the economy slumped again in 2001 and it went into another recession in 2002.

The extent of deflation increased from 2000 to 2003. The rate of CPI deflation reached around 1 per cent and the GDP deflator declined even more rapidly, at a rate of 3.5 per cent at one point. How to fight deflation became the top priority of monetary policy. Since many economists believe that inflation and deflation are ultimately a monetary phenomenon, there was increased attention on the Bank of Japan.

The *Bank of Japan Act* was revised in 1997 after an intense debate in public and in the parliament, and the new law became effective in April 1998.[4] The legal and institutional independence of the Bank of Japan was enhanced: the Governor

3. For a discussion of the failure of bank supervision and crisis management in the 1990s, see Cargill, Hutchison and Ito (1997). Ito and Harada (2000) showed that the Japanese premium, the spread charged by the western banks on the interbank lending rate to Japanese banks, virtually disappeared after April 1999.

4. See Cargill, Hutchison and Ito (2000) for a comparison of the language of the old and new Bank of Japan laws, an assessment of the change in the Bank's independence, and an analysis of experiences of the Bank's operations during the early years.

and Board members could not be dismissed for differences of opinion with the government, or any other reason other than physical and mental incapacitation. The newly enhanced Monetary Policy Board, consisting of the Governor, two Deputy Governors, and six full-time members who must be recruited from outside the Bank, became fully responsible for setting monetary policy. Mr Hayami, aged 72 and long-retired from the Bank, was appointed as Governor. Some Board members from the old regime were retained, to be replaced at the expiration of their respective terms, and some vacancies were filled by new appointments with the new qualifications for Board members in mind. For example, Mr Yamaguchi, a long-time Bank economist, and Mr Fujiwara, a journalist, were appointed as Board members. Previously, the Board members represented different kinds of businesses – agriculture, large financial and regional financial institutions, and trade and industry – but under the new law, Board members had to have expertise in finance and banking. Two professors were also appointed as Board members: Professor Ueda of the University of Tokyo and Professor Shinotsuka of Ochanomizu University.[5] Minutes of discussions (without names) and voting records (with names) were to be disclosed with a delay of about one month, as a part of enhanced transparency. The mandate of the new Bank of Japan was clearly price stability, while the mandate of the Bank under the old law was to help maximise the potential growth of the economy.[6]

With independence, the Bank of Japan became accountable to the public for its actions and their consequences. Deflation, many critics argued, was the proof of its failure. As deflation became worse, critics argued that there was a danger of a deflationary cycle: deflation generates deflationary expectations, which raises the real interest rate and depresses investment and consumption; and lower aggregate demand results in more deflation. The Bank should have done everything it could to prevent deflation from worsening. The Bank – both Board members and staff economists – initially argued that deflation was not so serious and, moreover, deflation that resulted from technological innovation and cheaper imports could be desirable. The Bank lowered the policy interest rate (the call rate) to virtually zero in February 1999. As the nominal interest rate cannot become negative, the zero interest rate policy (ZIRP) was the ultimate conventional monetary policy instrument available to the Bank. However, from mid 1999 to 2000, calls for additional action to fight deflation increased among policy-makers and academics. The list of additional or unconventional policies (from the perspective of standard textbook central banking) included: quantitative easing (expanding the monetary base); an increase in the purchase of long-term government bonds; the purchase of riskier assets including commercial paper, corporate bonds, equities, and foreign bonds; and the adoption of inflation targeting. The arguments raised by proponents of inflation targeting included greater accountability, instrument independence, better communication with the market, and an influence on inflation expectations to break the deflationary cycle.

5. These professors had to resign from their respective universities, as the Board member position required full-time employment at the Bank of Japan.

6. The word ‘potential’ was probably meant to refer to the potential of the economy to support the war effort as the old law was enacted in 1942.

In fact, inflation targeting became somewhat symbolic of the additional unconventional steps that many argued the Bank of Japan should take to achieve a positive inflation rate. Most of the Bank's Board members and staff economists were publicly dismissive of inflation targeting. Several reasons were mentioned. First, inflation targeting was a simple-minded reflation policy. Second, no country had adopted inflation targeting to move from deflation to inflation. Third, there were no available policy measures to lift the inflation rate to positive territory, given that the interest rate was zero, so the announcement of inflation targeting, without tools to achieve a positive inflation rate, would damage the Bank's credibility. Fourth, the mere announcement of an inflation target would not change expectations. Fifth, if the public believes in the inflation target, the long-term interest rate would increase and this would damage the economy.

The Bank not only rejected calls for additional ways of easing monetary policy but tightened monetary policy, by 0.25 percentage points, in August 2000, citing a brighter outlook for the economy. However, the inflation rate was still in negative territory. This turned out to be a costly mistake: the ICT stock bubble had already burst and the US economic outlook was deteriorating; the peak of the cycle was near in Japan too. Sure enough, the economy started to contract from October 2000. The economy deteriorated to such an extent that the Bank of Japan had to change course in March 2001, and return to the ZIRP. At the same time, the policy instrument was changed to the current account at the Bank of Japan (basically excess reserves at the Bank of Japan). By targeting excess reserves, a regime of quantitative easing had started. In March 2001, the target for current account balances was set at 5 trillion yen, at the time when required reserves were about 4 trillion yen. The target amount has since been raised in several steps, and reached the range of 30–35 trillion yen in January 2004. The Bank also expanded its purchase of long-term bonds. The amount of monthly purchases was raised from 400 billion yen to 600 billion yen in August 2001, and in several steps to 1 200 billion yen in October 2002. Thus, since March 2001, the Bank has adopted some unconventional policy measures, but not inflation targeting.

The term of Governor Hayami expired in March 2003. He was replaced by Mr Fukui, employed in the private sector for the five years prior to his appointment, but an earlier Deputy Governor of the Bank of Japan. The tone of statements and communication with the public became much better than under Governor Hayami. Under Governor Fukui, the confrontational style with the government has melted away, and the fixation on raising interest rates as soon as possible has also disappeared. However, Governor Fukui has not adopted inflation targeting. The economy started to recover in the second half of 2003 and the growth rate has climbed up to above 3 per cent in 2003, and is expected to remain around this level in 2004. The degree of CPI deflation has shrunk to near zero, and economic expansion is spreading from electronic machinery exports (particularly of electronic machinery) to consumption.

As the economy continues to expand, some observers have started to speculate about when the ZIRP will be lifted. In October 2003, the Board refined the necessary conditions for lifting the ZIRP: the CPI inflation rate (excluding fresh food) has to be zero or above, on average, in the past few months; and the inflation rate has to be projected to stay above zero in the near future. Many private-sector forecasters predict that if economic growth remains strong in the second half of 2004 and the first half of 2005, the necessary conditions to end the ZIRP will be achieved sometime in 2005. There is a growing call for adopting inflation targeting as a part of the exit strategy from the zero interest rate regime.

The rest of this paper is organised as follows. Section 2 reviews experiences of deflation and monetary policy actions from 1998 to 2004. Section 3 examines the pros and cons of inflation targeting and explains why the Bank of Japan did not adopt inflation targeting; a detailed discussion of inflation targeting in the Bank of Japan's Monetary Policy Meetings is presented in the Appendix. Section 4 concludes the paper.

2. Deflation and Monetary Policy

2.1 Deflation: measurement and effects

Measured by the CPI (excluding fresh food), Japan has experienced deflation for much of the period since July 1998, and measured by the GDP deflator, Japan has been in deflation for nearly all of the period since the third quarter of 1994.[7] The level of the CPI in 2004:Q2 was 2.7 per cent lower than in 1998:Q4, and the GDP deflator in 2004:Q2 was 11.5 per cent lower than in 1993:Q4. This is deflation.

The changes in the CPI and GDP deflator are shown in Figure 1. Prior to 1995, the series moved in parallel most of the time, but have since deviated. The CPI, calculated using the Laspeyres index formula, has an upward bias, while the GDP deflator, calculated using the Paasche index formula, has a downward bias. Quality changes that are not fully captured in price measurement, in either the CPI or GDP deflator, would create an upward bias.[8] That explains part of the deviation. However, the reason for the widening of the bias is not immediately clear. It is also puzzling that even the directions of changes from 1998 to 2003 are different. For example, from 2000 to 2002, CPI deflation worsened, while GDP deflation moderated; and from 2002 to 2003, CPI deflation disappeared, while GDP deflation worsened. At the time of writing, the CPI is showing about zero inflation, while the GDP deflator is indicating 2 to 3 per cent deflation.

Whether this magnitude of deflation is a serious problem is debatable; Bank of Japan economists tend to take the optimistic view. Moreover, in 1999 and 2000 many Board members, including Governor Hayami, strongly argued that a decline in prices due to technological innovation, such as in computers, and cheap imports,

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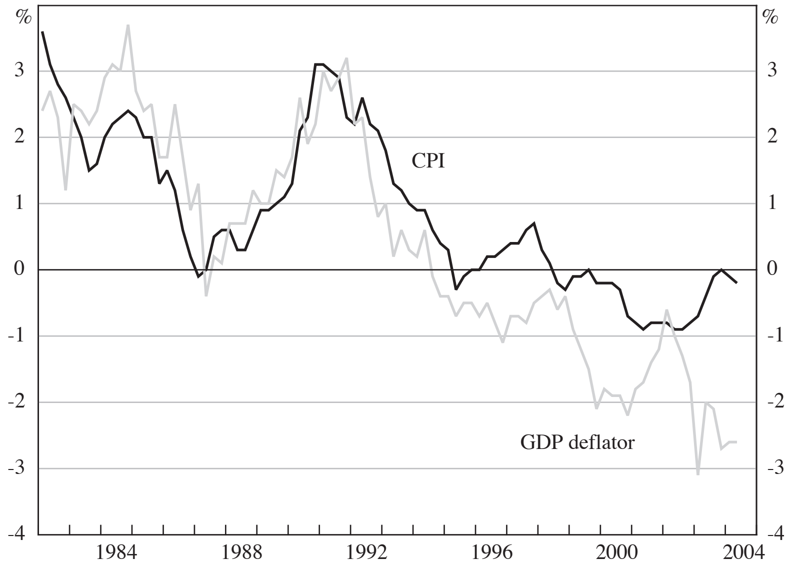
7. Since 1994:Q1 to the present, the change in the GDP deflator was continuously negative, except for the period from 1997:Q2 to 1998:Q1. This period was possibly influenced by the increase in the VAT rate from 3 per cent to 5 per cent. Theoretically, the GDP deflator should not be affected by the VAT, but the numbers are suspiciously higher for one year. An adjustment for the VAT tax increase is made in the following analysis.

8. Shiratsuka (1999) estimated the bias in the Japanese CPI to be 0.9 per cent.

Figure 1: Inflation Rates in Japan



Notes: Adjustments are made to the original series in order to remove the effects of value-added tax (VAT) rate increases. A 3 per cent VAT rate on all goods and services was introduced in April 1989, alongside the abolition of many excise taxes. Some very small businesses were exempted from charging the tax. The tax rate was increased from 3 per cent to 5 per cent in April 1997. Adjustments are as follows: for 1989:Q2–1990:Q1, 1.3 per cent and 1.4 per cent are deducted from the CPI and the GDP deflator, respectively; for 1997:Q2–1998:Q1, 1.5 and 1.3 per cent are deducted from the CPI and the GDP deflator, respectively, to offset the VAT increase.

is 'good deflation' and is not a concern for policy-makers.[9] However, as the duration of deflation increases, the decline in prices becomes large, and this has an impact on the real side of the economy. The impact of technological advancement and cheap imports on the price level raises the question of whether deflation occurred due to supply-side factors (that is, the aggregate supply curve shifted right) or to demand-side factors (that is, the aggregate demand curve shifted left).[10]

Since technological innovation and cheap imports from China are global phenomena, and not just Japan-specific phenomena, it would be incorrect to think

9. 'Though it is true that prices of a number of products have been declining, this is against the backdrop of various revolutionary changes including the so-called IT revolution, that is, the progress of technological innovation in information and telecommunications, as well as the revolution in distribution networks represented by the emergence of so-called "category killers". Such phenomena cannot necessarily be regarded as pernicious price declines' (Hayami 2000a).

10. Hayashi and Prescott (2002) argued that the economic stagnation of Japan in the 1990s was largely due to the slowdown in productivity growth, resulting from a reduction in the working week and other supply-side factors, such as capital deepening, which resulted in low returns to capital. The basic methodology assumes that actual GDP was tracing potential GDP most of the time, a tradition of real business cycle theory. This view sharply contrasts with the dominant view that aggregate demand growth was far less than potential, although estimates of the GDP gap vary from one researcher to another. See McKibbin (2001) for a simulation analysis which shows that inflation targeting would be beneficial for the Japanese economy.

that this is a major reason for the Japanese deflation. In the case of the US, where the 'new economy' (high growth, low unemployment and stable prices) was observed, it could be argued that the supply-side effects, namely productivity increases, made possible an output expansion without accelerating inflation.

It should also be noted that computers and other ICT-related products and services, and imports from China, are only a small fraction of consumer prices. The gross import-to-GDP ratio is around 10 per cent in Japan and the Chinese share in imports is about 20 per cent. So, the direct impact of China on GDP should be about 2 per cent. Even if the import prices from China dropped by a large margin, the direct impact would be limited. However, those who emphasise the impact from China argue that indirect effects on Japanese-made products are important. Many Japanese goods, including food, CDs, electronics, and even machinery, have become 'contestable', due to potential supply from China. The direct share of imports is thus argued to underestimate the impact of globalisation on the Japanese prices.

Relative prices are certainly affected by innovation and globalisation, but it does not follow that the general price level, such as that measured by the CPI, should follow the trend of a small category of goods and services. We expect that general price inflation is a monetary phenomenon, rather than the accumulation of relative prices changes.

2.2 Cost of deflation

In the case of Japan, unlike the US, disinflation and eventual deflation were the result of recession (a shift in the aggregate demand curve) rather than output expansion (a shift of the aggregate supply curve). In order to see the relationships between inflation and growth, and between inflation and unemployment, Phillips curve figures can be used. Figure 2 shows the relationship between the rate of CPI inflation and GDP growth (both measured as the four-quarter-ended percentage change). The figure shows a non-linear, although generally positive, relationship between the two variables: namely, lower inflation is associated with lower growth, suggesting that demand shocks are more dominant than supply shocks. However, the relationship is less robust if the sample is limited to the stagnation period (1993–2004).

Figure 3 shows the traditional Phillips curve relationship between the inflation rate and the unemployment rate. It used to be the case in Japan, say in the 1950s and 1960s, that the Phillips curve was more or less vertical (that is, there was little variation in the unemployment rate). This is no longer true. A downward-sloping curve, with a strong nonlinearity around 2 per cent inflation, can now be observed. The kink at around 2 per cent seems consistent with the predictions of Akerlof, Dickens and Perry (1996). Although the long-run Phillips curve is more or less vertical above the 2 per cent level of inflation, it is reasonably flat below the 2 per cent level. Akerlof, Dickens and Perry attribute such a result to the downward rigidity of nominal wages, providing evidence in support of this proposition. At a very low inflation rate, the adjustment of relative wages between different sectors becomes difficult, thereby increasing unemployment.

However, the extent of wage rigidity is smaller in Japan, because a substantial part (typically from two- to five-months equivalent) of annual earnings are paid in

Figure 2: Growth Rate versus Inflation Rate
1982–2003

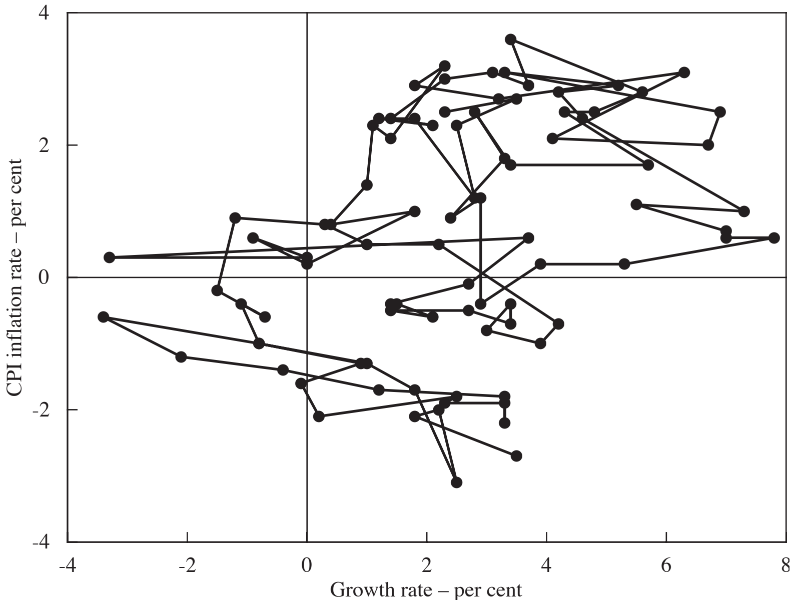
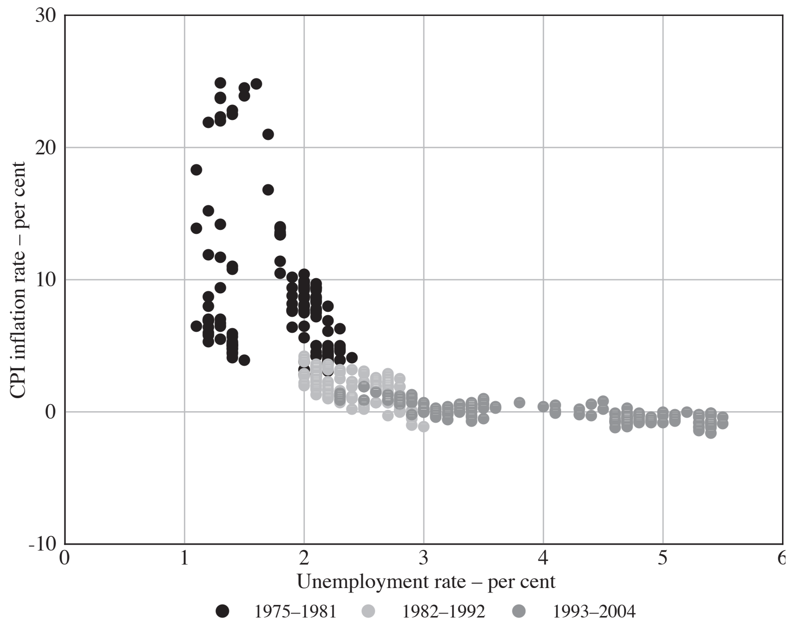


Figure 3: Japan – Phillips Curve



Note: Inflation rates are calculated as the change in the CPI from the same quarter of the year t-1, adjusted for VAT rate changes, and the unemployment rate is all ages, national average.

the form of bonuses for regular workers (not only executives, but also rank and file employees), and bonuses respond quite flexibly to company performance. Kuroda and Yamamoto (2003a, 2003b), using Japanese longitudinal data from 1993 to 1998, argued that the impact of wage rigidity on unemployment is quite small in Japan, at least among regular workers. Although downward nominal wage rigidity does exist in Japan, it is most prevalent among hourly-wage, part-time female employees, and is of limited importance for the regular monthly salaries and annual earnings of full-time employees.[11] Kuroda and Yamamoto (2003c) simulated the impact of downward rigidity on the male unemployment rate. Using the estimated rigidity for the full-time male workers (which is smaller than for other type of workers) from their previous studies, they fit the data to the Akerlof *et al* model. The simulation showed that downward rigidity would raise the unemployment rate by as much as 1.8 percentage points under the baseline parameters. Downward wage rigidity does not cause unemployment as long as the inflation rate is approximately 2.4 per cent or higher, whereas rigidity effects tend to increase gradually as the inflation rate falls below 2.4 per cent. This is consistent with Akerlof *et al* (1996). One of Kuroda and Yamamoto's more interesting conclusions is that when inflation is below approximately 1 per cent, the marginal increase in unemployment attributable to downward rigidity becomes small, since bonus adjustments and extensive wage cuts would be triggered at that point. However, the unemployment rate rose to 5.3 per cent in 2003, which was five years after their data set stopped. It would be interesting to see whether the same conclusion holds at the right-end tail of the Phillips curve.

Taking Kuroda and Yamamoto (2000a, 2000b, 2000c) literally, the cost of deflation was not evident through the wage rigidity channel in Japan.[12] Another channel from deflation to output and employment is through corporate activities that suffer from unexpected disinflation and deflation. In general, unexpected disinflation leads to income redistribution from borrowers to lenders.[13] Borrowers that borrowed long-

11. Kuroda and Yamamoto (2003a, 2003b) established the existence of downward rigidity of wages, and quantified its extent by applying econometric methods to control for individual characteristics and measurement errors. They argued that the rigidity in regular monthly salaries of full-time male and female employees was subject to a threshold: the monthly salary will not be cut as long as the notional (desirable from the employers' point of view) wages do not decline by more than about 7.7 per cent and 4.0 per cent, respectively. However, when the notional wage rate change exceed these threshold values, nominal wage cuts do occur.

12. The literature that questions the Akerlof *et al* mechanism includes Lebow, Stockton and Wascher (1995), Groshen and Schweitzer (1996, 1999), Card and Hyslop (1997), Crawford and Harrison (1997), Lebow, Saks and Wilson (1999) and Fares and Lemieux (2000).

13. Corporations that borrowed long-term funds expecting that their product prices would rise at a constant positive rate, and planned nominally-contracted repayment to banks based on the growth in nominal revenues, would suffer from an increasing real burden of repayments if an increase in product prices falls short of expectation. For example, think of a firm that contracted a 10-year loan in 1990 at a 6 per cent interest rate, hoping that the prices would continue to rise at 3 per cent for the following 10 years. Prices rose only 10 per cent from 1990 to 2000, instead of 30 per cent. If product prices behave similarly, revenues are lower than expected by 20 per cent by the end of the borrowing period. However, the amount of interest and principal payment to the bank would not change. Corporations may go bankrupt if the revenue shortfalls become serious or if interest payments cannot be made. Deflation is clearly bad for borrowers.

term funds at high interest rates suffer from low profits, and would not raise wages. Lower wages depress consumption and therefore output.

The number of corporate bankruptcies in Japan rose from about 6 500 in 1990 to about 19 000 in 2001, an almost three-fold increase. Not only did small and medium-sized firms go bankrupt, but large corporations also started to fall victim of stagnation toward the end of the 1990s. The total amount of bankrupt companies' debt increased from 2 trillion yen in 1990 to 26 trillion yen in 2000, a 13-fold increase. While unexpected disinflation is not the sole cause of bankruptcies, the combined impact of weak economic activity and disinflation does explain a major part of the dramatic increase in corporate bankruptcies. When many corporations go bankrupt, unemployment will increase, which is likely to be sustained for some time.

What makes the Japanese case more complex is that asset prices have fallen much faster than the general price level. Asset-price deflation hit the construction and real estate sectors hard. The non-performing loans common in these sectors by the mid 1990s dragged some financial institutions into insolvency. Deteriorating collateral values made recovery of loans more difficult. As the balance sheets of banks started to deteriorate quickly in the mid 1990s, the economic problem spread through the financial system. Large and medium-sized financial institutions failed in 1997–1998 and again in 2003. The protracted systemic instability also damaged potential growth. The general deflation and asset-price deflation were obviously intertwined and reinforced each other.[14]

If asset values fall below the nominal amount of debt, those who borrowed and invested in assets (such as real estate, equities, paintings, etc) will find it difficult to repay debts. Unexpected disinflation or deflation is a mechanism for unintended transfers of wealth from borrowers to lenders. This is quite harmful to the macroeconomy – just like unexpected inflation – and also to the functioning of capital markets. If investors are unable to sell their property, payments to banks would cease, creating non-performing loans. The fall in asset prices also discourages investment in assets, until new buyers are convinced of a bottoming-out in the market; in the process, prices will fall further. The banks with non-performing loans will become reluctant to extend any kind of bank loans and a credit crunch would result. The debt problem arising from asset-price deflation and nominal debt contracts is known in the literature as debt deflation, and is especially relevant in the context of the Great Depression.[15]

In addition to the costs of lost output, deflation may have other negative consequences for the economy. Deflation now may cause people to expect further deflation in the future. With expectations of deflation, if interest rates have already reached zero, monetary policy loses its potency, because the nominal interest rate is bound at zero. With a zero nominal interest rate, the real interest rate increases

14. Cargill *et al* (1997, 2000) and Hoshi and Kashyap (2001) discuss the structural problems in the corporate-bank relationship and bank and corporate governance in Japan.

15. Irving Fischer (1933) was the first to note the debt deflation process. The Great Depression is often used as an example of very negative consequences of debt deflation. See Bernanke (1983) and Mishkin (1978, 1991, 1997, 1998) for application to Japan.

as the expected inflation rate becomes lower. A high real interest rate in a stagnant economy reduces corporations' incentives to invest to expand production. In a sense, companies burned once by unexpected disinflation will not invest, say in additional plant and machinery, until the inflation rate is stabilised at a positive level. Deflation will therefore cause more deflation by generating deflationary expectations. This is the mechanism of a deflationary spiral.

Although Bank of Japan economists tended to argue that deflation was mild, and a deflationary spiral never happened, there is some evidence that deflation and deflationary expectations deteriorated from 1999 to 2002. The Bank of Japan Monetary Policy Board has published a semi-annual Outlook since October 2000. In the Outlook, Board members express their expected inflation rate for the fiscal year (where fiscal year *t* runs from April of year *t* to March of year *t*+1). In October 2000, the Board members' inflation expectations, taking out the most optimistic and most pessimistic forecasts, for FY 2000 (note that the time of the poll was already in the middle of the FY) ranged from –0.4 to –0.2 per cent. The expectation for FY 2001, at the beginning of that FY (April 2001) ranged from –0.8 to –0.4 per cent. One year later, in April 2002, the expectation was for further deflation in FY 2002, ranging from –1.0 to –0.8 per cent. It would therefore seem that deflationary expectations increased from 2000 to 2002.

In Japan, one additional consideration is the impact of deflation on fiscal settings. One of the largest borrowers at fixed interest rates is the Japanese government, with outstanding long-term debts of 550 trillion yen, more than 100 per cent of GDP. The Japanese government has regularly issued long-term government bonds with fixed interest rates. (Only in 2003 did the Japanese government start to issue inflation-indexed bonds, where the principal is protected from deflation.) Unexpected deflation during the 1990s meant that the Japanese government had an increased real debt burden – that is, more taxes in real terms have to be collected than otherwise to repay debt. In addition, since tax brackets are not adjusted for inflation, deflation meant that the government had less tax revenues due to the reverse of the well-known bracket creep phenomenon.

2.3 Chronology of policy responses

As the economic slump continued, the Bank of Japan has changed its position on whether and how to fight deflation. This sub-section examines the Bank of Japan's actions to fight deflation from 1998 (the birth of the new Bank of Japan) to mid 2004. I identify four stages of action in the period from 1998 to 2004:

- Stage 1. Cautiously lowering interest rates to the zero interest rate policy (ZIRP) April 1998–February 1999.
- Stage 2. ZIRP, lifting ZIRP and return to ZIRP: February 1999–March 2001. ZIRP 'until deflationary concerns are dispelled'.
- Stage 3. Quantitative easing (QE), phase 1: March 2001–March 2003. QE until CPI inflation rate becomes 'stably above zero'.

- Stage 4. QE, phase 2: March 2003–present. QE until CPI (excluding fresh food) is positive for a few months and is expected to remain positive in the future.

Stage 1. Lowering of interest rates to the ZIRP: April 1998–February 1999

When a new team took over the newly-independent Bank of Japan, there was high hope that pro-active actions would be taken and that the Bank would take accountability for its actions. Price stability became the stated mandate, rather than the *de facto* mandate. The Bank does not have to listen to, or try to guess the judgement of, the government on how monetary policy should be conducted, so that price stability should be genuinely pursued. However, in retrospect, the timing of independence was less than perfect or even unfortunate. The economic outlook was quickly deteriorating, due to the banking crisis and the lingering aftershocks of the Asian currency crisis. The yen was depreciating, reflecting a pessimistic mood towards prospects for the Japanese economy and the financial sector. Additional policy measures, both monetary and fiscal, had to be prepared.

In many monetary policy meetings (MPMs), Mr Nakahara proposed to lower the call rate. For example, in July, he proposed that the Bank lower the interest rate to 0.35 per cent, and at the 11 August meeting, he proposed 0.25 per cent. On both occasions his proposal was defeated, with 1 vote in favour and 8 against.[16]

On 9 September 1998, the Bank of Japan decided to lower the policy interest rate (the uncollateralised overnight call rate) to, on average, around 0.25 per cent.[17] However, negative growth was recorded in the second half of 1998, and the Bank finally decided to adopt the ZIRP in February 1999.

Stage 2. ZIRP, lifting ZIRP and return to ZIRP: February 1999–March 2001

The statement of the monetary policy decision on 12 February 1999 read as follows:

> The Bank of Japan will provide more ample funds and encourage the uncollateralized overnight call rate to move as low as possible. To avoid excessive volatility in the short-term financial markets, the Bank of Japan will, by paying due consideration to maintaining market function, initially aim to guide the above call rate to move around 0.15%, and subsequently induce further decline in view of the market developments (Bank of Japan, 'Announcement of the Board decision', 12 February 1999).

This was the beginning of the ZIRP. It was clear that the economy was in a very weak state. At the time it was thought that GDP had recorded five consecutive

16. In the description of discussions in the minutes, individual names are not disclosed. However, the name of the Board member who proposed a vote and the names of those who voted in favour and against are disclosed. So, in the case relating to 1–8 votes, one can guess who expressed the minority opinion in the discussion prior to the vote. By this process of deduction, we know that Mr Nakahara has been consistently the 'dove', and Professor Shinotsuka the 'hawk'.

17. Mr Nakahara voted with the majority in favour of the proposal, but Professor Shinotsuka voted against, insisting that the interest rate should not be lowered.

quarters of negative growth since 1997:Q4. (In later revisions to the GDP data, the consecutive quarters of negative growth disappeared.[18])

No additional actions were taken between February 1999 and the fall of 1999. From the summer to the fall of 1999, output remained basically flat. The government and business circles started to voice their concern regarding deteriorating conditions and called for the Bank of Japan to adopt a more aggressive monetary policy, dubbed quantitative easing. Just before the 21 September 1999 meeting of the Policy Board, some press speculated that the Board would decide to take some actions, most likely non-sterilised intervention in the foreign exchange market in cooperation with the Ministry of Finance. The market regarded non-sterilised intervention as a signal by the Bank of Japan for further action.

The Policy Board reacted strongly to the press speculation. The Board issued its statement at the conclusion of the meeting. At the time, the Governor's press conference was scheduled only two days after the Board meeting, so that the immediate response itself was a message. In the announcement, the Board emphasised that monetary policy would not respond to exchange rate movements and that non-sterilised intervention was not a useful policy. The Board strongly warned that the press was greatly mistaken in engaging in speculative reporting before the meeting: 'In the past few days, the market has substantially fluctuated by speculations on monetary policy. What should be clear is that the conduct of monetary policy is exclusively decided by majority vote at the Monetary Policy Meeting, a regular meeting of the Policy Board. It is never the case that our policy is determined in advance or in consultation with outside bodies. We would like to emphasize this point' (Bank of Japan, 'On the current monetary policy', 21 September 1999). The comment seemed to show the irritation and frustration that was felt by the Board. Any prior reporting of the expected decision was considered to be a challenge to independence. The Board successfully extinguished any expectation in the market that policy would accommodate the desires of the government or the markets. Any doubt about independence was thus clearly erased. However, such a strong statement might also have indicated a sense of insecurity on the part of the new Bank of Japan. The Bank's assertion of its righteousness, and its shutting out of any external suggestions, prompted increased calls for accountability.

The Board took the view that the exchange rate was one of the variables that should be monitored, but that monetary policy should not respond to exchange rate movements *per se*.[19] The Board then explained that non-sterilised intervention

18. In spring 1999, the growth rate for the five quarters from 1997:Q4 to 1998:Q4 was estimated as negative. The current estimates for the same period are 0.7, –1.0, –1.1, 0.8 and 0.1 per cent.

19. 'The foreign exchange rate in itself is not a direct objective of monetary policy. One of the precious lessons we learned from the experience of policy operations during the bubble period is that, monetary policy operations linked with control of the foreign exchange rate runs a risk of leading to erroneous policy decisions. Having said this, it does not mean that monetary policy is pursued without any consideration to the development of the foreign exchange rate. The Bank considers it important to carefully monitor the development of the foreign exchange rate from the viewpoint of how it affects the economy and prices' (Bank of Japan, 'On the current monetary policy', 21 September 1999).

was not a useful concept for a central bank that watches total funds in the market, whatever various sources they came from.[20]

The Board indicated that it had done enough to ease monetary conditions, and it even cited the 'side-effects' of the ZIRP. The Board also challenged the market expectation that non-sterilised intervention would be pursued. This was indicative of their desire to end the ZIRP as soon as possible.[21]

No additional easing was adopted between the fall of 1999 and the summer of 2000, except for liquidity injections to deal with Y2K concerns. In the spring of 2000, Governor Hayami started to suggest that the ZIRP may end soon, as the economy showed some signs of recovery. Stock prices in particular were suggesting a rosier situation: ICT-related stock prices had soared, some tripling in a year, and the Nikkei 225 index had increased by 30 per cent between March 1999 and March 2000. Corporate profits rose and corporate investment started to increase. Some Bank economists suggested that these corporate earnings would trickle down to households to stimulate consumption sooner or later.[22] This argument was dubbed the 'dam theory': water (profits) was filling up the corporate dam and would overflow to downstream (households' income) sooner or later.

By June, Governor Hayami was frequently suggesting that there were bright signs in the economy so that the ZIRP could, and should, be ended soon. Yet many economists thought that ending the ZIRP would be premature. They called for an easing of monetary policy, or quantitative easing, while the Bank of Japan was looking at a tightening of monetary policy – not a healthy situation.

The ZIRP was indeed lifted on 11 August 2000, as the Board decided that the deflationary concern was over.[23] However, it was realised at this time that the further recovery of the Japanese economy was in doubt. First, the ICT bubble had already burst, and ICT stock prices in the US and Japan had already crashed, suggesting

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20. 'In relation to the foreign exchange rate policy, we have heard arguments in favor of non-sterilised intervention. In the reserve market, however, there are various flows of funds such as currency in circulation and Treasury funds other than those resulting from the intervention. The Bank conducts its daily market operations taking into account all the money flows, in order to create ample reserves to such an extent as described above. This strong commitment of fund provision is consistent with the government's current foreign exchange rate policy' (Bank of Japan, 'On the current monetary policy', 21 September 1999).

21. 'The Bank views the current state of the Japanese economy as having stopped deteriorating with some bright signs, though a clear and sustainable recovery of private demand has yet to be seen. In pursuing the zero interest rate policy, we need to carefully examine its adverse side-effects, but deem it important to support the economic recovery by continuing easy monetary policy for the periods ahead' (Bank of Japan, 'On the current monetary policy', 21 September 1999).

22. 'Currently, it is our judgment that Japan's economy is at the stage where the number of firms taking the offensive has started increasing, that is, the economy is moderately recovering parallel with structural adjustment … with respect to the recovery of private demand, it seems natural that the corporate sector, which has regained profitability as a result of restructuring, should take the lead by increasing investment followed by the household sector as income conditions gradually improve. This is the development we are now witnessing' (Hayami 2000b).

23. Governor Hayami intended to raise the interest rate in July. However, a large department store, Sogo, failed and the economy showed some weakness. The plan to lift the interest rate was postponed without being submitted to the meeting.

investment and consumption would be adversely affected in the near future. Second, the US economy was decelerating. Third, and most importantly, the inflation rate was still negative and projected to be negative for at least a year. How could the Bank of Japan tighten policy when the inflation rate was negative?

The government disagreed with the Bank on the outlook for the economy and the appropriateness of raising the interest rate, and motioned that the vote to repeal the ZIRP should be delayed. Putting forward a proposal of delay in voting by the government representative is allowed in the Bank of Japan law. The government motion was overruled by the Board by an 8 to 1 vote. The lifting of the ZIRP was then decided by a 7 to 2 decision.

Immediately after the ZIRP was ended, the Japanese economy entered recession. The growth rate in 2000:Q3 turned negative, which was offset to some extent by a brief recovery in 2000:Q4. The peak of the business cycle was later dated as October 2000. As the economy entered recession, the criticism of the Bank of Japan's actions increased once more.

Many indicators were showing weakness in the last quarter of 2000, and the Bank started to examine ways to ease monetary policy. In February 2001, the Bank introduced the so-called Lombard lending facility and also cut the official discount rate from 0.5 per cent to 0.35 per cent. The Lombard lending facility allowed for automatic lending to banks with collateral at the official discount rate, so that the interest rate would be capped at 0.35 per cent. But the call rate was around 0.20 to 0.25 per cent, and consequently there seemed to be little impact from the introduction of the Lombard facility. A dramatic switch in monetary policy followed.

Stage 3. Quantitative easing, phase 1: March 2001–March 2003

The MPM of 19 March 2001 turned out to be significant in several respects. First, it effectively restored the ZIRP by adding liquidity to the interbank market for excess reserves. The target interbank rate was lowered immediately to 0.15 per cent, and would be reduced to zero, as conditions warranted. The official discount rate was also cut to 0.25 per cent. Second, the announcement of the instrument switch from the interest rate to the current account balance (the sum of required and excess reserves) at the Bank of Japan suggested that further steps expanding the monetary base, as part of a quantitative easing policy, would be taken in the future if they were considered necessary. Third, the new relaxed monetary policy was to continue until the CPI (excluding fresh food) inflation rate stabilised above zero.

The target of the current account was set at 5 trillion yen. However, by targeting an amount beyond required reserves (about 4 trillion yen), it effectively meant that the interbank rate (that is, the call rate) would go to zero, and so it did. Targeting the current account beyond 4 trillion yen meant targeting excess reserves.[24]

24. In March 2001, before it was adopted, Bank of Japan economist Mr Okina (1999b) reviewed excess reserve targeting as a possible next step in monetary easing. He pointed out a few problems with this option. First, 'what kind of function can be expected of excess reserves' was not known with certainty and was thus identified as a problem. Second, excess reserves was not reliable 'as an indicator for monetary easing'. Third, Dr Okina pointed to an operational hurdle.

From March 2001 to March 2003, quantitative easing was expanded in several steps. In August 2001, another measure of quantitative easing was employed. The amount of Bank of Japan outright purchases of long-term government bonds was raised from 400 billion yen per month to 600 billion yen per month. At the same time, the current account target was raised to 6 trillion yen (or about 2 trillion yen of excess reserves). In September 2001, the official discount rate was cut to 0.1 per cent, but this did not have any impact given that there was ample liquidity in the form of excess reserves. In December 2001, the monthly purchase of long-term bonds was increased from 600 billion yen to 800 billion yen and the current account target was raised to 10–15 trillion yen. In February 2002, the monthly purchase of long-term bonds was increased from 800 billion yen to 1 trillion yen. In October 2002, the monthly purchase of long-term bonds was raised to 1.2 trillion yen, and the current account target was raised to 15–20 trillion yen.

Stage 4. Quantitative easing, phase 2: March 2003–present

In March 2003, at the time of the expiration of terms, a new team of Bank Governor and Deputy Governors was appointed. The new Governor, Mr Fukui, was a former Deputy Governor before he resigned in March 1998. An ex-Ministry of Finance official, Mr Muto, and a professor of economics, Mr Iwata, were appointed as the two Deputy Governors. Mr Iwata was known to have advocated inflation targeting while he was the Director General of the Cabinet Office.

Almost from the beginning the new team gave a sign that it would work with the government in fighting deflation: Governor Fukui was sending a message that he would continue the ZIRP for a long period of time. His tone was much more supportive of the ZIRP than his predecessor. The market was thus much more assured of a sustained ZIRP in the future.

In his speech to the Japan Society of Monetary Economics, Governor Fukui (2003) explained the effects of the monetary policy framework he inherited in a way that was much closer to mainstream economists' thinking outside the Bank of Japan. The increase in the quantitative easing was aimed at the portfolio balance effect:

> [as] the marginal value of liquidity services became zero, people would start to rebalance their portfolios by investing in assets with higher marginal values whether these were real or financial assets, if the Bank increased further its position of liquidity. The aim of this process was thus to generate positive economic momentum, acting, for example, to push up asset prices. So far, however, the effect has not been widely observed.

This is quite consistent with the view outside the Bank, but different from discussions in the Policy Board under the previous regime, in which even the slightest inflation was considered to be bad because, by helping debtors, it delayed structural reform. Governor Fukui also described the increase in long-term bonds as a successful operation, contributing to 'the smooth implementation of quantitative easing'. He also explained the commitment to continuing the ZIRP and quantitative easing as a strong one, because even if the future inflation rate was expected to be positive, the ZIRP would continue as long as the current CPI (excluding fresh food) inflation rate is below zero. Considering the lag in the effects of monetary policy, he suggested that the policy could end up tolerating inflation. This kind of presentation also sounds close to what was being advocated by supporters of inflation targeting, although Governor Fukui stopped short of embracing inflation targeting.

After Mr Fukui became Governor, the target amount of the current account was raised in several steps, to 30–35 trillion between March 2003 and January 2004. In October 2003, the Board elaborated on the two necessary conditions to end the ZIRP. Essentially, these are: (1) the CPI (excluding fresh food) inflation rate is ‘zero per cent or above’ as a trend ‘for a few months’; and (2), the prospective CPI is not expected to be ‘below zero per cent’ according to forecasts of ‘many Policy Board members’.[25]

In the next few sub-sections, the changes in monetary policy actions are summarised according to the instruments of monetary policy.

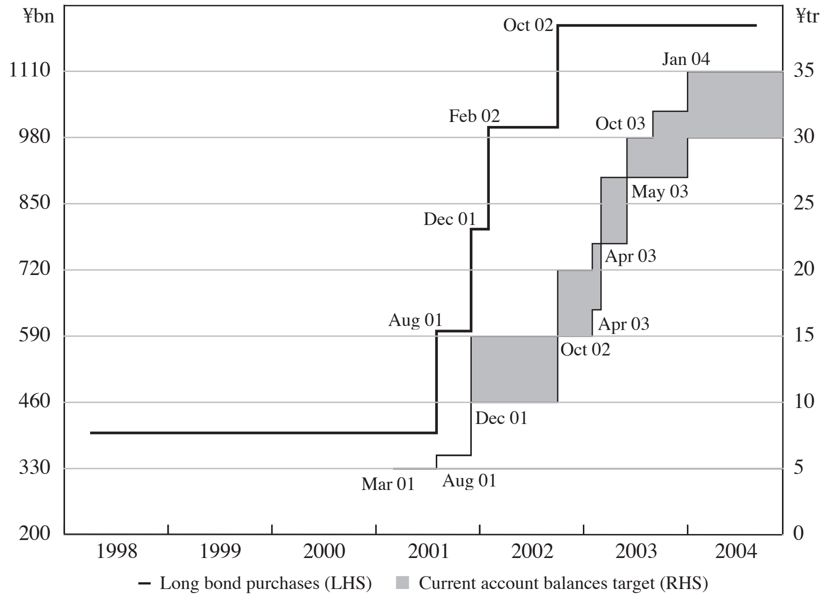
2.4 Quantitative easing and unconventional monetary policy

As mentioned above, the Bank adopted quantitative easing in March 2001, and increased its amount of outright purchases of long-term government bonds. The monthly purchase was raised from 400 billion yen before March 2001, to 1.2 trillion yen in October 2002. It is somewhat remarkable that Governor Hayami, who seemed to have opposed easing and also led the move to lift the ZIRP in August 2000, had changed the position and implemented the increase in government bond purchases after March 2001. Although excess reserve targeting was introduced in March 2001, it was increased from 5 trillion to 15–20 trillion in October 2002. Most of the jump in excess reserves came under Governor Fukui’s leadership after March 2003. The measures of long-bond purchases and the Bank of Japan’s target for current account balances are summarised in Figure 4. The chart shows the increase in purchases of long-term bonds and the current account balances target over time.

In terms of the two options of increasing the purchase of long bonds and increasing excess reserves, the former is believed to have an immediate impact on the economy, through lowering (or preventing the increase in) the long-term interest rate, and forcing portfolio shifts among private-sector investors. An increase in the purchase of long bonds had been implemented between April 2001 and October 2002, the

25. The announcement on 10 October 2003 read as follows: ‘With the aim of laying the foundation for sustainable growth of Japan’s economy, the Bank is currently committed to maintaining the quantitative easing policy until the consumer price index (excluding fresh food, on a nationwide basis, hereafter the core CPI) registers stably a zero per cent or an increase year on year. Such commitment is underpinned by the following two conditions. [Para] First, it requires not only that the most recently published core CPI should register a zero per cent or above, but also that such tendency should be confirmed over a few months. [Para] Second, the Bank needs to be convinced that the prospective core CPI will not be expected to register below a zero per cent. This point will be described in such materials as the analysis and the forecasts of Policy Board members in the Outlook Report. To be more specific, many Policy Board members need to make the forecasts that the core CPI will register above a zero per cent during the forecasting period. [Para] The above conditions are the necessary condition. There may be cases, however, that the Bank will judge it appropriate to continue with quantitative easing even if these two conditions are fulfilled’. Calling the CPI excluding fresh food as the core CPI may be misleading because it still contains energy prices.

Figure 4: Quantitative Easing



last two years of the Hayami regime, and the amount of monthly purchases has remained the same since Mr Fukui became Governor. Mr Fukui was more aggressive in increasing the target for current account balances at the Bank of Japan.

2.5 ZIRP and exit conditions

The ZIRP was adopted on 12 February 1999, and two months later Governor Hayami elaborated on the conditions when it would be ended (in the press interview of the Governor, on 13 April 1999, available in Japanese only on the Bank of Japan's homepage). However, neither he nor the Board defined what 'deflationary concerns' meant or when and under what conditions they would be judged to be 'dispelled'. The Bank had also not decided which price indicator should be used to define inflation/deflation or the number that would be a threshold of inflation/deflation.[26]

The reference to 'deflation concerns' left room for an interpretation that deflation was not necessarily being experienced at the time. Many economists contended that the economy was already in a state of deflation. But the Bank, and the Governor, was perhaps indicating that the problem was concern about, rather than the reality of, deflation.

26. 'Price indicators such as the GDP deflator, CPI, and Wholesale Price Index (WPI) often move differently. Even when these indicators exhibit the same movement, the extent to which the sound development of the national economy will be achieved may depend on such factors as whether property prices are stable or rising sharply' (Okina 1999a, p 164).

In 2000, the ZIRP was lifted, as the exit condition was met, as judged by a majority of the Board members. In the minutes of 11 August 2000 the reason for judgement is explained as follows:

> On the current economic situation, members shared the view that the economy was recovering gradually, with corporate profits and business fixed investment continuing to increase. As for the outlook for the economy, many members expressed the view that the economy was likely to recover gradually, led mainly by business fixed investment. Accordingly, the majority of members agreed that the economy had reached the stage where deflationary concern had been dispelled.

It is surprising that the above paragraph made no mention of price movements in the past or future. Deflationary concern was judged to have been dispelled, because of economic recovery (an increase in real GDP), corporate profits, and business fixed investment. Although one could interpret the paragraph as a forward-looking inflation judgement – economic recovery results in price increases – there is no explicit mention of this linkage. A more likely interpretation was that the Board members at that point were not using price movements to guide policy, because price declines were due to 'supply-side factors' and technological innovation and cheap imports were a good thing.

The Bank of Japan was also responding to new calls for a more careful definition of price stability. On 13 October 2000, two months after raising interest rates, the Policy Board issued a report called 'On price stability'. In the document, price stability was defined as a state that is neither deflation nor inflation. This apparent tautology did not help settle the debate.

When the ZIRP was effectively reintroduced in March 2001, the condition became more concrete: the CPI excluding fresh food was identified as the right price index on which to focus. The relaxed monetary policy would continue until the inflation rate measured by the CPI excluding food became 'stably above zero'. However, what 'stably above zero' meant was not defined. But, at least, it specified that the inflation rate had to be positive at the time of ending the ZIRP.

Clearly, if this condition had been applied from the beginning, the ZIRP would not have been lifted in August 2000. Therefore, such a condition can be seen as introducing a tacit admission that the action of August 2000 was a mistake. The condition was further clarified in October 2003.

In October 2003, 'stably' was further defined as above zero for a few months and when there would be no risk of falling back into deflation. Also, while these two conditions were explicitly mentioned as necessary conditions, they may not be sufficient.

In summary, the exit conditions from ZIRP and the definition of price stability have changed over time, as follows:

(1) February 1999. Adoption of *de facto* ZIRP.

(2) April 1999. Exit condition was 'until deflationary concerns are dispelled'.

(3) August 2000. Exit from ZIRP.

(4) October 2000. The report called 'On price stability' was issued. Price stability was defined as a condition where there is no inflation or deflation.

(5) March 2001. Return to ZIRP with a new exit condition: until the CPI (excluding perishables on a nationwide basis) registers stably at zero per cent or an increase year on year.

(6) October 2003. Elaboration of two necessary exit conditions: a backward-looking one, the inflation rate has to be, on average, at zero per cent or above for a few months; and a forward-looking one, the inflation rate should be projected not to fall back to deflation.

One might ask whether these exit conditions constitute *de facto* inflation targeting. As the inflation indicator is specified and the inflation target floor rate is at least mentioned, the commitment seems to be a half-step toward inflation targeting. But there are four important reasons why we should not regard the exit conditions as fully-fledged inflation targeting. First, the inflation target ceiling rate is not specified. Second, the projected date when the Bank would like to achieve its target is not specified. Third, the conditions are more reactive than pro-active: the Bank is not expressing that it would do everything it takes to achieve the inflation rate. Instead, it reads that the conditions may occur with luck or some forces external to the Bank's actions. Fourth, no accountability mechanism is attached to the current exit condition.

2.6 Purchases of equities and real-estate investment trust funds (REITs)

Some economists outside the Bank advocated that the Bank purchase riskier assets than government bonds, including the listed market-based stock index funds and the listed REITs. The Bank has refused to take these unconventional policy actions on several grounds. It was argued that these are risky assets that the central bank would not normally purchase, and that they are also more like fiscal operations rather than monetary operations. Piling up risky assets in the central bank balance sheet was also suggested to be a bad idea, since it may result in a situation in which the Bank would run huge losses and lose the confidence of the people.

However, in September 2002, the Bank of Japan started to purchase equities held by commercial banks. This policy was introduced to reduce the risks of stock price fluctuations on commercial banks' balance sheets and, as a result, their risk-based capital ratios. The policy was intended to contribute to financial market stability. The Bank of Japan was careful to discuss this in the regular Policy Board Meeting, as opposed to the MPM. The ceiling for purchases was set at 2 trillion yen initially, but expanded later to 4 trillion yen. As stock prices dropped from the time of implementation (October 2002) to May 2003, a lot of purchases were made, but after stock prices started to recover from the trough, commercial banks held on to equities.

2.7 Unsterilised intervention

A number of economists have advocated foreign exchange interventions as one expansionary measure that the central bank and the Ministry of Finance could undertake at the zero interest rate. Two explicit benefits have been cited. First, intervention would lead to a depreciation that would stimulate the export sector and increase import prices (which is good for an economy suffering from deflation). Second, foreign bonds purchased could be used as assets against which monetary base can be provided to the market. Increasing the monetary base by buying foreign bonds is essentially unsterilised intervention. In normal circumstances, when the interest rate is positive, the standard textbook story is that sterilised intervention may not work, because the interest rate would not change, and unsterilised intervention would work, because the increased monetary base would lower the interest rate. However, at a zero interest rate, the interest rate channel disappears. Whether one thinks that unsterilised intervention has a greater effect than sterilised intervention, even at a zero interest rate, then becomes equivalent to a question of whether quantitative easing, in terms of increasing the monetary base, is effective or not.

Svensson (2001) was explicit in recommending unlimited unsterilised intervention to peg the yen/dollar rate at a depreciated level to stimulate export demand. There are some complications to this kind of proposal. First, Japan is a large economy that is already running current account surpluses. An explicit depreciation policy and more exports may not be politically acceptable, as argued in Ito and Mishkin (2004). Another complication is that foreign exchange interventions are conducted by the Ministry of Finance in Japan, so that unsterilised intervention has to be coordinated between the Ministry of Finance and the Bank of Japan.

When several proposals were made for intervention during the ZIRP in 2000–2002, interventions were rare events (see Ito 2003 for a discussion of the effectiveness of sterilised interventions from 1991 to 2002). However, from January 2003 to March 2004, interventions suddenly became quite frequent and of a large size. In 2003, periodically intervention looked unsterilised, as the amount of intervention and changes in monetary base were running neck to neck (see Ito, forthcoming). For example, the accumulated intervention and increase in money supply were, respectively, 2.3 trillion yen and 1.7 trillion yen for 2003:Q1; 4.5 trillion yen and 6.1 trillion yen for 2003:Q2; 7.5 trillion yen and 0.9 trillion yen for 2003:Q3; and 5.9 trillion yen and 3.9 trillion yen for 2003:Q4. For calendar year 2003, accumulated intervention was 20 trillion yen and the increase in monetary base was 12.6 trillion yen. But, if the increase in the monetary base of 9.2 trillion for 2002:Q4 (when there was no intervention) was added to the increase in the monetary base, the two figures become about equal for the period from 2002:Q4 through 2003:Q4. Although the correspondence was most likely a coincidence rather than planned, it did provide a signal of the Bank's willingness to cooperate. (In 2004:Q1 there was another 15 trillion yen worth of intervention while the monetary base increased by less than 1 trillion yen.) In September 1999 any suggestion of unsterilised intervention was strongly rejected by the Bank, while in 2003 Deputy Governor Iwata himself pointed out the correspondence, although he concluded that 'it must be a coincidence'.[27]

3. Inflation Targeting

In this section the pros and cons of adopting inflation targeting in general, and under the deflationary environment in Japan in particular, are considered. The Bank of Japan (including most Board members and staff economists) has consistently argued against the adoption of inflation targeting, and that is a major reason why inflation targeting has not been introduced. Reasons that have been expressed by the Bank of Japan for not adopting inflation targeting are examined in the discussion below.

In the following I will not make sharp distinctions between inflation targeting and price-level targeting, unless necessary.

3.1 Inflation targeting proposals from academics

Inflation targeting was proposed in Japan in the context of fighting deflation and the (near-) zero interest rate. One of the problems associated with the (near-) zero interest rate bound is that as deflationary expectations deepen, the *real* interest rate increases. The higher real interest rate discourages investment and consumption and exacerbates the deflation problem. Therefore, in order to break the deflationary cycle, many economists thought that managing expectations was very important.

Krugman (1998) was probably the first to suggest some sort of inflation targeting. The essence of his argument was that the Bank of Japan had to promise a high inflation rate later to influence inflation expectations. Raising expectations regarding inflation helps to stimulate current economic activity by reducing the real interest rate, As the commitment device, he proposed an inflation target. After some calibration, he called for 4 per cent inflation for 15 years.

Ito (1999, 2001) proposed that the Bank of Japan adopt inflation targeting. As an independent central bank, accountability is needed, and inflation targeting is beneficial in that regard. It would also enhance instrument independence. Moreover, inflation targeting is an effective way to influence inflation expectations. With a zero interest rate, changing inflation expectations is the most effective way to avoid high real interest rates.[28]

Svensson (2001) presented his 'foolproof' way of escaping the liquidity trap at the Bank of Japan conference in July 2000. The paper recommended fixing the exchange rate at the depreciated yen/dollar rate until the price level catches up with the target, and then allowing the yen to float again. The kick-start for inflation comes from depreciation of the yen, and price-level targeting spells out the exit condition.

27. Press interview, 1 October 2003 in Sendai. The original is available in Japanese at <http://www.boj.or.jp/press/03/kk0310a.htm>.

28. The newspaper opinion piece by Ito (1999) was answered by a Bank economist, Okina (1999b), in the same space. A Board member, Ueda (2000), supported Okina's view several months later in another opinion piece.

McCallum (2000, 2003), Meltzer (2001), Bernanke (2003) and Eggertsson and Woodford (2003) also offered advice to the Bank of Japan broadly in line with an expansion of the monetary base with a resulting depreciation of the yen, and/or some form of inflation targeting or price-level targeting. See Svensson (2003) and Ito and Mishkin (2004) for a survey of this literature.

Ito and Hayashi (2004) argued for the desirability of adopting inflation targeting. Ito and Mishkin (2004), among other things, advocated a particular type of inflation target, namely the price level target in order to make monetary policy more path-dependent.

Many economists recommended that the Bank of Japan announce a low but positive target range, such as a 1 to 3 per cent CPI inflation rate, and that the Bank also announce its willingness to adopt policy to achieve the target in the medium run, say in two years. The positive inflation target is consistent with the legal mandate of price stability, because: (1) the price index has an upward bias; (2) having a buffer to zero is important given that a combination of deflation and a zero bound interest rate is a serious problem; and (3) a positive inflation rate makes it easier to realise necessary relative price and relative wage adjustments (recall the Akerlof *et al* argument).

3.2 Why the Bank of Japan should have adopted inflation targeting

The arguments of inflation targeting advocates in Japan can be summarised as follows.

(1) Accountability and transparency. Since the Bank of Japan became legally independent in April 1998, it has needed to be accountable for its actions. The mandate was clearly price stability, as mentioned in Article 2. But without a concrete definition of price stability, it is hard to assess whether the Bank has acted appropriately. A numerical target – either a point with a tolerance band around it like the United Kingdom or a range like New Zealand – would help to clarify the meaning of price stability. Once a target, either a point or a range, is clarified, policy actions can be easily explained, in the context of trying to achieve the target in the medium run. Actions become transparent, and communication with the market becomes easier.

(2) Instrument independence. If and when the Bank of Japan commits to the specific goal of an inflation target, how to achieve it should be completely left to the Bank. This is called instrument independence. As the Bank will be accountable for the consequences of its actions, the government would not need to pressure the Bank on specific policy measures. The Bank would also not have to respond to criticism or pressure and would not need to become so defensive about critics' arguments on what kind of policy actions should be taken. In other words, a situation like September 1999 would be avoided, or even if pressure comes, the Bank could divorce itself from the controversy.

(3) Impacts on inflation expectation. The fundamental problem faced by the Japanese economy since the mid 1990s (recall Section 1) has been a cyclical problem of deflation, combined with the interaction between deflationary expectations and the zero interest rate bound. The more pessimistic outlook on deflation meant higher real interest rates and depressed economic activity. Available policy tools, monetary and fiscal, are limited, and the best bet for breaking deflationary expectations is to adopt and commit to a target with a positive inflation rate. Combined with adopting unconventional monetary policy, an inflation target will also help influence the public's expectations. It may not have an immediate, tangible impact on inflation expectations, but with continued reference to it and policy measures implemented to achieve it, the impact would become stronger. The UK experience shows that the combination of independence and an inflation target would be a powerful weapon to stabilise inflation expectations at around the target inflation rate.[29]

3.3 Political economy of why the Bank of Japan did not adopt inflation targeting

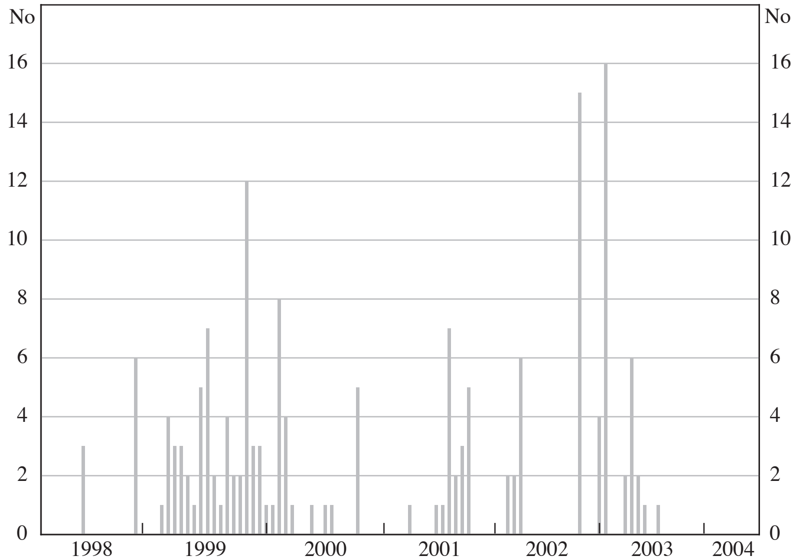
According to the minutes of the MPM discussions (disclosed about one month after the meeting), inflation targeting was sometimes discussed quite intensively, but, in general, there was an intermittent level of interest. In order to quantify the interest of the Board in inflation targeting I have counted the number of times 'inflation target[ing]' or 'target of inflation rate' was mentioned in the recorded minutes for the period of 26 March 1998 to June 2004. Figure 5 shows the number for each MPM discussion. The minutes from March 1998 highlight the waves of interest in inflation targeting. A detailed examination of each MPM when inflation targeting was significantly discussed and my comments on the discussion are in the Appendix.

The ***first wave*** was from mid 1999 to the spring of 2000. At this stage, Mr Nobuyuki Nakahara, a Board member, consistently proposed adopting inflation targeting, but was always voted down by 1 to 8 votes. According to discussions at the MPMs and speeches of Board members, the majority of the Board held the following view: deflation was not that undesirable as long as it reflected technological innovation and cheap imports. Moreover, when technological innovation puts downward pressure on prices, it is difficult to select an appropriate price index and to define price stability, let alone the numerical target of inflation. However, there was growing pressure from the academic community for the Bank to adopt inflation targeting. According to the minutes of various meetings, the majority of Board members remained sceptical about the merits of adopting inflation targeting. But the increasing interest in inflation targeting inside and outside the Bank led to the decision, on 9 March 2000, to conduct a comprehensive study on price stability. Until the study was done, discussions on inflation targeting were shelved.

The study, 'On price stability', was discussed on 11 October 2000. The study was not conclusive on any of the issues debated earlier. The report described price

29. See HM Treasury (1999, p 29).

Figure 5: Counts of 'Inflation Target' in Minutes



Note: In each of the minutes, 'counts' is defined by the number of times the following phrases appeared: 'inflation targeting', 'inflation (rate) target', 'targeting inflation', 'the target range of the inflation rate', 'target for the inflation rate', 'numerical target for (the future) inflation (rate)', 'special target for the inflation rate', 'a medium-term target for the inflation rate', 'a medium-term inflation rate target', 'the target for the monetary base and the inflation target', 'the target inflation (rate)', 'a target with a clearer time horizon that the year-on-year inflation', and 'neither a target nor a reference rate of inflation'.

stability 'as a situation which is neither inflationary nor deflationary'. Defining price stability as a state that is neither inflation nor deflation is not a definition, but a tautology. The report acknowledged that a price index had biases, but concluded that it is not easy to obtain a reliable estimate of the magnitude of bias, and that the magnitude can vary. With regard to the question of whether a quantitative definition of price stability was possible, the overall conclusion was negative. The key findings of the report were:

(1) In view of the current movement of prices in Japan, an inflation rate which is consistent with the sound development of the economy is likely to be lower in the short term than in the long term.

(2) If some numerical values are adopted as the definition of price stability, they are expected to be valid for a very long period of time. In view of the current development of prices in Japan, it is difficult to set specific numerical values to the definition of price stability that are consistent with the sound development of the economy. Furthermore, even if some numerical values were announced, they would not serve as a reliable guidepost in the conduct of monetary policy, and the exercise would not likely contribute to enhancing transparency of the

conduct of monetary policy. Therefore, it is not deemed appropriate to define price stability by numerical values.

(3) While paying due attention to changes in the economy, the Bank of Japan will nevertheless continue to explore whether price stability can be expressed by some numerical values.

After a six-month study, the report basically rejected inflation targeting. It is also notable that in the same MPM, the Outlook with Board members' forecasts of prices and the GDP growth rates in the future was approved. This was intended to enhance transparency.

The ***second wave*** of interest in inflation targeting, between March 2001 and early 2002, was somewhat intermittent. In March 2001, the Bank re-adopted the ZIRP with quantitative easing. The policy switch was also accompanied by a new commitment strategy that the ZIRP and quantitative easing would continue until the CPI (excluding fresh food) inflation rate stabilised above zero. A comprehensive study reported just six months earlier did not name the CPI excluding fresh food as an appropriate index, but it became the price index to watch after this meeting. The number zero was considered to be inappropriate due to the bias in the price index and the zero nominal bound. Still, the zero became a part of the commitment strategy. There seems to be a distinct change, although in the right direction, from the report of October 2000 to the commitment strategy of March 2001. Although the 9 March 2001 minutes clearly stated that the commitment strategy was not inflation targeting, mentioning the numerical value prompted a further discussion on inflation targeting in the following months. However, no concrete progress was made, and discussion died out in early 2002.

The ***third wave*** of interest in inflation targeting occurred between October 2002 and January 2003, probably in response to an increasing call for inflation targeting outside the Bank, in anticipation of the expiration of the term of the Governor and two Deputy Governors in March 2003.[30] There were substantial discussions on inflation targeting on 10 October 2002 and 21 January 2003. A number of reasons against adopting inflation targeting were mentioned, including: (1) the fact that none of the inflation-targeting countries had adopted inflation targeting in order to increase the inflation rate (MPM of 21 January 2003); and (2), that the main benefit of inflation targeting would be to increase inflationary expectations, but since there are no credible policy tools to achieve this, setting a target would impair public confidence in economic policy as a whole. One extreme opinion was recorded as follows: 'negative effects on the economy and the financial system, such as damage

30. Some politicians and government officials recommended candidates for Governor who were in favour of inflation targeting to the Prime Minister's Office. In Governor Hayami's press conference on 24 January 2003, a reporter asked the Governor for his view on inflation targeting, from the background of the political movement that the support for inflation targeting should be a prerequisite for the next Governor. In his reply, Governor Hayami branded inflation targeting as a 'reckless bet', which 'might make the economy extremely unstable and have side effects and risk'. He emphasised that the Bank had expanded the monetary base and taken other actions, and was confident that the economy would recover from deflation without such a bet (available only in Japanese at <http://www.boj.or.jp/press/04/press_f.htm>).

to the credibility of economic policy and to financial markets, would exceed the positive effects' (MPM of 10 October 2002). The Bank of Japan successfully lobbied politicians sympathetic to the Bank's view to have the previous Deputy Governor, Mr Fukui, who was in the private sector and not voicing any opinions on monetary policy at the time, appointed as the new Governor.[31]

One possibility is that the Bank of Japan, using the term of Cargill *et al* (2000), fell into an 'independence trap'. According to these authors, the Bank of Japan was afraid to take bold actions after it had just gained independence. Theoretically, flexible adjustments and bold actions were supposed to have become possible under independence, since actions were at the sole discretion of the Bank Board. On the contrary, the Bank became much more conservative and rigid in taking actions, especially unprecedented ones. They feared that action might be judged a failure later and damage credibility. If this is the case, the Bank of Japan was given independence precisely at the wrong moment because the economy called for unprecedented monetary policy actions.

3.4 The economics of the pros and cons of inflation targeting

As documented above, and in more detail in the Appendix, most Board members, including Governor Hayami and Deputy Governor Yamaguchi, as well as staff economists at the Bank of Japan, opposed inflation targeting. The arguments against inflation targeting, mostly presented during the Hayami period, will be presented and discussed here. The specific arguments have shifted somewhat over time, but the following seems to be a complete list. Rebuttals from advocates of inflation targeting are also considered.[32]

3.4.1 Reflation policy is bad, and the inflation rate cannot be controlled

In the early stage of arguments for inflation targeting, the Bank of Japan contended that inflation was not a solution to Japan's economic problems, and policies to raise the inflation rate may end up achieving a very high inflation rate, even if the aim is a moderate inflation rate. The reasons why moderate inflation was regarded as impossible seem to be two-fold: (1) it was technically impossible; and (2), it was politically irresistible.

One of the early criticisms of inflation targeting was a reaction to the proposal from Krugman (1998) of 4 per cent inflation for 15 years. Inflation targeting was characterised as a simple-minded reflation policy and thus rejected. As it came to be understood that inflation targeting is a flexible framework for monetary policy

31. See Fujii (2004, p 283) for an account of the lobbying.

32. The list is compiled predominantly from MPM discussions, summarised in the Appendix, but also press interviews, speeches and articles of the Governor, Deputy Governors, Board members, and staff economists. For the Bank economists' views on related issues see, for example, Okina (1999a, 1999b), Fujiki, Okina and Shiratsuka (2001), Okina and Shiratsuka (2002, 2004), and Okina, Shirakawa and Shiratsuka (2001).

and that the most likely target range would be somewhere between 1 and 3 per cent, this particular criticism disappeared.

Governor Hayami (2000a) categorised inflation-targeting proposals in two ways: an inflation policy, as advocated by Krugman, of aiming at 4 to 5 per cent; and, a variation of inflation policy, tolerating 'a moderate inflation rate of 2 to 3 per cent'. He assessed the latter policy as follows:

> it may vitalize economic activity. However, given the current situation in Japan where prices are almost level, such a proposal is tantamount to artificially creating inflation. Furthermore, to implement such a proposal, many have suggested that the Bank of Japan should increase its outright purchase of government bonds or underwrite them. Some even advocate that the Bank of Japan should purchase stocks or real estate. Thus, what started as a proposal aiming at a moderate inflation rate of 2 to 3 per cent under the *disguise of inflation targeting* for price stability has ended up being the same as inflation policy in that inflation should be artificially created at any cost [emphasis added by the author].

It is not clear from Hayami's speech what prevents the Bank of Japan from stopping inflation at around 2 to 3 per cent, and why it is technically impossible or politically impossible.

Hayami (2000a) argued that 'inflation is most likely uncontrollable once triggered'. Many argued at that time that it would be possible to pursue a policy aiming at a moderate inflation rate of 1 to 3 per cent. However, in response, Hayami commented: 'if we tried to contain inflation after it had gained momentum, we would need very strong monetary tightening, which might result in a substantial deterioration of economic activity and a steep climb in unemployment'. He seems to be arguing that the optimal and stable inflation rate is zero, and any deviation from it, even a modest amount, would end up in an inflationary spiral that would need strong restraint to end. This might be a reflection of the literature of the early1980s. Indeed, Hayami cited the experiences of the 1970s, where tolerating a small inflation rate triggered a further round of wage and price increases, which spiralled into a higher inflation rate. It was unfortunate that, in the early stage of deflation in Japan, the argument for moderate inflation targeting was dismissed on the grounds of a quite dated argument. The experience in the 1990s proved that inflation targeting could anchor expectations, so that it is possible to avoid a wage-price spiral.

3.4.2 No good price indicator

Inflation targeting is not possible if there is no agreement on which price index should be used to define inflation/deflation. Some form of the CPI is commonly used by inflation targeters. The menu of choices includes the headline CPI, core CPI excluding fresh food and energy prices, CPI excluding fresh food, or CPI excluding fresh food and rents. In most cases, the difference between the choices is not great, and a reasonably wide band would make the differences among these indices a secondary issue. A possible alternative for a price indicator is the GDP deflator. But it suffers from delayed and infrequent reporting (quarterly, instead of monthly) and constant revisions. No inflation targeter has used the GDP deflator. Some form of the CPI would be an appropriate price indicator. However, it took until March 2001 for the Bank of Japan to recognise that point.

The Bank of Japan was hesitant to name a price indicator for judging deflation/inflation. Okina (1999a, p 164) argued that '[p]rice indicators such as the GDP deflator, CPI, and Wholesale Price Index (WPI) often move differently. Even when these indicators exhibit the same movement, the extent to which the sound development of the national economy will be achieved may depend on such factors as whether property prices are stable or rising sharply'. Similarly, the 'On price stability' document, issued in October 2000, did not identify any price indicator as a possible price index. However, the debate was over on 19 March 2001, when the Bank of Japan decided to use the CPI excluding fresh food as an indicator for a necessary condition to terminate the ZIRP.

3.4.3 No optimal inflation rate can be identified

When deflation is caused by supply-side factors, such as technological innovation and cheap imports, then deflation may be desirable and can be tolerated. This argument was commonplace in 1999 and 2000 (recall the earlier discussion in Section 2.1).

Advocates of inflation targeting have pointed out that this argument confuses the relative price phenomenon – prices of goods subject to technological innovation would fall relative to other goods and services, but the average price level would remain predominantly a monetary phenomenon. In addition, a combination of low growth with declining prices is better explained by demand factors than supply factors.

Advocates of inflation targeting insist that price stability can be defined as a reasonable range, such as a medium-term range of 1 to 3 per cent, which allows for sufficient flexibility if prices are influenced by supply-side factors and temporary shocks. The 1 to 3 per cent target has been popular among inflation targeters, such as Canada and Sweden. The United Kingdom now has a target of 2 per cent for CPI inflation with a tolerance range of plus/minus 1 per cent.[33] The floor of the target, 1 per cent, is designed to allow for the upward bias of the price index and to provide a buffer against deflation. The buffer also helps to ensure that the economy would not instantly fall into deflation if it was hit by negative demand shocks, and thereby exhaust the conventional instrument (the interest rate) too quickly.

Economists at the Bank of Japan have argued for a long time that it is difficult to identify a specific number as a target inflation rate (or range). In short, they argue that the optimal inflation rate would vary depending on the type of shocks to the economy. Hayami (2000a) basically argued that a desirable inflation rate varies from country to country, and it was probably lower in Japan than other countries. He provided two reasons for this. First, deflation in Japan reflected supply-side shocks, and when such shocks lead to lower prices, deflation may be desirable. Second, since wages are flexible in Japan, output losses *à la* Akerlof *et al* (1996) would be small. Moreover, in terms of the lower end of the range acting as a buffer against deflation, Hayami (2000a) stated that '[t]he idea of tolerating a certain positive rate

33. Until December 2003, the target rate was 2.5 per cent, based on the retail prices index excluding mortgage interest payments (RPIX).

of inflation to ensure a cushion for monetary policy seems to be something like putting the cart before the horse'.

On 13 October 2000, two months after raising interest rates, the Policy Board issued a report called 'On price stability'. In the document, price stability was defined as a state that is neither deflation nor inflation. The document did not mention any numerical number that would define deflation or inflation, and as a consequence, price stability.

The debate moved to a new phase on 19 March 2001, since a zero per cent inflation rate was mentioned as a necessary condition to terminate the ZIRP. It seems that the Bank of Japan still regards a zero per cent inflation rate as price stability, but mentioning a particular number was still a sign of some progress. However, while the Bank of Japan still prefers zero per cent as a magic number, other central banks are moving away from zero per cent, precisely due to the buffer argument. New Zealand revised its target range from 0 to 3 per cent to 1 to 3 per cent in September 2002.

3.4.4 Inflation targeting in deflation is unprecedented

Another popular argument against inflation targeting was that no country had adopted inflation targeting to return to inflation from a state of deflation.[34] However, no other major country has faced sustained deflation in the post-war period. As such, the fact that 'no country has done it' is not a valid argument against the proposal.

During the Depression of the 1930s, many countries suffered from deflation. Sweden adopted a kind of inflation targeting (to be precise, price-level targeting) when it departed from the Gold Standard, in an attempt to use a nominal anchor to avoid deflation (see Berg and Jonung 1999).

3.4.5 Announcement alone will not be credible

It is often argued that the mere announcement of an inflation target would not change expectations.[35] In response, advocates of inflation targeting would contend that, although expectations are the most important and unique channel of inflation targeting, the effects may not be immediate. Having a target, in combination with the use of other measures, such as some degree of unconventional monetary policy, would certainly raise the probability of anchoring expectations faster than otherwise. The loss of credibility if the inflation target was not achieved – often referred to by the Bank economists and Board members – has to be balanced against the loss of credibility by not forcibly acting on the deflation problem.

It is certainly true that a mere announcement would not significantly change the public's inflation expectations. The introduction of inflation targets among advanced countries tends to be accompanied by an institutional framework that makes inflation targeting credible and accountable. In several countries, including New Zealand and

34. The view was expressed in the MPM on 21 January 2003; see the Appendix.

35. The view was expressed in the MPM on 12 January 2001; see the Appendix.

Australia, inflation targeting is an agreement between the government (typically the Ministry of Finance or Treasury) and the central bank, and both are committed to policy that is consistent with the inflation target. In several countries, including New Zealand and the UK, when inflation exceeds the target by a wide margin, the Governor is required to provide an explanation to the parliament. With accountability and commitment, inflation targeting does become credible.

3.4.6 The long-term interest rate will go up

Another argument against inflation targeting is based on the possibility that inflation targeting could be instantly believed – the opposite scenario to the preceding point. If the public believes in the inflation target of, say, 2 per cent, then the long-term interest rate would increase by 2 per cent, before the economy recovers, which would damage the economy.[36]

Since the long-term interest rate is a compound of future (expected) short-term rates, a belief that inflation targeting would lead to an average 2 per cent inflation rate would raise the long-term interest rate. However, if the amount of a rise in the nominal interest rate is less than the amount of a rise in inflation expectations, then the real long-term rate will fall. Therefore, the nominal interest rate hike *per se* is not damaging, but the real interest rate hike is. When the economy is in a depressed state, it is more likely that the increase in inflation expectations at the long end of the yield curve would result in a reduction, not an increase, in the real interest rate.

3.4.7 No additional instruments at the zero interest rate

The opposition to inflation targeting in Japan boils down to the feasibility of adopting available instruments. Those who oppose inflation targeting always raise the issue of no tools being available at the zero interest rate.[37] Given that the interest rate is zero, no policy measures are available to lift the inflation rate to positive territory, so that the announcement of inflation targeting, without tools to achieve the target, would damage the credibility of the Bank. Therefore, committing to a target when the Bank did not have the tools to achieve it would cause the Bank to lose credibility.[38]

Advocates have argued that several unconventional instruments, including quantitative easing and aggressive purchases of riskier assets, are available, even at the zero interest rate. Under the guise of quantitative easing, long-bond purchases

36. This view was frequently mentioned in MPMs and also in speeches. For example, see the MPMs on 28 June 1999 and 10 October 2002. The view was also expressed by Hayami (2000a).

37. This view was expressed throughout the period of the Hayami regime by Board members and Bank economists. Early citations include the MPMs on 13 October 2000 and 12 July 2001. See also Oda and Okina (2001, pp 352–356).

38. '[T]he BOJ argues, as is recorded in the minutes of Monetary Policy Meetings, that "since we cannot explicitly show the way to achieve the desired inflation rate, such action would most likely result in the BOJ losing credibility"' (Okina 1999a, p 165). In response, critics argued that as non-conventional monetary policy measures exist that could achieve a positive rate of inflation, the credibility argument is based on incorrect assumptions.

and increasing the monetary base have been implemented since March 2001. Prior to this, Board members were sceptical about the effectiveness of quantitative easing. In addition, buying foreign bonds, market-based stock index funds, and listed real-estate trust funds are frequently mentioned as potential measures. The debate would then shift to the appropriateness of unconventional measures. This debate is not covered here, but Ito and Mishkin (2004) provide a survey of the literature, and Ahearne *et al* (2002) and Bernanke (2002) discuss unconventional instruments in the context of the Federal Reserve Board.[39]

One of the concerns with unconventional policy – purchasing stocks, foreign bonds and real estate – was the possible damage to the Bank of Japan's balance sheet. Prices of risky assets may go down, and the Bank's capital may be depleted and credibility would be lost. Advocates of unconventional policies argued that the Bank's balance sheet was not a concern; if the Bank is regarded as a part of the public sector, the consolidated balance sheet with the government would not show a problem. In the extreme case, a capital injection from the government is possible. If inflation targeting had been adopted, it would also be easier to justify the Bank's action of purchasing risky assets. The government would inject capital, as long as the inflation target is met, without asking questions. Thus an additional benefit of inflation targeting, from the accountability viewpoint, is that it would enable the Bank to take bold actions.[40]

Some of these instruments, as they are in the realm of fiscal policy, need the cooperation of the Ministry of Finance.[41] Foreign exchange intervention is decided and conducted by the Ministry of Finance in Japan.[42] Most of the foreign reserves in Japan are held in the special account of the government. So, the central bank purchase of foreign bonds can only be achieved by intervention by the Ministry of Finance with an equivalent increase in monetary base. Any short-term government bonds are essentially absorbed by the Bank of Japan, so long as the ZIRP is maintained. As such, so-called 'helicopter money' can be dropped into the economy by way of a tax cut financed by the government issuing short-term government bonds. So, at the zero interest rate, the line between monetary policy and fiscal policy is blurred. It is thus essential that the Bank of Japan and the Ministry of Finance cooperate to achieve a common goal, namely getting out of deflation.

39. See Fujiki *et al* (2001) for the Bank of Japan's view. Views from the US on the Japanese experience are available in Ahearne *et al* (2002) and Clouse *et al* (2000).

40. Currently, most of the risk in the Bank's balance sheet arises from the long-term government bonds it holds. An increase in the long-term interest rate would cause unrealised capital losses in these long bonds. Bernanke (2003) proposed that the government substitute the straight bonds that the Bank of Japan holds with floating-rate government bonds, in order to protect the Bank's balance sheet from the interest rate risk.

41. This point was made by Robert McCauley during this conference.

42. See Ito (2003) for the institutions of foreign exchange intervention in Japan, and Ito (forthcoming) for intervention records in 2003–2004.

4. Concluding Remarks

Advocates of inflation targeting have put forward basically three reasons why inflation targeting was a good idea: accountability and transparency; instrument independence; and effects on inflation expectations. For the third reason, it is particularly desirable for the Bank of Japan to adopt inflation targeting in a deflationary environment, as advocates have argued. However, inflation targeting has not been adopted, although some quantitative easing measures that were resisted in early years have been. In examining the reasons put forward by opponents of inflation targeting, it has been shown that, for each item of opposition, there are good rebuttals. Opponents of inflation targeting seem to have prevailed for political economy reasons.

Inflation targeting was not adopted in Japan in the early years (the first wave, 1999–2000) because the Board members were not sure which price index would be best, and whether a specific number for an appropriate inflation rate could be determined. A study, commissioned in March 2000, and completed in October 2000, did not give any clear answers to this, and the Bank missed the opportunity. Inflation targeting was not adopted in later years (2001–2003), despite the inflation-targeting-like commitment strategy adopted in March 2001, because the Board members thought that conventional tools to increase the inflation rate were not available. As such, announcing a target with a positive inflation rate would damage confidence – just announcing inflation targeting would not increase the inflation rate. In terms of introducing unconventional measures, the Bank of Japan worried about the transmission channels and the damage to its balance sheet. Towards the end of Governor Hayami's term, the views against inflation targeting turned sharply negative, as news reports suggested that it may be linked to the new Governor's appointment. Therefore, why inflation targeting was not adopted, can be explained and understood from a political economy perspective.

This paper explained why the Bank of Japan hesitated to adopt inflation targeting. In other countries, the adoption of inflation targeting and the setting of a specific numerical target is often done by the Treasury (Ministry of Finance) or by consultation between the Treasury and the central bank. Another question is why the Ministry of Finance did not formally propose the adoption of inflation targeting to the Bank of Japan. One possible explanation is that officials at the Ministry of Finance thought that if the government set the goal that would be viewed as a violation of central bank independence. However, the literature and practice in other countries, such as Australia, New Zealand and the United Kingdom, show that goal independence is not an essential part of central bank independence. On the contrary, government involvement in setting the target is considered to be a good way of achieving coordination between fiscal and monetary policy. Another possible explanation for why the Ministry of Finance was not pushing the Bank of Japan to introduce inflation targeting was that the Ministry feared that the long-term interest rate would go up sharply if inflation targeting was adopted (see Section 3.4.6).

As of writing this paper, the Japanese economy seems finally to be getting out of its long stagnation. If the current strength in the economy continues, there is a chance that deflation could be overcome in coming months, rather than years. The necessary conditions to exit from the ZIRP – that is, positive inflation rates backward and forward – have been clearly stated since October 2003. When the exit from deflation and the ZIRP is achieved, that will be the beginning of a new regime for the Bank of Japan. One of the obstacles to adopting inflation targeting – that is, there are no instruments to achieve positive inflation rates at the ZIRP – will be gone. In order to facilitate accountability in the post-ZIRP area, inflation targeting should be given serious thought. Preparation should be started sooner rather than later.

Appendix: Inflation Targeting as Discussed in Monetary Policy Meetings (MPM) – A Chronological Review[43]

Inflation targeting was first discussed by the Board on ***16 July 1998***. One member 'remarked that inflation targeting was worth considering as it could work on people's expectation … in an extremely severe economic situation in which an optimal monetary policy was to realise negative real interest rates, targeting inflation at a moderate rate, for example at 1.0–1.5 percent, would be worth considering as an effective way of dispelling deflation'. The need for positive inflation expectations to overcome the problem of the zero bound of the nominal interest rate was correctly recognised, and the Board member noted that inflation targeting was a means to achieve positive inflation expectations.[44] According to the minutes, no substantial discussion followed.

The next discussion of inflation targeting did not occur for four months. The minutes of ***27 November 1998*** recorded discussion of the pros and cons of introducing inflation targeting and also some technical questions. According to the minutes, one member proposed that 'the Bank would encourage the uncollateralised overnight call rate to move on average around 0.15 percent, aiming at raising the annual average rate of increase in the consumer price index (all items) to zero in the medium term'. Other members commented on this proposal. One member asked three technical points: '(1) How could a situation that is neither inflationary nor deflationary be described over price indicators, "rate of increase at zero" or "an increase by a small margin"? (2) What indicators should be used in measuring prices, the consumer price index (all items) as suggested in the proposal or other alternative price indicators? (3) How long the target period could be to achieve certain results?' These are essential questions, and if they had been seriously discussed, the introduction of inflation targeting might have been feasible as early as end 1998. However, there seemed to be some objections and scepticism towards inflation targeting in this meeting. One member doubted that announcing an inflation target 'could have effects on the activities of people expecting deflation'. Another member questioned the need

43. The minutes record a detailed summary of discussion of the MPM and are made public after they are approved in the MPM of one to two months later. Names of discussants are not disclosed, except for those who propose a motion for voting decision and voting records. Transcripts with names will be disclosed in the distant future.

44. 'Another member remarked that inflation targeting was worth considering as it could work on people's expectations, an opinion that the member had been expressing publicly … The member had advocated that in an extremely severe economic situation in which an optimal monetary policy was to realise negative real interest rates, targeting inflation at a moderate rate, for example at 1.0–1.5 percent, would be worth considering as an effective way of dispelling deflation concerns' (Minutes of the Board on 16 July 1998).

for an announcement altogether, since it was known that the Bank was pursuing price stability.[45]

In 1999, inflation targeting was discussed fairly regularly. Inflation target(ing), or the target (range) of inflation rate, was mentioned at least once from February 1999 to February 2000. In several of the meetings, a substantial discussion took place (evidenced by comments of more than two persons, and more than five counts of 'inflation target' recorded in the minutes). In particular, the discussions on ***28 June 1999***, ***27 October 1999*** and ***10 February 2000*** seem to have been very interesting.

At the ***28 June 1999*** meeting, 'One of the members, who considered that deflationary concern persisted, advocated further monetary easing through inflation targeting and expansion of the monetary base'. He gave six reasons for this proposal, including its effects on expected inflation. The rise in expected inflation greater than the nominal long-term interest rate would lower the real long-term interest rate. Several members commented on this assertion and proposal. Some were sceptical of the 'argument that a rise in nominal interest rates would be acceptable as long as real interest rates declined, saying that economic activities were affected by both nominal and real interest rates'. The criticism of inflation targeting based on the fear of rising long-term interest rates was debated without reaching a firm conclusion.

In the MPM of ***27 October 1999***, the minutes recorded a lengthy summary of discussions. This was probably the first Board discussion that contained serious debates between advocates and sceptics of inflation targeting.[46] There were two or more advocates of inflation targeting and others who were sceptical. Advocates argued that 'inflation targeting had the merit that it enabled the Bank to indicate a medium- to long-term commitment'. Sceptics argued that 'it was too simple to think that setting a numerical target would increase the transparency of monetary policy, and it was necessary to discuss the pros and cons as well as the feasibility of inflation targeting giving due consideration to its basic nature'. One member compared 'a medium-term inflation target', which allows short-term flexibility, and a rule-like inflation targeting policy, 'where every possible measure was employed to create a certain level of inflation', and preferred the former, 'although it involved technical difficulties'. These comments suggest a deeper understanding of the different types

45. 'Some members questioned the consistency between setting a price target and reducing the uncollateralised overnight call rate by 0.1 percent. In addition, one of the above members doubted that announcing such a target could have effects on the activities of people expecting deflation. [Para] Another member expressed an opinion that the Bank did not need to indicate a specific target figure because it had already been widely known that the Bank has responsibility for stabilising prices, that is to avoid inflation and deflation, as stipulated in Article 2 of the Bank of Japan Law. [Para] Another member expressed a view that, in implementing monetary policy, it was natural that a central bank has a will to avoid genuine deflation. The member was, however, of the opinion that it was not appropriate to declare such a will in the form of inflation targeting, and in addition, it was difficult to include the declaration of the will in the directive on money market operations, and the will should rather be expressed in some other forms and styles' (Minutes of the Board, 27 November 1998).

46. Coincidentally, this was the first MPM after Ito's (1999) *Financial Times* article.

of inflation targeting, the reasons why such a policy was advocated, and the cautions involved in setting a target.

The MPM of ***10 February 2000*** provided another instance of detailed discussion on inflation targeting. The following was recorded as the 'consensus' of the Board on inflation targeting: 'First, they were against inflation targeting that aimed at creating a certain level of inflation – a reflation policy – and had no intention of adopting such a policy. And second, inflation targeting that aimed at making monetary policy more transparent and expressing a strong commitment to price stability was worth considering, although it had some technical difficulties'. Many members 'shared the opinion that, in deliberating inflation targeting in the latter sense, it was necessary to go over in further depth the various points of consideration that had been revealed at previous MPMs. Also, it was important to examine not only the pros and cons of inflation targeting but also various issues related to enhancing the transparency of monetary policy – for example, what was meant by price stability and whether to disclose the Bank's forecasts of prices and the economy'.

This almost sounds as if the Board would examine technical issues in preparation for the introduction of inflation targeting to enhance transparency and commitment. However, there was a cautious remark by one member: 'First, it could pave the way for a policy that aimed at creating a certain level of inflation as hopes were strong that inflation would lighten the burden of debts. And second, the degree of the upward bias of price indexes changed as structural reform progressed. The member continued that it was preferable to enhance transparency by disclosing economic forecasts and thereby realize constructive dialogue with financial markets'. What happened in the subsequent months was that this cautious person's view carried the meeting. From the spring to the summer of 2000, many members of the Board were busy debating whether and when the ZIRP would be ended, and no discussion on inflation targeting took place. The Board also carried out, or asked the staff to prepare, a study 'On price stability', which would be made public in October 2000. From this time, individual Board members would also issue personal forecasts for prices and economic activity. So it seems that a series of debates from mid 1999 to February 2000 resulted in more basic study, which would take more than six months, and alternative ways of achieving 'transparency'. Effectively, the Board rejected the adoption of inflation targeting in 1999 and early 2000.

On ***9 March 2000***, the Board decided to conduct a comprehensive review of the price stability. The Chairman (Governor) proposed that the staff conduct the study 'On price stability' as follows:

(1) The Bank's staff would study the following issues taking account of the points discussed at MPMs: (a) the Bank's basic thinking regarding price stability; (b) issues regarding price indices; (c) the evaluation of recent price developments in Japan; and (d) issues related to the numerical quantification of price stability (including setting a target and projecting the movement of a specific numerical indicator).

(2) The Board would discuss price stability on the basis of the staff's report, and issue a comprehensive report on its thinking on price stability.

(3) During this process, the Bank could release information compiled by the staff that was appropriate for disclosure.

(4) The Bank would issue a report by around the end of summer 2000.

It was advantageous that a comprehensive study would be conducted, but in retrospect, this action put off, or at least put aside, any further discussions of inflation targeting, until the study's completion. In the meantime, in the meeting of 11 August 2000, the ZIRP was ended on the majority's judgement that deflationary concern was dispelled. In fact, at that point, 'deflation' was not defined by the Board, since it was under study. Although it was planned to be released by 'the end of summer 2000', the study was not issued until October 2000.

On ***13 October 2000***, the long-awaited document 'On price stability' was released, along with the 'Release of outlook and risk assessment of the economy and prices'. Both documents were discussed by the Board. The discussion reveals the thinking of Board members at the time quite well. Below are excerpts from the minutes and my comments on them.

> [D]iscussions centered on the issue of expressing price stability by a numerical value. A few members expressed the view that the optimal rate of increase in price indexes over the medium and long term was small but positive considering issues such as the upward bias of price indexes and the zero constraint on nominal interest rates.

This view on 'optimal rate of increase in price indexes' expressed by the 'few members' seems quite appropriate and completely non-controversial from the view of mainstream monetary economics. What is surprising is the discussion that follows.

> However, many members including those above agreed with the conclusion of the report that it was not appropriate to define price stability by numerical values at this point for the following reasons. First, supply-side factors such as technological innovation were exerting downward pressure on prices at present. And second, the available orthodox monetary policy measures were limited. At the same time, these members shared the view that the Bank should continue to explore whether price stability could be expressed by numerical values, taking account of actual changes in the market and the economy.

This paragraph summarises why the Bank of Japan did not adopt inflation targeting in 2000. First, it was thought that if supply-side factors were affecting price levels, inflation targeting was inappropriate. However, as was discussed earlier in this paper, demand, not supply, factors were dominant, since output was sluggish in Japan, but not in the United States. Also, supply-side factors mostly affect relative prices, and average prices are more affected by macroeconomic factors and policies. Second, the Board recognised that the room for manoeuvre with conventional policy measures, that is, the interest rate, was limited. At this time, the Bank had just raised the interest rate to 0.25 per cent, and the majority of the Board was not considering lowering it back to zero.

Board members asked for a number of further issues to be studied: (1) the relationship between price stability and financial system stability; (2) whether it would be inappropriate to use numerical values to express a price stability objective, as long as downward pressure on prices from the supply side remained; (3) ways to improve data on the supply side that were essential for assessing prices; and (4) ways that countries that had adopted inflation targeting would deal with issues related to technological innovation, which made compilation of reliable price statistics more difficult, and asset prices, which were becoming increasingly important for the conduct of monetary policy.

These issues reveal that the majority of Board members thought either that setting a numerical target was a bad idea, when supply-side factors are having a large impact, or that more research was needed on the issue. The following paragraph seems to give a summary view of the majority of the Board:

> [A]nother member said that it would be difficult to define price stability in terms of numerical values in view of structural changes that Japan was undergoing, bias in price indexes, and Japan's economic situation which was subject to strong influence from external developments. Therefore, the member thought that the issue should be studied further and would, at this point in time, prefer to give only a qualitative or conceptual definition of price stability. The member further commented as follows. The discussions on the issue of quantifying price stability had been initiated in response to public criticism that the goal of monetary policy was unclear. Therefore, the discussion started from the very fundamental question of the significance of price stability, but some issues required further study. In that sense, the member would like to emphasize that the conclusion was not fully satisfactory.

In contrast, one member in favour of inflation targeting gave the case for immediate adoption:

> One member, while supporting the Bank's plan to make public its thinking on price stability, disagreed with the contents of the report as the member believed that the Bank should immediately set a numerical target for the inflation rate. The member expressed the following opinions. First, without a numerical target, the Bank would not be able to assess its performance and would not be accountable to the public as a central bank. Second, it was natural that an inflation target should be adjusted in line with structural changes and this would make the adoption of an inflation target viable. And third, the European Central Bank (ECB) had defined price stability as year-on-year price increases of below 2 per cent, and some central banks in industrialized countries, such the United Kingdom and New Zealand, had adopted inflation targeting. In view of this, the report should explain convincingly and in depth why Japan did not have a numerical target for prices.

After the discussion on the document of 13 October 2000, there was no significant discussion on inflation targeting or price indices until 19 March 2001, when the Board decided to change the monetary policy instrument from the interest rate to the current account at the Bank of Japan, effectively restoring the ZIRP.

The minutes of the ***19 March 2001*** meeting contain interesting discussions on adopting a condition for continuing the ZIRP. The Board members agreed to ease monetary policy, given the deteriorating economic conditions. Members agreed that '(1) it was necessary to make a strong commitment in terms of policy duration in order to ensure the "commitment effect", and (2) it was desirable to make the commitment clearer than "until deflationary concern was dispelled", the phrase the Bank had used under the zero interest rate policy'. In a sense, they admitted that this time the Bank had to explain the ZIRP better than it had when it was previously used (from February 1999 to August 2000). Thus, a clearer expression than 'until deflationary concern was dispelled' was sought. The change in the policy instrument and the exit conditions were decided as follows:

(1) The Bank will change its main operating target for money market operations to the outstanding balance of the current accounts at the Bank of Japan.

(2) The Bank will continue the new framework for money market operations prescribed in (1) until the CPI (excluding perishables, on a nationwide basis) registers stably a zero per cent or an increase year-on-year.

It is remarkable that the Board agreed on: (1) the particular price index, CPI excluding fresh food, that it was going to focus on as a condition of monetary policy; and (2), the numerical number, zero. The zero was chosen because the Board members 'were in agreement that a situation that was neither inflationary nor deflationary was desirable, and thus, it was appropriate to make a commitment to continue the policy until the rate of increase in the CPI recovered to zero percent'. One member, citing a study that suggested the upward bias in the CPI in Japan was 0.9 per cent, insisted that a higher number was chosen, but did not prevail. Instead, '[o]ne member added that, although the Policy Board should further discuss the desirable rate of increase in prices, it would be appropriate to use a phrase such as "stably a zero percent or an increase year on year" and imply that it would conduct policy "aiming at a small but positive inflation rate"'. In the end, the vote was taken to endorse a new policy: '(1) change the main operating target for money market operations to the outstanding balance of the current accounts at the Bank of Japan; and (2) make a commitment to continue this new framework until the CPI registered stably a year-on-year increase of zero percent or more'.

This meeting finally put to end the discussion of what was the appropriate price index. The discussion had persisted for almost three years. Even in the major document 'On price stability', which was released just six months earlier, the question was not settled. But, suddenly, in this MPM, the question of the appropriate price index was resolved.

This MPM is also remarkable in the sense that the Board endorsed what was considered to be quantitative easing that had long been resisted. Specifically, the Board voted to (8 in favour, 1 against): '(3) change the main operating target for money market operations to the outstanding balance of the current accounts at the Bank of Japan; (4) make a commitment to continue this new framework until the CPI registered stably a year-on-year increase of zero percent or more; (5) increase the amount of the Bank's outright purchases of government bonds when it was considered necessary in order to provide liquidity smoothly; (6) establish a clear ceiling for the Bank's government bond holdings, set at the outstanding amount of banknotes issued; and (7) increase the outstanding balance of current accounts at the Bank to around 5 trillion yen for the time being'.

What was curious about this MPM discussion is that the Board members denied any link of this new commitment strategy to inflation targeting.

> Many members agreed that such a commitment differed from inflation targeting in that under the latter a desirable inflation rate from a medium- to long-term perspective was set as a target and monetary policy was changed when the inflation rate was expected to deviate from the target.

From the viewpoint of inflation-targeting advocates, these measures, including deciding on the price index to measure inflation, mentioning the number zero, and taking actions on quantitative easing, were more than a half-step towards fully-fledged inflation targeting. It is quite puzzling to the advocates of inflation targeting why the Board members still had to deny the resemblance of the new policy to inflation targeting. If one wants 'commitment', inflation targeting is the better way. Perhaps 'target' was a word that was disliked by the Board members, as it would make the Board accountable for the consequences of its actions.

At the ***19 March 2002*** meeting, an advocate of inflation targeting proposed that the numerical target should be made in consultation with the government: '[O]ne member said that it was not appropriate to introduce a numerical target with a specific time frame without having any concrete means to achieve the target, but it would be meaningful if the Bank shared a numerical target for prices with the Government in some way as a policy framework. In response to this, one member said that in setting a numerical target with the Government, the Government's policy commitment in achieving the target would be another important factor, but there could be a contradiction in the current deflationary situation between implementing fiscal consolidation and setting an inflation target'.

From the fall of 2002 to the beginning of 2003, an interest in inflation targeting re-emerged. The Board had two intensive discussions, on 10 October 2002 and 21 January 2003. During this time, discussions on inflation targeting were also gathering pace outside the Bank of Japan, as the end of the terms of Governor Hayami and the two Deputy Governors were approaching, and interest was raised in whom the government would appoint as replacements. The Bank felt defensive at first, but subsequently presented arguments to convince the public about the correctness of the policy. They emphasised the importance of explaining what they had been doing in one of the MPMs.[47]

In the MPM of ***10 October 2002***, several negative opinions on adopting inflation targeting were mentioned. Inflation targeting was characterised by some members as inappropriate because it has 'negative effects on the economy and the financial system, such as damage to the credibility of economic policy and to financial markets, [which] would exceed the positive effects'. The implication seems to be that inflation helps debtors. Another member commented that, given that quantitative easing did not stop prices declining, and as more negative shocks were expected from an accelerated resolution of the problems of non-performing loans, inflation targeting was not appropriate due to a lack of instruments to achieve the target.

47. In connection with the critics' call for taking more drastic policy, the Board member remarked that 'it was vital to explain the risks and the possible side effects of individual policy tools as concretely as possible, in order to gain greater public understanding of the Bank's conduct of monetary policy' (21 January 2003).

> Members who commented on inflation targeting expressed the view that if inflation targeting were to be adopted in the current economic situation, the mechanism to achieve the target would rely mostly on an upward shift in inflationary expectations, unless public expenditures were substantially increased. These members then said that it was theoretically not possible to shift inflationary expectations upward unless there were sufficient and credible policy tools and transmission mechanisms to achieve the target, and that setting a target in the absence of such tools and mechanisms would impair public confidence in economic policy as a whole.

This summarises the negative opinion at the time quite well. Concern about the implications for the long-term bond rate was also expressed: 'if inflationary expectations were to shift upward, it was the bond markets that would be most likely to be affected'.[48] One member countered that 'effects of a rise in long-term interest rates on banks' balance sheets … might be smaller than expected … because banks had been controlling risks'.[49]

It is interesting that some members suggested that the Bank was essentially running an inflation-targeting policy without saying so.

> [t]he Bank's current monetary easing was already aimed at incorporating the advantages of inflation targeting, given the monetary policy measures the Bank could adopt in the current situation … One of these members said that the Bank had already adopted inflation targeting policy in a broad sense, in that it made a commitment to continue the quantitative easing measure until the consumer price index registered stably zero percent or an increase year on year. On this basis, this member pointed out that the difference between the Bank's current easing policy and inflation targeting in a strict sense was mainly whether the specific period within which the target was to be achieved was indicated. This member added that the latter policy would inevitably require extreme measures that would have serious risks or adverse effects.

Given that a sharp dissociation of the new policy from inflation targeting had been recorded at the 19 March 2001 meeting, this kind of assessment is very interesting. It is not clear whether more Board members became favourable to inflation targeting or Board members wanted to counter the call for inflation targeting by saying that it had already been adopted.

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48. 'Based on the above discussion, these members said that if long-term interest rates rose before economic activity was sufficiently stimulated, this was likely to cause the economy to make a hard landing, the opposite result to an easing of the pain arising from NPL reduction. This was because a rise in long-term interest rates would substantially increase the interest burden on the Government and firms and would negatively affect the financial position of banks since they held a huge amount of [Japanese Government bonds] JGBs' (10 October 2002).

49. Another member said that the Bank's current monetary easing measures along with the commitment effect in terms of policy duration had reduced interest rates with relatively long maturity to the lowest possible level, which in turn supported the Government's funding. In this sense, the current policy was desirable in terms of harmonisation with the Government's policy. This member said that it was difficult to understand why some Government officials advocated inflation targeting in the current situation despite the possibility that it would cause a rise in long-term interest rates and would increase the Government's interest payments. This member expressed a desire to hear the Government participants' opinion, if possible (10 October 2002).

The MPM of ***21 January 2003*** turned out to be the last MPM that discussed inflation targeting at length, and was probably the longest discussion to date under the regime of Governor Hayami. Again, the dominant view rejected the adoption of inflation targeting. First, '[o]ne member pointed out that inflation targeting had never been adopted for the purpose of overcoming deflation by any central bank overseas, including those in New Zealand and Sweden'. Second, without having conventional monetary easing measures, setting an inflation target with a specific time limit is different from situations of other inflation-targeting countries. They were implying that there are no measures to achieve the inflation target: 'First, there was a large output gap and a financial system problem. Second, short-term interest rates were at the zero lower bound. Third, fiscal consolidation and structural reform were in progress. And fourth, global downward pressure on prices of goods was substantial'.

Some recognised that the government has more tools than the Bank of Japan to stimulate the economy, namely fiscal spending and foreign currency intervention.[50] Some Board members were probably unaware that the Ministry of Finance was about to launch an unprecedented scale of foreign exchange interventions starting this month (January 2003) to March 2004.

What is somewhat surprising is an expression again that the Bank was already practicing *de facto* inflation targeting, just like the opinions expressed in the 10 October meeting.

> Some members noted that the Bank's commitment to continue the current monetary easing framework until the inflation rate became stably zero or more had virtually already factored in most of the effects that inflation targeting purported to achieve. This was because the commitment using the actual figure of the CPI, not a forecast figure, reflected in fact the Bank's intention to achieve a small positive inflation rate, taking into account the time lag.

They viewed calls for the adoption of inflation targeting as based on a misunderstanding of the 'side effects' of policies that are required to achieve an inflation target, and that these misunderstandings had been corrected.

One member raised, as a thought experiment, the question of how the Bank should approach the issue of adopting inflation targeting, if the Government were to concede total control over both fiscal and foreign exchange policy to the Bank and if the Government were to cover all losses arising from the Bank's purchases of risky assets. This member said that this exercise would be useful in considering how the Bank should respond to calls to adopt inflation targeting, particularly from academics

50. Some members remarked that, to make the inflation rate positive within a relatively short period, substantially expanding fiscal spending or conducting an active foreign exchange rate policy would have to be considered as policy options. These members said that, if an inflation target were set by the Bank alone, it would not be credible, since fiscal and foreign exchange policy were under the control not of the Bank but the Ministry of Finance. These members also contended that, if Japan were to prioritise realising a positive inflation rate with a certain time limit, it would be essential for the Government to give a concrete outline of how it would conduct fiscal and foreign exchange policy to achieve it (21 January 2003).

overseas: '[T]he view that inflationary expectations would be shifted upward merely by a central bank's announcement of inflation targeting was becoming a minority opinion overseas. Moreover, the view that the remaining measures that could be employed by the Bank alone were ones whose effects were uncertain seemed to have become the majority view overseas. These members pointed out that the risks and side effects of individual policy tools had not been sufficiently understood, and this lack of understanding was behind the persisting view that the Bank should try adopting any policy tool, if the possible side effects could be considered small, even though its effectiveness might be uncertain'.

Moreover, in response to the suggestion by critics that the Bank's policy of purchasing risky assets would be harmful: 'one member said that there was an extreme view that the Bank should purchase not only [Japanese Government bonds] JGBs and foreign bonds but also risky assets that were securitised such as stocks and real estate without limit until prices rose. However, if the Bank actually implemented such a policy, it would be likely to cause many side effects, such as a loss of fiscal discipline, a deterioration of the central bank's assets, and a rise in long-term interest rates, and would therefore negatively impact the economy before the inflation rate rose'.

Some Board members criticised inflation targeting because it would destabilise the market: 'One member noted that inflation targeting was basically aimed at stabilizing people's expectations. However, the mechanism of an upward shift in inflationary expectations currently envisioned by advocates of inflation targeting was highly likely to destabilize people's expectations, and this could in turn destabilize long-term interest rates and the economy. This was because, as most people still expected that it would take time to overcome deflation, some would start to anticipate that to achieve the target the authorities would employ extreme means that could damage the public's confidence in them'. This argument is difficult to understand, because if inflation targeting is credible, it would certainly stabilise expectations. To endorse people's expectations that it would take a long time to overcome deflation – to not rock the boat – sounds like a strategy not to fight deflation.

Then, without inflation targeting, how would deflation be overcome? Many Board members remarked that deflation would be overcome when the economy got back on the path of sustainable growth, but how to achieve growth was not particularly well answered.[51] They basically reaffirmed that there is little that monetary policy can do.

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51. 'One member emphasized that the measures to overcome deflation were not ones designed to create inflation, but ones that would realize sound economic growth … overcoming deflation could only come into prospect when the economy realized sustainable growth. The member continued that the authorities should present credible policies to deal with the fundamental cause of the price falls, namely the lack of demand and the stagnation of the economy … two factors were causing the decline in economic growth in Japan, namely, the weakness in aggregate demand and the delay in overcoming structural problems of the economy … fiscal policy could still have a great impact in revitalizing the Japanese economy, and the efficiency of fiscal spending would significantly affect the direction of the economy'.

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Discussion

1. Robert N McCauley[1]

The author has written a broad and balanced account. This paper makes the reader think about this critical period of monetary policy-making differently. My remarks concern the main thesis, monetary and fiscal policy at a zero overnight interest rate, and abstaining from inflation targeting.

The main thesis

This paper argues that the Bank of Japan shrank from doing the right thing because it required the adoption of unconventional policies that might lose the Bank its newly acquired independence. Taka Ito frankly recognises that this argument has a problem: the Bank of Japan adopted two and a half of the recommended unconventional policies: increasing excess reserves, buying government bonds and buying shares – with the last counted as one-half because the justification was couched in terms of financial stability rather than monetary policy. Moreover, the author seems to argue that the other unconventional policy of buying foreign bonds, or in Svensson's formulation, depreciating the exchange rate, was in effect adopted in the form of heavy intervention by the Ministry of Finance, matched by a broadly parallel rise in excess reserves at the central bank. This leaves only inflation targeting as the unadopted unconventional policy.

In passing it should be noted that inflation targeting does not belong on the list of unconventional measures, either logically or historically. Taka argues that an inflation target would have been achieved through the above-named unconventional measures, implying that inflation targeting is not logically just another such instrument. Historically, it is hard to call inflation targeting an unconventional policy in a world in which it is recommended so widely.

In the end, it appears that the Bank of Japan was unwilling to adopt inflation targeting, but not because it was unwilling to adopt the measures that the author feels would have served to hit the target. Rather, it was unwilling to commit to pushing these unconventional measures to hit pre-announced targets within a certain time. In other words, the Bank of Japan was willing to adopt the measures (means) urged by its critics, but not in the service of an announced, symmetric and time-bound inflation commitment (end) that they would consider inflation targeting. The Bank of Japan feared that it could not deliver on such a commitment.

Monetary and fiscal policy at a zero short-term interest rate

This paper devotes considerable space to arguments that are not central while leaving most of the central economic arguments off-stage. On the first count,

1. The views expressed in this note are those of the author and do not necessarily reflect those of the BIS.

much of the discussion of the costs of deflation, particularly on the interest burden on corporations and the government, really concerns the costs of unanticipated disinflation. The transition to deflation differs from disinflation because of the zero lower bound in nominal wage growth, if any, and nominal interest rates. The discussion of the first suggests that the bonus system allowed nominal wages to fall. A graph of real wages over the period of deflation would be useful. Similarly, some evidence on real interest rates, at the short and long term, would enrich the discussion of deflation and interest burdens. Whatever the deficiency, from Taka's point of view, of the Bank of Japan's commitment to keep nominal interest rates at zero (no ceiling for inflation, no time frame for achievement), what is remarkable, and what would surprise Keynes most in the story, is how nominal 10-year yields got down to a half per cent. What is called the 'policy duration effect' seems to have been powerful indeed. The same low Japanese government bond yields imply, however, that market participants believed until quite recently that the unconventional measures (rising excess reserves, bond buying and foreign exchange intervention) would not reliably whip deflation in five years.

Regarding the off-stage argumentation, reference is made to what 'mainstream' economists urged, appealing to a broad agreement on the underlying economics. On the basis of this paper alone, the presumption of shared analysis seems to encompass an embrace of both base monetarism and the related usefulness of the distinction between sterilised and unsterilised intervention at zero interest rates. At a deeper level, there is a presumption that anything that can affect the price level is potentially and properly a policy to be pursued by the central bank. Let us consider these in turn.

My starting point is the near-perfect substitutability of excess reserves at the Bank of Japan, and the treasury or financing bills of the Ministry of Finance at zero interest rates. Both carry essentially zero interest rates, offer great liquidity and pose much the same credit risk. In effect, when the Bank of Japan set the overnight rate at zero, it gave the Ministry a printing press. One argument for a difference is that the excess reserves are permanent additions to the monetary base and so will support a higher nominal GDP. But the commitment of the Bank of Japan to maintain effectively zero interest rates until inflation returns implies that the oversized current balances at the Bank of Japan are temporary.

If one compares the situation of 6 trillion yen in excess reserves with the one of 31 trillion in excess reserves, the difference is 25 trillion yen of short-term government debt in private hands in the first case, and 25 trillion yen in overnight deposits at the Bank of Japan in the second case. It is very hard to see why the behaviour of private parties would differ between these two cases. Viewed as a commitment device, excess reserves *per se* seem weak since they can be rapidly withdrawn at low cost.

If one accepts this near-perfect substitutability, then unsterilised versus sterilised intervention becomes a distinction without a difference. In one case, the private sector holds the short-term, essentially non-interest-bearing paper of the Ministry of Finance, and in the second case, the Bank of Japan holds the Ministry paper and the private sector holds the short-term, zero-interest claim on the Bank of Japan.

Taka and I agree that intervention can affect the yen. I would interpret the effect as running through the portfolio balance effect: unlike Ministry paper and Bank of Japan balances, Ministry paper and US Treasury notes are not perfect substitutes, so that their relative supplies affect their relative price, the exchange rate. We may differ if Taka attaches importance to the rough parallel in the increase in Ministry's holdings of dollars and the Bank of Japan current balances. I would attach importance only to the dollar holdings at zero interest rates.

At another level, there is an unstated presumption that anything that can affect the price level is properly in the field of action for the central bank. This presumption covers the purchase of bonds, risky domestic assets and foreign exchange, all of which can affect inflation. However, such unconventional 'monetary measures' are really the province of the government, both conceptually and practically.

- *Purchase of bonds*: The supply of duration to any government bond market is fundamentally a treasury responsibility. In the late 1990s, there was a debate within the Ministry of Finance over whether to issue a smaller share of debt in the form of long-term bonds, but those responsible for debt management resisted. Conceptually, having the central bank issue overnight liabilities to buy 10-year bonds must be recognised as poor man's debt management, 'poor' because the balance sheet of the central bank is smaller than that of the government. A bold debt management policy would have not only ended the issue of new long-term fixed-rate debt (in favour of floating-rate or indexed-linked debt), but also bought outstanding bonds back. Banks would have been denied the easy option of earning profits by taking duration but not credit risk. Practically, the Ministry of Finance stands to gain in tax revenues from a revival of nominal growth, so it makes sense for it to bear the (opportunity) cost of a rise in interest rates.
- *Purchase of equities, etc*: Buying risky assets puts the government in the position of favouring certain issuers over others. Like tax and expenditure policy, this is highly charged politically. The first best solution is to follow the model of Herbert Hoover's Reconstruction Finance Corporation, with explicit legislative authority for an entity to purchase risky assets – just as legislation underpinned the Japanese government's recapitalisation of the banks.
- *Buying foreign bonds*: Looking across countries, the assignment of foreign exchange risk-bearing to the government seems to be the exception rather than the rule. But in Japan, foreign exchange policy has been the responsibility of the Ministry of Finance. Its purchases of foreign exchange require financing that is subject to legislative approval. Having the Bank of Japan buy foreign bonds would not have been any more effective in economic terms (by the argument above) but would have evaded this legislative control.

Expediency could be seen to override these arguments. The debt managers insist on pumping out long-term bonds, so the central bank should buy some of them and risk the need for recapitalisation; the legislature cannot agree on the government buying equities or real estate, so the central bank should do so; the legislature cannot agree to increase the debt limit, so the central bank should buy foreign exchange on its own account. Is it obvious, however, that the legislature would be happy to recapitalise the central bank *ex post* for losses from risk-taking that the legislature would not appropriate funds for *ex ante*? More fundamentally, we need to think twice about recommending putting tax-payers money at risk without the consent of their representatives. It is a fine judgement whether events constitute such an emergency as to require an override of parliamentary prerogatives.

The most powerful lever on the price level of these unconventional measures is intervention in the exchange rate. Foreign exchange intervention allowed global equity investors to return to their neutral weightings on Japan without pushing up the exchange rate. If Japan's recovery continues and the economy exits from deflation, this policy deserves credit. Would the Bank of Japan have been well-advised to count on this outcome within a given period of time? There was the usual uncertainty about transmission (in this case the pass-through from foreign prices to the domestic price level). Beyond this, however, was the question of whether trading partners would acquiesce in the exchange rate management. Would it have been safe to presume an acceptance in Washington of the proposition that recovery in Japan is so much in the US interest that it should be allowed even at the expense of US net exports? Was the ultimate acceptance a function of the larger trans-Pacific relationship involving non-economic elements? It seems fair to ask: had the central bank been willing to manage the exchange rate on its own account to break the deflation, was it clear *ex ante* that it would be able to do so?

Abstaining from inflation targeting?

Is there an argument for a central bank that shares the low inflation goal of formal inflation targeters to abstain from inflation targeting? Baltensperger, Fischer and Jordan (2002) have argued that central banks that enjoy a measure of goal independence may refrain from binding themselves with an inflation target. This argument can go beyond Ken Kuttner's weighting on output stability to the possibly competing goal of financial stability. While it is possible to translate financial instability into output instability, as have some RBA papers, it seems to me that concern for financial stability can in practice compete with inflation stability.

It is not clear how these considerations might apply to the Bank of Japan on the far side of its current policy. One can imagine that the Bank chooses inflation targeting and thereby underscores its measure of goal independence.

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2. General Discussion

An important theme raised in the discussion was the wider implications that could be drawn for monetary policy from the Japanese experience. One participant highlighted the need for complementarity between a central bank's actions and communication. This follows from the importance of managing the public's and financial markets' expectations to best achieve successful outcomes, and also highlights a key reason why the Bank of Japan's (BoJ) use of unconventional policies proved unsuccessful. The problem was not the policies themselves, but that the BoJ's communication led the public to believe that these policies would be prematurely reversed.

A number of participants suggested that the BoJ had difficulty dealing with its independence. Borrowing from the title of Ken Kuttner's paper, one participant suggested that, like adolescents, the BoJ wanted independence, but once they had received it, they were not quite sure how to proceed, nor were they prepared to take responsibility for their actions. Another facet of the 'independence trap', referred to in Ito's paper, was the feeling of insecurity, which had led the BoJ to reject courses of action suggested by outsiders. A prominent example of this was the reaction to Paul Krugman's suggestion that the BoJ should announce a 4 per cent inflation target for 15 years. While the merits of the proposal were open to debate, one effect of Krugman's (undoubtedly bold) suggestion was to discourage the BoJ from taking bold action of any sort.

There was some discussion of the roles of different institutional factors in the debate over introducing inflation targeting. One participant suggested that the presumption of the debate seemed to be that the introduction of inflation targeting was entirely the decision of the BoJ. This contrasted with the international experience, where the introduction of inflation targeting was commanded by the government and not the central bank, though Australia was an obvious exception. The author responded that there was some support within the Ministry of Finance and among politicians to introduce inflation targeting, but this did not make it into the mainstream because the Finance Minister at the time, Kiichi Miyazawa, opposed the idea.

The role of academic economists in the debate over inflation targeting was also raised. One participant suggested that Ito's paper gave the impression that within Japan academics were on one side of the debate (supporting inflation targeting) and central bankers were on the other side (opposing inflation targeting). Yet the arguments presented by some academics, that Japan's difficulties reflected a supply-side shock and the impact of sizeable gains in China's competitiveness, indicate that there was some support from the academic community for the BoJ. That being said, such supply-side arguments were criticised by a number of participants.

In terms of the recent economic upswing in Japan, one participant cautioned against the risk of attributing the improvement in performance solely, or even largely, to monetary policy. The participant contended that performance had improved for other reasons, such as the flow-on effects from the continued strong growth in China and also balance sheet recovery in the corporate sector. Ito's paper was seen as particularly important in this regard, as it laid out the policy mistakes that had occurred, at least prior to the cementing of the most recent ZIRP.

One participant suggested that it was now opportune for the BoJ to introduce inflation targeting: the cyclical recovery had created some credibility for the BoJ in financial markets; the banks' bad debts were declining; and, there was greater confidence in equity markets. Another participant agreed, suggesting that the real challenge for the BoJ will come when it is ready to cease quantitative easing and move away from the ZIRP, at which time it may need to develop a new target. A number of participants thought that the introduction of inflation targeting could be of significant assistance in this regard.

Wrap-up Discussion

1. Alan Bollard

Compared to most people around this table, as a relatively new central banker I have so far had limited experience and exposure to monetary policy, so I thought I would talk from my strengths, reflecting my experiences.

Before becoming Governor of the Reserve Bank of New Zealand, for five years I was Secretary to the New Zealand Treasury. Before that, I was Chair of our competition authority, the Commerce Commission, for five years.

This leads me to comparisons between what I see happening in monetary policy with fiscal policy and competition policy, as examples of other areas of applied and policy-related developments in economics. Monetary policy is different in a number of ways. Monetary policy is quite mature in the way that people think about it and reach conclusions about it. In fact, I think it is probably the area where, if you could measure it, most has been done, most has been achieved, and there is most agreement about what one does. By contrast, among the theoretical underpinnings of fiscal policy you still hear a lot of discussion about things such as Ricardian equivalence or arguments about cause and effect. In the area of competition policy, people are still arguing about Schumpeterian views and would it not be a good thing to help promote R&D and intellectual property rights, or is competition and allocative efficiency the important thing to develop.

In monetary policy I am not hearing any unstable underlying debates about theoretical underpinnings. I think people pretty much accept and have now broadly agreed with these. And in that sense it is quite different from other areas of applied policy and related economics. If you look at policy applications, I think the same applies. As I see fiscal policy around the world at the moment, you still have things like the Bush political Keynesian revival going on. Indeed, where does that fit? There is a lot to play out of that yet. You have got quite big disagreements about how you run fiscal policy – look at Australia, which is just about to get rid of debt; look at Germany and the growth and stability pact; they are in completely different spaces – there are quite different understandings around where policy should work. The same I think is true with competition policy, where there is a lot of argument about how you prevent abuses of monopoly power and things of that nature.

We are talking about, it seems to me, a honed-down generally converged area, broadly called flexible inflation targeting, although there are arguments about quite whether particular approaches fit under that heading or not. This leads to a much more convergent and focused sort of discussion than we might have in other areas. This includes ways of talking about measures of inflation, yet we still find quite big differences, say in fiscal policy, about how you measure the effects of fiscal policy, and what fiscal conditions indices should have in them, as well as public accounting standards. In competition policy, the measures are still a long way away from convergence and there is disagreement about what constitutes market power or monopoly power. On monetary policy, as I see it, we are pretty much agreed, although, having said that of course, one starts to learn a lot at more focused levels. I thought I largely understood the various inflation measures, but having gone through the Robert Hill and the Alex Heath, Ivan Roberts and Tim Bulman papers, you know there is a lot more there if you really drill into it.

The second point I would make is that from what I see we have had a lot of discussion about monetary policy over time and monetary policy across countries. Broadly, I see monetary policy converging. For example, I see convergence across all of Ken Kuttner's four characteristics of flexible inflation targeting. With things like numerical targets we discuss whether 2 or 2.5 per cent is desirable – but these are very finely honed differences to be talking about. In regard to conduct and communication there is broad belief in things like an effective level of transparency. Likewise for behaviour, there is broad agreement about accountability, good governance and independence.

How has convergence happened? Well in quite different ways. You can talk about the early adopters versus the late adopters; you can talk about the textbook adopters versus the, if you like, adaptive adopters; you can talk about the clean sheet adopters versus the accommodative adopters. Of course, I am talking here basically about the underlying Bledisloe Cup of monetary policy – New Zealand and Australian differences and similarities. But, of course, you would expect that convergence would be happening at this stage of technological and policy development because there is very good communication not just from central banks to markets, but across all the researchers and operators of monetary policy around the world. And, I would argue, there is probably more communication amongst that group than almost any other group of equivalent economics-based policy-makers. So it is globalisation that is going to force this technology convergence. When one looks at how that networking takes place, how that convergence takes place, I guess there are some particular characteristics of monetary policy researchers that are relevant. They generally run out of central banks, and central banks tend to be well resourced and very well networked. Thus, I see quite a bit of fairly convergent research going on.

This is an area that, compared to other economic policy areas, is highly quantitative and perhaps mechanical, and of course there are risks in that. We are doing binary decision-making off analytical and forecasting information. In the Reserve Bank of New Zealand I, as a new Governor, have said 'Can you tell me about this or that?' and every time my staff have responded with quantitative answers to my questions, many of which I did not think were capable of quantification. So we can express risks, we can express regrets, we can express some uncertainties all in quantitative terms and we have got some techniques like fan charts that one sees more in this area than in other areas. It is a world of models; it is a world of working rules; and it is a world of reaction functions much more than any of those other policy realms that I have talked about.

Of course, there are dangers in that – there are dangers of not being able to assimilate qualitative information; there are dangers in overly mechanical interpretations and use of these sorts of policies; there are dangers in overuse of iconic things like transparency and accountability. Transparency only matters for what it delivers, and we have got to keep remembering that, and so too for accountability. It is also different from these other policy areas in that not only is there a big supply of policy discussion but there is also a massive public demand for it, and that is something that I have had to learn coming in. Financial markets want and demand continuous information. Central banks supply discrete information; and analysts arbitrage between the two. How do we best deal with that? Well, that is one of the things that, say for example, the Ellis Connolly and Marion Kohler paper talked about – a lot of really interesting stuff, but very hard to measure.

Is this going to change? Actually I think that, as has been mentioned, scanner data is a key to a future which could be quite different for central banks – electronic transactions being recorded and analysed in real time – we might be in a position where we are doing continuous monetary policy, if not discrete monetary policy. That might be good or bad.

Is there a danger of diminishing returns to research in this area? I think there could be. I see people drilling in quite scientific ways into particular bits of material trying to understand connections where really you are looking at quite small changes. For example, you are only going to get so far in trying to measure the impact of slightly different communication and transparency strategies.

One other observation I would make is that, compared to other policy areas, where generally you are looking at average or mean impacts of policy on particular variables in systems, monetary policy seems to be a world of variance, volatility, confidence intervals, instability, probability and uncertainty. I realise now we have volatility in this game and a lot of the discussion and a lot of the measures are around variance, not the mean.

We can get into questions that came out from Robert's paper, such as does it matter if the bias is stable, but you do not know what it is? That is drilling right into the depths in terms of response and effect that you do not get in these other policy areas. I recall LBJ running his presidential election on the third derivative – arguing that the increasing rate of inflation was slowing. Some of this sort of discussion reminds me of third derivatives.

But overall I see here a mature area of policy convergence, but possibly the risk of diminishing returns as we go on. I enjoyed Malcolm Edey's comment about how to say nothing. I had my LBJ moment in my first press conference. It is tough coming into the central bank governor's role where you have got complete transparency and press conferences. We had an interest rate track that went out and I described it – I said we had no change and this is a flat track and we had balanced risks – and a woman from one of the news agencies turned to me and said 'Dr Bollard, I understand you have no change, you have got a flat track and you have got balanced risks, but would that be biased in an upward or downward direction?'

2. Claudio Borio

It is a great pleasure for me to be here to share some personal reflections on the past and future of inflation targeting. 'Personal' should be taken literally. Although much of what I will be saying is based on research carried out with colleagues at the BIS and, in particular, with Phil Lowe, who is now back at the RBA, the views expressed are my own and do not necessarily reflect those of my colleagues or the BIS.

If I had to summarise my assessment of inflation targeting in a single sentence, it would be the following: So far so (surprisingly) good, but unresolved questions remain about the future … and the future has already started. Some of the challenges ahead are of a traditional type, and will not be the focus of my presentation. Obvious examples are more hostile supply 'shocks', such as sharp increases in oil prices of a magnitude similar to those experienced in the early 1970s and 1980s. Others are relatively new, and it is on these that I would like to elaborate. To my mind, these new challenges arise from the conjunction of a liberalised financial environment and the hard-won anti-inflation credibility. In this sense, they are the result of past successes rather than failures. The specific issue I would like to highlight is how to address booms and busts in credit and asset prices in a non-inflationary environment. To be sure, this challenge applies to monetary policy generally, regardless of the specific framework adopted. But, for reasons that will become clearer later, it is especially hard to address in some variants of inflation targeting.

Given the limited time available, let me anticipate the bottom line. In my view, addressing this challenge calls for three steps. First, it requires longer policy horizons than the 1–2 years commonly used in inflation-targeting frameworks and greater attention to the balance of risks to the outlook. As I will explain shortly, these two changes are intimately related. Second, and above all, it requires a change in the way we typically think of the role of financial factors in general, and booms and busts in credit and asset prices in particular, in business cycles. We need to bring them from the 'periphery' to the 'core' of our thinking. Finally, and supporting the previous two steps, it requires major communication efforts. These should be designed to explain how strategies that at first sight may appear inconsistent with an inflation-targeting framework are, in fact, fully compatible. This is true as long as the objective is interpreted, as it should, as securing price stability in a sustainable way. The key word here is 'sustainable'.

Let me first say a few words about the past, recalling briefly the record of inflation targeting, before focusing on the emerging challenge.

The past

Personally, I was originally quite sceptical about inflation targeting when it was first introduced. For someone who had spent a lot of time thinking about the 'intermediate target' problem in monetary policy, the idea that announcing a numerical objective for inflation could be the solution seemed rather bizarre. The perennial issue had precisely been ***how*** to achieve a given target to start with in the light of the serious informational limitations that plague policy (information lags, transmission lags, structure of the economy, etc). But inflation targeting, in contrast to monetary targeting or an exchange rate peg, say, is silent about these issues. Inflation targeting seemed to be a *prima facie* case of: 'if you cannot will the means, will the ends'. Moreover, I did not draw any further comfort from the observation that the countries adopting the inflation-targeting regime had exhibited a relatively less successful performance in controlling inflation. In this, one could even discern a certain element of 'doubling the bets' or, cynics might say, one of slight desperation: the countries adopting the framework had little to lose and had tried various alternatives in vain.

Contrary to my original expectation, however, inflation-targeting regimes have done remarkably well. As we have seen, countries adopting inflation targeting have been able to 'catch up' with the rest in terms of the level and variability of inflation.

To be sure, die-hard sceptics have raised questions about this too. They have noted that the sample period is too short to reach conclusions with great confidence. They have stressed that many other broad-ranging changes have taken place, such as the generalised shift to central bank independence, making it hard to assess the marginal contribution of inflation-targeting regimes. And they have emphasised that background economic conditions have been favourable, not least because of the absence of adverse supply-side 'shocks'. A rising tide lifts all boats.

Even so, while these objections may have some force, on balance, they go way too far. After all, countries adopting inflation targeting have been able to secure a goal that had remained elusive for so long. There was nothing pre-ordained or automatic about this. Inflation targeting has served them remarkably well. And it passes the ultimate 'no regrets' test: no country embracing inflation targeting has regretted doing so.

To my mind, the greatest merit of inflation targeting has been that of enhancing ***discipline*** in pursuit of price stability, both within the central bank and externally. Internally, it has done so by providing an unambiguous focus to help organise thinking, processes and actions. Externally, above all, it has supported this by providing a clear objective to focus expectations and a framework to evaluate central bank performance.

The bottom line is that in a generally favourable environment, inflation targeting has done its job, namely that of fostering, institutionalising and making operational the public's and body politic's support for price stability.

The future

So much for the past, what about the future? Will the recipes that have served us so well up to now continue to be as effective? The nagging concern is that this may not be so.

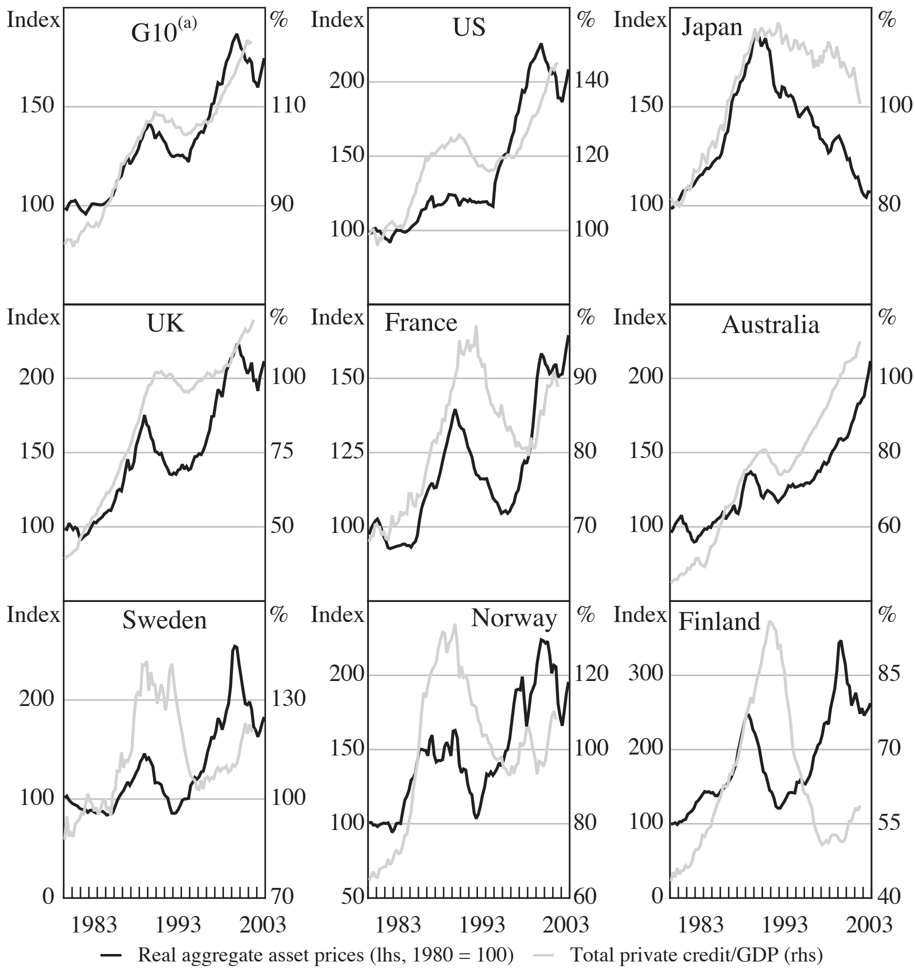
This concern is based on a broad hypothesis, namely that changes in the financial and monetary regimes worldwide may have been subtly altering the dynamics of the economy and hence the nature of the challenges that central banks face (Borio and Lowe 2002b, Borio and White 2004). On the one hand, financial liberalisation may have made it ***more likely*** that financial factors in general, and booms and busts in credit and asset prices in particular, act as drivers of economic fluctuations. On the other hand, the establishment of a regime yielding low and stable inflation, underpinned by central bank credibility, may have made it ***less likely*** that signs of unsustainable economic expansion show up first in rising inflation and ***more likely*** that they emerge first as excessive increases in credit and asset prices (the 'paradox of credibility'). As a result, the current environment may be more vulnerable to the ***occasional*** build-up of financial imbalances, that is, overextensions in (private sector) balance sheets driven by excessive credit and asset price increases, which herald economic weakness and disinflation down the road as they unwind. This unwinding can also raise the risk of financial strains and possibly broader financial instability. The unwinding may occur either because inflation eventually does emerge and the central bank is forced to tighten or because the boom falters under its own weight. And starting from a low level of inflation, this could also result in 'unwelcome disinflation' (sometimes a euphemism for the dreaded 'D' word, 'deflation').

What is the evidence for this hypothesis? This has been documented in a number of papers. Here, however, let me just briefly note three pieces of evidence and refer the reader to that work for further elaboration.

First, especially since financial liberalisation in the early 1980s, we have seen larger booms and busts in credit and asset prices across both industrial and emerging market countries (Borio and Lowe 2002b). These are illustrated in Figure 1, which shows the broadly coincident swings in (private sector) credit and asset prices in a number of industrial countries. Asset prices are measured on the basis of an aggregate asset price index, which weighs equity and property prices by estimates of their shares in private sector wealth. Not infrequently, such booms and busts have been followed by outright financial crises or at least serious financial strains with material consequences for the real economy.

Second, more formal empirical evidence indicates that proxies for financial imbalances based on real-time measures of ***joint*** excessive asset price and private sector credit increases can help to predict banking distress, economic weakness and disinflation over a 3–5 year horizon (Borio and Lowe 2002a, 2002b, 2004). Note that this horizon is longer than the 1–2 years normally used for monetary policy. This suggests that, on these occasions, it is possible to distinguish sustainable from unsustainable economic expansions exclusively on the basis of the characteristics of the boom. The underlying rationale for the composite indicator is straightforward. The asset-price component is a rough measure of ***misalignment***, which can be taken as an indicator of the likelihood and size of an asset-price reversal; the credit component (based on the ratio of private sector credit to GDP) is a rough measure of private-sector ***leverage*** and can be taken as an indicator of the absorption capacity of the system, and, hence, of the likely damage caused to the economy by the reversal in asset prices. Both of these elements measure deviations from the 'normal' range of historical experience and, importantly, have to be outside that range ***simultaneously***.

Figure 1: Large Medium-term Swings in Asset Prices and Credit

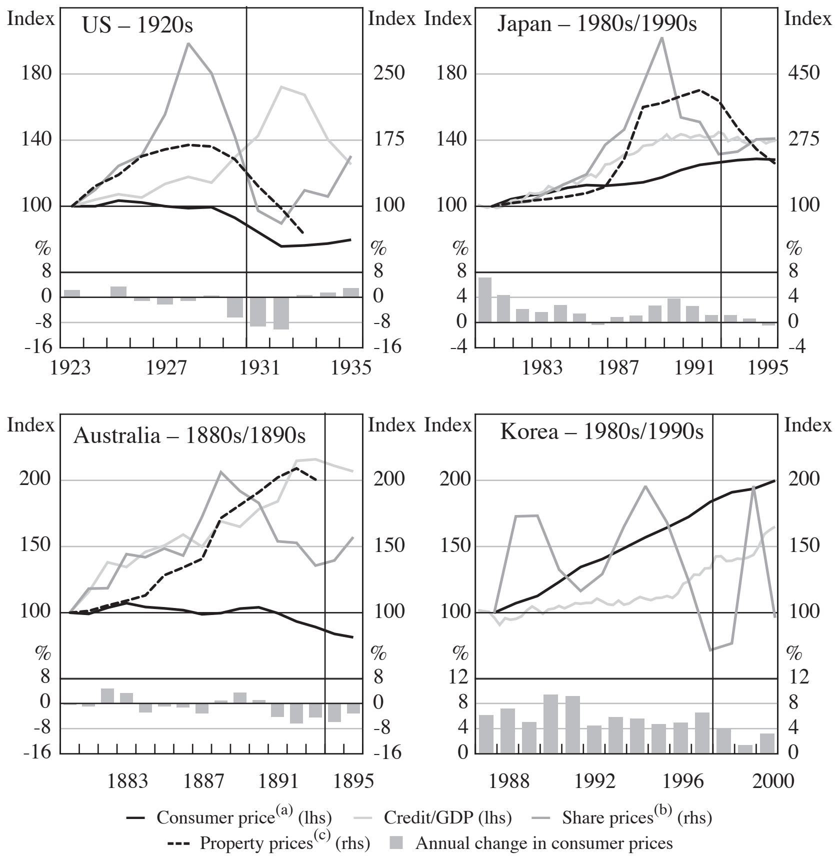


(a) GDP-weighted average of the Group of Ten countries, plus Australia, Denmark, Finland, Norway and Spain; weights based on 2000 GDP and PPP exchange rates.

Sources: BIS calculations; Borio and White (2004); national data; private real estate associations

Finally, financial imbalances have also frequently occurred during periods of low and stable inflation (Figure 2, Borio and Lowe 2002b). This has been true during both the classical and exchange gold standards; think, for instance, of the booms and busts in Australia in the late 1880s–early 1890s and in the United States in the run-up to the Great Depression. And it has also been evident more recently, as in the cases of Japan in the late 1980s–early 1990s, a number of east Asian countries in the late 1990s and, later still, the United States. In this context, one may also wonder about the booms in residential property prices under way in several economies.

Figure 2: Low and Stable Inflation and Financial Instability – Selected Episodes



(a) For Australia – GDP deflator

(b) US – S&P 500, Japan – Nikkei 225, Australia – All Ordinaries, Korea – Korean Stock Exchange KOSPI composite

(c) US – Chicago land value, Japan – Tokyo commercial land prices, Australia – Melbourne capital value of rateable property

Notes: Vertical lines indicate times of significant financial system distress. Index base year = 100 – US 1923, Japan 1980, Australia 1880, Korea 1987

Sources: For property prices: Australia – Kent and D'Arcy (2001); Japan – National Land Agency and local governments; US – Hoyt (1933). For other data: Borio and White (2004); Global Financial Data Inc (http://www.globalfindata.com); national sources

This hypothesis has implications for both prudential and monetary policy.

Here, I have no time to discuss the significant implications for prudential policy, which have been explored in some depth elsewhere (see, for example, Borio 2003). Let me just note that I would caution against the natural reaction of many macroeconomists, who expect prudential policy to do the job. First, prudential authorities would legitimately raise a whole host of technical objections against the use of the tools at their disposal – not unlike those raised in the context of monetary policy – and would be reluctant to address problems that they would tend to see as falling outside their remit owing to their perceived macroeconomic origin. Moreover, while it is legitimate to consider prudential policy as a first line of defence, it may not be a fully effective one. Serious macroeconomic consequences can arise even if financial imbalances do not lead to a full-blown banking crisis. Arguably, capital market financing is subject to similar boom-and-bust cycles. In addition, as imbalances unwind, banks may remain relatively healthy and willing to supply credit to creditworthy clients but borrowers may come under great pressure to retrench and cut expenditures in order to restructure badly damaged balance sheets. In other words, the source of disruption may be weak demand for external funding rather than unusually restrained supply. Finally, arguably it is central banks that have the ultimate control over credit expansion in the economy.

As regards monetary policy, the key implication is that the framework should allow enough flexibility for policy to lean against the build-up of financial imbalances ***even if near-term inflation pressures remain subdued***. A tightening can help to reduce the size of the imbalance and hence also the risk that the subsequent unwinding will have serious consequences for the economy. In fact, in extreme downturns, if interest rates were forced to zero, the effectiveness of the monetary levers could also be seriously impaired, as indicated by the Japanese experience.

Such a strategy, however, may be especially difficult to implement in certain inflation-targeting frameworks for both operational and political economy reasons.

Operationally, it calls for a careful consideration of events and risks ***beyond a 2–year horizon.*** The cumulative processes underlying financial imbalances take time to unfold and the timing of the unwinding is highly uncertain. But relaxing the constraints of 1–2 year horizons is especially hard in those inflation-targeting frameworks where these are seen as the cornerstone to evaluate the performance of the central bank, as underpinned by the rhetoric of the frameworks, possibly with the additional presentation of formal forecasts. Note also that, importantly, the extension of the horizon should ***not*** be interpreted as a simple mechanical extension of point forecasts. Because of the uncertainties involved, this would be highly misleading. And true transparency requires recognising not just what we know but, more importantly perhaps, what we do not know. Rather, the longer horizon should be used as a device to assess the balance of risks faced by the economy and the costs of policy action and inaction in a more meaningful and structured way. Therefore, the two concepts – horizon and balance of risks – are intimately related and mutually supportive.

From a political economy perspective, it is generally very hard to explain a tightening of monetary policy when the main objective, inflation, is well behaved, not least if the economy and asset prices are booming. But this is especially hard in those inflation-targeting regimes where the whole rhetoric has trained the public, markets and the body politic to judge success or failure exclusively on the basis of the attainment of inflation objectives over short horizons, as a means of enhancing the accountability of the central bank.

Needless to say, I am fully aware of the objections to such a pre-emptive policy response aimed at addressing the build-up of financial imbalances. Many would prefer to limit the response to cushioning the unwinding, if and when it occurs. Serious questions have been raised about the feasibility of identifying imbalances with sufficient confidence, about the difficulties in calibrating the policy response and about its effectiveness.

While powerful, as argued elsewhere, I do not feel that these objections rule out the occasional use of monetary policy altogether (for example, Borio and Lowe 2002b, Borio and White 2004). To my mind, it is therefore essential that the ***frameworks*** allow the authorities sufficient room for manoeuvre to pursue a pre-emptive strategy when they judge that, on balance, financial imbalances raise material risks for the economy. Of course, I do recognise that major efforts are required to establish a sounder basis for such a strategy. We need more analytical work on the relationship between financial imbalances, the real economy and inflation. We need more empirical work on the identification of imbalances and their response to policy. Above all, we need more educational efforts to explain how such strategies are consistent with securing price stability on a ***sustainable basis***. Central banks should take a leading role in this debate; some already have. Even so, policy-makers may not have the luxury to wait until these efforts bear full fruit. As economic events unfold, judgements need to be made based on necessarily incomplete information. And, as noted, the future has already started. The fortunes of inflation targeting could well depend on a successful response to this challenge.

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3. Pierre Duguay

I am pleased to be taking part in this conference on the future of inflation targeting. As Ken Kuttner reminded us, inflation targeting is now in its adolescence. Like all adolescents, it needs guidance, and this conference has much to offer. Adolescence is also a time of self-doubt. So let me start by putting our adolescent's mind at ease: inflation targeting has a promising future. It is the clearest framework yet for conducting – and explaining – monetary policy.

I will focus my remarks on four points heavily debated at this conference: Is inflation targeting too inflexible? Are inflation-targeting central banks less than candid? What is the contribution of forecasts to monetary policy communication? And, what have we learned about the inflation process under inflation targeting?

But, first, let me congratulate the Reserve Bank for including a session on price measurement. It is important for an inflation-targeting central bank to delve into the arcane art of price measurement, to promote improved measurement of price indices, and to encourage statistical agencies to display greater transparency when it comes to reporting quality adjustments. And that is not primarily because measurement errors take on greater significance at low rates of inflation. Indeed, since price indices are used to calculate real GDP and real income, measurement errors are equally important at high rates of inflation: they affect the measures of real income, productivity, and potential output. Furthermore, a reduction in the (positive) measurement bias of price indices that is not accompanied by an equivalent reduction in the targeted inflation rate would prompt an easing of monetary policy that would result in higher growth rates of nominal wages, nominal income and money supply, and higher interest rates (eventually). If, instead, the target rate is adjusted along with reduction in the bias, monetary policy would not respond, and all these rates would remain unchanged in nominal terms (though higher in real terms).

That said, let me now turn to the first question.

Is inflation targeting too inflexible?

Should inflation-targeting central banks not acknowledge the short-run trade-off they face between stabilising output and stabilising inflation when confronted with supply shocks? The consensus that seems to emerge from this conference is that inflation targeters are more flexible in practice than their rhetoric would suggest – although Ken Kuttner has argued that we may not, as yet, have been truly tested. My take on this is different. When monetary policy is credible and inflation expectations are well anchored to the target – and there is ample evidence that successful inflation targeting does indeed anchor expectations – supply shocks have one-off price-level effects. They do not produce a trade-off between future inflation and the output gap.

When focusing on the trend of inflation, or inflation two years ahead, a credible inflation-targeting central bank accommodates one-off price-level shifts from supply shocks and avoids any undue destabilising influence on output and interest rates that may arise from lags in the effect of monetary policy actions. In my estimation, it need not do more.[1] Besides, we must keep in mind that potential output is not known with any degree of certainty. It has to be estimated judgementally, along with the trend of inflation. At the Bank of Canada, we use a variety of indicators of trend inflation and capacity pressures (Bank of Canada 2002; Macklem 2002) and regard persistent forecast errors on core inflation as a signal that our estimates of potential output need to be re-assessed (Thiessen 1997; Dodge 2001).

Are inflation-targeting central banks less than candid?

At the Bank of Canada, we have been very explicit about our focus on the trend of inflation (because of the lags in the effects of monetary policy), our willingness to accommodate one-off price-level shocks, and our intention to resist any second-round effects. Our communications emphasise that inflation control helps keep the economy near its potential, by prompting the Bank to take actions to curb both excess demand and excess supply. We are one of the few central banks (along with the Reserve Bank of New Zealand) to present an estimate of the output gap and to give a forecast of when we expect the gap to close. And we have found that this helps, rather than hinders, communication. I would argue that inflation-forecast targeting is an answer to the so-called 'central bank dirty little secret'; it clearly establishes inflation control as the goal of monetary policy and clarifies the role of the output gap as an indicator of inflationary pressures. Moreover, inflation targeting acts as an economic stabiliser in the case of demand shocks.

It is not surprising that inflation-targeting central banks put so much emphasis on transparency. Transparency is needed for accountability (given the lags in the effects of monetary policy and the unavoidable reliance on imperfect forecasts); it is instrumental in raising the effectiveness of monetary policy; and it is significantly facilitated by the clarity of the inflation-targeting framework. But, how much transparency is useful, and how much is too much? To us, transparency is not about votes, about minutes, or even about detailed forecasts. It is about telling a coherent story – a story that explains the logic of central bank decisions and allows the public, and markets, to make their own assessment of future Bank actions, based on their own outlook for the economy and inflation. These independent assessments, in turn, provide a valuable alternative source of intelligence informing the Governing Council's deliberations (Macklem 2002).

We believe in keeping the story simple and focused on key macroeconomic developments over the policy horizon. More importantly, we try to convey a sense of the risks to the outlook, and of the conditionality of monetary policy actions, by listing the main factors that we will be watching in the period ahead. Among inflation-targeting central banks, our *Monetary Policy Reports* and *Updates* are the shortest (25–30 pages and 4–6 pages, respectively). And they are published only two days after a scheduled interest rate announcement. We try to provide a

1. The choice of a policy horizon that prevents unnecessary fluctuations in output can be motivated by a loss function expressed in terms of the squared derivations of inflation from target and of output from potential.

full and timely account of the factors driving monetary policy decisions. Thus, we find it gratifying that Fracasso, Genberg and Wyplosz (2003), who rated the Bank of Canada's *Monetary Policy Report* poorly on the amount of detail provided, but highly on clarity, actually found that clarity was the single most important characteristic in helping markets to anticipate monetary policy actions.

What about forecasts?

The Bank of Canada's projections for output and inflation incorporate an endogenous policy response that will generally close the output gap and bring (core) inflation to target over the policy horizon (18 to 24 months).[2] The projection described in the *Monetary Policy Report* is the Governing Council's and may differ from that of the staff. Therefore, the projections for output and inflation (both core and headline) reveal a great deal about the objective of monetary policy. They do not, however, reveal much about future policy actions, since the policy interest rate responds to the forces acting on the output gap and inflation, not to the outcomes.[3]

The Bank does not publish the interest rate path that underlies its economic projection, as that would do little (in our view) to reduce financial market risk. This is because our commitment is to our policy objective, not to a particular interest rate path. Under inflation targeting, the effect of shocks falls primarily on interest rates. Therefore, the projected interest rate path is subject to considerable revision from one projection to the next, as new information is processed. It does not constitute a reliable guide to future policy actions. Nonetheless, staff estimates of the interest rate path required to bring or to keep inflation on target, conditional on their analysis of macroeconomic developments, constitute a critical input for the Governing Council's deliberations.

I see significant problems with the use of a constant interest rate assumption to formulate macroeconomic projections. From a communications point of view, because such projections are silent on the policy objective, they cannot help but raise questions about the central bank's commitment to the target. (I must confess that I find it more suspicious than remarkable that those inflation-targeting central banks that use a constant interest rate assumption typically end up with inflation projections that hit their target. This strikes me as an implausible coincidence.) Also, from a decision-making perspective, constant interest rate projections can be quite misleading. Typically, the mounting pressure that develops under such a scenario will cause interest rates to jump when the constraint is lifted. In the forward-looking projection model that we use at the Bank of Canada, the anticipation of such a jump serves to mute the consequences of holding the interest rate constant for a while, thus severely understating the risks involved.

2. Under an endogenous policy response in the context of a targeting rule rather than a reaction function, output and inflation beyond that horizon are tacitly projected to remain near potential or target, since shocks, by definition, cannot be forecast.

3. Indeed, the true test of whether a central bank targets inflation is not found in the correlation between its policy moves and changes in its inflation forecast, but in the absence of correlation between inflation at $t+k$ and information at time t (Rowe and Yetman 2000).

What have we learned about the inflation process?

We have observed a significant reduction in the persistence of inflation movements as monetary policy has gained credibility and inflation expectations have become solidly anchored to the target. This implies that the high level of inflation persistence observed historically is related more to shifts in the nominal anchor and to uncertainty about monetary policy (confirming the old adage that inflation is indeed always and everywhere a monetary phenomenon) than to the sluggish adjustment to marginal costs highlighted by the new-Keynesian perspective (Kozicki and Tinsley 2003). Indeed, new evidence shows that individual prices tend to adjust fairly rapidly to sector-specific shocks, but more slowly to macroeconomic (monetary) disturbances (Boivin, Eliasz and Giannoni 2004).

We have found in Canada – as have Alex Heath and her co-authors for Australia – that successful inflation targeting erodes the predictive power of core measures of inflation (Armour, forthcoming), or of any leading indicator for that matter, since the best forecast of future inflation then becomes the targeted rate. This does pose problems for the econometrician. But it also provides an opportunity to estimate the time-varying neutral, or natural, interest rate (Rowe 2002).

In Canada, we have also observed increased volatility in high-frequency movements of headline, and even core, inflation in the last few years, as relative price adjustments have become magnified under a stable nominal anchor. This is not particularly worrisome, since it is the longer-term predictability of inflation, or its trend over time, which matters most for production, spending, and investment decisions. But it is worth noting. Another notable finding is the apparent reduction in the pass-through of both exchange rate and energy price changes to core inflation (Bailliu and Bouakez 2004; Bank of Canada 2000).

Conclusion

All things considered, inflation targeting provides a robust framework for conducting and explaining monetary policy. That is not to say that the conduct of monetary policy can no longer be improved. But I find it quite remarkable that the inflation-targeting strategy that we laid out in our 1991 background document (Bank of Canada 1991) still applies today. While the implementation and communication of policy have evolved significantly – towards increased transparency – the basic strategy hasn't changed materially.

When we revised our background document in 2001 (Bank of Canada 2001), we emphasised the longer-term predictability of inflation and proposed an additional measure of accountability: we pointed out that if deviations of the annual inflation rate from the target midpoint were actually random – as they should be under successful inflation targeting – then inflation averaged over a number of years should stay within a range that narrows in proportion to the square root of the number of years in the average (Crawford 2001).

Let me conclude by expressing the hope that the idealism and rebellious spirit that animate adolescence will spur exploration of further progress towards price stability. Somehow, there is something unsatisfactory about a statement that would say: we aim to foster confidence in money by eroding its purchasing power at a slow, steady, and predictable pace.

I hasten to add, however, that many of the unwarranted criticisms levelled at inflation targeting would become quite relevant for price-level targeting. Discussion of escape clauses and factors conditioning the choice of the horizon over which the price level is to be brought back to target following a supply shock would take on added significance – as would the choice of the targeted price index. On the other hand, the fear that price-level targeting would involve costly declines in the price level is demonstrably unwarranted (Duguay 1994).

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4. Glenn Stevens

It's been a fascinating conference and what I'd like to do is to put my remarks into two parts: first the past – experience with inflation targeting to date, and second, more speculatively, the future – where to for inflation targeting from here?

Inflation targeting was, of course, adopted originally against a background of fairly unsatisfactory performance by almost all of the countries which chose it, including ourselves. But the fact that it's been successful thus far I think is fairly clear on four counts.

Firstly, the outcomes have been pretty close to target, in our case perhaps more so than even the optimists might have expected. Inflation targeters have delivered what they promised. Secondly, and not unrelated, the inflation process seems very well anchored. It's perhaps only a slight exaggeration to characterise Alex Heath's findings as saying that in Australia, if you want to make a forecast of inflation, just write down the number 2.5.

A third measure of success is the way questions of measurement of prices are coming up, as we saw in Robert Hill's paper. Ten or fifteen years ago, when we were trying to get out of two decades of 8 per cent inflation, these were second- or third-order questions that never got a hearing. They still may not be first-order questions, I think, but the fact that they are discussed at all is, in some sense, a sign of how far we've come.

Fourthly, inflation targeting amongst the earlier adopters has been emulated by many others, in particular a number of emerging-market countries. That is presumably a sign that it is regarded as a successful model, not just by the initial practitioners, but more broadly.

There's been some evolution in the conduct of inflation targeting. This was mainly in the rhetoric, as was made clear in Ken Kuttner's paper. The rhetoric initially was tougher than the action in most cases. Policy-makers have tended to move towards a more flexible rhetoric in recent times. Actions, as Ken showed, have in fact always been reasonably flexible. In Australia, given the way we came to inflation targeting – that is, with a strong sense of the need for flexibility – the trend towards more open acknowledgement of flexibility is one that we very much welcome.

Communication has been a big part of inflation targeting, and has been a big part of this conference. I was quite taken by David Gruen's amended version of Warwick McKibbin's curve, and the point that, if you went back 10 or 15 years, central banks were generally at the far left-hand end of that curve. That is, there was an unsatisfactory degree of transparency. Things have improved a great deal since then, and we are now arguing about the point at which diminishing, or even negative, returns to further transparency might be encountered. Of course, opinions will vary on this, but Rick Mishkin made the point quite nicely that *total* transparency is not necessarily optimal. Rather than simply assuming that more disclosure must, by definition, be better, I think it is useful to come at this issue by asking what sort of disclosure actually will help deliver the best outcome in terms of the quality of the policy decision and the economy's response to it. If we can, from here on, have a more subtle discussion as a result of those sorts of considerations, that would be a step forward.

So what of the future of inflation targeting?

To take up the language used by Ken Kuttner and others during the conference, thinking of inflation targeting as an adolescent, we could say that, like most adolescents, some parts of its character are already formed, while others are still a work in progress. Its attempt to be forward-looking, to work on anchoring expectations through its words, while remaining reasonably flexible in its actions, are evident and will surely continue.

Communication is still evolving though, and some observers still want something more. In discussion on this point I think I heard that the academics wanted more technical details of forecasts, while market practitioners wanted more 'stories', as opposed to more numbers and forecasts. We didn't hear from members of the media, but the media would surely have an interest in more material. So that area of inflation targeting no doubt remains a work in progress – hopefully with the criteria in mind of maximising the quality of policy decisions, as opposed to maximising transparency *per se*.

In thinking about monetary policy regimes, it's worth asking the question: will there be some event, or some set of shocks, that will overwhelm them and sweep them away? After all, history has disposed of more than one regime. When we think of monetary targeting, for example, it was swept away by financial liberalisation. This changed the demand function for money in ways that made money growth so unpredictable we couldn't use that policy approach any more. Exchange rate pegs have usually tended to break, once the cost of keeping them exceeded the benefits of doing so.

So could there be events which overwhelm inflation targeting?

It's true that adolescent inflation targeting, as several have pointed out, has been shielded thus far from adverse supply shocks. That won't always be true, so an issue for the future is how well we will cope with supply shocks when they come. I am more confident today than I used to be about handling supply shocks, because inflation expectations are so much better anchored. That means that we have more flexibility in dealing with supply shocks than we once would have had.

Could there be some sort of asset-price episode which could overwhelm inflation targeting? I suppose that remains a possibility, though inflation targeting has not been shielded from asset-price booms and busts to date – it hasn't had an entirely sheltered existence thus far. Several countries have grappled with the issue, and continue to do so.

The response seems to be to allow the system to evolve – a capacity which is in my view crucial. If that can continue, then there is a good chance that, like any organism, inflation targeting can evolve to adapt to changing circumstances. The ways in which it will need to evolve probably have to do with stressing flexibility, thinking about longer horizons and so on – the sorts of things that Claudio Borio talked about. Given such evolution, there are reasonable prospects that fairly big events can be handled without the framework being overwhelmed.

If inflation targeting does continue, will more countries adopt it? In 10 years' time, if we have another conference on inflation targeting, will we have the Fed, the ECB and the Bank of Japan here as practitioners? It's an interesting question on which to speculate – though I don't claim to know the answer.

Certainly some of the reservations that Japan has expressed about inflation targeting are being taken away by the effluxion of time. It does look like Japan will be back in inflation before too long, and therefore needing to find an exit strategy from the 'unconventional policy', so inflation targeting may well be a sensible choice for them, as Taka Ito suggests.

I don't know about the outcome for the other two major central banks. The ECB is arguably very much like an inflation targeter anyway. As for the Fed, I personally don't think there's all that much difference between what we're doing in Australia, and what the Fed is doing. If the world continues to evolve much as it has for the past decade, any distinction could well become virtually impossible to detect.

Of course, if there is a set of adverse supply shocks, the distinctions could get clearer. It is for precisely these sorts of circumstances that those who have reservations about inflation targeting tend to stress the need for flexibility, so as to give weight to output concerns. But with 10 or 15 years of credible inflation targeting behind them, and very strongly anchored expectations, it could well be the inflation targeters who find themselves to have the most flexibility in dealing with that shock. If that occurred, then it may change the thinking of some other countries about the usefulness of inflation targeting.

So to conclude, I think it has been a fascinating conference. It's been very nice to have this against the background of a successful practice of inflation targeting for, in our case, 11 years now. I can recall the 1992 conference on monetary policy and inflation, where we *thought* we were about to embark on a successful period of holding inflation down, but couldn't be sure. Things have turned out well on the inflation front both in Australia and most other places over that period. Bearing in mind Alan Bollard's point about the possibility of diminishing returns to ongoing research here, maybe we shouldn't have another conference on inflation targeting too soon. But if we do have one some years hence, hopefully that also will be against a background of success, dealing with as yet unknown shocks.

5. General Discussion

The discussion in the wrap-up session built on a number of themes that had been considered earlier in the conference. One focal point was the likely durability of inflation targeting in the face of significant challenges, such as adverse supply-side shocks or substantial asset price swings. But as one participant noted, whatever the nature of future challenges, and even if they were to force a major evolution of the monetary policy regime, there would be a number of constructive legacies of inflation targeting. These include the re-establishment of low inflation expectations (which would make it easier to deal with various challenges), a deeper understanding of the economy and the inflation process, as well as an acceptance of the importance of communication with the public and financial markets. Another participant suggested that the inflation-targeting approach placed greater emphasis on central bank independence than other policy regimes, which was an important reason for the success of the approach. This might prove problematic, however, in a less benign environment. For instance, dealing with abnormally large shocks may require a far greater degree of policy coordination between monetary and other areas of public policy, such as fiscal policy and prudential regulation, as was highlighted by Takatoshi Ito's discussion of Japan.

Another theme discussed in the wrap-up session was the appropriate horizon for monetary policy. One participant suggested the generally accepted one- to two-year horizon made sense because it corresponded to a reasonable horizon for the transmission of monetary policy. This view was not widely shared. Numerous participants supported, in principle, extending the horizon beyond the typical two years in order to account for a number of possible challenges. Foremost among these were the potential for large adverse supply shocks and large swings in asset prices to have lasting effects on inflation and economic activity. Some participants noted, however, that this would be problematic given the difficulties already entailed in forecasting out to two years. One participant warned that if the horizon was extended, policy may end up reacting to phantom shocks, which may increase the variability of inflation and output. This view was tempered by the argument that monetary policy was fundamentally about decisions under uncertainty, and that uncertainty affected not just inflation, but also output and financial sector developments, which also need to be taken into account by policy-makers. It follows that it might be necessary to at least form broad judgements about what might happen more than two years hence in order to determine the appropriate setting of policy at the present moment.

The pros and cons of different types of central bank communication were also raised. One participant from the press noted that, given the varied demands on the central bank, it was not possible for a particular level of transparency and communication to please everyone. Having said that, in the context of the various approaches around, the RBA probably had the balance about right. This sentiment was shared by several participants. There was a general consensus among the press and financial market economists that qualitative 'stories' from the central bank were just as important, if not more so, than hard numerical forecasts. As one participant noted, this was contrary to the academic literature on central bank behaviour, which focused on quantification and formal mathematical modelling. From the perspective of central bankers, the academic literature also tended to focus on second-order issues, such as whether the central bank should publish its model and reaction function. As such, until the academic literature was better able to depict actual central banking behaviour, there was likely to be a disconnect between the findings of the academic literature and the ability of central banks to assimilate those findings. On the upside, a rethinking of the methodology of modelling central bank action will hopefully provide some new insights for practitioners.

Finally, one participant from the financial markets noted that maintaining low inflation over the inflation-targeting period had proved to be much easier than envisaged when inflation targeting was first introduced. Part of the reason was that the world had become more 'inflation proof' with globalisation, the emergence of China and a more benign wage-setting environment. In the context of the 'constrained discretion' characterisation of monetary policy in an inflation-targeting regime, the return and maintenance of low inflation led this participant to suggest that there was greater scope for central banks to act with discretion and incorporate other elements into the inflation-targeting framework. This was seen as a feasible and desirable development.

Biographies of Contributors

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Claudio Borio

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Gordon de Brouwer is Principal Adviser (Macroeconomic) at the Australian Department of the Treasury. He was previously Professor of Economics in the Asia Pacific School of Economics and Government and Executive Director of the Australia-Japan Research Centre at the Australian National University (ANU). His research has spanned economic developments in Australia, Japan and east Asia, as well as open economy macroeconomics and policy, monetary and financial economics, and international relations. Dr de Brouwer's publications include *Hedge funds in emerging markets* (2001), *Financial integration in east Asia* (2003), and he is the contributing editor of *Financial governance in east Asia* (2003) and *Financial markets and policies in east Asia* (2001). He is co-author of *Strengthening Australia-Japan economic relations* (2002), a major report written for the Department of Foreign Affairs and Trade. Before joining the ANU in January 2000, Dr de Brouwer was Chief Manager, International Markets and Relations, at the Reserve Bank of Australia. Dr de Brouwer holds a PhD from the ANU, and a Masters of Commerce from the University of Melbourne.

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Pierre Duguay is a Deputy Governor of the Bank of Canada, a position he has held since January 2000. Pierre Duguay has published on numerous topics, including the monetary transmission mechanism, the macroeconomic effects of fiscal policy, and macroeconomic modelling; he has been a member of Statistics Canada Price Measurement Advisory Committee since 1999 and a member of Statistics Canada National Accounts Advisory Committee from 1994 to 1999. Prior to his current appointment, Mr Duguay served in a number of senior positions with the Bank of Canada, including Adviser to the Governor (1992–1999), Chief of the Research Department (1991–1992), and Chief of the Department of Monetary and Financial Analysis (1987–1991). Pierre Duguay has an MA in economics from the Université de Montréal.

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international perspectives, based on a joint BIS-SAFE seminar. After joining the BIS in October 1994, he analysed fixed income and foreign exchange markets, and authored a BIS monograph on bond market volatility. He also published several works questioning the consensus that the euro would appreciate from its inception, including the Princeton Essay, *The euro and the dollar*. Before joining the BIS, he worked for 13 years for the Federal Reserve Bank of New York, serving at times as chief economist for the interagency committee of bank supervisors that rates country risk. There he wrote on international comparisons of the cost of capital, foreign bank lending to US corporations and the unprofitability of foreign direct investment in the US. In 1992 he taught international finance and the multinational firm at the University of Chicago's Graduate School of Business. In 1999, MIT Press published his co-authored book, *Dodging bullets: changing US corporate capital structures in the 1980s and 1990s*.

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Frederic Mishkin is the Alfred Lerner Professor of Banking and Financial Institutions at the Graduate School of Business at Columbia University, a Research Associate of the National Bureau of Economic Research, a Senior Fellow at the Federal Deposit Insurance Corporation Center for Banking Research and the President-Elect of the Eastern Economic Association. Professor Mishkin has published extensively on monetary policy and its impact on financial markets and the aggregate economy in leading journals and is the author of more than ten books. Prior to his current appointment, he was Executive Vice President and Director of Research at the Federal Reserve Bank of New York and an associate economist to the Federal Open Market Committee of the Federal Reserve System. Professor Mishkin has taught at a number of universities, including Chicago, Northwestern, Princeton and Columbia. Professor Mishkin holds a PhD from the Massachusetts Institute of Technology.

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Andrew Stone is a Senior Research Manager in the Economic Research Department of the Reserve Bank of Australia, where he has worked since January 2001. Prior to that he spent just over five years at the Australian Department of the Treasury, after returning to Australia from the US, where he worked for a year as a Visiting Assistant Professor in the Mathematics Department of the University of California at Irvine. Dr Stone has published articles in a number of mathematics journals, as well as in the Bank's Research Discussion Paper series. Dr Stone holds a PhD in Pure Mathematics from Stanford University, and a Graduate Diploma in Economics from the Australian National University.

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John Williams is a Senior Vice President and Advisor in the Economic Research Department of the Federal Reserve Bank of San Francisco. Dr Williams has published articles on numerous topics including the implications of a low-inflation environment for monetary policy, monetary policy rules, inflation expectations, business cycles, and long-run growth. Prior to his current appointment, Dr Williams served as a Senior Economist at the Council of Economic Advisers and as a Senior Economist at the Board of Governors of the Federal Reserve System, where he was active in developing the staff's large-scale macroeconometric model, FRB/US. Dr Williams holds a Master's degree in economics from the London School of Economics and a PhD in economics from Stanford University.

List of Conference Participants

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Michael Blythe	*Commonwealth Bank of Australia*
Alan Bollard	*Reserve Bank of New Zealand*
Claudio Borio	*Bank for International Settlements*
Jillian Broadbent	*Company Director* and *Reserve Bank of Australia Board Member*
Tim Bulman	*Reserve Bank of Australia*
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Barry Hughes	*Credit Suisse Asset Management*
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