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Research Discussion Paper

Inflation Targeting: A Victim of Its Own Success?

Christian Gillitzer and John Simon

RDP 2015-09

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August 2015

Economic Research Department
Reserve Bank of Australia

This paper was presented at the RBNZ/IJCB Conference ‘Reflections on 25 Years of Inflation Targeting’, Wellington, New Zealand, 1–2 December 2014. A revised version is forthcoming in the *International Journal of Central Banking*. We would like to thank Troy Matheson and Emil Stavrev for sharing Matlab code used to estimate Phillips curves with time-varying coefficients. We are grateful for comments provided by Christopher Kent and Peter Tulip. The views expressed in this paper are those of the authors and do not necessarily reflect the views of the Reserve Bank of Australia. The authors are solely responsible for any errors.

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Abstract

Since the introduction of inflation targeting, inflation expectations have become firmly anchored at target and there has been a flattening of the Phillips curve. These changes mean that a ‘divine coincidence’ between headline inflation and output gap stabilisation is less apparent than when inflation targeting was introduced. This has led some to call for a fundamental re-engineering of inflation-targeting regimes: either adopting explicit dual mandates or replacing headline inflation with a target inflation measure more closely related to domestic output gaps. We argue instead for an evolution in the practice of CPI inflation targeting. In practice, many central banks have already moved in this direction with the adoption of flexible inflation-targeting frameworks.

JEL Classification Numbers: E31, E52, E58

Keywords: inflation targeting, Phillips curve, Australia

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Inflation Targeting: A Victim of Its Own Success?

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1. Introduction

Despite one of the largest global recessions in decades during the financial crisis, global inflation barely budged. In some respects, this could be seen as a triumph for inflation targeting – inflation remained close to target despite some of the largest economic shocks in living memory. In the eyes of some, however, the financial crisis has demonstrated the weaknesses of inflation targeting. It has been argued that, in the face of record levels of unemployment in many economies, central banks should weigh unemployment outcomes much more heavily in their objectives. There have also been arguments that central banks, in responding to imported inflation shocks while domestic demand is depressed, or focusing on low headline inflation while asset prices are accelerating, have focused on inappropriate or misleading inflation measures. This paper makes the argument that these two, seemingly contradictory, outcomes – inflation remaining close to target and inflation targeting being heavily criticised – are a reflection of the general success of inflation targeting. Like a vaccination program, once the disease is effectively conquered, people begin to question the value of vaccination. This means that the communication challenges for central banks are magnified, but it doesn't necessarily mean that the vaccination program itself, inflation targeting, needs to be fundamentally re-engineered.

To reach this conclusion, we first look at the behaviour of inflation in Australia over the past 25 years or so since inflation targeting was introduced. While we look at data from Australia, reflecting our familiarity with the Australian experience, the findings are illustrative of a broader experience that is common across most inflation-targeting central banks, and our subsequent discussion is not specific to any one country (see IMF (2013)). We document significant changes in the behaviour of inflation over that time period: long-term inflation expectations have become firmly anchored at target inflation rates; the simultaneous flattening of the Phillips curve has contributed to a substantial reduction in the variability of prices affected by domestic monetary policy; and imported inflation now accounts for a much larger share of the variability in consumer price inflation than in the past, while also having less ongoing influence on inflation.

These changes in the inflation process have made CPI inflation a less reliable guide to the appropriate stance of monetary policy. Changes in CPI inflation are now more likely to reflect idiosyncratic shocks than changes in domestic economic conditions. Furthermore, the flattening of the Phillips curve, whether caused by or coincident with the adoption of inflation targeting, has complicated the task of identifying deviations in output from potential and, thus, forecasting inflation. Inflationary pressures arising from imbalances between demand and supply are smaller and more difficult to separate from idiosyncratic variation in inflation.

We consider the implications of these changes in the inflation process for the conduct of inflation targeting over the next 25 years. We focus our discussion around the central bank objective of maintaining price stability rather than also exploring the other major responsibility of central banks – financial stability. This is not to say that financial stability is not important. Rather, it is a sufficiently large topic that it would be difficult to do it justice within the same paper. Notwithstanding this, we do touch on financial stability considerations to the extent that financial stability can affect price or output stability. Thus, reflecting our focus on the price stability mandate, we discuss two particularly prominent proposals for change: either adopting explicit dual unemployment-inflation mandates; or changing the target to a measure more closely related to domestic economic conditions than CPI inflation. Our discussion emphasises that a breakdown in the correspondence between output and inflation stabilisation, caused in part by the success of inflation targeting, motivates these proposals for change and can help understand the perceived ‘failings’ of inflation targeting during the recent crisis. We conclude by suggesting some particular areas of the practice of central banking that will need to change and improve if inflation targeting is to celebrate its 50th anniversary 25 years from now. We do not recommend wholesale change, but there may be some scope for enhancements.

2. The Past 25 Years

When inflation targeting was first introduced in New Zealand 25 years ago, the world was a very different place to the one we know today. In New Zealand, inflation was hovering around 7 per cent and interest rates, both monetary policy and mortgage, were in the high teens. The high interest rates were a reflection of the fact that, with limited inflation credibility, an aggressive policy response was required to reduce inflation. The situation was not so different in Australia: highly

contractionary monetary policy in the early 1990s – mortgage interest rates were around 18 per cent – preceded a large disinflation and the adoption of inflation targeting. Previous frameworks, such as fixed exchange rate regimes and money demand targeting, had broken down and the even higher inflation and interest rates experienced in the 1970s were very much an ongoing concern rather than the distant memory they are today.

Since those times, our understanding of what inflation targeting means and the practice of inflation targeting has evolved substantially, as has the economic environment. This early evolution occurred in small open economies such as Australia, Canada and New Zealand, and was driven by the practicalities of making monetary policy decisions in an uncertain world. There were large debates about how to implement inflation targeting and the questions that were asked then are not so different from the ones being debated today. Policymakers and academics debated: Should the target be aggregate consumer prices or only non-traded consumer prices? Should asset prices be included in the objective function or not? What was the appropriate horizon for achieving an inflation target?

From these debates, and the experience gained implementing inflation targeting, emerged the inflation-targeting frameworks we have today. These frameworks are commonly described as ‘flexible inflation targeting’, whereby central banks give priority to controlling inflation over the medium run but, where the opportunity exists, stabilise output or employment as well. Furthermore, while targets are invariably stated in terms of headline inflation, underlying inflation measures are routinely used as a guide for policy. These frameworks have proved to be remarkably successful in both reducing inflation and anchoring expectations. As we demonstrate in this section, the successful implementation of inflation targeting has dramatically altered the behaviour of inflation.

A direct way of seeing one aspect of this change in behaviour is to look at the way long-term inflation expectations respond to inflation surprises. If expectations are well-anchored they should not respond to surprises. On the other hand, if inflation expectations are adaptive or otherwise poorly anchored one would expect to see revisions to longer-term expectations when a surprise occurs. To assess this we use Consensus Economics forecasts of inflation and look at the way expectations change between the March and September quarters. The change in current year inflation expectations between these two dates is a good indicator of the inflation

surprise between those dates. Reflecting our comparative advantage, we conduct this exercise on Australian expectations – results for other countries are similar.¹

Formally, for forecast horizons up to six years ahead, we estimate the regression

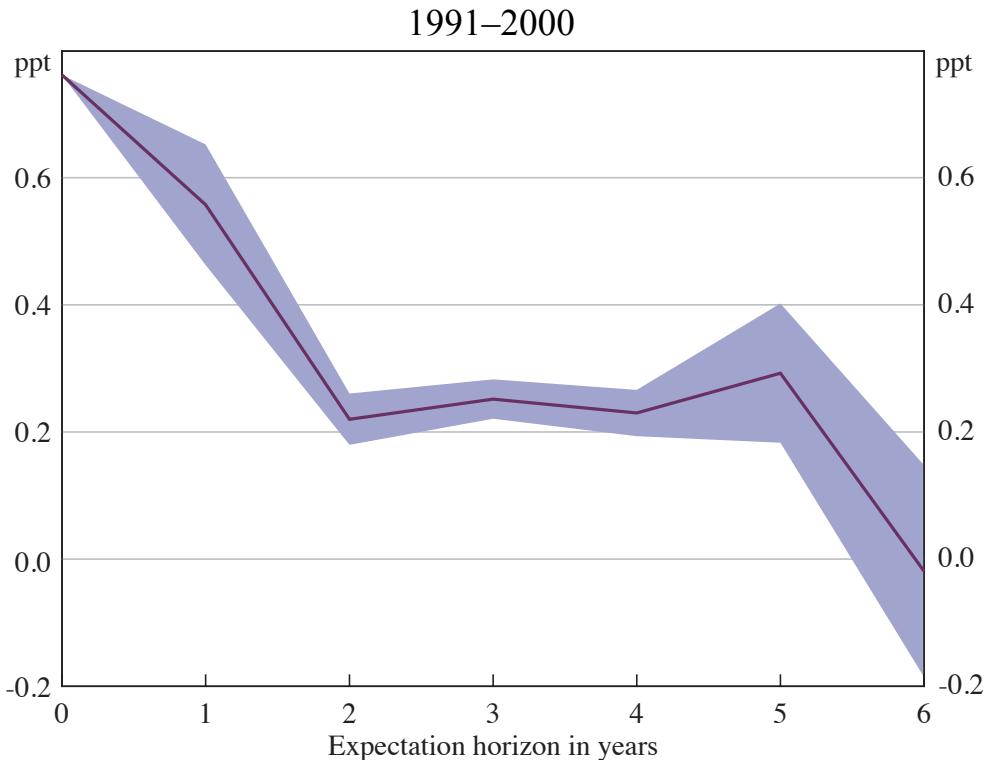
$$F_t^{Sep} \pi_{t+h} - F_t^{Mar} \pi_{t+h} = \alpha_h + \beta_h (F_t^{Sep} \pi_t - F_t^{Mar} \pi_t) + \varepsilon_{t+h}$$

where $F_t^{Sep} \pi_{t+h}$ is the September quarter Consensus forecast in year t for inflation in year $t+h$, and similarly for the other forecast terms in the regression. The coefficient β_h is the estimated revision to inflation expectations at horizon h in response to a surprise in current-year inflation.

Data are available from 1991, so we split the sample approximately in half, with a sample from 1991 to 2000 that covers the initial years of inflation targeting in Australia and a sample from 2001 to 2013 reflecting more recent experience. We estimate regression coefficients β_h for each sample period, and show in Figures 1 and 2 the response of inflation expectations to a one standard deviation surprise in current-year inflation: $F_t^{Sep} \pi_t - F_t^{Mar} \pi_t$. In the pre-2000 period for Australia, a one standard deviation surprise (March to September) in current-year inflation tended to raise professional forecasters' inflation expectations at a five-year horizon, but in the post-2000 period inflation surprises have had a negligible effect on expectations (abstracting from base effects). Inflation expectations are clearly better anchored today than they were when inflation targeting was first being established in Australia.

¹ See IMF (2011).

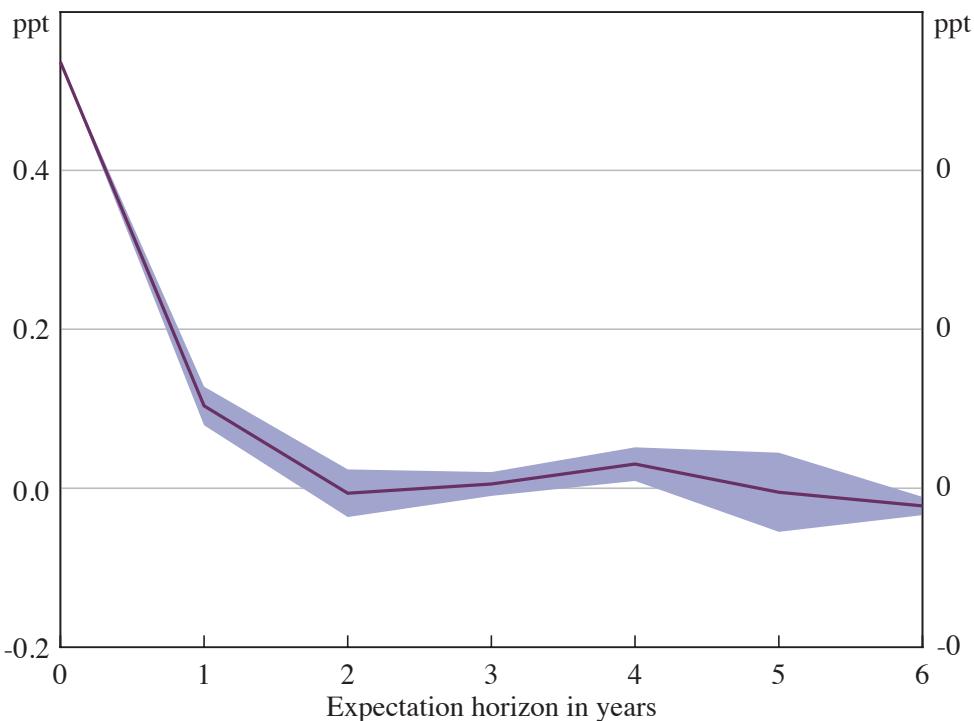
Figure 1: Response of Inflation Expectations to a Surprise Change in Current-year Inflation – by Horizon



Note: Change in year-on-year Consensus inflation expectations between the March and September quarters for the current year and each year out to a six-year horizon, in response to a one standard deviation surprise in current-year inflation

Sources: Authors' calculations; Consensus Economics

Figure 2: Response of Inflation Expectations to a Surprise Change in Current-year Inflation – by Horizon
2001–2013



Note: Change in year-on-year Consensus inflation expectations between the March and September quarters for the current year and each year out to a six-year horizon, in response to a one standard deviation surprise in current-year inflation

Sources: Authors' calculations; Consensus Economics

While this evidence is relatively direct and transparent, it is only partial. There are other ways in which inflation targeting may have affected the behaviour of inflation. For example, there is ongoing debate about whether the relationship between economic slack and inflation has been changing or, conversely, whether more stable inflation has been a sign of small levels of economic slack despite heightened unemployment.² Furthermore, particularly in small open economies, there has been a debate about the changing influence of imported goods and services prices on domestic inflation. To address these issues in a more comprehensive way, we estimate a relatively standard New-Keynesian Phillips curve. To allow for the fact that the inflation process may have changed over time, we estimate a model with time-varying parameters using a non-linear Kalman filter developed by Matheson and Stavrev (2013). This framework allows us to simultaneously examine changes in the slope of the Phillips curve, the degree of

2 See Debelle and Vickery (1997) and Kuttner and Robinson (2008).

anchoring in inflation expectations, and the level of the non-accelerating inflation rate of unemployment (NAIRU).

More technically, in our estimation annualised inflation π_t is described by a Phillips curve that depends on inflation expectations π_t^e , the deviation of unemployment from its natural rate ($u_t - u_t^*$), and import price inflation $\hat{\pi}_t^{4,m}$:

$$\pi_t = \pi_t^e - k_t(u_t - u_t^*) + \gamma_t \hat{\pi}_t^{4,m} + \varepsilon_t^\pi.$$

The import price term is demeaned tariff-adjusted import price inflation relative to CPI inflation, in year-ended terms. Inflation expectations is a weighted average of a forward-looking measure, long-term Consensus inflation expectations, and a backward-looking measure, lagged year-ended inflation:³

$$\pi_t^e = \theta_t \bar{\pi}_t + (1 - \theta_t) \pi_{t-1}^4.$$

The unemployment gap evolves according to the first-order autoregressive process

$$(u_t - u_t^*) = \rho(u_{t-1} - u_{t-1}^*) + \varepsilon_t^{(u-u^*)}$$

with the NAIRU evolving according to a random walk process:

$$u_t^* = u_{t-1}^* + \varepsilon_t^{u^*}.$$

The shock $\varepsilon_t^{(u-u^*)}$ is interpreted to be a demand shock, and $\varepsilon_t^{u^*}$ a shock to the level of the natural rate of unemployment. The slope of the Phillips curve $k_t \geq 0$, the weight on long-term inflation expectations $1 \geq \theta_t \geq 0$, and the coefficient on import prices $\gamma_t \geq 0$ are time-varying, each evolving according to a constrained random walk. The coefficient ρ is constant throughout the sample period.

³ After 1991, the long-term inflation expectations series is Consensus' forecasts for CPI inflation 6–10 years ahead; expectations are surveyed in the June and December quarters, and we linearly interpolate between observations. From 1986 to 1991, we use long-term inflation expectations implied by inflation-indexed bonds, and before 1986 expectations are proxied by the difference between 10-year nominal bonds and an estimate of the world real interest rate (see Debelle and Laxton (1997)).

The natural rate of unemployment and time-varying parameters are treated as unobserved states, and estimated using a constrained non-linear Kalman filter. A non-linear Kalman filter is required because the measurement equation is multiplicative in unknown state variables: the natural rate of unemployment and the coefficient on the unemployment gap are both allowed to be time-varying.

Initial values for the shock variances are calculated using 10-year rolling non-linear least squares regressions, with the parameters and the natural rate of unemployment assumed to be constant within each 10-year window. Constrained maximum likelihood is used to estimate the parameter ρ and the shock variances, subject to the constraint that the estimated shock variances are no larger than across the 10-year rolling windows. Because there is a potential identification problem for the unemployment gap demand shock $\varepsilon_t^{(u-u^*)}$ and the natural rate shock $\varepsilon_t^{u^*}$, the relative variance of these two shocks is imposed. We follow Matheson and Stavrev (2013) in choosing $S \equiv \text{var}(\varepsilon_t^{(u-u^*)}) / \text{var}(\varepsilon_t^{u^*})$ equal to 15, resulting in relatively stable estimates for the natural rate of unemployment; for robustness we also estimate the model assuming $S = 5$, which results in a relatively flexible NAIRU (shown on Figure 3 but the corresponding parameter estimates are omitted on Figures 4–6 for clarity – they are qualitatively similar to those shown).⁴ We estimate the system at a quarterly frequency for the period 1965–2013, using CPI inflation excluding interest charges and health and tax policy changes.⁵

Figures 3–6 report the two-sided smoothed estimates of the natural rate of unemployment and the slope parameters. The estimated NAIRU depends on the imposed degree of stability, and so the size of the unemployment gap at any point in time is quite uncertain, the more so at the end points. To give a sense of the uncertainty inherent in these estimates, we present two such estimates in Figure 3. Furthermore, as we discuss later, changes in the inflation process have made it much more difficult to estimate the NAIRU precisely. As such, little weight should

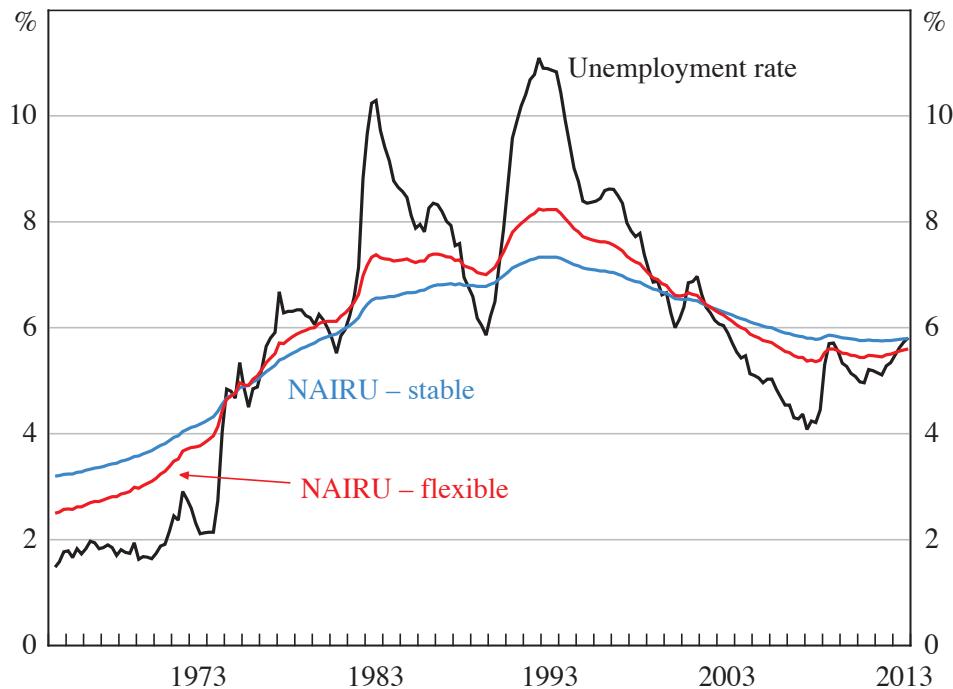
⁴ To avoid convergence on unrealistic variances for the shock processes when $S = 5$, we restrict the estimated variances of the shocks to the parameters k_t , θ_t and γ to be no less than one-quarter of their estimated magnitude in 10-year rolling regressions; at an optimum, these constraints do not bind.

⁵ The official target measure for Australia used Treasury underlying inflation between 1993 and 1998; the econometric results are similar using Treasury underlying inflation in place of CPI inflation for this period.

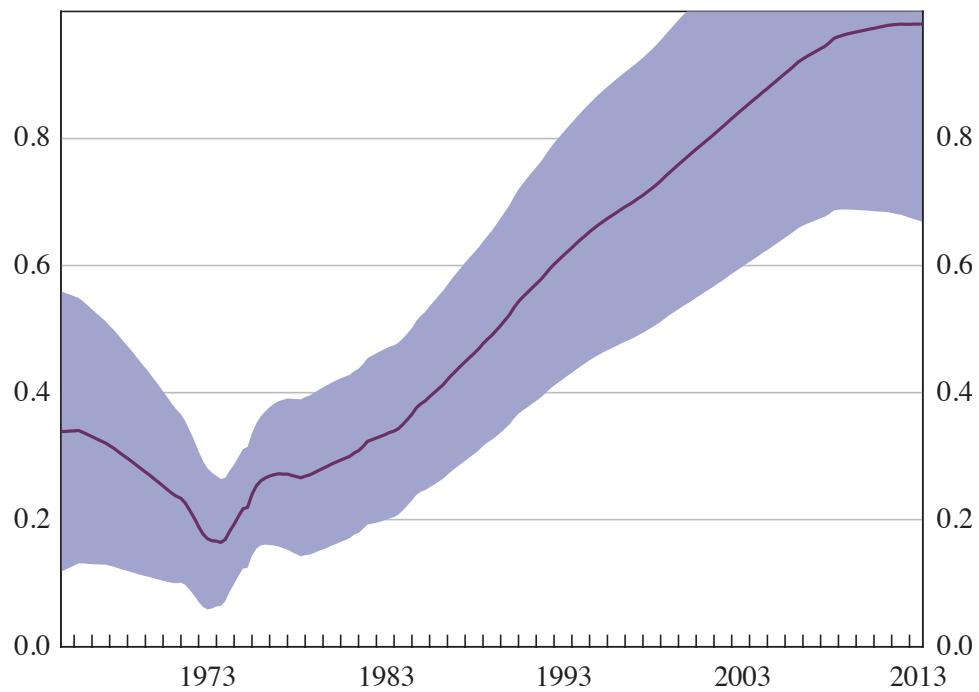
be placed on the particular estimates of the NAIRU shown here. For our purposes, the important aspect of these estimates is that we use a NAIRU that is internally consistent; the estimates of the other parameters are not particularly affected by the degree of smoothness we impose on the NAIRU.

Turning to the parameters of most interest, we see that, following the introduction of inflation targeting, inflation has become more firmly anchored on long-term expectations, and less on the previous year's inflation rate: the coefficient θ_t on long-term bond market inflation expectations has risen toward unity over the inflation-targeting period. Furthermore, since the introduction of inflation targeting, long-term inflation expectations have themselves become better anchored: since 1998, long-term inflation expectations have never deviated from the midpoint of the RBA's inflation target by more than 0.2 percentage points, unlike in earlier years when co-movement between long-term expectations and current inflation was clearly evident. At the same time, the coefficient k_t on the unemployment gap has become smaller, indicating a flattening of the Phillips curve. Although tradeable inflation now accounts for a larger share of overall inflation variability, the speed with which import price changes pass through to consumer price changes appears to have slowed. In particular, Figure 6 shows that the effect on consumer price inflation of a one standard deviation increase in year-ended import price inflation is estimated to have declined over the inflation-targeting period.

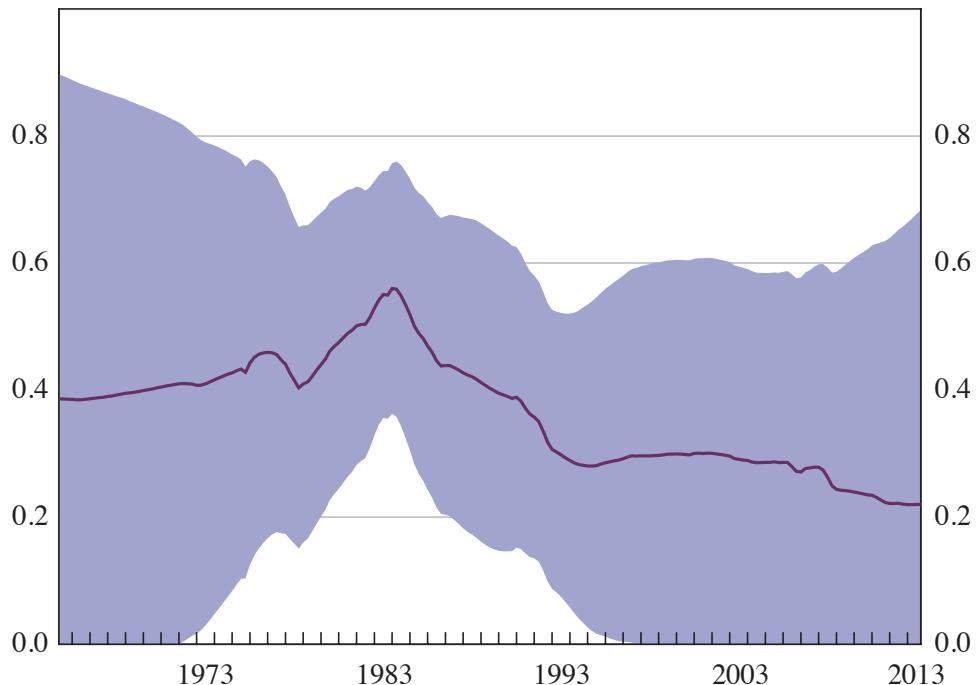
Our econometric results suggest that shocks have much less of an effect on inflation now than prior to the introduction of inflation targeting. The wage-price spirals that economists of the 1970s worried about seem to be less of a concern today, reflecting better-anchored inflation expectations, but also decentralisation of the wage-bargaining process. The transitory nature of inflation surprises in an inflation-targeting world is confirmed by a trend-cycle decomposition of inflation. For the United States, Stock and Watson (2007) show that the variance of the trend component of inflation declined sharply in the mid 1980s, following the Volcker disinflation, and declined further after 1990, falling to a level of volatility not seen since the mid 1950s. Variability in the transitory component is largely beyond the control of central banks, and has remained unchanged. Thus, the share of inflation variability accounted for by transitory shocks has risen sharply.

Figure 3: Unemployment Rate and the Natural Rate of Unemployment

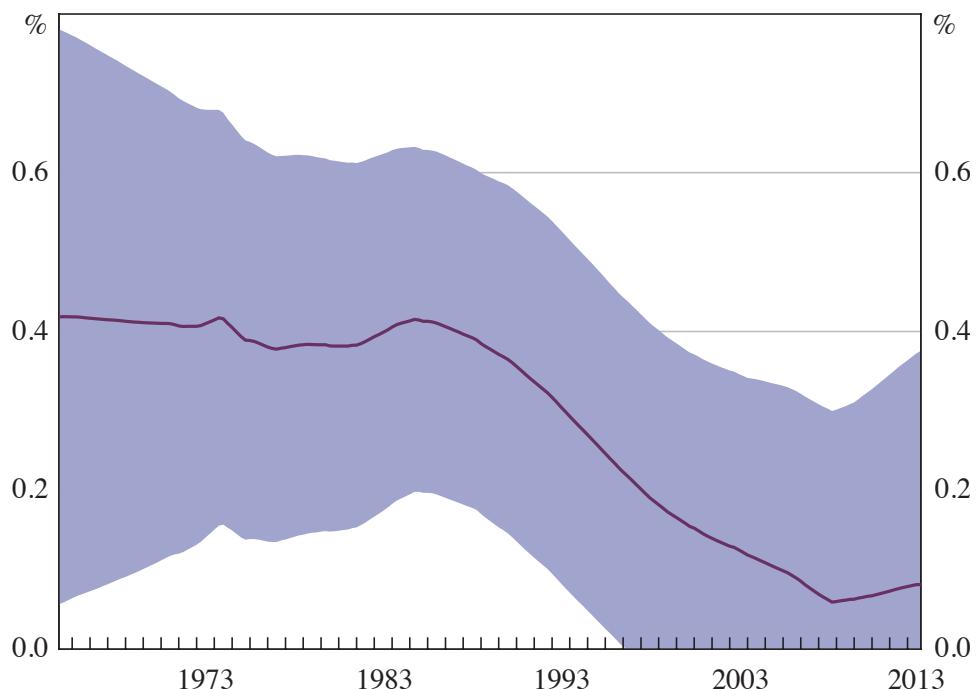
Sources: ABS; Authors' calculations

Figure 4: Anchoring of Expectations – Θ 

Note: \pm one standard deviation confidence interval is shown

Figure 5: Slope of Phillips Curve – κ 

Note: $\pm/-$ one standard deviation confidence interval is shown

Figure 6: Response of CPI Inflation to a One Standard Deviation Increase in Real Import Prices

Notes: $\pm/-$ one standard deviation confidence interval is shown; import prices have been adjusted to include tariff changes

For Australia, a simple way to see this change in the inflation process is to compare tradeable and non-tradeable inflation between the 1980s and 1990s, when inflation targeting was in its infancy, and today. Although tradeable inflation includes a domestic retailing component, a large portion of the variation in tradeable goods and services prices reflects external influences. Consistent with the results of Stock and Watson (2007) for the United States, the first panel in Table 1 indicates that there has been a negligible change in the variance of tradeable inflation in the pre- and post-inflation targeting periods. (We exclude the disinflationary period from these calculations to guard against attributing the mean shift in inflation to variability in the pre-inflation targeting period.) In contrast, the variance of non-tradeable inflation – the set of prices influenced by Australian monetary policy – has fallen by more than half. Compounding the increase in the relative importance of imported inflation, the covariance between tradeable and non-tradeable inflation has declined between the pre- and post-inflation targeting periods. The persistence of non-tradeable inflation has fallen together with its variance between the pre- and post-inflation targeting periods: the sum of the autoregressive coefficients for non-tradeable inflation falls from 0.44 in the pre-inflation targeting period to 0.21 in the post-inflation targeting period (see the second panel in Table 1). Consistent with our earlier results, the variance of shocks to non-tradeable inflation, estimated by the residuals of the autoregressive models for the pre- and post-inflation targeting periods, has fallen substantially. There is little evidence of persistence in tradeable inflation in the pre- or post-inflation targeting periods.

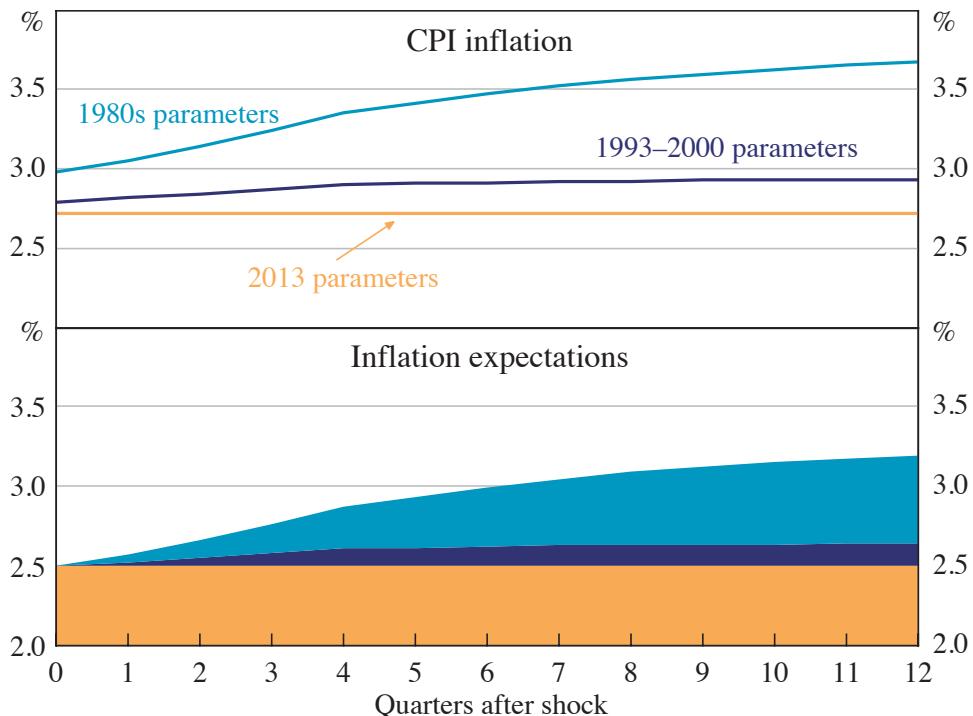
Table 1: CPI Inflation Variance Decomposition – Australia

		Pre-inflation	Post-inflation
		targeting	targeting
		1982:Q2–1990:Q4	1993:Q1–2013:Q4
Original series	Variance: non-tradeables	0.90	0.15
	Variance: tradeables	0.60	0.58
	Covariance	0.31	-0.02
Autoregressive model: p-lags			
Non-tradeables	Sum of coefficients	AR(1): 0.44	AR(4): 0.21
	Variance of residuals	0.69	0.12
Tradeables	Sum of coefficients	AR(0): 0	AR(2): -0.16
	Variance of residuals	0.60	0.49
	Covariance of residuals	0.22	-0.03

Notes: Data are in percentage points, at a quarterly frequency, excluding tax changes and interest charges; lag lengths were selected using the AIC criterion

Associated with these changes, the relationship between unemployment and inflation has become substantially weaker. To illustrate the flattening of the Phillips curve, we forecast the response of inflation under old and current parameter values to a sustained one percentage point deviation in unemployment below its natural rate. Figure 7 indicates that the predicted response of inflation to an unemployment gap is now smaller than under parameter values estimated prior to and in the early years of inflation targeting. Inflation is less sensitive to an unemployment gap than in the past for two reasons: first, the slope of the Phillips curve has declined, and second, because inflation expectations are now firmly anchored on the inflation target, the increase in inflation caused by the unemployment gap has a negligible effect on inflation expectations.⁶ The contribution of inflation expectations to predicted CPI inflation for each scenario is indicated by the shaded areas in Figure 7. The sensitivity of inflation to import prices is also estimated to have declined, although our scenario assumes unchanged import prices.

⁶ We assume long-term inflation expectations remain anchored at target, which we believe is reasonable provided deviations from the inflation target caused by policy errors are rare.

Figure 7: Predicted CPI Inflation

Notes: Inflation is at an annualised rate; prior to the shock, the unemployment gap is assumed to be equal to zero and inflation expectations to be 2.5 per cent per annum; ‘1980s parameters’ uses the average of the estimated model parameters for the 1980s, and analogously for ‘1993–2000 parameters’; ‘2013 parameters’ uses the estimated model parameter values at end 2013

With a flatter Phillips curve, much of the variability in inflation is now dominated by transitory changes, and deviations in unemployment from its natural rate are more difficult to detect in inflation data than in the past. Excess demand pressures are more likely to be swamped by noise than in previous decades. Conversely, changes in unemployment and output are less useful for forecasting inflation than in the past. In a particularly stark demonstration of this point, Atkeson and Ohanian (2001) found NAIRU-based inflation forecasts to now be little better than naïve inflation forecasts of US inflation. For Australia, this was demonstrated by Heath, Roberts and Bullman (2004).

3. The Next 25 Years

As we have seen, there is strong evidence that 25 years of inflation targeting have delivered inflation processes that are much better anchored and much less affected by the business cycle than they were before the advent of inflation targeting. Although we focused on Australia above, its experience is illustrative of the

experience of many countries around the world.⁷ These changes mean that the challenges facing central banks are likely to be of a quite different character to the challenges dealt with over the past 25 years. Moreover, the financial crisis has stimulated a renewed debate about whether inflation targeting is the most appropriate way to conduct monetary policy. We suggest that it is – subject to some evolutionary changes. But, before we get there, it is useful to review some of the criticisms that have been directed at inflation targeting since the financial crisis. We discuss the alternative monetary policy frameworks that have been suggested in light of these criticisms and how these criticisms are a natural consequence of the changed behaviour of inflation over the past 25 years. It is, ultimately, the fact that the changed behaviour is a reflection of successful inflation targeting that argues against wholesale change.

3.1 A Flavour of the Debate

The financial crisis has been the catalyst for much criticism of inflation targeting. Wren-Lewis states

Whatever the causes, there is now a clear conflict between what a sensible UK monetary policy would be doing and what is actually happening. Monetary policy is not providing enough stimulus to the UK economy, because it is focusing on the inflation target, and not the output gap. Inflation targeting in the UK is not working, and something needs to change. (Wren-Lewis 2013)

Joe Stiglitz (2011) put it thus, ‘[t]he idea that targeting inflation will lead to financial stability or that focusing on only price and financial stability is sufficient for maintaining a low output gap and stable and robust growth is fundamentally flawed’.⁸ Jeffrey Frankel (2012a) has already prepared an obituary for inflation targeting, writing that ‘[t]he monetary regime, known affectionately as “IT” to its friends, evidently passed away in September 2009’.

7 See IMF (2013).

8 Notably, however, he acknowledges the following in a parenthetical comment immediately after his criticism ‘(In extreme cases, of course, where the issue is not 3, 4, or 5 percent inflation but more like 10 percent inflation, central banks must focus on inflation as well. But in places like the United States and Europe, *where inflation has been controlled*, this is not the issue.)’ (emphasis added). We believe this really is the issue and discuss it further below.

These criticisms stem from a view that, given depressed economic conditions, central banks should be running very stimulatory monetary policy, pretty much regardless of the rate of headline inflation. While central banks have generally been running stimulatory policy, the criticism is that they have not been aggressive enough because of fears of breaching their inflation targets. For example, it is suggested that the European Central Bank delayed lowering interest rates because it was overly concerned about headline inflation rates that were being boosted by temporary oil and commodity price increases. In the United Kingdom, as alluded to by the quote from Wren-Lewis above, the suggestion is that persistently high inflation outcomes and rising inflation expectations constrained the stimulus that the Bank of England provided.

In short, in the view of many critics, current monetary policy frameworks place too much weight on CPI inflation. The solutions that have been proposed address the perceived shortcomings in two main ways. One strand of suggestions has been to focus on inflation measures other than the consumer price index – in particular, to focus on measures that respond more closely to domestic cyclical conditions. For example, targets could be defined in terms of the rate of increase in labour earnings net of productivity gains (unit labour costs). Monetary policy would thus be tightened when abnormal increases in wages signal bottlenecks in the labour market. Another suggestion is to give asset price inflation more prominence in monetary policymaking, given the large asset price rises that occurred during the first decade of the 2000s and their role in the financial crisis. Asset price developments may signal changes in financial stability and, thus, inform judgements on the risks to output. To the extent that monetary policy can influence asset prices, sacrificing near-term output by ‘leaning against the wind’ could in some circumstances more than offset the expected future output cost of a financial crisis. While both labour earnings net of productivity gains and asset price changes are still measures of inflation, the ideas have at their heart the goal of choosing targets that are more in line with output fluctuations. If the economy is booming, it is argued, it is more likely to be showing up in wage measures or asset price rises than in headline inflation.

The other main strand of suggestions is to target output fluctuations more directly. For some, this would be an explicit mandate to stabilise output – similar to the Federal Reserve’s so-called dual mandate. In this dual-mandate framework, central banks’ decisions would be based not only on their views about inflation, but also

on direct measures of output and unemployment gaps. Central banks would thus have more discretion to allow inflation fluctuations if addressing them would exacerbate cyclical downturns. Alternative approaches would incorporate output into the framework by making nominal GDP the target of policy.

3.2 What are the Options?

As discussed above, there are two broad suggestions for how to ‘fix’ inflation targeting given the tensions revealed in the aftermath of the financial crisis: (i) modify the particular definition of inflation that is being used or (ii) incorporate output into the target more explicitly. There is, also, a third option to maintain the current framework. We discuss these general suggestions next.

3.2.1 Modify the target definition

During the Great Moderation there was an unusual correspondence between stabilisation of CPI inflation and output: cost-push shocks were short-lived and typically small. But as the Bank of England’s experience illustrates, this correspondence has broken down. Confronted with persistent imported inflationary pressures, it has been argued that the CPI inflation target restricted its ability to accommodate non-domestically generated variation in inflation. In contrast, the rise of China and other emerging market economies as low-cost producers of manufactured goods in the 1990s and early 2000s restrained tradeable inflation and allowed central banks to tolerate relatively high rates of non-tradeable inflation. Put this way, it seems natural to consider adjusting the target inflation measure to allow for a greater degree of flexibility.

Adopting an inflation measure that corresponds more closely to domestic economic conditions reduces the potential conflict between output and inflation stabilisation, while maintaining a credible nominal anchor for monetary policy. A target inflation measure that abstracts from idiosyncratic variation is attractive because doing so holds the central bank responsible only for the prices under its influence.

Replacing CPI inflation with non-tradeable inflation as the target measure, for example, would largely abstract from commodity price and exchange rate movements. As Bharucha and Kent (1998) explain, targeting non-tradeable rather

than CPI inflation allows the central bank to tolerate relatively large movements in the exchange rate. They draw attention to the exchange rate channel of monetary policy transmission, and show using a small open economy model that it is optimal for a central bank with a non-tradeable inflation target to respond relatively aggressively to supply and demand shocks, at the expense of exchange rate and CPI inflation variability. Targeting a non-tradeable inflation measure does not hold central banks responsible for cross-country spillover effects of export price inflation, but neither does current practice: Inflation-targeting central banks use consumer rather than producer price target measures.

A complication associated with adopting non-tradeable inflation as the target measure is that non-tradeable inflation has consistently exceeded tradeable inflation. Because non-tradeable inflation is a biased measure of average CPI inflation, consumer inflation expectations might become anchored at this higher level because it was the target of policy. If so, policymakers would have to either tolerate a higher level of average inflation, or engineer a costly disinflation to align the pace of non-tradeable inflation with the existing inflation target.

As mentioned earlier, another alternative is to adopt a measure of labour earnings net of productivity as the target measure, potentially providing a better indication of the trend pace of inflation than a consumer price measure. A drawback is the notorious difficulty in estimating productivity growth: reliable productivity estimates are only available for the market sector, and the data are often substantially revised. Changes in the composition of employment over the business cycle would also complicate the use of a labour cost target measure to guide monetary policy. Furthermore, such a measure would abstract from the important role that changes in margins play in the inflation process.

3.2.2 Target output more explicitly

Rather than change the target inflation measure, central banks could adopt an explicit output stabilisation objective, to complement the inflation target. A dual mandate would provide flexibility to accommodate persistent commodity price or exchange rate shocks that push inflation above target during times of economic slack. In contrast, a strict CPI inflation objective requires monetary policy tightening, exacerbating the fall in output. The flattening of the Phillips curve would also suggest that a re-evaluation of the trade-off between inflation and

output would be in order as offsetting even relatively minor cost-push shocks requires a larger fall in output than in the past.

One mechanism to increase the importance of output relative to inflation is to replace inflation targeting with nominal GDP growth targeting, an old idea that has gained prominence since the financial crisis. A nominal GDP growth target implicitly places equal weight on output and inflation stabilisation, which to its proponents achieves a better balance of objectives than inflation targeting. But targeting nominal GDP growth does more than reweight the inflation and output stabilisation objectives: it changes the target inflation measure. The consumer price inflation measure used by inflation-targeting central banks includes the price of imports and excludes the price of exports, while the GDP price measure does the reverse. Excluding import prices automatically accommodates imported inflation, such as oil price shocks, as would adopting non-tradeable inflation as the target inflation measure. However, the desirability of adopting a target measure that includes export prices is less clear. Frankel (2012b) argues that producer price targeting has the beneficial effect of stabilising export prices in local currency terms. But for a small open economy such as Australia, the inclusion of export prices in the target inflation measure would expose the non-resources economy to large, and mostly exogenous, monetary policy changes. This is potentially problematic when there are level shifts in the terms of trade that the central bank must seek to identify in real time.

A more radical proposal is the adoption of nominal GDP as a level rather than growth target. Like price level targeting, a nominal GDP target does not let ‘bygones be bygones’: past deviations from target must be corrected in the future. During his time as Governor of the Bank of Canada, Mark Carney (2012) argued that nominal GDP targeting has particularly attractive properties at the zero lower bound. In an economic slump nominal GDP falls, and inflation expectations must rise for the central bank to maintain its nominal GDP target; any rise in inflation expectations lowers the real interest rate and stimulates demand. In essence, a nominal GDP target might endogenously generate countercyclical inflation expectations. The success of nominal GDP targeting crucially depends on the speed with which consumers’ and firms’ inflation expectations adjust. Following the adoption of inflation targeting, inflation expectations remained substantially above target for several years. Imperfect inflation credibility is likely to have been important, but so was sluggish adjustment of inflation expectations. Supporting

this, a growing literature argues that information frictions are an important source of inertia in the monetary policy transmission mechanism (see, for example, Mankiw and Reis (2002)). If inflation expectations adjust sluggishly, a nominal GDP target may only raise inflation expectations marginally in an economic slump, undermining one of its key features.

Conflict between output and inflation stabilisation in the post-financial crisis period should not be overemphasised: inflation has remained close to its target for most inflation-targeting central banks, despite substantial economic slack and highly accommodative monetary policy. With the exception of the United Kingdom, the potential relevance of a dual mandate policy is clearer in the lead-up to the crisis, during the sustained rise in oil prices. Jeffrey Frankel (2012a) argues that ‘... it is widely suspected that the reason for the otherwise-puzzling decision of the European Central Bank to raise interest rates in July 2008, as the world was sliding into the worst recession since the 1930s, was that oil prices were just then reaching an all-time high’. Regardless of whether Frankel’s assessment is correct, it is this type of conflict between output and inflation stabilisation that a dual mandate policy is designed to avoid.

3.2.3 Maintain current targets

An alternative to changing the target measure or adopting a dual mandate is to retain CPI inflation as the target. CPI inflation is perhaps the simplest and most relevant inflation target to consumers: it measures consumers’ average inflation experience, is a key input to wage negotiations, and is used for indexation purposes in contracts. However, this is not a ‘no change’ option. For a start, inflation targeting has evolved over time and generally takes account of activity in practice. Furthermore, even if the ultimate target does not change, that does not mean that further evolution of the framework is precluded. Indeed, there are a couple of changes in practice that may be worth considering in light of the changes identified above.

First, the communication of the central bank may need to become much more nuanced. Some inflation shocks, those that reflect fluctuations in domestic economic activity, may have to be addressed aggressively, while it may be better to look through others, such as exchange rate shocks. Of course, not all exchange rate shocks are alike, and the appropriate degree of monetary policy accommodation

depends on the source of the shock. The challenge for central banks' communication strategies is to explain why certain shocks are being ignored, while others are being addressed. Similarly, there would be communications challenges to the extent that financial stability concerns motivate any leaning against the wind. Second, central banks' internal analysis may need to improve. While the flattening of the Phillips curve and anchoring of inflation expectations might seem like good news, it has an important drawback. Inference about the state of the economy based upon the behaviour of inflation is now much more difficult. Previously, capacity constraints would show up in inflation relatively clearly and induce an appropriate tightening of policy. Now, with the effect muted, it can be hard to identify a structural tightness in the economy, which can lead to persistence of that tightness that may have undesired effects. A prime example would be the experience of many euro area countries that saw property booms in the lead-up to the financial crisis. Contained inflation was taken as evidence that output gaps were smaller than they actually were and allowed stimulatory policy to go on for longer than it otherwise would have. Compounding these analytical challenges are the difficulties of forecasting the highly non-linear effects of financial instability. In short, the flattening of the slope of the Phillips curve and greater anchoring of expectations means that the separation of systematic movements in inflation from random noise is now much harder – NAIRU-based forecasts of inflation are now much less reliable and new techniques will need to be developed. And changes in the processes governing inflation identified above mean that the Lucas Critique applies with great force. Models which fail to take account of this are likely to make systematic errors.

3.3 Discussion of the Options

In thinking through the options, it is worth emphasising that the effects of inflation targeting evident in the data are twofold. First, there has been a flattening of the Phillips curve, whereby the linkages between inflation rates and output gaps have weakened. Second, there has been an increase in the anchoring of inflation around long-run expectations, which are invariably the same as the stated targets. Although we have documented these changes in the inflation process for Australia, the same qualitative changes have been documented elsewhere for other countries (see IMF (2013)), so the implications we draw apply generally.

The strongest critics of inflation targeting argue that wholesale change is required: either adopt explicit dual mandates or change target inflation measures. Both these proposals share the common objective of minimising the chance of conflict between output and inflation stabilisation. But, as we have argued, these arguments for change are, in part, a consequence of the success of inflation targeting. With inflation expectations now firmly anchored at target and the Phillips curve flatter, the non-tradeable component of inflation has been stabilised, and the relative importance of the idiosyncratic and uncontrollable component of CPI inflation has risen. Inflation is now much more affected by shocks where the inflation and output stabilisation objectives are in conflict than in the past. And, in such an environment, a pure CPI inflation target risks destabilising output to offset idiosyncratic shocks. The adoption of a dual mandate minimises the possibility of conflict by permitting inflation to be above target when output is depressed, as does changing the target to an inflation measure more closely associated with economic activity. A difficulty, however, with proposals to down-weight the inflation target is that, even if it does not affect the slope of the Phillips curve relationship, it risks undermining the anchoring of expectations. And it is only because expectations are so strongly anchored that idiosyncratic shocks appear to be so important.

Furthermore, the characterisation of inflation-targeting central banks as caring exclusively about CPI inflation is something of a straw man. The practice of inflation targeting has evolved in conjunction with monetary policy frameworks. For example, the Reserve Bank of New Zealand's inflation target band was widened from 0–2 per cent to 0–3 per cent in December 1996 to provide additional flexibility, and the 2010 'Statement on the Conduct of Monetary Policy' between the Reserve Bank of Australia and the Australian Government officially recorded the Reserve Bank's responsibility for financial system stability. More generally, underlying inflation measures are now routinely used as a guide for policy, abstracting from sharp idiosyncratic variation in inflation that is unrelated to domestic economic conditions. Central banks have also become more forward looking, setting monetary policy based on forecasts of inflation and output/unemployment, rather than contemporaneous estimates. These forecasts are typically guided by a Phillips curve relationship and, because idiosyncratic changes in inflation more than a couple of quarters ahead are essentially unforecastable, inflation forecast-targeting central banks implicitly set monetary policy based on a measure of inflation that reflects domestic economic activity. (Although, as the

simulation above showed, if those forecasts are premised on an unchanged Phillips curve, they may prove to be misleading.) As Ryan and Thompson (2000) explain, the benefit from adopting a non-tradeable inflation target is unclear when monetary policy is guided by inflation forecasts that abstract from exchange rate shocks.

There is, thus, a middle ground between the wholesale change envisaged by the sharpest critics of inflation targeting and a ‘do-nothing’ position: remove barriers to the practice of ‘flexible inflation targeting’ where they exist by lengthening the target horizon and continuing the evolution that has been occurring over the past 25 years. A long horizon, such as the Reserve Bank of Australia’s ‘over the cycle’ criterion, maintains CPI inflation as a clear, transparent, medium-term nominal anchor, but minimises the likelihood of conflict between output and inflation objectives. A lengthening of the target horizon is a natural consequence of changes in the inflation process we have documented over the inflation-targeting period. Now that inflation credibility has been established, there is greater scope than in the early years of inflation targeting to tolerate meaningful deviations from target: consumers and firms are less likely to interpret deviations from target as revisions to the implicit inflation target than when inflation targeting was in its infancy. How much central banks can leverage their credibility to tolerate persistent deviations in inflation from target is an unknown empirical question. Clearly, there is a limit: expectations adjust, even if only sluggishly. Nevertheless, the potential for inflation expectations to become ‘unanchored’ should not be overemphasised: a defining feature of the past decade has been the constancy of long-term inflation expectations through large swings in commodity prices and a deep economic slump.

Our suggestion should not be mistaken for complacency. Indeed, we cannot forget that the benign inflationary outcomes during the 2000s masked the build-up of imbalances that contributed to the financial crisis. Rather, central banks must be increasingly vigilant in identifying changes in the trend pace of inflation, and at the same time willing to tolerate commodity price or exchange rate shocks that push CPI inflation away from target for a time. Clear communication will be required to explain changes in the stance of policy. Policy tightening may be required when the trend pace of inflation is forecast to rise even if CPI inflation remains close to the target. Conversely, in the presence of idiosyncratic shocks, monetary policy may often remain accommodative. Because the appropriate policy response to an inflation surprise crucially depends on its cause, structural models that can identify

the source of shocks are needed. Furthermore, the breakdown in the forecasting performance of the Phillips curve suggests that near-term forecasting will need to make use of a broad range of economic indicators.

4. Conclusion

The practice of inflation targeting over the past 25 years has fundamentally changed the character of target inflation measures. Unlike in the early years of inflation targeting, before credibility had been established, long-term inflation expectations are firmly anchored at target, moving little in response to inflation surprises. Variability of the domestic component of inflation has declined substantially, and much of the variation in CPI inflation is now caused by imported shocks, such as commodity price and exchange rate changes. Stabilisation of the domestic component of inflation has weakened the relationship between inflation and domestic economic conditions – the Phillips curve has become flatter.

These changes in the inflation process have resulted in a breakdown in the correspondence between output and inflation stabilisation. Changes in CPI inflation are now more likely to reflect idiosyncratic shocks than signal deviations in output from potential. Some critics argue that this calls for inflation-targeting frameworks to be fundamentally reengineered, placing more weight on output than inflation stabilisation. It is argued by some that weighting output more heavily in central banks' objective function would avoid the stability of inflation blinding central banks to spare capacity, and reduce the likelihood of inappropriate monetary policy tightening in response to imported price shocks.

We argue that while the character of target inflation measures has changed, the fundamental structure of the economy and the nature of the shocks have not. Sound monetary policy still requires the stabilisation of output about potential, and the accommodation of idiosyncratic inflation shocks. Inflation targeting should not be abandoned or fundamentally reengineered, but its practice must reflect the changing nature of target inflation measures. With inflation credibility now firmly established, central banks can afford to accommodate persistent commodity price and exchange rate swings. Similarly, policymakers can choose to exert gradual pressure to offset cost-push shocks rather than needing to induce large upfront contractions in activity to avoid any unanchoring of inflation expectations. But stabilisation of output about potential is now a more complicated task as the

relationship between domestic output and inflation is weaker than in the past and domestic inflationary pressures are likely to be hidden in noise. Identifying deviations in output from potential is as important as ever, but the task has become much harder.

This creates a problem for central bank communications and analysis. First, because the analysis required to differentiate domestically generated demand shocks from imported shocks is tricky, the communication challenge for the central bank is likely to be similarly difficult. While some inflation shocks will be accommodated, others will merit a response. This is compounded if the appropriate response is much more gradual than in the past – the central bank may appear to be being too passive. Second, because the potential for shocks to be hidden in noise is magnified now that the effect of any given shock is smaller, there is an increased possibility that mistakes might be made.

Notwithstanding this, the solution is not to declare victory over inflation and switch the primary focus to output. While widespread vaccination has dulled the memory of how dangerous measles and other infectious diseases can be, that does not mean they have become any less dangerous. Both inflation targeting and vaccination programs are victims of their own success. The inflation process has changed over the past 25 years, and the practice of inflation targeting must evolve accordingly. But the same issues that led to the choice of inflation targeting over the alternatives in the past continue to apply with the same force.

References

- Atkeson A and LE Ohanian (2001)**, ‘Are Phillips Curves Useful for Forecasting Inflation?’, Federal Reserve Bank of Minneapolis *Quarterly Review*, 25(1), pp 2–11.
- Bharucha N and C Kent (1998)**, ‘Inflation Targeting in a Small Open Economy’, RBA Research Discussion Paper 9807.
- Carney M (2012)**, ‘Guidance’, Remarks to the CFA Society Toronto, Toronto, 11 December.
- Debelle G and D Laxton (1997)**, ‘Is the Phillips Curve Really a Curve? Some Evidence for Canada, the United Kingdom, and the United States’, *IMF Staff Papers*, 44(2) pp 249–282.
- Debelle G and J Vickery (1997)**, ‘Is the Phillips Curve a Curve? Some Evidence and Implications for Australia’, RBA Research Discussion Paper 9706.
- Frankel J (2012a)**, ‘The Death of Inflation Targeting’, VOX, 19 June, accessed 28 May 2014. Available at <<http://www.voxeu.org/article/inflation-targeting-dead-long-live-nominal-gdp-targeting>>.
- Frankel J (2012b)**, ‘Product Price Targeting—A New Improved Way of Inflation Targeting’, Monetary Authority of Singapore *Macroeconomic Review*, 11(1), pp 78–81.
- Heath A, I Roberts and T Bullman (2004)**, ‘Inflation in Australia: Measurement and Modelling’, in C Kent and S Guttmann (eds), *The Future of Inflation Targeting*, Proceedings of a Conference, Reserve Bank of Australia, Sydney, pp 167–207.
- IMF (International Monetary Fund) (2011)**, ‘Target What You Can Hit: Commodity Price Swings and Monetary Policy’, *World Economic Outlook: Slowing Growth, Rising Risks*, World Economic and Financial Surveys, IMF, Washington DC, pp 101–133.

IMF (2013), ‘The Dog That Didn’t Bark: Has Inflation Been Muzzled or Was It Just Sleeping?’, *World Economic Outlook: Hopes, Realities, Risks*, World Economic and Financial Surveys, IMF, Washington DC, pp 79–95.

Kuttner K and T Robinson (2008), ‘Understanding the Flattening Phillips Curve’, RBA Research Discussion Paper 2008-05.

Mankiw NG and R Reis (2002), ‘Sticky Information Versus Sticky Prices: A Proposal to Replace the New Keynesian Phillips Curve’, *The Quarterly Journal of Economics*, 117(4), pp 1295–1328.

Matheson T and E Stavrev (2013), ‘The Great Recession and the Inflation Puzzle’, *Economics Letters*, 120(3), pp 468–472.

Ryan C and C Thompson (2000), ‘Inflation Targeting and Exchange Rate Fluctuations in Australia’, RBA Research Discussion Paper 2000-06.

Stiglitz JE (2011), ‘Macroeconomics, Monetary Policy, and the Crisis’, Paper presented at IMF Conference ‘Macro and Growth Policies in the Wake of the Crisis’, Washington DC, 7–8 March.

Stock JH and MW Watson (2007), ‘Why Has U.S. Inflation Become Harder to Forecast?’, *Journal of Money, Credit and Banking*, 39(s1), pp 3–33.

Wren-Lewis S (2013), ‘Carney and the Treasury Select Committee: Episode One Preview’, Mainly Macro, 6 February, accessed 11 June 2014. Available at <<http://mainlymacro.blogspot.com.au/2013/02/carney-and-treasury-select-committee.html>>.



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