

INFLATION AND GROWTH TARGETING

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Abstract

Inflation targeting needs to be supplemented by an economic growth target so that central banks will not adopt monetary policy which results in stagnation. There is no guarantee that the economy will move towards full employment by itself when the inflation rate is kept between two to three per cent. Monetary policy does not have a comparative advantage in achieving price stability. Svensson's proposal that the Keynesian interest rate channel and the Phillips curve can be exploited by the monetary authority for the purpose of inflation targeting may not work. The R in NAIRU should stand for "range" not "rate".

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I. Introduction

Inflation targeting (IT) represents the state of the art of monetary policy. Australia, among numerous other countries, has embraced this 'technology' as a means of achieving the macroeconomic goals of price stability, full employment and economic growth. In a recent address, Mr G. R. Stevens, the Deputy Governor of the Reserve Bank of Australia (RBA) reviewed Australia's experience with IT and arrived at the verdict that "Inflation targeting has been a successful model for monetary policy in Australia. It has been associated with lower, less variable inflation, and better and less variable economic growth." (Stevens, 2003, p. 26.)

William Poole and William Gavin wrote recently that "The primary goal of a central bank is to develop and maintain an efficient monetary system whose primary goal is price stability, ..." (2003, p.5.) It has been asserted by many monetarists and like-minded economists that the monetary authorities have a comparative advantage in achieving price stability.

In this paper, we question this "conventional wisdom" that the monetary authorities should take primary responsibility for achieving the goal of price stability. Since the operational instrument used by most central banks nowadays is the target cash rate and we do not live in a classical world, we cannot rely on the classical Quantity Theory of Money to provide a direct relationship between interest rate and the price level or the rate of inflation. As an alternative, the central bank seeks to exploit the indirect relationship between interest rate and inflation via the influence of the former on aggregate demand. This Keynesian channel of transmission of the effect

of monetary policy puts the central bank in no better position to influence economic activity than the fiscal authority. The latter is able to change directly certain components of aggregate demand like government expenditure and indirectly, private consumption and investment by altering the tax rates on personal and corporate income and by using transfer payments. Fiscal policy may be more efficacious in targeting aggregate demand than monetary policy and hence may be more reliable in controlling inflation. Even though monetary policy may be more flexible than fiscal policy, the case for using the former for fine-tuning the economy is hampered by the widely acknowledged "long and variable lags" in its effect on the real sector.

We posit that central banks should attempt to target output and the price level or economic growth and inflation, i.e., inflation and growth targeting (IAGT). Except when the economy is in a liquidity trap, monetary policy does have impact on aggregate demand and should be employed in such a way that it contributes to achieving the two goals. The *Reserve Bank Act 1959* stipulates explicitly three objectives, namely, "(a) the stability of the currency of Australia; (b) the maintenance of full employment in Australia; and (c) the economic prosperity and welfare of the people of Australia." The RBA is not fulfilling its charter if it puts primary emphasis on the first objective and pays only lip service to the other two.

When stagflation emerged in the mid-1970s, monetary targeting was considered to be the panacea. After ten years or so, monetary targeting was suspended. The demand for money function, the key economic relationship according to the monetarists, was shown to be unstable and financial deregulation wrought

havoc to the supply of money. Now more than ten years have elapsed since New Zealand first adopted the strategy of inflation targeting. The jury on IT is still out.

Interestingly enough, IT was born out of the severe recession of the early 1990s not when inflation was rampant in the 1970s or the 1980s. In the early 1990s, due to the severe recession, inflation was coming down fast and IT was blamed for the heavy toll it had on unemployment. As the world economy recovered in the mid-1990s, IT has been credited for maintaining a low rate of inflation. However, countries which have not adopted IT also have low rates of inflation. Whilst economic growth has been sustained in some IT countries such as Australia, the overall picture for the world economy has not been too rosy. It may be time to re-examine the strategy of IT.

In Section II, we explain why both inflation and growth should be targeted by the central banks. Section III examines the transmission mechanism relied upon by proponents of IT and finds that the Phillips curve and the interest rate effect on aggregate demand may not be sufficiently reliable for the monetary authority to achieve their goals. A simple macroeconomic model is specified in Section IV to clarify how output and the price level can be determined. One may have greater confidence in this structural approach in achieving the macroeconomic goals than clinging on to the slender reed of the Phillips curve. The last section summarises our arguments and provides some concluding remarks.

II. Inflation and Growth Targeting

The preference function of policymakers in the theory of economic policy is often specified as a quadratic function of the deviation of the actual from the desired level of output and the actual from the desired rate of inflation:

$$L = w_1(Y - Y_f)^2 + w_2(\pi - \pi^*)^2 \quad (1)$$

where L is a loss function to be minimised, w_j , $j = 1, 2$, the weight attached to the j^{th} target, Y , real output, Y_f , the full employment level of output, π , the actual and π^* , the desired rate of inflation. In Australia, the RBA's charter stipulates that both w_1 and w_2 should be positive. However, the agreement signed by the Governor of the RBA when he was appointed in September 1996 only committed him to achieving a target rate of inflation "between 2 to 3 per cent, on average, over the cycle." (RBA, 1996, p. 2). The focus of the BRA should be "on price (currency) stability while taking account of the implications of monetary policy for activity and, therefore, employment in the short term. Price stability is a crucial precondition for sustained growth in economic activity and employment." (RBA, 1996, p. 2). The same sentiments were expressed in the *Second Statement on the Conduct of Monetary Policy* released by the Treasurer in conjunction with the reappointment of Mr Ian Macfarlane as Governor of the Reserve Bank in August 2003.

One interpretation of the *Statement on the Conduct of Monetary Policy* is that the Treasurer and the Governor (designate) believe that (i) the long run Phillips curve is vertical at the natural rate of unemployment (U_n), (ii) the latter is identical to the full employment level of unemployment (U_f), (iii) there is a tendency for the economy to converge to $U_n = U_f$, (iv) any deviation of the actual unemployment rate (U) from

U_n is due to random shocks and is short-lived and (v) any attempt to reduce U below U_n will result in an acceleration in inflation, subscribing to the so-called accelerationist theory.

It is notoriously difficult to pin down the Phillips curve accurately because there are deficiencies with the theory and price inflation does not respond in a consistent manner to unemployment in the labour market which is a poor proxy for the level of excess demand in the product market. The definition of the long run used by Friedman and Phelps is not in terms of the number of years in real time but in terms of the mathematical property that the actual (π) and expected rate of inflation (π^e) are equal. There is no sound theoretical justification for asserting that $U = U_f$ when $\pi = \pi^e$.

The model of unemployment and inflation used by Barro and Gordon (1983) is represented by the following (inverted) expectations-augmented Phillips curve relationship:

$$U_t = U_{nt} - \alpha(\pi_t - \pi_t^e), \quad \alpha > 0. \quad (2)$$

The implication is that when $\pi_t = \pi_t^e$, then $U_t = U_{nt}$. The original definition of U_n by Friedman (1968) is that of (2). In a later address, he (1977) identifies U_n as U_f , i.e., the unemployment rate which is consistent with equality between the supply of and demand for labour. However, one can postulate an alternative hypothesis, viz.,

$$U_t = \alpha_0 + U_f - \alpha_1(\pi_t - \pi_t^e), \quad \alpha_0 \geq 0, \alpha_1 > 0 \quad (3)$$

U_f includes structural and frictional unemployment at the full employment level of output. When inflationary expectations are fulfilled ($\pi_t = \pi_t^e$), U_t is greater than U_f by α_0 , which represents demand-deficient unemployment.¹

Empirical support for hypothesis (3) is provided by the current state of the Japanese economy. Since February 1999, the target call rate in Japan has been driven to zero by the Bank of Japan. The CPI has been remarkably stable in the last ten years. It was 100.0 in August 1993 and 99.7 in June 2003. Unanticipated inflation should be minimal and yet unemployment has been rising from 2.0 per cent in February 1992 to 5.3 per cent in June 2003. Japan is in a liquidity trap and (3) is a better description of the Japanese economy today than (2).

McDonald defines an "equilibrium unemployment rate" (U_e) as one such that "the rate of inflation is tending not to change." (2002, p. 451). This is sometimes called the nonaccelerating inflation rate of unemployment (NAIRU). Therefore, we have $U_e = U_n = \text{NAIRU}$. U_e depends on the structure of the economy, the level of unemployment benefits and other labour market characteristics. McDonald claims that U_e can change with the level of aggregate demand. Some empirical studies have found that NAIRU is not constant over time. As a result, some econometricians have portrayed it as a time-varying variable and it moves with the actual rate of

¹ Hagger and Groenewold (2003) have estimated something like U_f and α_0 using an equation similar but not exactly the same as (3).

unemployment.² This interpretation is suspect because NAIRU now depends on the level of aggregate demand which may be deficient. Friedman (1977) makes explicitly the assumption that $U_n = U_f$ so that there is no demand-deficient unemployment.

To accommodate McDonald, we can assume that

$$U_e = \alpha_0 + U_f. \quad (4)$$

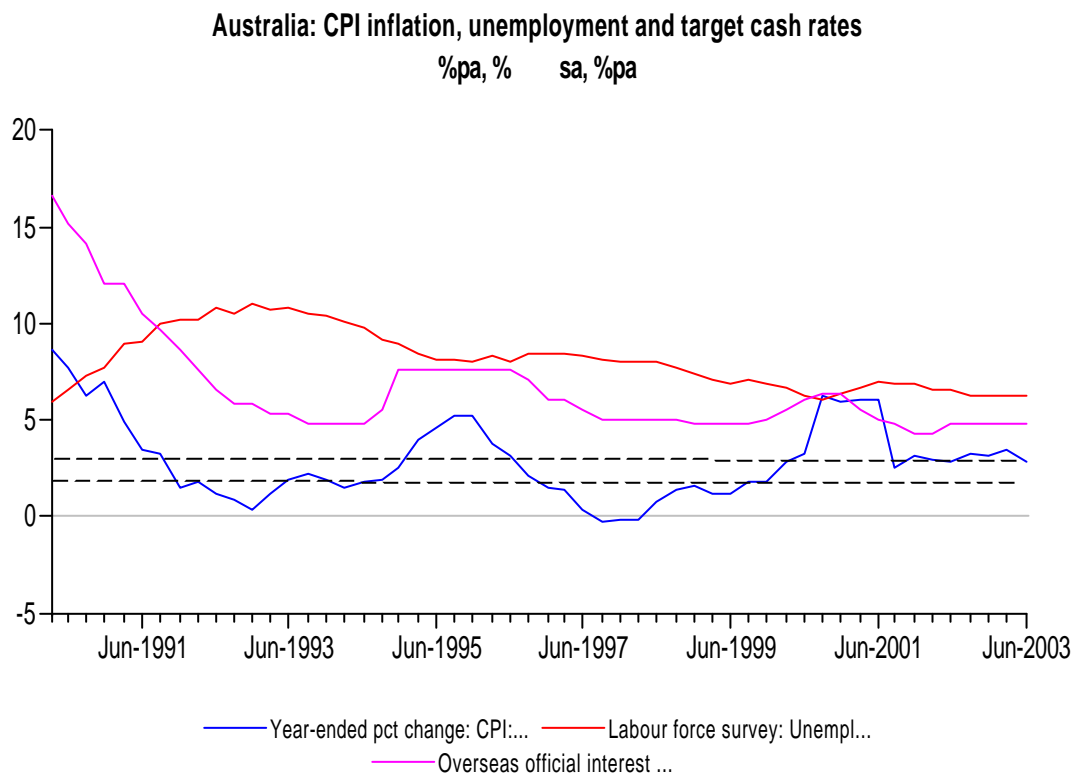
U_e is consistent with the Keynesian notion that underemployment equilibrium is possible and α_0 represents unemployment caused by insufficient aggregate demand. Inflation can persist in a Keynesian world when money supply increases and the price level rises. The inflation rate does not change unless there is a change in the rate of monetary expansion.

McDonald has summarised the empirical literature on the estimation of U_n or U_e in Australia and his findings tend to support our contention. His conclusion is that "equilibrium unemployment either follows a hysteretical pattern or is a range of values. There is little support for a unique equilibrium rate of unemployment that is independent of aggregate demand and influenced only by supply side factors, that is for the concept of the natural rate of unemployment." (2002, p. 464.) It appears that (3) may be a more realistic hypothesis than (2). NAIRU should refer to nonaccelerating inflation *range* of unemployment.

² A time-varying U_n is proposed by advocates of the natural rate of unemployment hypothesis to justify the shifting of the goal posts to save the theory. See Gordon (1997), Staiger *et al* (1997), Debelle and Vickery (1998) and Gruen *et al* (1999).

Among the numerous Phillips curve studies for Australia, Groenewold and Hagger (1998) finds that U_n was 9.5 per cent in 1997(2) in Australia when the actual U was only 8.2 per cent. It would be hard to convince many Australians that $U_f = 9.5$ per cent. As U has come down gradually to 5.8 per cent in August 2003 and inflation is only 2.7 per cent per annum in June quarter 2003, the figure for U_n estimated by Groenewold and Hagger appears to be decidedly more than U_f .³ Figure 1 shows that both U and π kept coming down after 1997(2). This contradicts the U_n theory which claims that to keep $U < U_n$, π would have to be increased from period to period so that $\pi > \pi^e$ and people are fooled until π^e catches up with π .

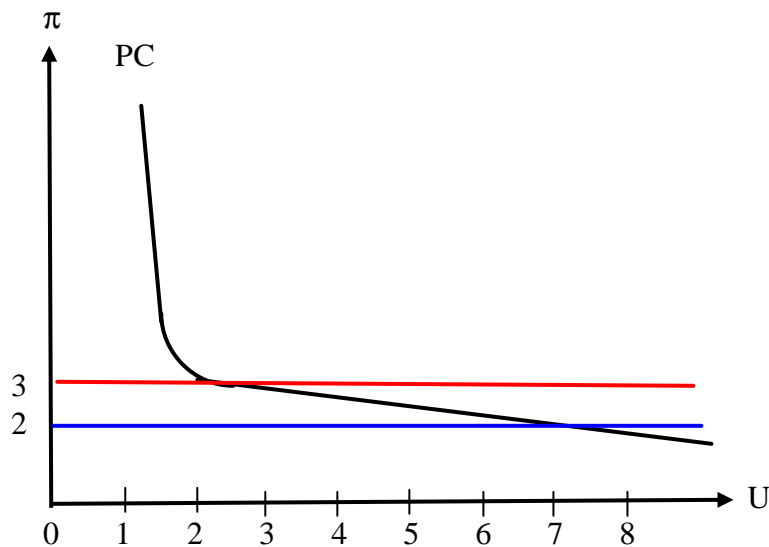
FIGURE 1



³ The NAIRU provided by Hagger and Groenewold (2003) for June 1997 is 7.0 per cent when the actual rate was 8.8 per cent.

It is possible that the stylised Phillips curve for Australia, if it exists, may be L-shaped and looks like Figure 2. Based on the data for U and π in Australia in the 1950s and 1960s, we surmise that there may be a steep section when U is between 1.5 per cent to 2.5 per cent and a fairly flat section above 2.5 per cent. The U_f may be as low as 1.5 per cent. If trade unions keep the wage demand to be no more than the rate of growth of labour productivity so that there is no wage-push inflation, excess demand inflation may not occur until U reaches a very low level. If the real world inflation-unemployment tradeoff resembles that drawn in Figure 2, then it is paramount that the central bank does not regard 8 per cent as the U_n , equate that to U_f and starts a pre-emptive strike when U is expected to slip below it. This is why the central bank should have a growth or output target so that it will not push the economy in the wrong direction.

FIGURE 2



Our conjecture of a L-shaped Phillips curve is supported by McDonald who finds that "in many studies the slope of the short-run Phillips curve is insignificantly different from zero." (2002, p. 464) The Phillips curve drawn in Figure 2 may also be

compatible with the notion of nonaccelerating inflation *range* of unemployment. In this case, the range may cover 2 to 8 per cent. Inflation is steady for $2 \leq U \leq 8$ per cent and π only edges up significantly when $U < 2$ per cent.

The need for the monetary authority (MA) to target output can be illustrated using Figure 3. Aggregate demand (Y^d_0) intersects aggregate supply (Y^s_0) initially at a. Suppose the inflation target (π^*) is between 2 and 3 per cent. $(P^*_3 - P_0)/P_0 = 3$ per cent and $(P^*_2 - P_0)/P_0 = 2$ per cent. Without an output target, the RBA would have discharged its duty and won a slap on the back if Y^s_0 shifts to Y^s_1 or Y^s_2 , even though output has contracted from Y_0 to Y_2 or Y_1 . If $w_1 = 0$, the loss of welfare by RBA is the same when compared to the case of Y^d_0 shifting to Y^d_2 or Y^d_3 . In both cases, the inflation target is achieved and $L = 0$.

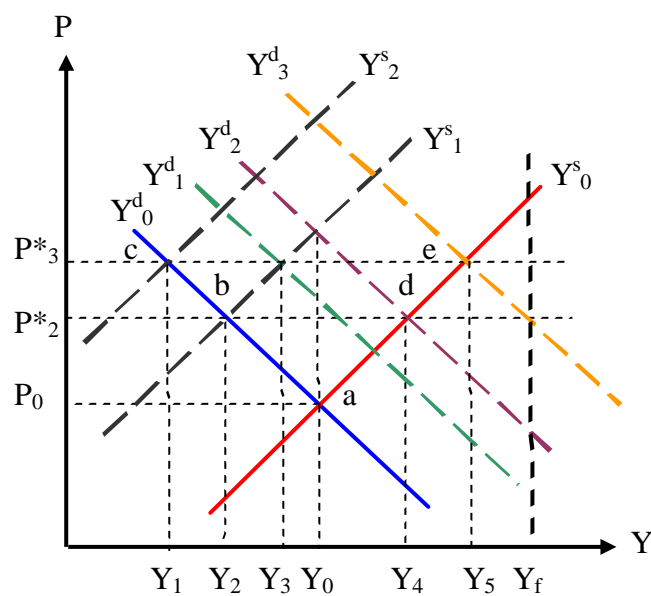
However, if $w_1 > 0$ and the target Y^* is Y_f , the loss is much smaller when the system is at d or e than at b or c. Y_4 and Y_5 are closer to Y_f than Y_2 or Y_1 . Therefore, it is crucial that output should enter the welfare function of the policymakers with a positive weight. The MA should adopt IAGT not just IT.

Consider what happens when there is an adverse supply shock and Y^s_0 is shifted to Y^s_1 . With an inflation target only, MA does not have to do anything and the mission is accomplished when Y^d_0 intersects Y^s_1 at b. Output declines from Y_0 to Y_2 and unemployment rises and the economy is experiencing stagnation. Even within the constraint of the 2 to 3 per cent inflation target, there may be room for the MA to use expansionary monetary policy to shift Y^d_0 to Y^d_1 so that output drops only to Y_3 instead of Y_2 .

If the adverse supply shock is a one-off event like the oil price shock in 1973/74 or in 1979/80 or the introduction of the GST in Australia in July 2000, there may be good grounds for MA to adopt an expansionary monetary policy to shift Y^d_0 to, say, Y^d_2 , so that at least the initial output of Y_0 is maintained. The supply of money can be increased in proportion to the rise in the price level in order to prevent the money supply from declining in real terms. The upper bound of π^*_3 may have been exceeded temporarily. With the passage of time, the impact of the one-off event will wear off and price becomes stable again.

Now consider the case that the Y^s curve is stable and the system is at a in Figure 3 initially. To achieve the target inflation range, the MA has a choice of shifting the Y^d curve from Y^d_0 to Y^d_2 or Y^d_3 . An output target will prompt MA to shift the Y^d curve to Y^d_3 , as long as Y_5 is less than the full employment level of output (Y_f).

FIGURE 3

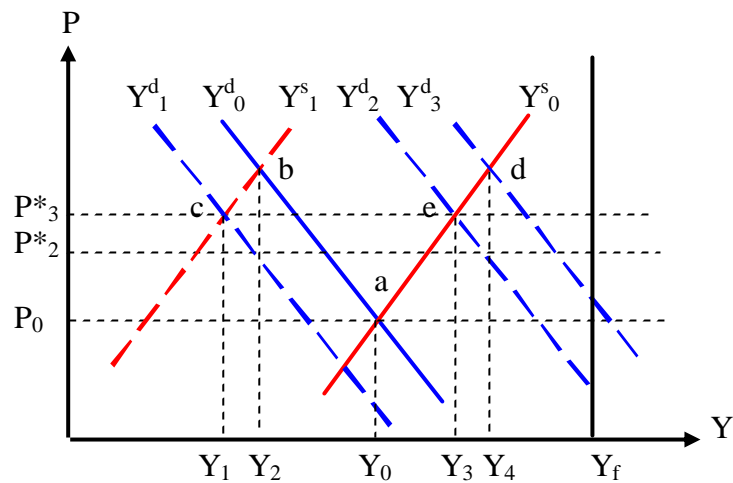


The view that it is not appropriate to use monetary policy to fight cost-push inflation is widely held by economists and central bankers concur.⁴ Suppose initial equilibrium is at a in Figure 4. An adverse supply shock shifts Y^s_0 to Y^s_1 which intersects Y^d_0 at b. To achieve the target P^*_3 , the MA has to use contractionary monetary policy and shift Y^d_0 to Y^d_1 . This will aggravate the decline in income. The decrease in Y is from Y_0 to Y_1 instead of Y_2 .

It is not often realised that there may be a cost involved when monetary policy is used to fight what is supposed to be demand-pull inflation. Suppose there is a rise in aggregate demand and Y^d_0 is shifted to Y^d_3 to intersect Y^s_0 at d in Figure 4. If no offsetting deflationary monetary policy is used, then inflation will rise above 3 per cent, the upper bound of inflation target. There is actually no excess demand because Y_4 is less than Y_f . However, as the inflation target is agreed to by the Governor of the central bank and the Treasurer or the Chancellor of Exchequer, the former has no choice but to adopt contractionary monetary policy to shift Y^d_3 to Y^d_2 . The cost of lowering inflation is a rise in unemployment. Therefore, the MA has to raise the interest rate to “combat” excess demand when there is really no excess demand. It is a fact of life that prices tend to rise before full employment is reached. As long as it is not a runaway inflation, there is a good case for the Treasurer or the Chancellor to reconsider the inflation target.

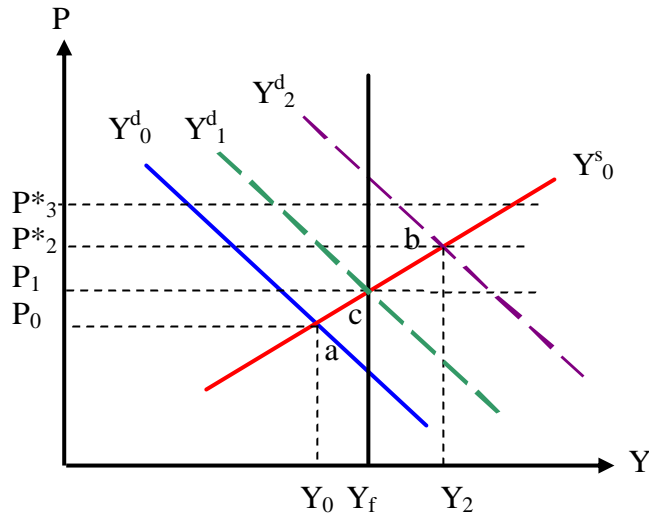
⁴ See Stevens (2003).

FIGURE 4



It is possible that even an inflation target of 2 to 3 per cent may be too high if the economy is close to full employment. Figure 5 shows that attempting to achieve the inflation target will result in overheating of the economy and produce further inflation in later periods. Suppose the initial equilibrium is at a and Y is less than Y_f . The IT band is between P^*_2 and P^*_3 . To achieve even the lower limit of the band, expansionary monetary policy has to be adopted to shift Y^d from Y^d_0 to Y^d_2 , which intersects Y^s_0 at b. But Y_2 is greater than Y_f and will cause further price rises. If the MA has an output target, then realising that $Y_2 > Y_f$, it will adopt a less expansionary monetary policy and shift Y^d from Y^d_0 only to Y^d_1 , which intersects Y^s_0 at c. The lower limit of IT of 2 per cent has been breached but, at least, it has not generated any inflationary pressure. c is preferred to b because the economy is at full employment at c and overly expansionary policy to get the economy to b will cause excess demand. The “2 something” inflation target is not sacrosanct. If equilibrium at c implies 1 per cent inflation and full employment, so be it. This will be a more desirable outcome than at b with $Y_2 > Y_f$ but inflation hitting the target.

FIGURE 5



III. The Transmission Mechanism for Achieving Inflation Target

Inflation is an endogenous variable which depends on the structure of the economy and the setting of the policy instruments. It is not an instrument under the control of the MA. Therefore, how the inflation target can be achieved is a challenge. The classical Quantity Theory of Money states that

$$M.V = P.Y, \tag{5}$$

where M is the supply of money, V, the velocity of circulation of money, P, the price level and Y, the real income. In terms of rates of growth, we have

$$\hat{M} + \hat{V} = \pi + \hat{Y}, \tag{6}$$

where a hat above a variable indicates its rate of change and $\pi = \hat{P}$. In the classical world, V is determined by payments habits and Y is at the full employment level.

Both are assumed to be constant in the short run. As a result, money is neutral in the classical world. In a monetarist world captured by (5) and (6), there is a direct relationship between M and P or \hat{M} and π . Therefore, inflation or monetary targeting will produce equally satisfactory outcome.

Unfortunately, we do not live in a classical world and the MA is not using \hat{M} to target π . The operational instrument adopted by most central banks is like the target cash rate (i) in Australia or the Federal funds rate in the U.S. Since there is no relationship between i and π according to the classical model⁵, we need to find the transmission mechanism which links the two variables. Svensson (1997), one of the most fervent advocates of IT, uses a three-equation structural model of the economy to provide the theoretical underpinning for IT. The rate of inflation next year (π_{t+1}) is assumed to depend on output this year (y_t) and an exogenous variable (x_t). Output next year (y_{t+1}) in turn depends on output this year (y_t) and the real rate of interest ($i_t - \pi_t$) and x_t . x_{t+1} is assumed to depend on x_t . After adding the random disturbances, he gets

$$\pi_{t+1} = \pi_t + \alpha_1 y_t + \alpha_2 x_t + \varepsilon_{t+1}, \quad (7)$$

$$y_{t+1} = \beta_1 y_t - \beta_2 (i_t - \pi_t) + \beta_3 x_t + \eta_{t+1} \quad (8)$$

$$x_{t+1} = \gamma x_t + \theta_{t+1}, \quad (9)$$

where y_t is the log of output relative to the potential output, ε_t , η_t and θ_t are i.i.d. shocks in period t . It is assumed that

$$\alpha_1, \beta_2 > 0, \alpha_2, \beta_3 \geq 0, \text{ and } 0 \leq \beta_1, \gamma < 1. \quad (10)$$

Output is serially correlated. The potential output is normalised to equal zero. The target cash rate affects output with a one-year lag and inflation with a two-year lag. Thus, the control lag is two years. From (7) to (9), he gets

$$\pi_{t+2} = a_1 \pi_t + a_2 y_t + a_3 x_t - a_4 i_t + (\varepsilon_{t+1} + \alpha_1 \eta_{t+1} + \alpha_2 \theta_{t+1} + \varepsilon_{t+2}) \quad (11)$$

where

$$a_1 = 1 + \alpha_1 \beta_2, a_2 = \alpha_1 (1 + \beta_1), a_3 = \alpha_1 \beta_3 + \alpha_2 (1 + \gamma), a_4 = \alpha_1 \beta_2. \quad (12)$$

⁵ The interest rate is determined by thrift and productivity in the classical model.

Svensson's model thus makes inflation two years from now a function of the inflation rate, output gap, the exogenous variable (x_t) and the target cash rate this year. (7) can be interpreted as a Phillips curve and (8) the IS curve. Money supply becomes endogenous once the cash rate is used as the policy instrument. Inflation is generated by excess demand in the goods market and cost-push inflation is ruled out (unless x_t represents cost). The major drawback of the transmission mechanism portrayed by Svensson is that changes in the target cash rate have to influence inflation indirectly through its effect on aggregate demand and the Phillips curve. We know that the investment function is volatile and depends on many factors other than the cost of funds. Due to the complicated and uncertain transmission process of changes in i_t leading to changes in y_{t+1} , the estimate of the coefficient β_2 in (8) is likely to have a large standard error.⁶

The price level is not determined by the quantity of money or equilibrium between supply and demand for real balances in the money market in Svensson's model. Inflation is not determined by the rate of monetary expansion but by the Phillips curve relationship. Not only the theoretical underpinning of the Phillips curve has been questioned by numerous economists, its estimation has often produced very poor fit.⁷ According to Staiger, Stock and Watson(1997), the estimation of NAIRU is

⁶ See Arestis and Sawyer (2003) who question the effectiveness of interest rate policy in affecting the real economy.

⁷ McDonald (2002) discusses the theory and summarises the measurement of the equilibrium rate of unemployment in Australia derived from empirical studies estimating the Phillips curve. The statistic, R-squared, reported by Galbraith (1997) after estimating the Phillips curve for the U.S. for the whole sample period of 1960 to

subject to great uncertainty. To put faith in the Phillips curve when the central bank undertakes IT is plainly taking a big risk. Galbraith (1997) suggests that NAIRU should be buried forthwith and Hagger and Groenewold (2003) also proposes to ditch the natural rate.⁸

Figure 1 shows that unemployment in Australia experienced a downward trend after peaking in 1993. Except for the four quarters after the introduction of GST in July 2000, inflation did not pose a problem. For policymakers, the important decision is where to place the NAIRU. Should it be 8 to 9 per cent, 4 to 5 per cent or 2 to 3 per cent? Therefore, the MA must have an inkling of where the economy is heading which means that it should have both an inflation and a growth target. If the target unemployment rate was 6 per cent, the RBA would not have raised the target cash rate three times in 1994 when the unemployment rate was over 9 per cent. The target cash rate would not have been raised 5 times between November 1999 and August 2000 when the unemployment rate stood at 7.0 per cent in September 1999. In the next section, we outline a rather conventional model and attempt to demonstrate that

1996 was 0.029. When the sample period was divided into three sub-periods, the R-squared was 0.063 for 1960-1967, 0.027 for 1968-1983 and 0.0006 for 1984-1996. The equation estimated by Crosby and Olekalns (1998) to derive the NAIRU for Australia results in R^2 of 0.39 for 1959-95, 0.42 for 1959-73, 0.48 for 1974-84 and 0.30 for 1984-1997.

⁸ Gruen *et al* (1999) have estimated the Phillips curve for Australia with 'impressive' fit. Stock and Watson (1999) find that forecasting inflation using the Phillips curve is more accurate than using other macroeconomic variables.

targeting the price level and output or the rate of inflation and economic growth is superior to IT.

IV. *Modelling Output and Price Determination*

To keep the theoretical exposition simple, we have adopted the closed economy IS-LM-AD-AS model which is described by four equations. Product market equilibrium requires

$$I(r) + G = S(Y) + T(Y), \quad I_r < 0, S_Y, T_Y > 0 \quad (13)$$

where I is investment, r , the rate of interest, G , government expenditure, S , savings, Y , income and T , taxes. Money market equilibrium requires

$$M = P.L(Y, r), \quad L_Y > 0, L_r < 0 \quad (14)$$

where M is the supply of money, P , the price level and L , the demand for real balances. Demand for labour is at the point where the marginal product of labour (MP_N) is equal to the real wage rate ($w = W/P$).

$$W = P.Y_N(K, N), \quad Y_{NK} > 0, Y_{NN} < 0 \quad (15)$$

where W is the nominal wage rate, K , the stock of capital and N , the level of employment. We assume that W and K are given. The production function is given by

$$Y = Y(K, N), \quad Y_K, Y_N > 0 \quad (16)$$

Totally differentiating (13) to (16), we get

$$I_r dr + dG = S_Y dY + T_Y dY \quad (17)$$

$$dM = P(L_Y dY + L_r dr) + L dP \quad (18)$$

$$dW = P(Y_{NN} dN + Y_{NK} dK) + Y_N dP \quad (19)$$

$$dY = Y_N dN + Y_K dK \quad (20)$$

Substituting (20) into (19) and assuming that $dK = 0$, we get

$$dW = P(Y_{NN}/Y_N)dY + Y_N dP \quad (21)$$

(17), (18) and (21) can be used to solve for Y , r and P , given G , M , W and K . In matrix notation, we get

$$\begin{bmatrix} S_Y + T_Y & -I_r & 0 \\ PL_Y & PL_r & L \\ PY_{NN}/Y_N & 0 & Y_N \end{bmatrix} \begin{bmatrix} dY \\ dr \\ dP \end{bmatrix} = \begin{bmatrix} dG \\ dM \\ dW \end{bmatrix} \quad (22)$$

The determinant of the matrix on the left-hand side is

$$J = (S_Y + T_Y)PL_r Y_N + I_r(PL_Y Y_N - LPY_{NN}/Y_N) < 0. \quad (23)$$

The impact multipliers can be solved and their signs are given in Table 1. Since the official cash rate is achieved by open market operations which result in changes in the money supply, the present exposition has followed the more conventional method of treating M as the instrument.

TABLE 1

	dG	dM	dW
dY	+	+	-
dr	+	-	+
dP	+	+	+

The approach used to derive the policy impact multipliers as reported in Table 1 is fundamentally different from that of the Quantity Theory of Money or Svensson's model. The Quantity Theory ignores the real sector and postulates a direct relationship between money supply and the price level or the rate of monetary expansion and the rate of inflation. There is no interaction between the monetary and

the real sectors. Svensson's model relies on the Phillips curve. The linkage between the goods market and the money market, if it exists, is not explicitly specified. The IS-LM-AD-AS framework provides a simple structure of the economy and allows income, the interest rate and the price level to be determined simultaneously by the choice of policy parameters, G , M and W . Inflation can result from increasing G , M or W over time and does not depend on the output gap or inflationary expectations. As the model is not dynamic and the solution is a static equilibrium, the expected variables must be the same as the actual ones when the system is in equilibrium. Otherwise there will be changes. Assume that unemployment (U) is inversely related to output. P and U then become inversely related until full employment is reached.⁹

A major difference between our model and that of Svensson's is that he assumes that α_1 in (7) is positive whereas the conventional IS-LM-AD-AS model assumes that $\alpha_1 = 0$. Inflation is driven by the output gap in Svensson's model. One can have price stability with underemployment equilibrium in the IS-LM-AD-AS model. The high unemployment rates and low inflation rates experienced by some European countries and Japan in recent years attest to the fact that under-employment equilibrium can exist for a long time.

Another difference between the two models is that aggregate demand can be manipulated directly by altering G and indirectly by changing real disposable income by taxation. Since the investment function is volatile and may not respond to changes

⁹ It is interesting to note that Hangger and Groenewold (2003) relate U to the difference between the actual and the expected price level, not the actual and expected inflation rates.

in the interest rate, policymakers should take the more direct route of targeting aggregate demand using G or T than the indirect route of changing r which may affect I and L (demand for money) with long and variable lags.

V. Conclusion

To summarise, IAGT is superior to IT because the MA needs to know where the economy is going in terms of the level of output, the rate of economic growth or the level of unemployment. Our paper has shown that IT in its pure form, i.e., when output and economic growth are given no weights, is not likely to maximise social welfare. Whether the economy has contracted or expanded, the welfare is the same as long as the inflation target is met. With IAGT, economic growth is welfare enhancing and stagnation is welfare reducing.

When there is an expansion in aggregate demand, the inflation target imposed on the MA may cause the latter to adopt contractionary policy which pushes the economy further away from full employment. Thus, what appears to be demand-pull inflation when the actual inflation rate is compared with the targeted rate may actually be a reflection of the nature of an upward-sloping aggregate supply curve. There may be no excess demand because output still falls short of the full employment level after the increase in aggregate demand.

Svensson's model which is used to underpin IT relies on the Phillips relationship and the interest rate effect on aggregate demand. Both are suspect as a guide to monetary policy. The Phillips curve may be L-shaped and NAIRU should be interpreted as a range not a unique rate.

REFERENCES

- Arestis, P. and Sawyer, M (2003), 'Can Monetary Policy Affect the Real Economy? The Dubious Effectiveness of Interest Rate Policy,' *Public Policy Brief*, no. 21, Levy Institute.
- Barro, R. J. and Gordon, D. B. (1983), 'A Positive Theory of Monetary Policy in a Natural Rate Model,' *Journal of Political Economy*, 91, August, 589-610.
- Crosby, M and N. Olekalns (1998), 'Inflation, Unemployment and the NAIRU in Australia,' *Australian Economic Review*, 31, 117-29.
- Debelle, G. and J. Vickery (1996), 'Is the Phillips Curve a Curve? Some Evidence and Implications for Australia', *Economic Record*, 74, December, 384 - 398.
- Friedman, M. (1968), 'The Role of Monetary Policy,' *American Economic Review*, 58, 1-17.
- Friedman, M. (1977), *Inflation and Unemployment: the New Dimension of Politics*, London: Institute of Economic Affairs.
- Galbraith, J. K. (1997), 'Time to Ditch the NAIRU', *Journal of Economic Perspectives*, 11, Winter, 93-108.
- Gavin, W.T. and Poole, W. (2003), 'What Should A Central Bank Look Like?', *The Regional Economist*, July, www.stlouisfed.org, 5-9.
- Gordon, R.J. (1997), 'The Time-Varying NAIRU and its Implications for Economic Policy,' *Journal of Economic Perspectives*, 11, Winter, 11-32.
- Groenewold, N. and Hagger, A.J. (1998), 'The natural rate in Australia since the seventies', *Economic Record*, 74, 24-35.
- Gruen, D., Pagan, A. and Thompson, C. (1999), 'The Phillips curve in Australia', *Journal of Monetary Economics* 44, 223-58.

- Hagger, A.J. and Groenewold, N. (2003), 'Time to Ditch the Natural Rate?', *Economic Record*, 79, 324-335.
- McDonald, I. (2002), 'Equilibrium unemployment: Theory and measurement in Australia using the Phillips curve,' *Economic Record*, 78, December, 451-470.
- Reserve Bank of Australia (1996), 'Statement on the Conduct of Monetary Policy,' *Reserve Bank of Australia Bulletin*, September, 1 - 3.
- Reserve Bank of Australia (2003), 'Second Statement on the Conduct of Monetary Policy,' *Reserve Bank of Australia Bulletin*, August, 57 - 59.
- Staiger, D., Stock, J.H. and Watson, M.W. (1997), 'The NAIRU, Unemployment and Monetary Policy,' *Journal of Economic Perspectives*, 11, Winter, 33-49.
- Stevens, G.R. (2003) 'Inflation Targeting: A Decade of Australian Experience,' *Reserve Bank of Australia Bulletin*, April, 17-29.
- Stock, J. H. and Watson, M. W. (1999), 'Forecasting inflation', *Journal of Monetary Economics*, 44, 293-335.