Should the Bank of Israel Have a Growth Target? - What Are the Issues?

Alex Cukierman

October 27 2004

1 Introduction

This paper is meant to open a systematic discussion of the case for or against assigning growth targets to the Bank of Israel. Since potential output is widely believed to be unnaffected by monetary policy the paper interprets such targets as implying "flexible inflation targeting". Under this targeting method the Bank is supposed to pick the settings of monetary policy, in each period, in a way that optimally trades off losses from deviations of inflation from the target with losses from deviations of output from its potential level.

In spite of wide acceptance by economists of the view that money is neutral in the long run many economists and policymakers believe that monetary policy should also contribute its share to the stabilization of temporary fluctuations in real output. Twenty years ago this view led to the formulation, by Rogoff (1985), of a well known tradeoff betwen the credibility needed to achieve price stability and the flexibility required to engage in anticyclical policy. Rogoff's theoretical conclusion was that the central bank (CB) should be allowed to engage in some stabilization policy.

Following the increase in CB autonomy and the introduction of inflation targets during the nineties a distinction has been drawn between strict and flexible inflation targeters (Svensson (1997)). Since he does not care about cyclical fluctuations in output a strict inflation targeter strives to attain the target in each and every period. By contrast, since he also cares about

the cyclical position of the economy, a flexible inflation targeter tries to achieve the target only on average. In particular during periods of recession a flexible inflation targeter does not immediately offset the inflationary impact of cost shocks in order not to aggravate the recession. During periods of disinflation in which the focus is on the buildup of credibility many monetary policymakers tend to behave nearly as strict inflation targeters.[1] But after price stability has been reestablished for a sufficient lenght of time most Western monetary policymakers tended to behave as flexible inflation targeters.

Israel instituted inflation targets during the first half of the nineties and gradually reduced its rate of inflation to the level of major developed economies. Following the virtual elimination of Israeli inflation since 1999 the view that the Bank of Israel should also contribute to the stabilization of real output is being heard more persistently than in the past. In addition the recent attempt of the Treasury to keep the mounting budget deficit in check lent more weight to the argument that the Bank of Israel should contribute more to stabilization policy. Several "practical" proposals are floating around. One is that the Bank should also be assigned a real "growth target" in addition to the currently existing inflation target. Another is that the inflation target be replaced by nominal GNP targeting.

There is broad consensus among economists that, since it cannot affect potential output, monetary policy could be directed at the reduction of temporary cyclical deviations of actual from potential output but not at the management of potential output. Although not all advocates of growth targets take the trouble of distinguishing between "growth targets" that are applied to this "output gap" from growth targets that are applied to total output this distinction is fundamental since targeting of total output involves, inter alias, targeting of potential output over which monetary policy has no effect. Targeting of potential output causes inflation in periods of low potential growth and deflation in periods of high potential growth, raising inflation variability and uncertainty, without any effect on output. It therefore does not make much sense to adopt a targeting method that, directly or indirectly, involves the targeting of potential output.

I therefore take the view that the useful part of "growth targeting" is only in terms of

[1] Evidence on this tendency appears in Cukierman and Muscatelli (2003).

the output gap which is identical to flexible inflation targeting. Since it has some leverage over the output gap monetary policy can be used to reduce the severity of recessions during periods of cyclically low growth and to dampen the inflationary consequences of expansions during booms. This view underlies practically all the recent policy oriented literature on monetary policy tradeoffs like Taylor (1993) Clarida, Gali and Gertler (1999) and Svensson (2003). The broad message of this literature is that, even in the absence of a systematic inflation bias, the CB faces a tradeoff between inflation variability and output variability.

Since they possesses only one instrument even flexible inflation targeters must specify, at least implicitly, how much they are willing to "pay" in terms of inflation variability for a unit reduction in the cyclical variability of output. The more they are willing to pay at the margin in terms of inflation variability the more "flexible" are such inflation targeters and the larger and more persistent are the deviations they are willing to tolerate from the inflation target (Svensson (1997)). It follows that flexible inflation targeting that assigns a positive weight to the level of economic activity requires the specification of the magnitude of the "flexibility parameter". Following Rogoff's philosophy government could impose a flexibility parameter on the CB. However in all inflation targeting countries governments shy away from assigning a flexibility parameter to their respective banks. The general impression is that, in spite of the fact that they often critisize the conduct of monetary policy, politicians are reluctant to explicitly state their subjective tradeoffs betweeen the variability of inflation and that of output. Interestingly, in spite of their recent emphasis on transparency, all inflation targeting central banks are also quite hazy about their flexibility parameters (Cukierman (2002)).

The objective of this paper is to develop a framework that would make it possible to start a systematic discussion of the desirability of requiring the Bank of Israel to **also** pay attention to the phase of the cycle by explicitly requiring it to act as a flexible inflation targeter. A related question is how "flexible" should the Bank be in the conduct of monetary policy.[2] An important determinant of the answer to this question is obviously the degree of conservativeness (or of the desired flexibility parameter) of society as shaped by its elected officials. But the optimal degree of flexibility in the conduct of monetary policy also depends on the relative magnitudes of the

[2]Note that the answer to this question also allows the particular case of a strict inflation targeter that is not required to stabilize real output.

effects of changes in the interest rate on inflation and on output to which I refer as the tradeoff coefficient.

If a decrease in the short term rate of interest has a strong and sufficiently sustained effect on economic activity and a relatively small and distant effect on inflation, a high level of flexibility in the conduct of monetary policy is indicated. But if the converse is true a low level of flexibility in targeting inflation - - perhaps even strict inflation targeting - - is indicated. In particular, if due to Israel's inflationary history, the effect of a decrease in the interest rate on inflation is large and swift, the formal introduction of flexible inflation targeting or "growth targeting" may not be a good idea.[3] More generally, although growth targeting may be desirable in countries like Germany, the UK and the US which, due to a long history of nominal stability, possess low tradeoff coefficients, it may not be as desirable in countries, which due to long histories of nominal instability, possess high tradeoff coefficients. The first main question posed in this paper is; What kind of information do we need to assemble and to look at in order to determine whether Israel is currently nearer to the first or to the second group of countries?

The second main issue raised in the paper is related to the fact that our ability to decompose total output into its potential and cyclical components is limited. As a consequence, even with the "right" degree of flexibility in the targeting of inflation there generally are policy errors under flexible inflation targeting. In some periods monetary policy overreacts to movements in potential output and in others it underreacts to cyclical movements in output. As long as fluctuations in the rate of growth of potential output are small the resulting policy errors are not too serious. But following periods of substantial changes in the rate of growth policy errors under growth targeting may become large and persistent.

The paper is organized as follows. Section 2 discusses how the parameters of the economic structure affect the case for or against the introduction of growth targeting or equivalently, flexible inflation targeting. Section 3 applies the general framework of section 2 to the Israeli economy. Section 4 discusses the implications of unobservability of potential output for the desirability of growth targets. This is followed by concluding remarks.

[3] I use the terms flexible inflation targeting and growth targeting interchangeably.

2 Growth targeting and the structure of the economy

2.1 Economic structure

An important determinant of the desirability of growth (or of flexible inflation) targeting is the structure of the economy. If a change in the interest rate has a strong impact on inflation and a weak impact on output (a large tradeoff coefficient) flexible targeting is not desirable. By contrast if the tradeoff coefficient is low, flexible targeting is desirable. This section identifies some of the more basic parameters of the economy that determine the crucial tradeoff coefficient. This is done within an expanded version of a New Keynesian, closed economy, framework due to Clarida, Gali and Gertler (1999) (CGG(1999) in the sequel). The expansion of their closed economy model is needed to incorporate the fact that small open economy considerations are important in the Israeli economy. The model is given by

$$x_t = -\varphi(i_t - E_t\pi_{t+1}) + \theta(e_t + p_t^* - p_t) + E_t x_{t+1} + g_t \tag{1}$$

$$\pi_t = \lambda x_t + \beta_\pi E_t\pi_{t+1} + \beta_{ps}(e_t - e_{t-1} + \pi_t^*) + u_t \tag{2}$$

$$e_t = i_t^* - \varkappa i_t + E_t e_{t+1}. \tag{3}$$

where x_t is the output gap, π_t the rate of inflation, e_t is the (log of the) nominal exchange rate, p_t and p_t^* are (the logs of) the domestic and foreign price levels, i_t and i_t^* are the domestic and foreign interest rates respectively, g_t is a demand shock and u_t is a cost shock. The symbol $E_t z_{t+1}$ denotes the expected value, as of time t of z_{t+1}. The first equation states that the output gap is a decreasing function of the exante real rate of interest, of the output gap expected for next period and of the real exchange rate - - $e_t + p_t^* - p_t$. This equation is basically the New Keynesian output gap equation from CGG (1999) augmented by the real exchange rate term. The second equation states that inflation depends positively on the output gap, on the rate of inflation expected for the next period, and on the rate of change in the domestic currency price of foreign goods. Except for the last term which reflects the impact of foreign prices on domestic

inflation it is identical to the inflation equation in CGG.[4]

The third equation is a version of uncovered interest rate parity that allows for imperfect substituability between domestic and foreign financial assets. It states that, given the foreign interest rate and the expected level of next period's nominal exchange rate, the current exchange rate is higher (more depreciated) the lower is the rate of interest set by the CB. The coefficient $\varkappa$ measures the marginal risk premium on domestic financial assets. The lower it is, the larger is the risk premium on domestic financial assets. When $\varkappa < 1$ there is a risk premium on domestic financial assets. When $\varkappa > 1$ there is a risk premium on foreign financial assets. There is no risk premium on either type of asset and substituability is perfect when $\varkappa = 1$.[5]

2.2 Final objectives of monetary policy

As in CGG the loss function of society is given by

$$E_0 \sum_{t=0}^{\infty} \delta^t L_t \tag{4}$$

where δ is the discount factor and L_t is given by equation (5)

$$L_t = \alpha x_t^2 + \pi_t^2. \tag{5}$$

The parameter α measures the degree of CB liberalism. That is how much the CB cares about stabilization of output in comparison to stabilization of inflation. This specification postulates, without much loss of generality, that the targets for both inflation and the output gap are both zero. The higher α, the more policymakers care about achieving the growth target for potential output.

[4] In the formulation of the output gap equation the long run values of the real rate and and of the real exchange rate are implicitly normalized to zero so that one can think of the real rate of interest and of the real exchange rate as being in terms of deviations from their long run zero values. Thus, when those deviations and the expected future output gap are all zero, the equation implies that the current output gap is zero as well.

[5] To see this note that equation (3) can be rewritten as $i_t = \frac{1}{\varkappa}(i_t^* + E_t e_{t+1} - e_t)$. For $\varkappa = 1$ substituabiliy is perfect. Otherwise there is a risk premium or discount on domestic financial assets depending on whether $\varkappa$ is smaller or larger than 1. Note that the existence of a risk premium - - $\varkappa < 1$ - - (rather than a discount) on domestic financial assets reduces the impact of the short term interest rate on the nominal exchange rate.

2.2.1 Characterization of optimal policy

To characterize optimal monetary policy it is convenient to reformulate inflation and the output gap as functions of **only** the interest rate, the exogenous shocks and the expected future values of the endogenous variables . Substituting equation (3) into equations (1) and (2), solving for x_t and π_t, and rearranging

$$\begin{aligned} x_t &= \frac{1}{1+\lambda\theta}\left\{-\left(\varphi+(1-\beta_{ps})\frac{\theta}{\varkappa}\right)i_t+B_{xt}\right\} \\ \pi_t &= \frac{1}{1+\lambda\theta}\left\{-\left(\lambda(\varphi+\frac{\theta}{\varkappa})+\frac{\beta_{ps}}{\varkappa}\right)i_t+B_{\pi t}\right\} \end{aligned} \tag{6}$$

where

$$\begin{aligned} B_{xt} &\equiv E_t x_{t+1}+\theta(1-\beta_{ps})E_t e_{t+1}-\theta\beta_\pi E_t\pi_{t+1}+Z_x-\theta Z_\pi+g_t-\theta u_t \\ B_{\pi t} &\equiv \lambda E_t x_{t+1}+(\lambda\theta+\beta_{ps})E_t e_{t+1}+\beta_\pi E_t\pi_{t+1}+\lambda Z_x+Z_\pi+\lambda g_t+u_t \end{aligned} \tag{7}$$

and $Z_x \equiv \theta(i_t^*+p_t^*-p_{t-1})$ and $Z_\pi \equiv \beta_{ps}(i_t^*-e_{t-1}+\pi_t^*)$ are combinations of exogenous variables.

An optimal monetary policy that takes into consideration both inflation and growth objectives can now be characterized as follows. Choose values of the interest rate for the current period (period 0) and a contingency plan for future interest rates (periods $1,2,..$) so as to minimize the expected value of losses in equation (4). The currently expected values of next period's endogenous variables depend on the (currently) expected value of next period's choice of interest rate by the CB, but **not on the current choice** of interest rate. Hence the choice of i_t involves an intraperiod tradeoff between inflation and output gap variability but no intertemporal tradeoff.[6] These considerations lead to the following string of first order conditions

$$\alpha x_t\frac{\partial x_t}{\partial i_t}+\pi_t\frac{\partial\pi_t}{\partial i_t}=0,\ i=0,1,2..\ . \tag{8}$$

[6] This is a consequence of the fact, that for simplicity, the model does not include lagged endogenous variables. The introduction of lagged endogenous variables creates a link between the current choice of interest rate and future values of final objectives (inflation and the output gap).

Using equations (6) and rearranging, these conditions can be rewritten as

$$\frac{x_t}{\pi_t} = -\frac{1}{\alpha}\frac{\frac{\partial \pi_t}{\partial i_t}}{\frac{\partial x_t}{\partial i_t}} \equiv -\frac{b}{\alpha} = -\frac{1}{\alpha}\frac{\lambda(\varphi + \frac{\theta}{\varkappa}) + \frac{\beta_{ps}}{\varkappa}}{\varphi + (1-\beta_{ps})\frac{\theta}{\varkappa}},\ t = 0, 1, 2.. \ . \tag{9}$$

This condition states that, at the margin within each period, the interest rate has to be chosen so as to equate the marginal loss from missing the inflation target to the marginal loss of missing the (potential) output target. Note first, from equations (6) and (7), that it always pays to fully offset the demand shock, g_t, since this shock affects the output gap and inflation in the same direction. Hence, in the face of demand shocks there is no meaningfull tradeoff between the variability of inflation and the variability of the output gap. But, since it affects inflation and the output gap in opposite directions, the realization of a (positive) cost shock, u_t, imposes a non-degenerate tradeoff on the monetary authority. If it reduces the interest rate to offset the decrease in output, it aggravates the problem of inflation and if it raises the interest rate to reduce the inflationary consequences of the shock, it aggravates the recession.[7] Equation (9) states that, in such a case, it is optimal to allocate the costs of the shock to variability in output and to variability in inflation around the target in line with two basic sets of parameters. One is the degree of conservativeness of policymakers ($\frac{1}{\alpha}$) and the other is an objective tradeoff coefficient that measures the relative impact of the interest rate on inflation and on the output gap. From equation (9) this tradeoff coefficient is given by the combination of parameters denoted by the letter b.

Equation (9) suggests that, given α, the larger is b the larger is the relative size of the deviation from the growth target in comparison to the deviation from the inflation target that it is optimal to tolerate. Conversely, if b is relatively low it is optimal to tolerate relatively large deviations from the inflation target in order to maintain deviations from the growth target within a sufficiently narrow range. At one extreme, given α, if b is very large it is optimal for all practical purposes to have only strict inflation targeting and to forget about stabilization of the output gap and growth targeting. At the other extreme, if b is sufficiently low a combination of inflation and of output gap or growth targeting is indicated. Thus, given the degree of liberalism

[7] Probably the most important cost shocks are those that originate from fluctuations in wages. A more explicit discussion of the consequences of the tradeoff in the text for monetary policy in the presence of wage setting unions and monopolistically competitive firms are discussed in Coricelli, Cukierman and Dalmazzo (2002).

of society (which is determined in practice by elected officials) the relative importance that should be given to inflation and to growth targeting depends on the size of the tradeoff coefficient, b. I now turn to a scrutinization of the more basic determinants of the size of this parameter.

It appears from the definition of b in equation (9) that the tradeoff coefficient depends on the coefficient, λ, that characterizes the impact of the output gap on inflation, on the passthrough coefficient, β_{ps}, on the coefficient, φ, that characterizes the impact of a change in the interest rate on the output gap, on the coefficient, θ, that measures the impact of the real exchange rate on the output gap and on the parameter, $\varkappa$, which characterizes the marginal impact of the short term interest rate on the nominal exchange rate. The tradeoff coefficient is increasing in λ and β_{ps} and decreasing in φ. The impact of the remaining parameters is generally ambiguous. Due to various forms of indexation of domestic prices to
the price of foreign exchange the passthrough coefficient is non negligible in the Israeli economy. Some of those indexation arrangements are informal remnants from the time of the great inflation. For example prices in the housing market (rentals and sales) are still quoted in terms of US $. As a consequence nominal depreciations have a swift effect on this component of the general rate of inflation.

3 Implications for Israeli monetary policy and institutions

The discussion of the previous section identifies some of the basic paramaters that determine the magnitude of the tradeoff coefficient, and through it, the relative desirability of having an output or growth target on top of the inflation target. To reach more informed conclusions about this issue one obviously needs as precise as possible estimates of the various parameters that determine this aggregat coefficient. Since there is not much evidence on those parameters this paper can be partially viewed as a motivating plea for the production of more such estimates.

There is much, sometimes heated, debate in Israeli policy circles about how much attention the Bank of Israel should pay to the state of the economy when setting the interest rate The Bank is periodically accused of not paying enough attention to the state of the economy.

Voices are sometimes heard suggesting the imposition, by Government, of a growth or a nominal GDP target on the Bank.[8] Under Governor Frenkel the Bank often reacted by appealing to the notion that monetary policy affects mostly prices rather than output, even in the short run. Remarkably, this recurrent debate is usually completely divorced from empirical estimates of coefficients of the transmission process of monetary policy in the Israeli economy. Admittedly, there is not much empirical evidence on the parameters of the Israeli transmission process but even those that exist have usually been disregarded, at least in public policy debates. The discussion of the previous section suggests that, to an important degree, the resolution of the debate for also having (or not having) a growth or output gap target, on top of the inflation target, depends on the magnitude of the tradeoff coefficient, b.

3.1 A numerical illustration

This subsection presents an illustrative "guesstimate" for the possible range of the tradeoff coefficient. Unfortunately the evidence on the parameters that determine the Israeli tradeoff coefficient is scant. Elkayam et. al. (2002, table 3) present estimates for the parameter, λ, that characterizes the effect of the output gap on inflation for various proxies of the output gap. The estimates for the two to three quarters effect of an increase in the output gap on inflation vary between 0.78 and 1.07.[9] I therefore take $\lambda = 1$ as a proxy for this parameter. I am not aware of any estimates of the effect, φ, of a change in the real rate on the output gap. Note that the lower this coefficient, the higher the tradeoff coefficient and the worst the case in favor of growth targets. To initially stack the case in favor of growth targeting I first take the parameter φ to be equal to one half. This seems to be a reasonable upper bound since it implies that a one percent decrease in the real rate of interest reduces a negative output gap by half a percent. I

[8] Since nominal GDP includes both real and nominal components, nominal GDP targeting is a particular way of introducing an output or growth target on top of the inflation target. This targeting method implicitly assigns the same weight to a one percent inflation as it does to a one percent real GDP growth. It also does not distinguish changes in real growth that are due to changes in potential output from changes that are due to fluctuations in the output gap.

[9] Elkayam et. al (2002) feature two quarterly lags on inflation. This specification creates a discrepency between the impact and the total effects of an increase in the output gap on inflation. Since the New-Keynesian model utilized here does not feature any lags I interpret its coefficients as compressed representations of the total effect. This view leads to the utilization of the **total** effect of the output gap on inflation from Elkayam et. al. (2002) as a proxy for λ.

take $\theta = 1$. This assumption means that a one percent change in the real exchange rate reduces a negative output gap by one percent. The value of this parameter is also partially chosen to stack the case in favor of growth targets. I also make the, neutral, assumption that there is no risk premium or discount on domestic financial assets so that $\varkappa = 1$.

Probably the most volatile component of the tradeoff parameter is the pass-through coefficient. Fortunately there is some recent evidence on this coefficient. Leiderman and Bar-Or (2000) have estimated a time varying pass-through coefficient for the nineties. They find that this coefficient fluctuated between 0.3 and 0.55 (see table 5). They also find that the coefficient tends to increase during expansions and to decrease during recessions. Since this non linearity is not reflected in the linear model presented above the marginal impact of depreciations on inflation may not be fully accounted for. To somehow compensate for that I take the upper bound on β_{ps} to be 1 rather than 0.55. I take, as in Leiderman and Bar Or (2000) the lower bound on it to be 0.3 and evaluate the tradeoff coefficient for the above parameters and for these two extreme values of β_{ps}. For $\beta_{ps} = 0.3$ the tradeoff coefficient is 1.5 implying that at the lower bound on β_{ps} a one percent increase in the cyclical component of output is associated with one and a half percent increase in the rate of inflation. At the upper bound the tradeoff coefficient is 5 implying that a policy that raises the cyclical component of output by one percent, raises the rate of inflation by 5 percent. Note that, since the tradeoff coefficient is increasing in the pass-through coefficient, the tradeoff coefficient increases monotonically from 1.5 to 5 as β_{ps} increases from 0.3 to 1. All in all, these values of the tradeoff coefficient do not appear to imply that growth targeting should be totally disregarded.

3.2 Sensitivity analysis

Since the discussion above is based on rather diffuse priors regarding some basic parameters, sensitivity analysis is indicated. In this context a crucial parameter is the marginal impact, φ, of a change in the real rate of interest on the output gap. In what follows I examine the magnitude of the tradeoff coefficient for the same two values of β_{ps} under the alternative assumption that a one percent decrease in the real rate raises the contemporaneous output gap by only 0.1 of a percent. The other parameters are as before. The corresponding low and upper bounds on

the tradeoff coefficient are now 1.75 and 22. Again, the lower bound certainly leaves room for serious consideration of "growth targets". On the other hand, since it implies that a one percent increase in the cyclical component of output is associated with a twenty two percent jump in inflation, the upper bound raises serious questions about the wisdom of a growth target for the Bank of Israel.

The morale of this discussion is that availability of reasonably reliable estimates for a crucial parameter like φ is essential for serious evaluation of the wisdom of output gap or growth targeting. More detailed empirical work on the magnitude of this parameter and of the other parameters that affect the magnitude of the tradeoff coefficient, b, is needed before a verdict about the desirability of flexible inflation (or growth) targeting can be reached. However, even if it is found that the tradeoff coefficient is sufficiently small to warrant a serious consideration of growth targeting, there is an additional hurdle that must be taken into consideration before rushing to impose such targets on the Bank of Israel. The following section discusses this additional issue.

4 Unobservability of potential output and the risks of growth targeting

4.1 The problem

Nobody really knows with certainty what is the time path of potential output. Although part of this uncertainty is resolved with the benefit of hindsight there is normally substantial uncertainty about the current and near future expected level of this variable at the time monetary policy choices have to be made. Since the output gap is defined as the difference between actual and potential output this uncertainty is also injected into the output gap. A major implication of this observation for the choice of monetary policy procedures is that, due to poor real time knowledge about the output gap, flexible inflation targeters (or growth targeters for that matter) condition their policy on a variable that is measured with a substantial amount of error.

In an important paper Orphanides (2001) shows that during the second part of the seventies and part of the eighties the Fed systematically overestimated potential output leading

to substantial overestimation of the magnitude of the recession at that times. Since the Fed behaved as a flexible inflation targeter those forecast errors induced a monetary policy stance which came to be considered, with the benefit of hindsight, as excessively loose thus contributing to the inflationary bulge of the second half of the seventies in the US. The fact that there was a substantial decrease in output during the second half of the seventies is well known and is not under dispute. What is at issue here is how much of this decrease was due to cyclical elements over which monetary policy has some temporary impact versus how much was due to changes in potential output over which monetary policy has little or no impact.

Since errors of forecast are sometimes positive, at other times negative, and normally not persistent, one may think at first blush that policy errors induced by poor measurement of the output gap should not inject persistent errors into the choice of monetary policy. Unfortunately, this is not the case with the output gap. Cukierman and Lippi (2002) show that errors in forecasting potential output and the output gap are generally serially correlated and that the average magnitude of this serial correlation depends on the underlying parameters of the economy. The intuitive reason is that, unlike forecasts of many variables whose true values become known with a lag of one period, the true values of potential output and of the output gap are not revealed with certainty, even after the fact. As a consequence monetary policy errors of flexible inflation targeters become serially correlated as well. In periods in which potential output does not deviate much from its trend the measured persistence in policy is small and may not constitute a serious problem for growth targeting. But in periods with large deviations of potential output from its trend policy errors may be quite persistent over time. Thus, in the presence of growth targeting, the inherent unobservability of the output gap is particularly dangerous for nominal stability around and following turning points in the path of potential output.[10]

Since inflation depends on the output gap this problem may arise under strict inflation targeting as well. However since, under this targeting method, the poorly measured output gap

[10]This statement is consistent with recent empirical findings in Orphanides (2000). Orphanides utilizes real time data on the perceptions of policymakers about potential output during the 1970's and compares those perceptions with current estimates (as of October 1999) of the historical data. Taking the "current" rendition of estimates of potential output as a proxy for the true values of potential output during the seventies he finds highly persistent deviations between the current and the real time estimates of the output gap (see his Figure 3 in particular).

variable does not enter into the objective function of the CB, the policy errors are likely to be smaller. This intuition is backed by the discussion in section 6.1 of Cukierman and Lippi (2002). Using a backward looking Neo Keynesian model of the economy they show that the higher the degree of conservativeness of the CB (the lower α), the lower the difference between the choice of interest rate in the presence and in the absence of uncertainty about potential output and the output gap.

4.2 The output gap: practice and theory

Empirical estimation of the output gap relies on estimates of potential output. Those estimates are based on alternative methods without any clear criterion for ranking them. Among those are various smoothing procedures like the HP filter, linear and polynomial time trends and the aggregate production function approach that derives potential output as predictions from a regression of output on the labor force, the capital stock and a time trend.[11]

At the conceptual level Woodford (2002) proposes to define the "business cycle" as the deviation of actual output from the level of output that would have been produced in the absence of price stickiness. Woodford's "business cycle" is limited since it considers only fluctuations that are due to the interaction of price stickiness with unanticipated shocks. There may be some question as to whether the real impact of money is due mainly to sticky prices or to sticky wages.[12] But the broad current consensus among economists is that, in the absence of either type of stickiness money would have been neutral even in the short run. One could obviously extend Woodford's conception by defining the output gap as the deviation of actual output from its level in the absence of **both** sticky prices and wages. Such an approach appears as safer and more general since it does not take a position on whether the real effects of money are due to price or to wage stickiness. Nonetheless, there still is no clear correspondence between this extended conception and empirical measures of the output gap.

Although, unrelated to empirical measures of the output gap above and limited in scope a

[11] Further details appear in Artis et. al. (2003) and in Elkayam etr. al. (2002).

[12] A framework in which monetary policy affects output, even under flexible prices, due to sticky wages is discussed in Coricelli et. al. (2002). The relative merits of sticky prices versus sticky wages as reasonable levers for the real effects of monetary policy are discussed in Cukierman (Forthcoming).

view of the output gap as being due to either price or wage stickiness, or both, has one important merit. It puts the spot light on those parts of output fluctuations over which monetary policy **has** an impact. Other types of fluctuations in output are irrelevant for monetary policy since this policy cannot affect them.

4.3 A practical proposal

So where does all this lead us to? How should we start to evaluate whether, taking the considerations raised in this section, the Bank of Israel should be assigned a growth target? It would be presumptuous on my part to pretend to have a full answer to this difficult question. But I would like to make a proposal that may start to pave the way towards a more informed answer to this important question. The discussion of the previous subsection raises two difficulties with existing methodologies for the measurement of the output gap and, therefore, for deciding in an informed manner whether growth targets are desirable..First, there are several empirical ways for measuring the output gap whose fluctuations monetary policy is supposed to reduce. The bothersome aspect of this "abundance of choices" is that there is no obvious criterion for choosing among those measures. Second there is no clear link between any of those empirical proxies and that part of fluctuations in output that is affected by monetary policy.

A possible way to resolve both problems is to estimate output gap equations of the Israeli economy with alternative empirical measures of the output gap and to choose the one that, with appropriate controls, maximizes the impact of the real interest rate on the output gap. The conception underlying this procedure follows. Since it is the one that is most sensitive to monetary policy, the output gap proxy that maximizes the impact of the interest rate on this gap is likely to be the best approximant of that part of fluctuations in output that can be regulated by means of monetary policy. The main advantage of this procedure is that it is likely to best approximate the difference between actual output and the level of output under full price and wage flexibility. Recall that this is the part of output over which monetary policy is believed to have some impact. As a byproduct the procedure picks one empirical proxy out of the several that exist in the profession.

Obviously, this procedure stacks the deck in favor of growth targets. This may be a

disadvantage if the resulting tradeoff coefficient is found to be small and favors, therefore, growth targeting. On the other hand if it is found to be large the confidence with which growth targeting can be rejected is larger.

5 Evaluation of nominal GNP targeting

Nominal income targeting has been proposed already some time ago as an alternative to inflation targeting. A recent evaluation of the performance of this targeting method in the US economy appears in McCallum and Nelson (1999). They stress two advantages of this method; operationality and robustness. Nominal income targeting is obviously easy to implement because it requires only figures on nominal income which are available on a quarterly basis. McCallum and Nelson, McCallum and others also claim, based on various estimation and simulation experiments for the US that this targeting method is robust in the sense that it yields relatively higher levels of welfare than other targeting methods for a number of alternative specifications of the structure of the US economy. In view of pervasive uncertainty about the correct specification of the economic structure this robustness property is important. However the fact that nominal income targeting was found to be robustly better than other targeting methods in the US does not automatically implies that this is the case in the small, highly open, Israeli economy. Much additional empirical work is needed to establish whether a similar robustness property also obtains in the Israeli economy.

The conception underlying nominal income targeting is that it simply and automatically induces monetary policy to stabilize both inflation and output around their respective targets. But the method also raises a number of potential problems the most important of which is that it does not distinguish between output fluctuations that are due to changes in potential output from those that are due to changes in the output gap. This may lead to excessive inflationary monetary expansion in periods of decceleration in the rate of growth of potential output without any beneficial effect on output stabilization.

That this is a real possibility in the Israeli case is illustrated by the substantial reduction in real growth since the beginning of the second "intifada" and the recession in the world high tech industry. It is highly likely that most if not all of this growth decceleration originated in

potential output. Had the Bank of Israel been on a nominal income targeting regime at the time, it would have to reduce the interest rate without much effect on real output until nominal output growth would reach the nominal income growth target. In such an episode nominal income targeting is obviously a blueprint for inflating in periods of reductions in the rate of growth of GDP. One may hope that government would quickly recognize such episodes and adjust the nominal income target downward. However the previous section suggests, based on experience from a similar episode at the time of the oil shocks in the US, that it may take a while to recognize such occurences and that errors of forecast of potential output are serially correlated.

A second, subsidiary, problem with nominal income targeting is that it builds in the same weights on stabilization of inflation and stabilization of real output, absolving policymakers from the need to think hard about what are the appropriate subjective tradeoffs between stabilization of inflation and stabilization of real output.

6 Concluding remarks

The main objective of this paper is to contribute to the public policy discussion regarding whether or not a growth target (or a flexible inflation target) should be assigned to the Bank of Israel by reformulating this question in a way that leads to verifiable and falsifiable propositions. Two broad conclusions emerge from the discussion.

First, the answer to this question strongly depends on the structure of the economy as summarized by an objective tradeoff between stabilization of inflation and of output. If a change in the interest rate has a strong impact on inflation and little impact on output, strict inflation targeting is indicated. Otherwise, some form of growth (or flexible inflation) targeting is desirable. The paper identifies some of the basic parameters that determine the crucial tradeoff coefficient. Second, due to the unobservability of potential output and of the output gap, even optimal monetary policy is subject to serially correlated forcast errors. Flexible inflation targeting that assigns a positive weight to stabilization of the output gap leads to larger discrepencies between the actual and the full information interest rate than strict inflation targeting. The paper also briefly evaluates the case for nominal income targeting.

To illustrate those ideas in a precise manner I have used a particular forward looking, linear, New Keynesian model with no lags. Much experimentation with alternative specifications is needed to obtain more reliable quantitative answers to the question posed in the title of the paper. In particular, experimentation with lags and non linearities with some of the coefficients, like the passthrough coefficient are indicated. Possible interactions between the magnitude of the passthrough and the phase of the cycle should be checked as well.

7 References

Artis M. J., Marcellino M. and T. Proietti, 2003, "Dating the European Business Cycle", CEPR Discussion Paper No. 3696, January.

Clarida, R., Galí, J. and M. Gertler 1999), "The Science of Monetary Policy: a New Keynesian Perspective", **Journal of Economic Literature**, 37, December, 1661-1707.

Coricelli F. , Cukierman A. and A. Dalmazzo, 2002, "Monetary Institutions, Monopolistic Competition, Unionized Labor Markets and Economic Performance ", Available on the Web at: http://www.tau.ac.il/~alexcuk/pdf/ccd-revej1.pdf

Cukierman A., 2002, " Are Contemporary Central Banks Transparent about Economic Models and Objectives and What Difference Does it Make? ", **Federal Reserve Bank of St. Louis Review**, 84(4), 15-45, July - August.

Cukierman A., "Monetary Institutions, Monetary Union and Unionized Labor Markets - Some Recent Developments ", Forthcoming in: Beetsma R., C. Favero, A. Missale, V.A. Muscatelli, P. Natale and P. Tirelli (eds.), **Monetary Policy, Fiscal Policies and Labour Markets: Key Aspects of Macroeconomic Policymaking in EMU**, Cambridge University Press. Available on the Web at : http://www.tau.ac.il/~alexcuk/pdf/milansurvey.pdf

Cukierman A. and F.Lippi, " Endogenous Monetary Policy with Unobserved Potential Output ", December 2002, Available on the Web at: http://www.tau.ac.il/~alexcuk/pdf/lippi-iii-31-dec-02.pdf

Elkayam D., Regev, M. and Y. Alashvili, 2002, "Estimation of the Output Gap and Examination of its Effect on Inflation in Israel During the last Few Years", Discussion Paper # 2002.01, Bank of Israel, August.

Leiderman L. and H. Bar-Or, 2000, "Monetary Policy Rules and Transmission Mechanisms Under Inflation Targeting in Israel", Discussion Paper # 2000.01, Bank of Israel.

McCallum B. and E. Nelson, 1999, "Performance of Operational Policy Rules in an Estimated Semiclassical Structural Model", in J.B. Taylor (ed.), **Monetary Policy Rules**, University of Chicago Press, Chicago.

Orphanides, A., 2000, "Activist Stabilization Policy and Inflation: The Taylor Rule in the 1970s", manuscript, Board of Governors of the Federal Reserve System.

Orphanides, A., 2001, "Monetary Policy Rules based on Real-Time Data", **American Economic Review**, Vol.91(4): 964-985.

Rogoff K., 1985, "The Optimal Degree of Commitment to a Monetary Target", **Quarterly Journal of Economics**, 100:1169-1190.

Svensson, Lars O.E., 1997, "Inflation Forecast Targeting: Implementing and Monitoring Inflation Targets". **European Economic Review**, 41:1111-46.

Svensson, Lars O.E., 2003, "What is Wrong with Taylor Rules? Using Judgment in Monetary Policy through Targeting Rules", **Journal of Economic Literature**, 41:426-477, June.

Taylor J., 1993, "Discretion vs Policy Rules in Practice", **Carnegie Rochester Conference Series on Public Policy**, 39:195-214.

Woodford M., 2002, "Inflation Stabilization and Welfare," **Contributions to Macroeconomics**, 2.