

**OPEN ECONOMY INFLATION TARGETING ARRANGEMENTS AND
MONETARY POLICY RULES: APPLICATION TO INDIA**

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Abstract

There has been a great deal of discussion of whether the Reserve Bank of India (RBI) should adopt an inflation targeting arrangement. This debate has been further fuelled by the release of the Raghuram Rajan report of the Committee on Financial Sector Reforms (CFSR) which recommended that the Reserve Bank of India (RBI) adopt an inflation targeting arrangement. However, some of the popular discussion on the issue appears to be rather confused and insufficiently informed about the details of an inflation targeting arrangement. This paper attempts to clarify some of the issues at hand, and in particular, the implications of such an arrangement for exchange rate management. The paper also estimates a Taylor type Monetary Policy Rule for India.

Structured Abstract

Purpose

The purpose of the paper is to explore whether India is a suitable candidate for an inflation targeting regime where policy is implemented through a monetary policy rule (MPR). It begins by placing India's monetary policy actions in a broader context by discussing whether the Reserve Bank of India (RBI) should deviate from its current policy of heavily managed exchange rates to one involving greater currency flexibility. If the latter is chosen, then the selection of inflation targeting would appear an appropriate one.

Design/methods/approach

This paper has analytical, empirical and policy dimensions. Given the recent history of exchange rate centered policy in India, a discussion of the role of the exchange rate is needed. This is presented by the use of an analytical model where we examine how inflation targeting might work with the exchange rate. Then the decision rule from the model (the MPR) is adapted for empirical testing and is estimated to investigate whether an MPR that follows inflation targeting can work for India.

Findings

The empirical evidence suggests that there is some weak evidence to suggest that the RBI follows an MPR quite inadvertently. The MPR tends to react to current inflation but there is no evidence that it reacts to forecasts of inflation. Additionally, MPRs do not react at all to the exchange rate.

Originality/Value

This is a highly topical issue that has attracted a great deal of attention in policy discussions, both in India and in the region. Very few papers combine the analytical and empirical considerations in this topic.

Key words: Asia, Exchange Rate Regime, India, Inflation Targeting, Monetary Policy Rules

JEL Classification: E52, E58, F31

1. Introduction

Following the spate of financial crises in the 1990s, many observers have opined that the need to depoliticize exchange rate movements along with the frequency with which “soft pegs” have been susceptible to speculative attacks in this era of escalating global capital flows necessitates that developing countries adopt corner solutions to exchange rates arrangements. In other words, according to many observers, the exchange rate option for developing countries boils down to one between flexibility, on the one hand, and credible pegging, on the other. Countries have, however, been advised to steer clear of arrangements that lie anywhere between these polar extremes (i.e. those in the “middle”) as they were viewed as inherently unstable.

This “corners hypothesis” has drawn analytical support from the “Impossible Trinity”. Simply put, this states that a country cannot simultaneously conduct independent monetary policy and pursue a fixed exchange regime if it wants to remain completely open to international capital flows. From an analytical perspective however, Frankel (1999) has provided us with the timely reminder that the Impossible Trinity does *not* on its own imply that in an increasingly globalized world economy an intermediate regime is unviable or that countries will be compelled to abandon the middle ground.

Indeed, the sentiment in favour of the bipolar view of exchange rates has not been without its doubters. For instance, Bergsten et al. (1999) has made the important point that “(m)anaged floats do not have the clean, clear-cut allure of full institutional purity, but, in a world of second-bests, they are worth exploring” (p.9). Fischer (2001) has acknowledged that there are many instances where intermediate regimes might well be “more appropriate” than corner solutions¹. Willett (2003) too strongly has

¹ In fact, Fischer (2001) has noted that the bipolar view of exchange rates ought to be presented as a choice between a hard peg versus a “more flexible regime” rather than a flexible exchange rate regime *per se*. The latter option implies the absence of any explicit exchange

questioned whether countries really face such stark choices in their choice of exchange regimes, arguing that based on the Optimum Currency Area (OCA) criteria, many countries do not appear to be good candidates for either fixed exchange rates or completely flexible exchange rates. Consistent with this, data from the IMF reveals that since 2001 there appears to be a gradual shift back again towards intermediate regimes (Stone et al., 2008).

The preceding leads to the rather unsatisfying conclusion that when it comes to the choice of an appropriate exchange rate regime there exists a broad spectrum of choices. It is not a black-or-white issue; shades of grey abound. All that we can say with certainty is that in the absence of strong capital controls, currency intervention ought *not* to be framed as a specific target for the exchange rate. Such targets inevitably tempt speculators by offering them the infamous one-way option. Thus, exchange rate and monetary policy strategies must involve a “fairly high” element of flexibility rather than a single-minded defense of a particular rate.

One way of introducing greater exchange rate flexibility is for a country to adopt an open economy inflation targeting arrangement, something that has been advocated strongly by the IMF and many other observers. Since the East Asian financial debacle of 1997-98, a handful of countries in the region -- Korea, Indonesia, Thailand and the Philippines -- have instituted monetary policy arrangements fashioned around an inflation objective (Table 1). Each of these countries has passed legal and institutional legislations supporting their respective IT arrangements. These legislations so passed provide for many facets of the new monetary policy regime including the appointment of key personnel and their tenure, the independence and autonomy of the monetary authority, the stated objectives of monetary policy and the responsibilities and

rate target, i.e. intervention should not be framed primarily in terms of defending a particular exchange rate target. For a discussion of the pros and cons of various exchange rate regimes with particular reference to Asia, see Cavoli and Rajan (2008c, Chapter 1).

accountability with respect to the achievement of those objectives.²

Some observers have suggested that the Reserve Bank of India (RBI) should also adopt an inflation targeting arrangement. Most recently, the Raghuram Rajan report of the Committee on Financial Sector Reforms (CFSR) made the following recommendation: “The RBI should formally have a single objective, to stay close to a low inflation number, or within a range, in the medium term, and move steadily to a single instrument, the short term interest rate (repo and reverse repo) to achieve it.”³ This in turn has further fuelled a great deal of debate, particularly at a time when prices in India have been rising at an accelerating rate and the RBI does not appear to have clear monetary policy framework.⁴ This said, some of the popular discussion on the issue appears to be rather confused and insufficiently informed about the details of an inflation targeting arrangement. This paper attempts to clarify some of the issues at hand, and in particular, the implications of such an arrangement for exchange rate management.

The paper is organized as follows. Section 2 explores the case for and operational mechanics behind an open inflation targeting regime. Section 3 stresses if and how the exchange rate enters a monetary policy rule (MPR) under an inflation target arrangement. Section 4 attempts to empirically ascertain whether the RBI has inadvertently if not intentionally been following a Taylor type MPR. Section 5 concludes with a discussion of policy issues in the conduct of inflation targeting in practise.

² See Cavoli and Rajan (2007, 2008b and 2008c, Chapter 2) for a discussion of the inflation targeting arrangements in East Asia.

³ See http://planningcommission.nic.in/reports/genrep/rep_fr/cfsr_all.pdf. The broader debate of appropriate types of monetary policy in India, particularly in the face of rapid capital flows, has been ongoing for the last few years. For instance, see Shah (2008), Shah and Patnaik (2007) and Patnaik and Shah (2008). Somewhat less attention has been paid to appropriate monetary policy response in the event of supply shocks.

⁴ Inflation in India based on the Wholesale Price Index (WPI) touched a 13-year high of just over 11 percent y-o-y for the week ending June 7, 2008.

2. Open Economy Inflation Targeting and Monetary Policy Rules (MPRs)

Buoyed by the apparent success of inflation targeting in industrial countries in the early 1990s, it has been strongly advocated by the IMF and other as a viable policy option for emerging economies in Asia and elsewhere (IMF, 2006). There is a growing body of empirical evidence that finds inflation targeting arrangements to have improved the macroeconomic outcomes in emerging market economies in terms of lower and more stable inflation and lower output volatility without the fragility of pegs (IMF, 2006, Batini and Laxton, 2006 and Gonçalves and Salles, 2005).

But what exactly is inflation targeting? Eichengreen (2001) defines inflation targeting as follows:

(A) monetary policy operating strategy with four elements: an institutionalized commitment to price stability as the primary goal of monetary policy; mechanisms rendering the central bank accountable for attaining its monetary policy goals; the public announcement of targets for inflation; and a policy of communicating to the public and the markets the rationale for the decisions taken by the central bank (p.4).

So clearly an inflation targeting arrangement is not just about public pronouncement of an inflation target/range. Important features of an inflation target arrangement include the definition of what type of inflation is being targeting, the inflation target range, the use of exclusion clauses or caveats (i.e. under what circumstances the central bank is able to overshoot its target), and the target horizon (Heenan, Marcel and Scott, 2006). All of this information needs to be publicly available and fully transparent.

For the most part, inflation targeting is conducted in conjunction with a monetary policy rule (MPR). In general terms, a MPR is one element of a strategy employed by the monetary authority as part of its overall monetary policy. More specifically, the MPR should specify how the instrument of monetary policy is to be changed given the characteristics of the macroeconomy and the policy objectives of the monetary authority. The instrument of monetary policy is most commonly an

interest rate, usually a short-term cash rate or repo rate. However, other policy instruments could also be used⁵.

In an inflation targeting regime, MPRs implicitly assume that the instrument of monetary policy will always react strongly to inflation (or some forecast of future inflation). It is important to stress the differences between MPRs and inflation targeting. The two are different elements of a general monetary policy strategy. The MPR provides a guide to the policymaker for how to manipulate the instrument of monetary policy; the inflation target simply makes a statement of what the instrument is being ultimately used for. According to Taylor (2000), “(t)here is an interesting symbiotic relationship between inflation targeting and monetary policy rules...A monetary policy rule is nothing more than a contingency plan that describes as precisely as possible the circumstances in which a central bank changes the *instruments* of monetary policy” (p.2)

For much of this last decade, the literature on MPRs has developed in a closed economy context. It is only recently, when inflation targeting has been suggested as a serious policy option for small and open emerging economies that research has begun to focus on rules in open economy models and, consequently, the role of the exchange rate. For instance, Fischer (2001) notes that “in most countries, even those with floating exchange rate regimes, monetary policy is likely to respond to some extent to movements in the exchange rate” (p.13).

3. The Role of Exchange Rate under Inflation Targeting

Conventionally an inflation targeting arrangement ought to be accompanied by a flexible exchange rate, with the interest rate used as the monetary policy instrument. It is generally recognized that for emerging economies in Asia and elsewhere,

⁵ For instance, McCallum (1999) has suggested the use of the growth rate of money. In some cases, a weighted average for the interest rate and exchange rate (so-called Monetary Conditions Index or MCI) might be used. Kannan, Sanyal and Bhoi (2006) estimate a MCI index for India.

fluctuations in the exchange rate can have significant and direct effects on the domestic economy. In particular, assuming a significant degree of exchange rate pass through to domestic inflation, it has sometimes been argued that exchange rate fluctuations ought to be explicitly incorporated in any MPR.⁶

More formally, the degree to which a central bank is committed to an inflation targeting arrangement can best be assessed by a central bank loss function. Consider the following:

$$L_t = E_t \delta (\lambda_1 \pi_{t+1}^2 + \lambda_2 y_{t+1}^2) \quad (1)$$

where: π is the domestic inflation rate gap (deviation between forecasted minus target) and y refers to the output gap (deviation of forecasted output from its natural rate). E is the expectations operator and δ is the discount rate. The policy parameters, i.e. those specifying the precise nature of the monetary policy system, λ_1 and λ_2 are the weights placed on estimated inflation and output gaps. The ratio of the two parameters provides a summary of the nature of the policy regime. For instance, if $\lambda_1 = 1$ and $\lambda_2 = 0.5$, the central bank can be said to be twice as concerned about inflation as it is about output. In the literature, a situation like this ($\lambda_1 > \lambda_2 > 0$) is referred to as “flexible” inflation targeting. Output is secondary to the inflation target, but the weight on the output objective prevents excessive volatility in output and delays the attainment of the inflation target. If $\lambda_1 > 0$ and $\lambda_2 = 0$, it is referred to as strict inflation targeting where the inflation target is achieved at any cost.⁷

⁶ This said, there is evidence of declining exchange rate pass through in both industrial and emerging economies. See Ghosh and Rajan (2007) for a discussion of some of the reasons behind this. These include increasing product competition as markets become more open to domestic and foreign competition, greater stability in a country’s monetary policy and changing composition of a nation’s imports away from raw materials and energy imports towards manufactured imports.

⁷ While we could easily normalize λ_1 to 1 and have a single weight on output stabilization objective, $\lambda = \lambda_2/\lambda_1$, the rationale for specifying each λ is to show, in as explicit a manner as

The policymaker attempts to minimize the loss function subject to the following:⁸

$$y_{t+1} = \beta_1 y_t - \beta_2 r_t - \beta_3 e_t + \varepsilon_{t+1} \quad (2)$$

$$\pi_{t+1} = \pi_t + \alpha_1 y_t - \alpha_2 (e_t - e_{t-1}) + \eta_{t+1} \quad (3)$$

$$e_t = \theta r_t + v_t \quad (4)$$

where: r is the real interest rate, e is the real exchange rate (increase = appreciation of domestic currency), and ε , μ and v represent demand, inflation and (real) exchange rate shocks respectively. Equation (2) is an open economy IS curve where output is determined by its own lag, the real interest rate (the traditional transmitter of policy in a closed economy inflation targeting system) and the real exchange rate. Equation (3) is a conventional Phillips relation exhibiting inflation persistence and where output and the real exchange rate explain the rate of inflation next period. To be more specific about the exchange rate transmission channel in (2) and (3), a fall in e (real depreciation) leads to a higher inflation domestically (pass through) as well as boosts net exports and thus output.⁹ Equation (4) is a reduced form relationship between the real exchange rate and the real interest rate.¹⁰

possible, where each policy parameter appears in the optimal rule. The point here is to reveal how each coefficient is determined and how structural parameters (from the macro model) and policy parameters, λ , intersect in the MPR (equation 5).

⁸ The model is an open economy IS-LM type setup similar to Ball (1999) and a simplification of the model in Svensson (2000) based on Cavoli and Rajan (2007 and 2008c, Chapter 2). See also Cavoli (2008).

⁹ We abstract from the possibility of contractionary devaluation. See Bird and Rajan (2004) and Rajan (2007).

¹⁰ The intention of the model is to show how policy structural parameters intersect in the MPRs. Many papers in this literature derive rules from representative agent models where, once the first order conditions are derived and linearised, the results are usually forward-looking versions of what is presented in the paper. When solving for an optimal rule, these models are sometimes set up as state space systems where the control variable (the policy instrument) is a function of the predetermined state variables in the model. Inflation and output expectations can often appear as predetermined variables by virtue of the fact that these expectations are

We can specify a loss function similar to (1), where the central bank varies its policy instrument to minimize inflation and output deviations next period. Given the quadratic nature of (1) and the linear constraints (2) to (4), as is convention, we can expect the optimal MPR to also be linear. By substituting (4) into (2) and (3), re-substituting the resulting equations into (1), differentiating with respect to r_t and using $\dot{i}_t = r_t + \pi_t$ we can derive the optimal nominal interest rate MPR as follows:

$$i_t = f_\pi \pi_t + f_y y_t - f_v v_t + f_e e_{t-1} \quad (5)$$

where the optimal coefficients are given by:

$$f_\pi = 1 + \frac{\lambda_1 \alpha_2 \theta}{\lambda_1 \alpha_2^2 \theta^2 + \lambda_2 A^2} \quad (6)$$

$$f_y = \frac{\lambda_1 \alpha_1 \alpha_2 \theta + \lambda_2 A \beta_1}{\lambda_1 \alpha_2^2 \theta^2 + \lambda_2 A^2} \quad (7)$$

$$f_v = \frac{\lambda_1 \alpha_2^2 \theta + \lambda_2 A \beta_3}{\lambda_1 \alpha_2^2 \theta^2 + \lambda_2 A^2} \quad (8)$$

$$f_e = \frac{\lambda_1 \alpha_2^2 \theta}{\lambda_1 \alpha_2^2 \theta^2 + \lambda_2 A^2} \quad (9)$$

where: $A = \beta_2 + \beta_3 \theta$.

Several observations can be made about the role of the exchange rate. As long as the central bank is committed to pursuing monetary policy as specified by the loss function in (1) (i.e. λ_1 and $\lambda_2 > 0$) the optimal rule suggests that the instrument of policy will always react, in some way, to the real exchange rate even if the central bank is a

formed by the current period even though the expectation is for the next (for instance, see Clarida, Gali and Gertler, 2001; Walsh, 2003; and Obstfeld and Rogoff, 1996). A possible interpretation of using a backward model is that the current observation of both inflation and output contain sufficient information about future observations for the purposes of formulating policy under the MPR.

strict output targeter. The key point to recognize here is that it may be optimal for the central bank to respond to exchange rate movements insofar as any exchange rate shock affects its ability to reach its target. Hence, for an inflation targeter the central bank will react to exchange rate shocks in the process of achieving the inflation target. This particular behaviour by the central bank may sometimes be misinterpreted as exhibiting fear of floating (Eichengreen, 2001).¹¹ Nonetheless, by observing the composition of f_v by (8), it is clear that the reaction of the instrument to the exchange rate is not related to fear of floating per se as the exchange rate does not appear in the loss function. However, if the exchange rate policy parameter does enter the loss function with a positive coefficient, this represents an attempt by the monetary authority to manage the movements in its exchange rate (as well as output). For the exchange rate to directly enter the monetary authority's loss function it must either: (a) be valued for its own sake over and above its impact on inflation and output; or (b) if valued because of its impact on inflation and output, for some reason, cannot be adequately captured in the specified macro model (eqs. 2 and 5).

4. Estimating a MPR for India

The IMF classifies India as *managed floating regime with no predominant path for the exchange rate* (Cavoli and Rajan, 2008b and 2008, Chapters 1 and Chapter 4). There is a growing body of empirical evidence which confirms that the RBI's monetary policy framework has been based on a combination of sterilized foreign exchange intervention (via Market Stabilization Scheme (MSS) bonds), interest rate changes along with nonmarket monetary mechanisms such as hikes in the cash reserve ratio (CRR), or other ad hoc administrative measures such as capital controls (Ouyang and Rajan, 2008, Ouyang et al., 2008 and Cavoli and Rajan, 2008a and Cavoli and Rajan,

¹¹ It is widely held in the inflation targeting literature that the target will be met in two periods. However, in open economies, the inclusion of the exchange rate in the model ((2)-(4)) will result in the target being potentially met in one period. See Cavoli (2008) for an elaboration.

2008c, Chapter 4). The RBI's conduct of monetary policy has been criticized in the financial press as being non-transparent and even inconsistent (also see Shah, 2007 and Patnaik and Shah, 2008). More specifically, the RBI remains very elusive as to what is being targeted and whether it follows an implicit MPR when setting interest rates. Accordingly, this section investigates whether one can estimate a simple Taylor type MPR for India.

4.1 Framework for Estimating Taylor-Type MPR¹²

The MPR that will be the subject to our analysis is similar in specification to those found in Clarida, Gali and Gertler (1998) which has spawned many subsequent works in this area. In order to more accurately specify the MPR for empirical testing, we need to acknowledge the difference between the market interest rate, i and the inflation targeting policy interest rate i^* (the instrument of an inflation targeting policy). The simple analytical model discussed above did not specify this distinction.¹³ Consider the following expression for the short-term nominal market interest rate:

$$i_t = (1 - \rho)i_t^* + \rho i_{t-1} + v_t \quad 0 \leq \rho \leq 1 \quad (10)$$

The parameter, ρ , captures the persistence of the market interest rate. The policy instrument is specified as follows:

$$i_t^* = \bar{i} + \beta \pi_t + \gamma_t + \delta \epsilon_t \quad (11)$$

¹² This section is based partly on Cavoli and Rajan (2008c, Chapter 3).

¹³ We use market interest rates in the estimation of MPRs since policy rates do not exhibit sufficient variation for valid econometric analysis. The selection of the market interest rate to be employed is often made easier by virtue of the high correlation that tends to exist between similar market interest rate series'. For instance, the correlation between India's call money rate and the 91 day T-Bill rate (the one chosen for this analysis) is around 0.9 with similar means and standard deviations.

where \bar{i} is the equilibrium nominal interest rate (assumed constant in the model), π_t is the deviation of the rate of inflation from an inflation target, y_t is the deviation of real output growth from a long run value, e_t is the deviation of the nominal exchange rate from a long run value.¹⁴ Essentially, equation (11) is a version of the optimal MPR derived from the simple model in the previous section.

Substituting (11) into (10) obtains:

$$i_t = (1 - \rho)\bar{i} + (1 - \rho)\beta\pi_t + (1 - \rho)\gamma_t + (1 - \rho)\delta e_{t+n} + \rho i_{t-1} + v_t \quad (12)$$

By estimating an interest rate (equation 12) we seek information about the effectiveness of each MPR over the sample under consideration. We are interested in the nature of the reaction of each policy instrument to the key policy variables of inflation, the output gap and the exchange rate. As we are examining the effectiveness of the MPR for an inflation targeting regime, we are also interested in the reaction to a forecast of inflation at time $t+p$ periods conditional on information at time t . Under this scenario, equation 11 would be specified as follows:

$$i_t^* = \bar{i} + \beta E(\pi_{t+p} | \Omega_t) + \gamma_t + \delta e_t \quad (11a)$$

The resultant MPR for estimation then becomes:

¹⁴ The lagged interest rate term relates to the market rate and not the policy rate. As such, the central bank does not necessarily smooth the interest rate as an active policy choice. This is not to say that the market interest rate does not exhibit persistence, nor does it suggest that policy is not persistent, as anything that influences the policy rate at time t will influence the market rate at $t+1$. This suits the central bank that is concerned about financial market instability. However, the central bank can still respond aggressively to inflation by moving the policy rate.

$$i_t = (1 - \rho)\bar{i} + (1 - \rho)\beta\pi_{t+p} + (1 - \rho)\gamma_t + (1 - \rho)\delta e_{t+n} + \rho i_{t-1} + \varepsilon_t \quad (12a)$$

where $\varepsilon_t = v_t - (1 - \rho)\beta[E(\pi_{t+p}|\Omega_t) - \pi_{t+p}]$. Equation (11a) and (12a) then becomes the subject of our empirical testing.

4.2 Data and Empirics

The data come from three main sources. The interest rate data is the 91 day Indian Treasury Bill rates. These are sourced from Datastream (*INGBILL3*). We use two exchange rate indices as regressors, the trade weighted Nominal Effective Exchange Rate (NEER) sourced from the RBI website and the nominal exchange rate rupee per US dollar from the IMF International Financial Statistics (IFS) (*lineRF*).¹⁵ All other data are sourced from IFS. These include the WPI – *line 63* and industrial production (*line 66*) indices. The sample of data used is monthly observations from 1993:1 to 2007:12. The sample is constrained largely by the availability of the Treasury Bills data on Datastream.

Inflation is calculated as the 12 month log difference of the WPI which appears to be the price index targeted by the RBI. For our measure of the inflation forecast we lead this value by 12 months. The output variable is calculated by the log difference of IP from its Hodrick-Presscott (HP) filtered trend. We employ two measures of each nominal exchange rate measure. The first is the log difference of each series from its HP trend and the second is a simple log difference from the previous time period. We are interested in gauging how the RBI might react to the exchange rate.

Our estimation for the MPR with current inflation (equation 18a) is by OLS and for the MPR with future inflation we employ 2SLS to account for possible measurement error in the 12 month leading value of inflation (see Ullrich, 2003). The instruments for

¹⁵ See <http://www.rbi.org.in/scripts/publications.aspx>

each estimate are based on an autoregressive distributed lag (ARDL) model for inflation with 3 monthly lags. The selection of lag length reflects the need to address some higher order serial correlation in the inflation series; 3 lags was sufficient across all models tested to alleviate the serial correlation.¹⁶

4.3 Discussion of Findings

The results of the empirical tests are presented in Table 2. As mentioned in the previous sections, the particular areas of interest in this paper are around the extent to which the instrument of policy reacts to current inflation, a forecast of inflation and the exchange rate. Let us begin with some general observations. First, it is clear that the interest rate exhibits a great deal of persistence. This suggests that any policy actions that may induce a change in the interest rate do so in a manner that does not result in unnecessary instability in the financial system.¹⁷ Second, output has no effect on the interest rate, either in the magnitude of the coefficient value, or in terms of statistical significance.

From Table 2, it can be seen that the coefficient values for current inflation (β in equation 12) are all greater than 1 and are all statistically significant. This is strongly suggestive of the MPR exhibiting some tendency to lean against the wind regarding inflation. Specifically, a 1% increase in the current inflation rate is matched by the greater than 1% increase in interest rates. A coefficient value greater than 1 is a necessary condition for effective monetary policy that “leans against the wind” because this will then induce an increase in the real interest rate which in turn reduces aggregate demand. While this result is not conclusive, it does imply that there are

¹⁶ In the 2SLS estimates there is a degree of sensitivity of the coefficient value to lag specification in general. However, our results are quite robust to variations in lag length.

¹⁷ Engle Granger tests show that the near unit root process in the interest rate series did not result in spurious results.

some forces that act upon the nominal interest rate in a manner that is consistent with the existence of a de facto inflation targeting arrangement.

To be more certain about the existence of inflation targeting, the reaction of the interest rate to the inflation forecast must be examined. This is important because it implies a strategic intent on the part of the policy maker. An inflation targeting central bank would be more likely to pursue a future value of inflation based on a robust forecast rather than current inflation knowing that any interest rate changes now will take some time to affect inflation through the aggregate demand channel. From the 2SLS results in Table 2, the results from the inflation forecast coefficients (proxied by the 12 month future value of actual inflation) are, at best, inconclusive. The reactions have increased in magnitude in all but one case but none of these are statistically significant.

So how do we reconcile these results? The reactions to current inflation suggests a general inclination on the part of the prevailing policy regime to address inflation (tighten when inflation increases, loosen otherwise). However, this can be interpreted as perhaps a revealed preference on the part of policy. The reactions to future inflation tend to suggest that, while the policy regime has an inflation fighting element to it, it is not an inflation targeting arrangement per se, i.e. the RBI does not appear to respond to inflationary expectations in setting interest rate policy.

Finally, does the MPR react to the exchange rate? The short answer is no. While the signs are correct for all but one estimate, none are statistically significant.¹⁸ This is a somewhat surprising result for a country that bases its monetary policy around some degree of management of the exchange rate (see FN 25). This result is also robust to changes in the way we calculated the exchange rate – first differences or

¹⁸ Since the bilateral exchange rate is expressed as the rupee price of the US dollar and the NEERs are expressed as the foreign price of the rupee, we expect the signs to be different for regressions containing bilateral rates against those containing NEERs.

deviations from trend, bilateral per USD or NEER.¹⁹ The lack of significant results could reflect that there is insufficient feedback from the exchange rate to the interest rate in the model and/or that the real instrument of policy with respect to the exchange rate is the manipulation of reserves.²⁰

5. Concluding Remarks

The empirical analysis presented in this paper has highlighted that there is some – albeit weak – evidence that the RBI may actually be following a monetary policy rule inadvertently. Clearly it is not being done in an intentional or strategic manner as interest rates do not seem to respond to simple measures of inflation forecasts. The move to a more formal inflation targeting arrangement may therefore not be that much of a jump from the current rather ambiguous / inconsistent monetary policy framework (for instance, see Shah, 2007 and Patnaik and Shah, 2008).²¹ An inflation targeting arrangement should introduce greater clarity and transparency to the objectives, instruments and intervention strategies of the RBI which is particularly important as the Indian economy continues to integrate with global financial markets. A starting point would be for the RBI to be granted greater independence, be given

¹⁹ We also tried estimating exchange rate rules but they offered no particular insights into the exchange rate may have been employed as an instrument of policy and how it might react to inflation. This suggests that exchange rate management by the RBI has been done in a rather ad hoc manner rather than having any strategic orientation (i.e. in response to inflation and output).

²⁰ In relation to this, a referee of this journal suggests that the reason could be because of “the asymmetric intervention of RBI in the foreign exchange market i.e. it intervenes when the rupee is appreciating but not the other way round.” This is clearly an area in need of more research.

²¹ This is consistent with the conclusion of the Raghuram Rajan report (2008):

What modifications to the present monetary policy framework are needed to enhance its effectiveness? The RBI already has a medium-term inflation objective, and its actions and statements are consistent with that being a key objective of monetary policy. But making that *the* primary objective of the RBI and indicating this clearly to markets, both through communications and actions, may provide important additional benefits in terms of anchoring inflation expectations and the macroeconomic stability that would follow from that. Indeed, what is needed is not so much a drastic change in operational approach but rather a change in strategic focus (p.14).

See http://planningcommission.nic.in/reports/genrep/rep_fr/cfsr_all.pdf

specific (inflation) objectives, and be made accountable to meeting the predetermined objectives.

While it is commonly believed that implementation of a successful inflation targeting arrangement requires a laundry list of stringent preconditions such as central bank independence, strengthening the financial sector and developing a well-functioning currency and bond markets (both important for effective monetary policy transmission),²² the extent of fiscal dominance, inflation forecasting and modeling ability of the central bank, etc. While these are all important, a detailed report on inflation targeting arrangements in selected countries by the IMF (2006) suggests that some of the importance of these preconditions can be overstated. As the report notes:

Our findings also suggest the need for a more nuanced, less “mechanical” view of necessary, as opposed to desirable, conditions for successful adoption of inflation targeting. Most of the conditions viewed as essential for successful inflation targeting are important for any successful monetary policy framework, and some may be more important for other frameworks than for inflation targeting. The evidence suggests that meeting tough technical preconditions may be less important to successful adoption of inflation targeting than the sustained pursuit of improvements once the framework has been adopted.²³

In any event, with the important exception of fiscal dominance, India is generally better placed than many of the East Asian economies that have fairly successfully implemented inflation targeting arrangements. Arguably of most importance in the Indian context is the design and implementation of the institutional framework for inflation targeting (see Heenan et al., 2006 for details).²⁴

This apart, some concerns have been expressed in India and elsewhere that inflation targeting implies benign neglect of the exchange rate. It used to be conventionally believed that an inflation targeting regime ought to be accompanied by

²² The RBI's deputy governor, Rakesh Mohan (2006) discusses the monetary transmission channels in India.

²³ Also see Batini and Laxton (2006).

²⁴ Better quality data, especially with regard to improving the degree of accuracy and representativeness of price indices would be warranted.

a flexible exchange rate, with the interest rate used as the monetary policy instrument. However, the analysis in this paper has emphasized that an open economy MPR could involve incorporating movements in the exchange rate. Similarly, the above-noted report on inflation targeting arrangements by the IMF also concludes:

as non-industrial countries seek an alternative nominal anchor to fixed exchange rate, inflation targeting would be a good option for them to consider. Moreover, some aspects of the standard approach to inflation targeting can be modified to take account of particular characteristics of non-industrial countries, e.g., the larger exposure of these countries to movements in the exchange rate.

With such a flexible inflation targeting approach, as long as the country's inflation outlook remains consistent with the medium term inflation target range, the monetary authority has space to use its judgment to judiciously react to meet other objectives and respond effectively to various shocks in the interim. While the desire for output and employment stability is self-evident, a degree of exchange rate stability may also be warranted (over and above what is explicitly captured by the MPR), as sharp exchange rate cycles could compromise the growth of the tradable sector.

This said, there are limits to the extent to which exchange rates should be managed under an inflation targeting arrangement. Why? First, if one attempts to control the inflationary effects of exchange rate changes, it effectively implies raising interest rates during periods of exchange rate weakness to and vice versa during periods of exchange rate strength. The concern is that responding too heavily and frequently to currency movements in the short-term could risk transforming the flexible inflation target to a *de facto* soft currency peg which in turn tends to be crisis-prone and little different from the RBI's existing policy.²⁵ Second, insofar as interest rate

²⁵ Empirical analysis by Cavoli and Rajan (2008a, 2008c Chapter 4) for the period 1985 to 2004 concludes that the Rupee is a *de facto* soft US dollar peg. This is consistent with Reinhart and Rogoff (2004) who have classified India as a *de facto* crawling peg to the USD (i.e. peg with a drift). Using slightly different exchange rate flexibility indices than those used in this chapter, Willett et al. (2005) arrive at a similar conclusion on the Indian rupee and even go on to use it as a benchmark for pegged regimes. Also see Patnaik and Shah (2008) and Shah and Patnaik (2007). Ouyang and Rajan (2008) estimate that India has been sterilizing about 80-90 percent of the reserve accretion between 2000 and 2004. Cavoli and Rajan (2008a and 2008c Chapter 4) also find that the euro is gradually gaining greater importance in influencing movements in

changes have a lagged effect on the economy on the one hand, and pass through from exchange rates tends to be fairly immediate on the other, the central bank will have to forecast short-term exchange rate movements. This is near impossible to do on a consistent basis. At a time when inflation is rearing its ugly head in India and the RBI's credibility is starting to be questioned, the RBI should seriously consider adopting an inflation targeting framework. By making the inflation target/range explicit and committing the central bank to attaining the objective over a pre-determined period, the central bank is less likely to pursue time-inconsistent policies or be pressurized by political masters.

Assuming the RBI does adopt such a regime, it needs to decide whether it will err on the side of policy rigidity and discipline or discretion and flexibility? While the exact balance between flexibility and rigidity will no doubt vary between countries (and possibly over time within a country), broad rules of thumb suggest: (a) the less credible the central bank (i.e. poorer its inflation-fighting track record); (b) the less its technical ability; and (c) the lower its political independence, the more advisable it is to pre-commit to a "strict" or "hard" inflation target (i.e. preference of a rule over discretion). Regardless of the extent of flexibility or "constrained discretion" that is pursued, it is imperative that the RBI clearly articulate to the public the lexicographic ordering of its objectives (with inflation taking precedence over all others over time), as well as the time-frame over which the monetary authority is committed to returning inflation to its target.

the Rupee, but more so at the expense of the pound and yen rather than the USD. If the euro continues to gain in importance, one might have to eventually reclassify India as a (dual) basket peg over time.

References

- Ball, L. (1999), "Policy Rules for Open Economies," in M. Taylor (ed.), *Monetary Policy Rules*, Chicago: University of Chicago Press.
- Batini, N. and D. Laxton (2006), "Under What Conditions Can Inflation Targeting Be Adopted? The Experience of Emerging Markets," Working Papers Central Bank of Chile No. 406, Central Bank of Chile.
- Bird, G. and R.S. Rajan (2004), "Does Devaluation Lead to Economic Recovery or Economic Contraction? Examining the Analytical Issues with Reference to Thailand," *Journal of International Development*, Vol. 16, pp.141-156.
- Cavoli, T. (2008), "The Exchange Rate and Optimal Monetary Policy Rules in Open and Developing Economies: Some Simple Analytics", *Economic Modelling*, forthcoming.
- Cavoli, T. and R.S. Rajan (2007), "Inflation Targeting Arrangements in Asia and Elsewhere: Exploring the Role of the Exchange Rate," *Briefing Notes in Economics* No. 74, September-October.
- Cavoli, T. and R.S. Rajan (2008a), "Extent of Exchange Rate Flexibility in India," *India Macroeconomics Annual 2007*, SAGE Publication, pp.125-140
- Cavoli, T. and R.S. Rajan (2008b), "Still Searching for the Middle Ground: Asian Exchange Rate Regimes a Decade since the 1997-98 Crisis", in R.S. Rajan, S. Thangavelu and R.A. Parinduri (eds.), *Monetary and Financial Issues in Asia*, Singapore: World Scientific, forthcoming.
- Cavoli, T. and R.S. Rajan (2008c), *Exchange Rate Regimes and Macroeconomic Management in Asia*, Hong Kong: Hong Kong University Press, forthcoming.
- Clarida, R., J. Gali and M. Gertler (1998), "Monetary Policy Rules in Practice: Some International Evidence," *European Economic Review*, Vol. 42, pp.1033-1067.
- Clarida, R., J. Gali and M. Gertler (2001), "Optimal Monetary Policy in Open vs. Closed Economies," *American Economic Review*, Vol. 91, pp.248-252.
- Debelle, G. (2001), "The Case for Inflation Targeting in East Asian Countries," *Future Directions for Monetary Policies in East Asia*, Sydney: Reserve Bank of Australia.
- Eichengreen, B. (2001), "Can Emerging Markets Float? Should they Inflation Target?" mimeo (April).
- Frankel, J. (1999), "No Single Currency Regime is Right for All Countries or at all Times," *Essays in International Economics No.215*, International Economics Section, Princeton University.
- Fischer, S. (2001), "Exchange Rate Regimes: Is the Bipolar View Correct?" *Journal of Economic Perspectives*, Vol. 15, pp. 3-24.
- Ghosh, A. and R.S. Rajan (2007), "Exchange Rate Pass-through in Asia: What does the Literature Tell us?" *Asia Pacific Economic Literature*, Vol. 21, pp.13-28.

Gonçalves, C.E.S. and J.M. Salles (2005), "Inflation Targeting in Emerging Economies: What Do the Data Say?" mimeo (June).

Heenan, G., P. Marcel and R. Scott (2006), "Implementing Inflation Targeting: Institutional Arrangements, Target Design, and Communications," Working Paper No.06/278, IMF.

IMF (2006), "Inflation Targeting and the IMF," report prepared by Monetary and Financial Systems Department, Policy and Development Review Department, and Research Department (March 16).

Kannan, R., S. Sanyal and B.B. Bhoi (2006), "Monetary Conditions Index for India," Occasional Papers No. 27 (Winter), Reserve Bank of India.

McCallum, B. (1999), "Issues in the Design of Monetary Policy Rules," in J. B. Taylor and M. Woodford (ed.), *Handbook of Macroeconomics*, North-Holland.

Mishkin, F.S. (2002), "The Role of Output Stabilization in the Conduct of Monetary Policy," Working Paper No. 9291, NBER.

Mishkin, F.S. (2008), "How Should we Respond to Asset Price Bubbles?" speech at the at the Wharton Financial Institutions Center and Oliver Wyman Institute's Annual Financial Risk Roundtable, Philadelphia, Pennsylvania (May 15).

Mohan, R. (2006), "Monetary Policy Transmission in India," paper presented at the Deputy Governor's Meeting on "Transmission Mechanisms for Monetary Policy in Emerging Market Economies - What is New?" at Bank for International Settlements, Basel (December 7-8).

Obstfeld, M. and Rogoff, K. (1996), *Foundations of International Macroeconomics*, MIT Press.

Ouyang, A. and R.S. Rajan (2008), "Reserve Stockpiling and Managing its Liquidity Impact: The Case of India," *Macroeconomics and Finance in Emerging Market Economies*, Vol. 1, pp.75=91.

Ouyang, A., R.S. Rajan and T.D. Willett (2008), "Managing the Monetary Consequences of Reserve Accumulation in Emerging Asia," *Global Economic Review*, Vol. 37, pp.171-199.

Shah, A. (2008), "Managing Capital Flows: The Case of India," Discussion Paper No.98, Asian Development Bank Institute.

Rajan, R.S. (2007), "Managing New Style Currency Crises: The Swan Diagram Revisited," *Journal of International Development*, Vol. 19, pp.583-606.

Reinhart, C.M. and K. Rogoff (2004), "The Modern History of Exchange Rate Reinterpretation," *Quarterly Journal of Economics*, Vol. 199, pp.1-48.

Sgherri, F. (2005), "Explicit and Implicit Targets in Open Economies?" *Working Paper No.05/176*, IMF.

Shah, A. (2008), "New Issues in Indian Macro Policy," in T.N. Ninan (ed.), *Business Standard India*. Business Standard Books, forthcoming.

Shah, A. and I. Patnaik (2007), "India's Experience with Capital Flows: The Elusive Quest For a Sustainable Current Account Deficit," in S. Edwards (ed.), *Capital Controls and Capital Flows in Emerging Economies: Policies, Practices and Consequences*, The University of Chicago Press, pp.609-643.

Stone, M., H. Anderson and R. Veyrune (2008), "Exchange Rate Regimes: Fix or Float?", *Finance and Development*, March, IMF.

Svensson, L.E.O. (2000), "Open Economy Inflation Targeting," *Journal of International Economics*, Vol. 50, pp.155-183

Taylor, J.B. (1993), "Discretion Versus Policy Rules in Practice," *Carnegie-Rochester Conference Series on Public Policy*, Vol. 39, pp.195-214.

Taylor, J.B. (2000), "Recent Developments in the Use of Monetary Policy Rules," paper presented at a conference, "Inflation Targeting and Monetary Policies in Emerging Economies" at the Central Bank of the Republic of Indonesia, Jakarta, Indonesia (July 13-14).

Ullrich, K. (2003), "A Comparison Between the Fed and the ECB: Taylor Rules," Discussion Paper No.3-19, Zentrum für Europäische Wirtschaftsforschung GmbH.

Walsh, C. (2003), *Monetary Theory and Policy*, 2nd Edition, MIT Press.

Willett, T.D. (2003), "Fear of Floating Needn't Imply Fixed Rates: Feasible Options for Intermediate Exchange Rate Regimes," *Open Economies Review*, Vol. 14, pp.71-91.

Table 1
Highlights of Inflation Targeting Arrangements in Selected Asian Economies (as of June 2008)

Country	Date of initiation of Inflation Targeting Arrangement	Target price index	Target Rate	Target Horizon	Escape Clauses	Accountability	Target set by	Publication and accountability
Indonesia	May 1999	Headline CPI	4 – 6% (for 2008)	3 years	None	None, but parliament can request reports at any time	Government in consultation Central Bank	Quarterly Monetary Policy Report and Annual report to public
Philippines	Dec 2001	Headline CPI. Also monitors Core CPI (excluding agricultural products and petroleum products)	3 – 5% (for 2008)	2 years	Yes, in the event of oil price shocks, food supply shocks and significant government policies	Public explanation of the nature of the breach and steps to address it	Government in consultation Central Bank	Quarterly inflation report, publication of monetary policy meetings
Thailand	Apr 2000	Core CPI (excluding fresh food and energy)	0 – 3.5 %	1 year	None	Public explanation of breach and steps taken to address it	Central Bank in consultation with Government	Monetary Policy Report, inflation forecasts and publication of models used
Korea	Jan 1998	Core CPI (excluding non-cereal agricultural products and petroleum products)	2.5 – 3.5% (average over 2007-2009)	Indefinite (medium term target)	Changes caused by major force	None	Central Bank in consultation with Government	Monetary Policy report and submission to parliament, publication of monetary policy meetings

Source: Compiled by authors from Bank of Korea, Bank Indonesia, Bank of Thailand, Bangko Sentral ng Pilipinas website.

Table 2
Estimates for Monetary Policy Rules

Dependant variable: T-Bill Rate

	OLS estimates				2SLS Estimates			
Constant	1.49 (0.51)	0.28 (0.08)	1.85 (0.69)	0.08 (0.02)	3.81 (0.20)	-4.78 (-0.17)	-0.82 (-0.05)	-7.42 (-0.21)
Current inflation	1.12 (2.21)	1.35 (2.25)	1.02 (2.23)	1.38 (2.15)	-	-	-	-
Inflation forecast	-	-	-	-	0.58 (0.16)	2.44 (0.46)	1.44 (0.51)	2.95 (0.41)
Output	0.08 (0.38)	0.06 (0.27)	0.12 (0.63)	0.04 (0.17)	0.01 (0.02)	0.09 (0.20)	0.02 (0.06)	0.08 (0.13)
ER gap	0.43 (1.17)	-	-	-	-0.04 (-0.07)	-	-	-
NEER gap	-	-0.31 (-0.78)	-	-	-	-0.63 (-0.59)	-	-
D(ER)	-	-	0.95 (1.39)	-	-	-	1.13 (0.79)	-
D(NEER)	-	-	-	-0.74 (-1.02)	-	-	-	-1.96 (-0.90)
Lagged T-Bill Rate	<i>0.95</i> <i>(44.97)</i>	<i>0.96</i> <i>(50.57)</i>	<i>0.94</i> <i>(44.40)</i>	<i>0.96</i> <i>(52.30)</i>	<i>0.97</i> <i>(52.40)</i>	<i>0.98</i> <i>(49.85)</i>	<i>0.97</i> <i>(48.76)</i>	<i>0.98</i> <i>(48.22)</i>
Adj R²	0.93	0.95	0.93	0.95	0.95	0.95	0.95	0.95
DW	2.28	2.07	2.26	2.07	1.98	2.01	1.98	2.01
Obs	166	159	166	159	164	152	163	152

Notes: Figures in brackets are t-statistics. Those in bold (italics) are significant at 5% (1%).