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Designing Appropriate Exchange Rate Regimes for East Asia: Inflation Targeting and Monetary Policy Rules

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ABSTRACT

While favoring relatively more flexible regimes, emerging economies in East Asia and elsewhere appear to heavily manage their currencies despite being officially described as “floaters”. In other words, revealed preferences of regional monetary authorities appear to indicate a high degree of “fear of floating”. The paper first explores the reasons for this fear of floating. It then goes on to examine the case for and operational mechanics behind an open inflation targeting regime which has increasingly been advocated for small and open economies in East Asia and elsewhere. The paper also attempts a reconciliation between the discussion of analytics behind open economy inflation targeting and its implications for exchange rate design, on the one hand, and actual exchange rate ongoings in East Asia, on the other.

Keywords: exchange rate, East Asia, fear of floating, impossible Trinity inflation targeting, monetary policy rules

1. Introduction

An immediate lesson that many observers appear to have drawn from recent financial crises in emerging market economies in the 1990s is that the only viable exchange rate option boils down to one between flexibility, on the one hand, and "credible pegging", on the other. According to this view, emerging economies have to gravitate to these two extremes. Any currency arrangements that lie in between these polar extremes or corners (i.e. those in the "middle") are viewed as being inherently unstable and crisis-prone. The following observation by Eichengreen (2001a) typifies the mainstream view with regard to the supposed "hollowing out of the middle":

> high capital mobility has made it exceedingly difficult…to operate pegged-but-adjustable exchange rates…Intermediate regimes are fragile. Operating them is tantamount to painting a bull's eye on the forehead of the central bank governor and telling speculators "shoot here" (p.267).

A number of observers have strongly favored the corner - as opposed to an interior - solution of an irrevocably fixed regime. Such hard pegging or straitjacketing of the exchange rate is supposed to signal greater commitment to rule out arbitrary exchange rate adjustments (i.e. "escape clauses" cannot be invoked) and the willingness of the monetary authority to subordinate domestic policy objectives such as output and employment growth to the maintenance of the currency peg.

But how can an exchange rate peg be made credible? Only by making it almost unshiftable, i.e. a "hard peg" or "super fix". This might be done by maintaining one's national currency but creating a rigid commitment to permanently fixed or hard rates through institutional arrangements such as a Currency Board Arrangement, or by effectively abandoning the domestic

currency altogether by using domestically the currency of another country (dollarization or eurorization).

The political unpalatability of dollarization or euroization along with its significant policy constrictions - which inflict a currency board arrangement as well (see Rajan, 2002a and 2003 and Eichengreen, 2001a) - seems effectively to leave only a common regional currency as a practicable alternative. But is it? Eichengreen (1994, pp.4-7) appears to think so. He has predicted that, in the future, capital mobility will leave countries with one of two choices -- a super fix involving monetary union or the other corner of a floating regime. Von Furstenberg (2000, pp.199-200) argues more specifically that monetary unions are "inevitable..the wave of the future".

However, on examining the prospects on monetary unions in East Asia and elsewhere, Cohen (2002) reaches the following conclusion:

> While there is reason to believe that some groups of countries will move modestly to pool a degree of their monetary sovereignty, predictions of many full new monetary unions around the globe, on the model of Europe's EMU, appear premature at best. The difficulty of defending uncompetitive national currencies may be growing, but for most governments the disadvantages of monetary union continue to look more formidable still. Few countries share enough group loyalty to make the requisite sacrifice of monetary sovereignty seem acceptable; and even for those that might be prepared to make the commitment, willing partners are hard to find. The world's monetary map will include a growing number of limited alliances but few, if any, new joint currencies like the euro. The wave of the future will turn out to be little more than a ripple (p.19)[1].

While a monetary union in East Asia remains a serious longer-term proposition, its infeasibility over the short and medium terms, along with the well-documented limitations of other forms of super fixes, appears to leave a flexible regime as the only viable policy option for East Asia.

A priori, there are a number of reasons that underlie a preference for a greater degree of exchange rate flexibility.

First, the more flexible the exchange rate regime, the keener the incentives for agents to undertake appropriate foreign exchange (forex) risk management techniques in response to the higher element of exchange rate risk, while simultaneously reducing the extent of moral hazard which could lead to "excessive" unhedged external borrowing (referred to as a "fixed exchange rate bubble"). The introduction of these transactions costs and exchange rate risks may also help moderate the extent of capital inflows, consequently dampening the intensity of boom and bust cycles (this is essentially a moral hazard argument).

Second, small and open economies are far more susceptible to large external shocks, such as changes in foreign interest rates, terms of trade, regional contagion effects and the like. Received theory tells us that a greater degree of exchange rate flexibility is called for in the presence of external or domestic real shocks. By acting as a safety valve, flexible exchange regimes provide a less costly adjustment mechanism by which relative prices can be altered in response to such shocks as opposed to fixed rate regimes. The latter relies on gradual reductions in relative costs through deflation and productivity increases vis-à-vis trade partners to restore internal balance. This can prove to be prolonged and costly, as the Argentine example illustrates (Rajan, 2002). Hong Kong, which continues to operate a currency board, has been faced with similar, albeit less intense, deflationary pressures since 1998

[1] Also see Kenen (2000).

with ever more frequent calls for it to forsake its US dollar peg (Liu, 2002 and Rajan and Siregar, 2002)[2].

Third, many small economies have diversified trade structures (dependent on the US, Japan, Europe and intra-Asian trade). Optimum Currency Area (OCA) criteria suggest that such economies are good candidates to maintain more flexible regimes. Thus, in the case of East Asia, institutionalization of the pre-crisis dollar pegs (via a currency boards or dollarization) would not have helped domestic economic performance in 1996-97 (just prior to the crisis) to the extent that the problem was, at least partly, one of loss of competitiveness due to fluctuations in the US dollar and yen cross-rate (Bird and Rajan, 2002). Consistent with this, a recent study of exports by about 100 emerging economies to the US, Japan and Europe over the period 1983-92 concludes that the more flexible the exchange rate regime the better the export performance (Nilsson and Nilsson, 2000). However, countries pegging to a composite group of currencies do not appear to have experienced weaker economic performance than ones with independently floating regimes[3].

Fourth, there is a widespread belief that a pegged regime induces increased policy discipline as fiscal profligacy will lead to a reserve depletion or burgeoning debt and an eventual currency collapse. However, the effects of unsound macro policies become evident immediately under flexible rates through currency and price level movements (i.e. depreciation-inflation spiral). Thus, flexible rates ought to instill greater fiscal restraint, as the costs of

[2] The Deputy Chief Executive of the Hong Kong Monetary Authority, Tony Latter (2002), offers a stout defense of the Hong Kong US dollar peg.
[3] Their data is based on official IMF classification of exchange rate arrangements, i.e. they use *de jure* rather than *de facto* exchange rate regime.

macroeconomic policy transgressions have to be paid upfront. In other words, the key distinction between fixed and floating rates is in the intertemporal distribution of costs and benefits (Tornell and Velasco, 2000)[4].

Fifth, banks tend to dominate the financial systems in the region, and the credit transmission channel plays a significant role in these countries. Calvo (1999) has shown that, *ceteris paribus*, the operation of this credit channel (which affects the IS curve directly and acts as a real shock) could tilt the balance in favor of greater exchange rate flexibility[5].

While favoring relatively more flexible regimes, emerging economies in East Asia and elsewhere have continued to heavily manage their currencies despite being officially described as "floaters" (Rajan, 2002). Section 2 discusses the rationale for this "fear of floating", revisits the corners hypothesis and offers an alternative policy perspective. Section 3 explores the case for and operational mechanics behind an open inflation targeting regime which has increasingly been advocated for small and open economies in East Asia and elsewhere. This section stresses the importance of incorporating the exchange rate in open economy monetary policy rules. Section 4 examines the optimal policy responses by an optimizing monetary authority pursuing an open inflation target in the event of various shocks. The post-crisis East Asian monetary policy arrangements provide a suitable context for analyzing what part the exchange rate might play in the construction of an inflation-targeting regime. The final section attempts a reconciliation between the discussion of

[4] Gavin and Perotti (1997) provide some empirical validity of this argument. After controlling for a host of other factors, they find that Latin American fiscal policies were more prudent under flexible rates than under floating ones.

[5] As Calvo (1999) notes, and as is easy to show, this conclusion may not remain valid in the event that a financial crisis (which in turn reduces the money multiplier) is more likely under a flexible regime compared to a fixed one.

analytics behind open economy inflation targeting and its implications for exchange rate design, on the one hand, and actual exchange rate ongoings in East Asia, on the other.

2. Revisiting the Flexible Corner

2.1 Reasons for a "Fear of Floating"

In view of the afore-mentioned potential benefits of flexible regimes, many observers have enthusiastically advocated the flexible option.

Despite the foregoing reasons favoring a flexible exchange arrangement, countries with flexible regimes have experienced "excessive" volatility over the last few decades[6]. It is admittedly difficult to define what exactly is meant by the term "excessive". However, a reading of the relevant empirical literature reveals that evidence of excessive exchange rate variability comes in a number of forms (Bird and Rajan, 2001). For instance, a number of surveys of foreign exchange (forex) market participants clearly indicate that short term/high frequency exchange rate movements are caused by "speculative" or "trend-following" elements rather than underlying macroeconomic fundamentals. The problem of destabilizing speculation (as opposed to the Friedmanite speculators) - and consequent excessive or self-aggravating exchange rate volatility - and dominance of fads and bubbles appears to be aggravated in emerging economies, making a flexible regime especially unviable/unsuitable to them. This is particularly so since thin markets - which exist in emerging economies - imply that a few transactions can lead to extreme currency fluctuations.

Even if it were accepted that flexible exchange rates often appear to gyrate erratically – they exhibit far greater volatility than would be warranted by the underlying fundamentals, why might such excessive volatility be of concern? Recent studies have provided evidence of a negative impact of exchange rate volatility/uncertainty on investment (Corbo and Cox, 1995 and Huizinga, 1994). To the extent that investment has a significant positive impact on economic growth, declining investment will have an enduring adverse impact on the quantity of real resources. Even in the absence of a negative effect on the level of investment, exchange rate variability may have an adverse influence over the composition of production and investment since decisions could be based on disequilibrium prices, particularly as flexible arrangements have frequently been associated with currency misalignments.

It has often been argued that firms and other agents involved in international transactions can buy cover to hedge themselves against exchange rate movements. However, in addition to the costs involved with such operations, perfect hedges may be extremely difficult to create technically (given acute revenue-cost uncertainties) (Adler, 1994). Indeed, even if effective hedges could be created, they would entail non-negligible transaction costs, thus diverting scarce resources from "real" economic activity. This is especially true in the case of emerging economies where rudimentary capital markets have necessitated using cross-hedging techniques (rather than direct hedging), which invariably are far costlier.

Wei (1999) provides some important empirical evidence which suggests that exchange rate volatility has had a detrimental effect on trade

[6] Of course, almost no country has maintained a completely free (or pure) float, the authorities

between pairs of countries to a much larger extent than suggested by previous studies. More generally, in a comprehensive survey of the literature on the impact of exchange rate volatility on trade flows, McKenzie (1999) concludes that the recent empirical studies have had "greater success in deriving a statistically significant relationship between volatility and trade" (p.100). Calvo and Reinhart (2000a) review a more limited set of such studies and draw a similar conclusion. Another recent set of empirics by Andrew Rose based on gravity models using both cross-sectional and time series data suggests institutionally fixed exchange regimes (i.e. common currency, currency boards or dollarization) stimulates trade, which in turn boosts income (see Frankel and Rose, 2002, Glick and Rose, 2002 and Rose, 2000). As is common knowledge, proponents of the European Monetary Union (EMU) have used such an argument extensively in support of a single regional currency. In an important study, Bénassy-Quéré (1999) shows that exchange rate volatility could have a detrimental impact on FDI, comparable to the distortions created by currency misalignments.

The high import content of emerging market's output implies that pass-through of exchange rate variations to domestic prices cannot be ignored (Baqueiro, et al., 2002).

Unlike industrial countries, many emerging economies are unable to borrow overseas in their domestic currencies, leading to an accumulation of foreign currency debt liabilities that are primarily dollar denominated and unhedged (i.e. "liability dollarization")[7]. In the presence of a degree of liability

intervening intermittently to smooth market fluctuations. In other words "dirty floats" - i.e. forex interventions without commitment to defend any specific parity - have been the norm.

[7] This is commonly referred to as the "original sin" hypothesis, a term attributed to Hausmann (1999) and Hausmann et al. (2000).

dollarization, exchange rate fluctuations could alter the net worth of corporates and financial institutions with consequent real sector dislocations (so-called "balance sheet" effects). In addition, with a flexible regime, households, fearing the cost of currency fluctuations on their individual net worths, may shy away from holding domestic financial assets (asset denominated in domestic currencies), or from doing so within the domestic financial system, hence hindering the development of domestic financial markets.

Recent empirical evidence casts doubt on the extent to which floating regimes in emerging economies provide insulation from external shocks (see Frankel et al., 2000a and Hausmann et al., 2000). This has been attributed to the monetary authority choosing to use their exchange rate flexibility very sparingly. Many emerging economies appear to be plagued by an acute "fear of floating" (Calvo and Reinhart, 2000b) in the sense that they give continued priority to a high degree of exchange rate stability in emerging economies. In the final analysis, many policy makers in East Asia would probably concur with Williamson's (2002) conclusion about a floating regime:

> (It) is not the option I would recommend, because of my doubts as to whether.. (such).a regime…is consistent with the restoration of the sustained high rates of growth that were experienced by East Asia before the crisis (p.1).

2.2 The Impossible Trilogy Revisited

The discussion thus far leads one in the direction of rejecting the "hollowing out hypothesis" or corners solution to exchange rate regimes. This hypothesis seems to draw analytical support from the "Impossible Trilogy"[8].

[8] Also referred to as "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, Frankel (1999) has provided us with the timely reminder that the Impossible Trilogy 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. In fact, there is a growing body of opinion that recognizes the potential usefulness of restraints on financial flows as a financial safeguard; there is no longer an ideological belief in the benefits of a completely open capital account[9]. Once this is accepted, the analytical basis in support of the corners hypothesis weakens substantially; neither corner appears to work all that well for emerging economies.

Willett (2002) too strongly questions whether countries really face such stark choices in their choice of exchange regimes. As he notes:

> The theory of Optimum Currency Areas (OCA) yields a well-established list of..criteria that affect the costs and benefits of adopting fixed versus flexible exchange rates. The application of a sensible range of parameter values to these criteria suggests that many…countries are not good candidates for either genuinely fixed exchange rates where domestic monetary policy is fully determined by developments in the balance of payments or for completely flexible exchange rates where no weight is given to the exchange rate developments in setting domestic policy (p.3)[10].

Similarly, Fischer (2001) has acknowledged that there are many instances where intermediate regimes might well be “more appropriate” than corner solutions. He notes that the supposed bipolar view of exchange rates ought to be presented as a choice between a hard peg versus a “more flexible

[9]While empirical evidence regarding the benefits from capital account liberalization is unclear, risks of premature of ill-timed liberalization are unequivocal (Arteta et al., 2001 and Rajan, 2002b).

regime" rather than a flexible exchange rate regime *per se*. The latter option implies the absence of any explicit exchange rate target, i.e. intervention should not be framed primarily in terms of defending a particular exchange rate target. Thus, when it comes to the choice of appropriate exchange rate regime, all that can really be said is that there exists a broad spectrum of choices. It is not a black-or-white issue; shades of gray abound.

Design of an appropriate exchange rate arrangement cannot be done in isolation. It must be seen as part of a coherent macroeconomic strategy. No exchange rate regime will deliver stability if domestic macroeconomic policy is unsound, with large fiscal deficits, rapid monetary growth and inflation. Pegged exchange rates will become overvalued and reserves will fall, while flexible exchange rates will depreciate and may result in crises just as much as pegged regimes. Exchange rate policy in emerging economies may need to have a more limited objective. Rather than focusing on disciplining domestic macroeconomic policy and labor markets, perhaps the exchange rate regime should be designed in the first instance to minimize exposure to the third currency phenomenon (Bird and Rajan, 2002), where the problem for emerging economies arises from fluctuations in the values of the currencies of their major trading partners against one another.

In the absence of strong capital controls, currency intervention ought *not* 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

[10] Frankel (1999) and Kenen (2000) make similar points.

rate. This might best be achieved by a variant on sliding parities and wider bands around an appropriately weighted currency basket, the extent of which varying across the countries depending on individual circumstances and policy preferences -- a so-termed band-basket-or-crawl or BBC or a “flexible” inflation target. The latter involves gradual adjustment to an inflation target along with a positive weight on the exchange rate (in addition to inflation and output). While the topic of currency basket arrangements for East Asia has been extensively dealt with elsewhere (for instance, see Bird and Rajan, 2002, Rajan, 2000a, Rajan, 2003 and Williamson, 1999b, 2001, 2002[)], the remainder of this paper explores key aspects of open inflation targeting in general and particularly as they relate to East Asia.

3. Open Economy Inflation Targeting: Role of the Exchange Rate

3.1 Monetary Policy Rules in Open Economies

Buoyed by the apparent success of inflation targeting in industrial countries in the early 1990s, it has been advocated by the IMF and others as a viable policy option for emerging economies in East Asian and elsewhere. What exactly is inflation targeting? While definitions do vary in the literature, Eichengreen (2001b) 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).

As suggested by the preceding quote, inflation targeting is conducted in conjunction with a monetary policy rule (MPR). In general terms, the MPR

is one element of a strategy employed by the monetary authority as part of its overall monetary policy. The MPR specifies 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 MPR implicitly assumes that the instrument of monetary policy will always react strongly to inflation (or some forecast of future inflation). MPRs and inflation targets do not necessarily mean the same thing. The two are different elements of a general monetary policy strategy. The MPR provides a guide to the policymaker as to 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 (2000b):

> There 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) [11].

The instrument of monetary policy is most commonly an interest rate, usually a short-term cash rate or repo rate, though other policy instruments could also be used. For instance, McCallum (1999) has suggested the use of the growth rate of money. As will be discussed later, in some cases, a weighted average for the interest rate and exchange rate (so-called Monetary Conditions Index) might be used (also see fns 13 and 15).

For much of this last decade, the literature on MPRs and Inflation Targeting has developed in a closed economy context (Ball, 1997 and

[11] Closely related to the distinction between MPRs and IT is the need to distinguish between two types of policy rules, viz. an instrument rule and a target rule (Svensson, 1997, 2002). A target rule focuses policymaker's attention on the stated target and is very model-dependent. The instrument rule is not directly related a specific objective and offers the flexibility to be applied across models (Batini and Haldane 1999). There are many examples of target rules

Svensson, 1997). 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).

a) Stylized Macro Model

In order to clarify the role of the exchange rate in the setting of the MPR, consider a stylized dynamic model of a small open economy which can be represented by a usual output function or an open economy IS curve (eq. 1), an open economy, accelerationist Phillips curve equation (eq. 2), and an uncovered interest parity condition (in general form) with the expected depreciation of the exchange rate normalized to zero (eq. 3):

$$\mathbf{y_t = f\,[r_{t-1},\, y_{t-1},\, e_{t-1},\, \varepsilon_t]} \qquad \mathbf{(1)}$$

$$\mathbf{\pi_t = g\,[\pi_{t-1},\, y_{t-1},\, e_{t-1},\, \eta_t]} \qquad \mathbf{(2)}^{12}$$

$$\mathbf{e_t = h\,[r_t,\, r^*_t,\, rp_t]} \qquad \mathbf{(3)}$$

where r^*_t and rp_t is the foreign interest rate and a risk premium, respectively and f (.), g (.) and h (.) and general functional forms – although they could just as easily be written as linear functions as commonly presented in this literature. Assume ε_t and η_t are random shocks not known to the policy maker.

(for instance, see Svensson, 1997, 2000), the most widely cited being the Taylor Rule (Taylor 1993).

[12] Eq. 4 is sometimes specified as: $\pi_t = g\,[\pi_{t-1}, y_{t-1}, (e_{t-1} - e_{t-2}), \eta_t]$.

A key result of the model is that monetary policy affects inflation directly through the price effects of currency movements as well as indirectly via output (which in turn is impacted by both interest and exchange rate changes). The direct effect takes place with a one period lag, while the lag structure of the stylized economy implies that indirect effects on inflation via output occur after two periods[13]. The more open the economy the stronger the effects of import prices on domestic inflation, i.e. a larger coefficient on the e_{t-1} in eq. 2 and an increased effect of the exchange rate on goods demand in eq. 3.

b) Interest Rate Rule

Assuming the existence of a quadratic loss function (see Annex 1), it can be shown that optimal monetary policy rule is give by a variant of the Taylor Rule (*a la* Taylor, 1993, 2002a,b,c):

$$r_t = ay_t + b\pi_t + c_1 e_t + c_2 e_{t-1} \qquad (4)$$

where e_t and e_{t-1} refer to the foreign currency price of domestic currency in time period t and t-1, respectively; π_t is the inflation rate expressed as deviation from the target (π^*); y_t is real GDP in time t; and r_t is the real interest rate at time t, both variables expressed as deviations from their respective steady state/equilibrium mean values[14].

The relevant question is what value should the *c* parameters hold, if any. The original Taylor rule for a large and relatively closed economy like the

[13] Direct effect: r_t --> e_t --> π_{t+1} . Indirect effect: r_t --> e_t --> y_{t+1} → π_{t+2} .

US is one where $a, b > 0$ and $c_1 = c_2 = 0$. For a small and open economy, the exchange rate should enter the MPR with a non-zero coefficient. In particular, c_1 must be less than zero and c_2 must be greater than or equal to zero. This is so as an appreciation (increase) of the domestic currency necessitates a relaxation of monetary policy, i.e. currency appreciation tends to be deflationary. A positive c_2 represents a partial adjustment. Recent work using simulations on different types of macro models find values for c_1 range between -0.45 and -0.25, while those for c_2 range between 0.15 and 0.45 (Table 1).

There have been some recent contributions examining the effect of the exchange rate on interest rate rules. Clarida et al. (1998) estimated a set of MPRs for two sets of countries. The first set is Germany, Japan and the US while the UK, France and Italy form the second set. The latter set constitutes relatively smaller and more open economies. It turns out that the policy rules for the second set reacted relatively more strongly to the exchange rate (in this case, the DM) and to German monetary policy than did the first set. This is an indication that more open economies may feel the need to smooth the volatility of their exchange rates. There have been few if any studies to date that have looked at policy rules for East Asian countries; this is an important area for future research[15].

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[14] The MPR is sometimes modified to include an interest rate smoothing process which describes the gradual adjustment of the interest rate to its target by the monetary authority.

[15] The foregoing discussion skips over a host of important issues that need to be considered by an inflation targeting monetary authority. One, what type of exchange rate should be included in the policy rule. Strictly speaking, eq. 1 requires the inclusion of an export-weighted real exchange rate while eq. 2 requires the use of import weighted nominal exchange rates. Two, an alternative to an inflation target would be a price target, i.e. specifying the price level, as opposed to the inflation rate. Apart from the fact that price level targeting will inevitably lead to sharper gyrations in output and gives rise to more volatile short-horizon prices (but more stable longer horizon ones), most central banks in practice pursue an inflation as

c) Monetary Conditions Index (MCI)

Another way in which the exchange rate might be included in a rule is via a Monetary Conditions Index (MCI) (Ball, 1999 and Svensson, 2000). The MCI takes the following form:

$$wr_t + (1-w)e_t = ay_t + b\pi_t \qquad (5)$$

In other words, the MCI is merely a weighted combination of movements in the interest rate and the exchange rate.

The central idea behind a MCI is that the ratio between the exchange rate and the interest rate remains constant. This ensures, for example, that tight monetary policy is reflected in both the money and foreign exchange markets. This is done either by manipulating both of the instruments separately or by changing one instrument - usually the interest rate - which in turn will induce changes in the other. Ball (1999), for instance, suggests that the underlying instrument of the MCI is the interest rate. As such, the constant ratio between the interest rate and the exchange rate is maintained by shifting the interest rate which will then effect a change in the exchange rate. For this to work effectively there must exist a stable relationship between the two

opposed to a price level target. Three, some have suggested the need to include asset prices other than the exchange rate – real estate and equity prices, for instance. This literature is in its infancy with no unambiguous conclusion (for instance, see Bordo and Jeanne, 2002 and Cecchetti, et al., 2000 and 2002). Some of the general issues of clarity of objectives and transparency versus the benefits of discretion outlined in Section 5 are of particular relevance to this debate.

policy instruments[16]. This in turn requires the satisfaction of arbitrage price conditions (such as the UIP - eq. 3 above)[17].

Speaking about Thailand which has an MCI operational target, Hataiseree (1998) notes:

> The..MCI..can be used to compare the degree of importance between interest rate and the exchange rate in influencing the future inflation rate. Empirically, it was found that the MCI ratio for Thailand takes the value of 3.3 : 1. This ratio implies that when the baht is expected to depreciate at an average rate of 3.3% in any particular time, *ceteris paribus*, the interest rate needs to be raised by an average of 1% in order to prevent the expectation of the bath depreciation from effecting the forecasting of the future inflation rate (p.27).

While an important virtue of the MCI is its transparency and verifiability *a la* Frankel et al. (2000b), as will be discussed in the next section, a major drawback with its use as an operational target is that it straitjackets monetary policy in some instances to the detriment of output and employment. Considerable care therefore needs to be taken in the implementation of the MCI as an operational target. There is a growing consensus that, at best, the MCI offers a useful composite indicator of overall macroeconomic and financial conditions in a small and open economy (Hataiseree, 1998 and Siklos, 2000).

3.2 Exploring the Loss Function of the Monetary Authority in an Open Economy

[16] A second criterion for the working of an MCI is the absence of sterilization of the monetary effects of policy as this will undo the working of the MCI.

[17] Fung (2001) uses a VAR model to estimate the effects of a MCI for a sample of East Asian countries. Another option might be to employ the exchange rate as the sole policy instrument. The monetary authority can use the management of it's foreign currency reserves to allow the currency to react to, say, inflation and output, in the same as the Taylor rule uses the domestic interest rate (see McCauley, 2001).

The discussion thus far has focused on the use of the exchange rate as part of the instrument rule, or in some cases as the instrument itself. But what happens if the monetary authority is also concerned about exchange rate volatility as a policy objective in and of itself?

If the desire for exchange rate stability stems from its potential deleterious effects on growth, arguably this implies that eq. 1 above is mis-specified, with an additional term for exchange rate variability needing to be added on to the right hand side of eq. 1. If this is done, there ought not to be any reason to be concerned about exchange rate stability for its own sake (i.e. there is no reason that it should enter the monetary authority's loss function independently over and above inflation and output). Thus, for the exchange rate to directly enter the monetary authority's loss function - i.e. for the monetary authority to exhibit a genuine "fear of floating" - it must either: (a) be valued for its own sake in addition to its impact on inflation and output; or (b) if valued because of its impact on inflation and output, for some reason, its impact on the macroeconomy cannot be adequately captured in the specified macro model (eqs. 1 and 2).

Consider a generalized, intertemporal loss function of the monetary authority which is stated in quadratic form[18]:

$$E_t \sum_{s=t}^{\infty} \delta^{s-t} \left[\alpha \pi_s^2 + \lambda y_s^2 + \nu (i_s - i_{s-1})^2 + \mu (\pi_s + \Delta y_s)^2 + \kappa e_s \right] \qquad (6)$$

where δ is a discount factor representing the central bank's rate of time preference, α, λ, ν, μ, κ are policy parameters that relate to inflation (π),

output (*y*), interest rate (*i*) smoothing, nominal income and the exchange rate (*e*) respectively. The objectives of the monetary authority are principally inflation and output and also include an interest rate smoothing term[19].

On the basis of eq. 6 above, we can identify a number of possible targeting scenarios. These are summarized in Table 2[20].

Assume the simplest case where all coefficients in eq. 6 other than α are set to zero. This implies that the specified monetary authority focuses solely on the inflation objective (ignoring the interest smoothing objective)[21]. However, even with strict inflation targeting there is still a positive coefficient on the output gap in the MPR (eq. 4) in view of the importance of the output gap in impacting future inflation. The inclusion of the output variable effectively implies that the monetary authority pursues a "soft" or "flexible" inflation target, whereby the aim is not to hit the target inflation as soon as possible, but rather, do so over time (Debelle, 2001 and Mishkin, 2002). Similarly, even if the exchange rate is not in the loss function, the exchange rate will enter the MPR with a positive coefficient in view of its information content about current and future inflation (and output). We elaborate on this point in Section 5.

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[18] The quadratic structure of the loss function - which is used because of its mathematical tractability - along with the evolution of the state (eqs. 1 to 3) in turn gives rise to the linear MPR (eq. 4).

[19] We include the interest smoothing term in the loss function as in practice central banks tend are keen on prevent sharp fluctuations in the instrument (also fn 12 and Lowe and Ellis, 1997 and Sack and Weiland, 1999). Indeed, the same argument would probably hold in the case of the inclusion of the exchange rate, especially if the instrument is the MCI. Nonetheless, in the literature (as well as policy), while the exchange rate issue is viewed as being controversial, the interest smoothing one is not. It bears noting that even those who strongly advocate that the inflation targeting monetary authority should react to asset prices in the course of policy making, are clear that asset prices ought not to be included in the objective function. See Cecchetti et al. (2002) for a clear statement on this.

[20] Also see Debelle (2001) and Leitemo et al. (2002).

[21] Mervyn King (1996) terms such an optimizing monetary authority an "inflation nutter".

If all the coefficients in the loss function including the exchange rate policy parameter (κ) are positive, this represents an attempt by the monetary authority to manage the movements in its exchange rate (as well as output). When the loss function is minimized subject to a macro model as the constraints (eqs. 1 - 3), the resulting monetary policy rule (eq. 4) will include an exchange rate policy parameter in the same way as α is for inflation or λ is for output.

4. Responding to Shocks in an Open Economy Inflation Targeting Regime

An important issue that arises in the context of managing exchange rates in an inflation targeting regime pertains to shocks. How should the monetary authority respond to various shocks?[22]

Consider three general shocks, a positive domestic demand shock, a foreign financial shock like a risk premium shock and a terms of trade shock.

A positive demand shock affects y_t in eq. 1 directly, which in turn threatens to impact future inflation (from eq. 2). The policy response in this case is to increase r_t to the extent given by the parameter, a in the rule in eq. 4 which in turn leads to the appreciation of the currency (eq. 3). However, in the next period, if the MPR parameter c_1, has a negative value (see Table 1), part of the interest rate increase will be reversed in response to the appreciation. Clearly, in the case of a domestic demand shock, there is a trade-off between the goal of maintaining a stable exchange rate, on the one hand, and that of keeping inflation under tabs, on the other. One way of minimizing this trade-off would be ensure that the inflation objective is

[22] This section draws heavily on Ball (1999), Eichengreen (2001b) as well as Siklos (2000).

reached over time rather than as soon as possible. We return to this issue in Section 5.

Next consider the case of a negative financial shock such as a rise in the risk premium (rp_t) – a pure portfolio disturbance shock. A risk premium shock causes a reduction in the exchange rate today with consequent inflationary effects via pass through (eq. 2). Over time, the currency depreciation ought to have positive output effects via the competitiveness channel, which in turn will have inflationary effects via the Phillips curve relation (eq. 1). In this case, in view of the unambiguous inflationary effects of this shock, the inflation targeting monetary authority will raise interest rates. While this monetary policy response is optimal from an inflation perspective, it may be mistakenly interpreted as a "fear of floating" (i.e. exchange rate stability is viewed as an end in itself). Also, note here that the optimal interest rate policy response is not inconsistent with that suggested by an MCI as an operational target[23].

However, foreign shocks are not only of the financial variety. As noted by Eichengreen (2001b), a MPR is harder to use where the foreign shock involves a terms of trade/external demand shock. Consider a negative terms of trade shock. In this case, an interest rate hike would merely exacerbate the decline in aggregate demand. Insofar as the inflationary effects via the aggregate demand channel outweighs the direct price or passthrough effect, the appropriate interest rates response would be to lower interest rates. While this would be at odds with the policy that may be advocated by a "fear of floating" monetary authority, it is consistent with received wisdom which

suggests that the more variable the terms of trade, the more flexible ought to be the exchange rate regime. Note also that the policy recommendation would be at odds with a MCI as an operational target which would mandate a rise in interest rate to ensure that ratio between the exchange rate and interest rate remains more or less constant, though this would magnify the output loss (Ball, 1999).

The oft-noted example in this regard is that of New Zealand, which stringently adhered to the MCI as an operational target until 1998. The response of the Reserve Bank of New Zealand (RBNZ) to the negative export demand shock following the East Asian crisis was to raise interest rates to prop up the currency as required by the MCI. This in turn had sharp deflationary effects. Of course, the above analysis is rather oversimplified. As noted by Ball (1999), in actuality New Zealand was faced with a double whammy of a terms of trade shock as well as a financial one, the latter involving sharp capital outflows from the entire region. If one made the assumption that the financial shock outweighed the terms of trade shock, this would suggest that the policy bias ought to be towards an interest rate hike (which is what an MCI target would recommend). This is the policy that the Reserve Bank of New Zealand (RBNZ) pursued. To their credit, once the authorities realized that the net effects of the shocks and the initial policy response threatened to be sharply deflationary, the interest rate hike was reversed somewhat, though the easing was a case of being too little, too late (Chart 1b). The RBNZ has since forsaken the use of the MCI as an

[23] Indeed, use of the MCI as an operational target may be interpreted as the monetary authority demonstrating a degree of fear of floating.

operational target but continue to use it as an indicator of monetary conditions (Siklos, 2000).

As noted, an important characteristic of a number of emerging economies in East Asia and elsewhere is the extent to which their liabilities are dollarized. Does incorporation of this factor in any way change the preceding policy recommendations? In the case of a financial shock, insofar as the exchange rate depreciation implies a contractionary effect on aggregate demand, the initial policy recommendation of an interest rate hike not only keeps inflation down, it stabilizes the exchange rate and prevents an output contraction. Consider a terms of trade shock. In this case, as long as the balance sheet effect does not outweigh the competitiveness effect, the original policy recommendation of an interest rate hike goes through. If, however, the former exceeds the latter, an interest rate reduction will exacerbate the deflationary effects, thus suggesting the need for an interest rate hike. Eichengreen (2001b) notes of this case:

> (A) negative shock that reduces export demand and depresses output must be offset in the new long-run equilibrium by an appreciated exchange rate, not a depreciated one. In this peculiar world, overvaluation is good for output because its favorable financial effects dominate its adverse competitiveness effects. It can be reasonably objected that this is unrealistic…But relaxing this assumption means we are back in a world not just where the authorities allow the exchange rate to adjust to a new lower level following an adverse ..(terms of trade).. shock but also where they do not jack up interest rates to significantly slow its movement. In other words, we are back in the world where they display “fear of fixing” rather than “fear of floating”. A possible reconciliation is that when the exchange rate depreciates by a large amount, the adverse balance-sheet effects dominate, but when it depreciates by a small amount, the favorable competitiveness effects dominate. Large depreciations cause severe financial distress because they confront banks and firms with asset prices for which they are unprepared, while doing little to enhance competitiveness because of the speed with which they are passed through into inflation. For small

> depreciations, the balance of effects is the opposite; small depreciations are more likely therefore to satisfy the conditions for an expansionary devaluation (pp.27-9)[24].

Some support of this asymmetry between large and small exchange rate shocks is provided by Lahiri and Vegh (2001) and Moron and Winkelreid (2003). They find that in the case of country susceptible to balance sheet effects (i.e. a "financially vulnerable country" as they put it) a case can be made for a non-linear MPR. The non-linearity arises from the fact that the authority should defend the exchange rate in the "turbulent times" but allows the exchange rate to float in tranquil times.

The shocks that were examined above are very stylized and were assumed to be permanent. If they were transitory, the policy responses above would broadly remain intact though the interest rate change would be less marked, the rationale being that both the price and output effects tend to have inertial components (see eqs. 1 and 2) and therefore tend to be longer-lasting

While the preceding discussion is somewhat simplified, it does show that monetary policy under an inflation targeting regime may be flexible enough to allow the exchange rate to be addressed on the basis of responding to particular shocks. Just like inflation and output, if the exchange rate is in the *rule*, the monetary authority will react to it when it has moved as a result of a shock. In this case the exchange rate becomes an objective of policy not for its own sake but because of its impact in inflation directly or indirectly. This is not a genuine fear of floating. For a monetary authority to exhibit fear of floating, the exchange rate term must enter the monetary authority's objective function directly.

[24] See Krugman (1999) for an elaboration of these thresholds effects of devaluation in

5. Concluding Remarks

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. Each of these countries has passed legal and institutional legislations supporting their respective inflation targeting arrangements[25]. These legislations so passed provide for many facets of the new monetary policy regime including the appointment of key personnel and their tenure (five year terms in Korea and four years each in Indonesia and Thailand), the independence and autonomy of the monetary authority, the stated objectives of monetary policy and the responsibilities and accountability with respect to the achievement of those objectives. For example, Article 3 of the Bank of Korea Act states that "monetary and credit policies of the Bank of Korea shall be formulated neutrally and implemented autonomously and [its] independence …shall be respected". Article 6 provides for the annual setting of the price stability target (www.bok.or.kr). The new Bank Indonesia law states that the single objective of monetary policy is to "pursue and maintain stability of the value of the rupiah" (www.bi.go.id)[26].

How have these new inflation targeters performed since implementing an inflation targeting regime? The inflation performances of these new

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emerging economies.

[25] The revised Bank of Korea Act in December 1997 (and revised in April 1998), the new bank of Indonesia Act in May 1999 and the Bank of Thailand Act of May 2000, respectively.

[26] Alamsyah et al. (2001) note of the new Bank Indonesia pronouncement:

> The value of the rupiah" could refer to its value in terms of another currency unit – presumably the US dollar, but perhaps some other currency..The alternative interpretation is that it refers to the value of the goods and services the rupiah can buy. This interpretation implies that the objective is

regimes against their stated targets are provided in Table 3[27]. Thus far the performances have been reasonably good, with Thailand, Korea and the Philippines for the most part being within target. Indonesia has struggled to keep its inflation within its target range while Korea also exceeded its target for 2001 and 2002. In contrast to the *de jure* exchange rate classifications, observations of the *de facto* regimes – the exchange rate arrangements that countries are actually implementing – seem to suggest a reversion to US dollar pegs, albeit ones not as tightly as before the crisis (Charts 1c-g). Several studies have argued this to be the case (for instance, see Baig, 2001, Calvo and Reinhart, 2002 and McKinnon, 2000).

Is the relative fixity of regional currencies really a reversion to ad hoc managed floating regimes as many have argued, or is it a consequence of "flexible" or "soft" inflation target (Debelle, 2001)? The latter involves maintaining a fairly broad inflation target band that needs to be hit gradually over time, such as over the course of a business cycle, rather than as soon as possible. This allows for short-term over or under shooting of the target. Choosing a longer target horizon effectively involves putting more weight on other objectives like output and the exchange rate stability in the objective function of the monetary authority, i.e. they enter the loss function of the monetary authority directly along with inflation[28]. This way, the monetary

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the maintenance of domestic price stability, and it is this interpretation that has emerged as the operational one (p.314).

[27] Each of these monetary authorities defines inflation a little differently to each other. Indonesia excludes the effect of government prices and incomes policy. Korea uses CPI excluding petrol and some farm products. Thailand excludes raw food and energy prices. See McCauley (2001). See fn 28.

[28] Yet another way of thinking about this would be to say that the optimizing monetary authority places relatively greater weight on future inflation.

authority's performance is judged by the average inflation rate over the business cycle rather than at each year.

Ball (1999) suggests that in open economies, the monetary authorities ought to target "long-run inflation" which is a measure of inflation that is adjusted to transitory effects of exchange-rate movements. According to him, the reason to do so would be to ensure that policymakers do not react too strongly to exchange rate changes which may in turn have sharp output effects. While conceptually there may be little difference between this suggestion and targeting inflation over the business cycle, arguably the former is less easily and effectively communicatable to the public which may focus only on headline inflation[29].

As long as the country's inflation outlook remains consistent with the medium term inflation target range (i.e. the policy reference period), the monetary authority have space to use its judgement to judiciously react to other goals such as output, exchange rate or even asset price stability (though it would be imprudent to try and control too many elements in the economy). However, there needs to be a clear lexicographic ordering in favor of the inflation goal, such that if the inflation target is threatened at anytime, there is a commitment by the monetary authority to relinquish all other goals in order to meet the inflation target. The more flexible the inflation target (i.e. larger the band and longer the policy horizon) the greater the degree of discretion that can be used by the monetary authority to meet other objectives and respond effectively to various shocks in the interim, though this would be

[29] It is for the same reason that suggestions that the monetary authority explicitly target anything other than headline inflation (like CPI) probably ought to be eschewed. Many industrial countries target "core" inflation, i.e. overall price changes net of commodity prices.

at the expense of transparency and verifiability[30]. In other words, multiplicity of objectives/flexibility in implementing the inflation target invariably complicates the communication strategy of the monetary authority's monetary policy. As Mishkin (2002) notes:

> The KISS principle ("Keep It Simple Stupid") suggests that monetary policy should be articulated in as simple way as possible. The beauty of inflation target regimes is that by focusing on one objective – inflation – communication is fairly straightforward." (p.14).

Apart from lack of clarity regarding the goal of monetary policy, there are a number of concerns with incorporating multiple variables in the loss function (i.e. multiple targeting).

One, it is difficult to measure output gaps given the problems with measuring equilibrium output and exchange rate (Mishkin. 2002). Of course, one way to overcome this concern would be to target output and exchange rate variability as opposed to variation from equilibrium (Ades, 2002). In the case of the exchange rate objective this effectively implies the monetary authority focuses on the resource allocation costs of large exchange rate fluctuations as opposed to those due to currency misalignment[31].

Two, when monetary authorities explain their monetary policy actions by referring to the need to ensure output or exchange rate stability, "the political debate about monetary policy is likely to focus on short-run issues" (Mishkin, 2002, p.11), be it job creation, exchange rate stability of even asset

[30] One might call this the "Australian view" of inflation targeting. See Debelle (2001).

[31] A caveat is in order. Williamson (2001, 2002) has suggested that the monetary authority target a BBC with fairly wide bands, thus allowing for a degree of discretionary monetary policy to be implemented within the band. Also see Rajan (2002a). Willett (2002) makes the valid point that one could approach the design of exchange rate bands in an analogous manner to that of inflation targeting. Interestingly, the real effective exchange rates (REERs) of many East Asian countries appear relatively stable, leading one to wonder whether at least some of the regional authorities might not be targeting a real currency basket *a la*

price stability. This in turn may "obscure the transparency of monetary policy and make it less likely that the public will support a monetary policy that focuses on long-run considerations" (Mishkin, 2002, p.14) and will worsen the output-inflation tradeoff.

Three, in relation to the above, 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. This observation may be especially pertinent to some East Asian economies where there are concerns of a reversion to exchange-rate based monetary policy regime. For instance, an IMF report on exchange rate regimes has rightly cautioned that:

> There is an important danger…in slipping back into *de facto* pegging of exchange rates against the US dollar. While this may be sustainable for some considerable period, this may well eventually contribute to recreating the problems that led up to the Asian crisis." (Mussa et al., 2000, p.59).

The foregoing notwithstanding, the optimal monetary policy rules themselves can and do depend heavily on the foundation and structure of economic and financial systems of an individual country. Consequently, there is significant margin of error in the policy rules that are frequently written down in the form of a mechanical operational instruction (algebraic formula)[32], thus suggesting need for a degree of discretion in its implementation. Additionally,

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Singapore's monitoring band arrangement (Rajan, 2002a and Rajan and Siregar, 2002, 2003). This is a point requiring more in-depth exploration (also see fn 14).

some degree of flexibility is desirable given the uncertainty about the link between policy instruments (exchange rate and interest rate) and policy outcomes (inflation) as well as other types of uncertainty, including those inherent in forecasting inflation[33].

Bernanke and Mishkin (1998) opine that inflation targeting "is a broad framework for policy, which allows the monetary authority 'constrained discretion', rather than as an ironclad policy rule in the Friedman sense" (p.1). While the exact balance between flexibility and rigidity will no doubt vary between countries (and possibly over time within a country), suffice it to note that (a) the less credible the monetary authority (i.e. weaker its inflation-fighting track record); (b) the less its technical ability; (c) the lower its political independence; and (d) the lower the degree of liability dollarization, the more attractive would be a pre-commitment to hard inflation target (i.e. preference of a rule over discretion). Conversely, the more open the economy and the less ingrained are inflationary expectations in agents in the country and the less intense are the potential balance sheet effects of currency fluctuations, the greater the scope for discretion over strict inflation target rules. There are of course, all kinds of tradeoffs involved between the above categories – for instance, it is quite likely that countries where the central bank has limited credibility in the eyes of markets and a reputation of pursuing inconsistent monetary policies will also be the ones where liability dollarization is most pervasive.

[32] For instance, what are the factors that enter the monetary authority's loss function?; is the loss function quadratic?; what is the true structural economic model? All of these will impact the final policy rule that is derived.
[33] Though, of course, the longer the policy horizon the less reliable are inflation forecasts.

Regardless of the extent of flexibility or discretion that is pursued, it is imperative that the monetary authority pursuing an inflation targeting regime communicate effectively to the public the lexicographic ordering of its objectives (with inflation taking precedence over all others over time) and the time frame over which the monetary authority is committed to returning inflation to target.

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Table 1

Simulated Coefficient Estimates of Exchange Rate Variables

	c_1	c_2
Ball (1999)	-0.37	0.17
Svensson (2000)	-0.45	0.45
Taylor (1999)	-0.25	0.15

Source: Authors

Table 2
Types of Inflation Targeting (Based on Eq. 6)

	α	λ	ν	μ	κ
Strict inflation targeting	>0	0	0	0	0
Flexible inflation targeting	>0	>0	0	0	0
Interest rate smoothing	>0	>0	>0	0	0
Nominal income Targeting	>0	>0	0	>0	0
Exchange rate smoothing (fear of floating)	>0	>0	0	0	>0

Source: Authors

Table 3

Actual versus Targeted Inflation Rates (in percent):

Korea, Indonesia, Thailand, the Philippines

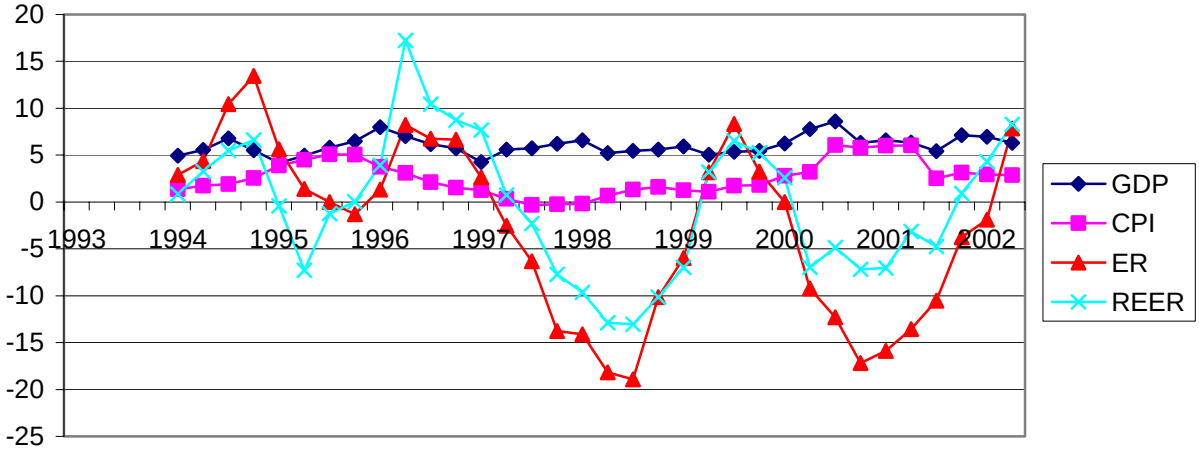
	1999		**2000**		**2001**		**2002**		**2003**
	Target	**Actual**	**Target**	**Actual**	**Target**	**Actual**	**Target**	**Actual**	**Target**
Korea	3.0	0.8	2.5	1.8	2.5	3.2	2.5	3.7	2.5
Indonesia			3-5	5.9	3-5	12.5	3-5	10.3	9.0
Thailand			<3.5	0.7	<3.5	1.2	<3.5	1.6	<3.5
Philippines					6-7	6.1	5.0*	3.1	5.0*

Notes: * *plus/minus half percentage point*

Sources: McCauley (2001), Bank of Korea, Bank Indonesia, Bank of Thailand, Bangko Sentral ng Phillipines

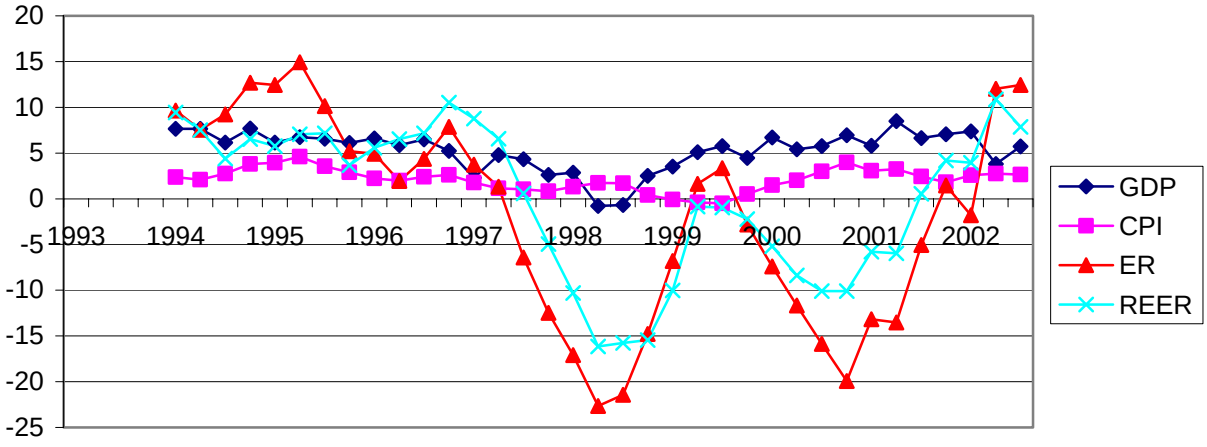
Figures 1a to 1g: CPI, GDP, Exchange Rate and REER (annual % change)

Figure 1a
Australia



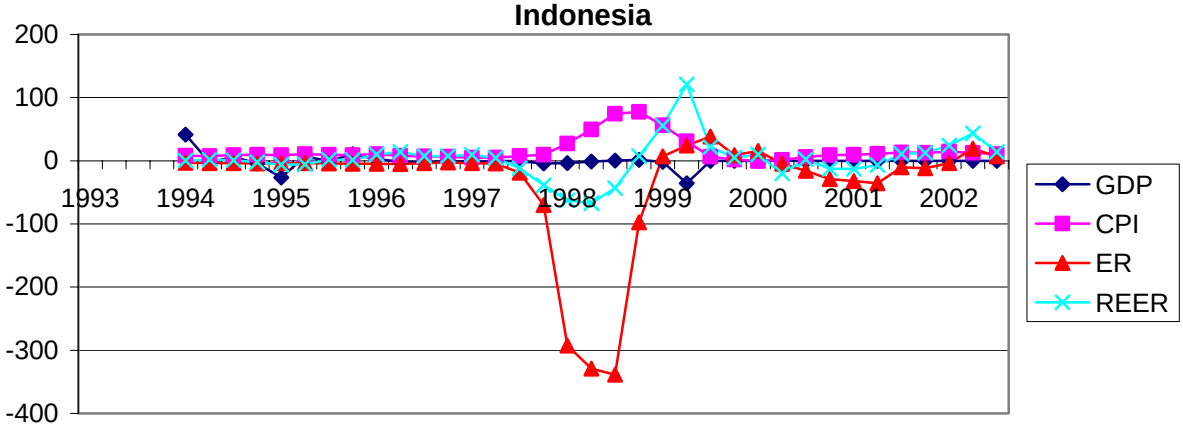
Sources: IFS and ARIC Database

Figure 1b
New Zealand



Sources: IFS and ARIC Database

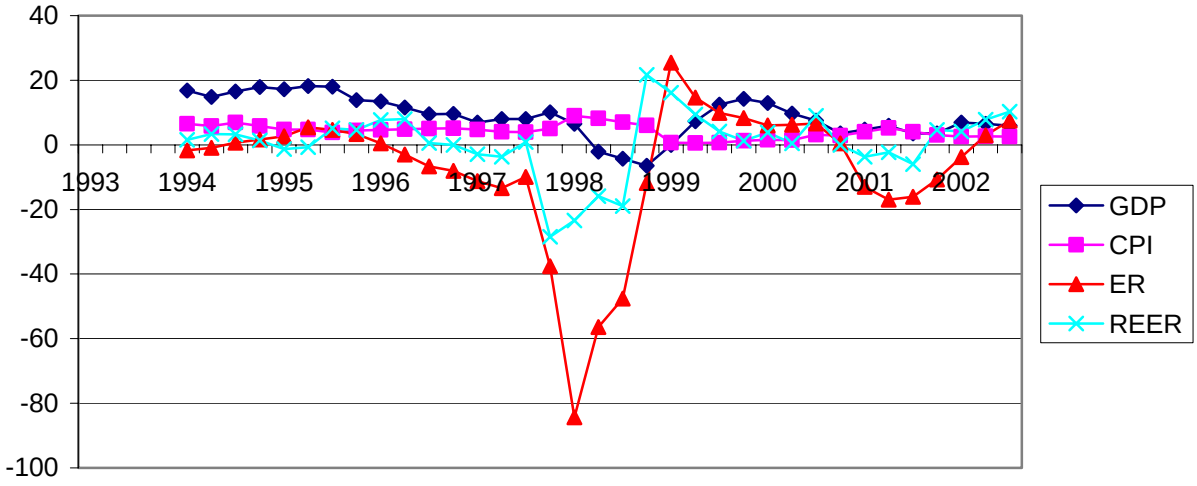
Figure 1c
Indonesia



Notes: GDP is proxied by production of crude petroleum. (line 66AA IFS)

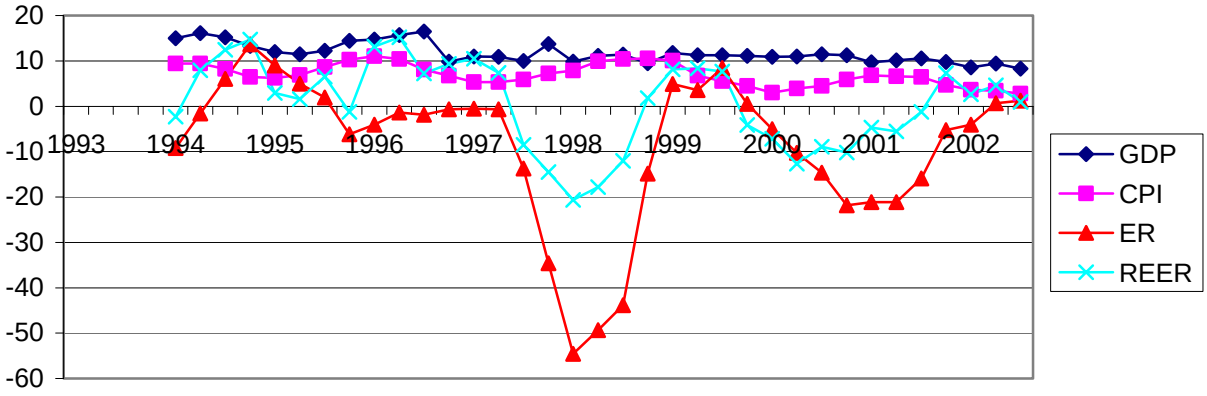
Sources: IFS and ARIC Database

Figure 1d
Korea



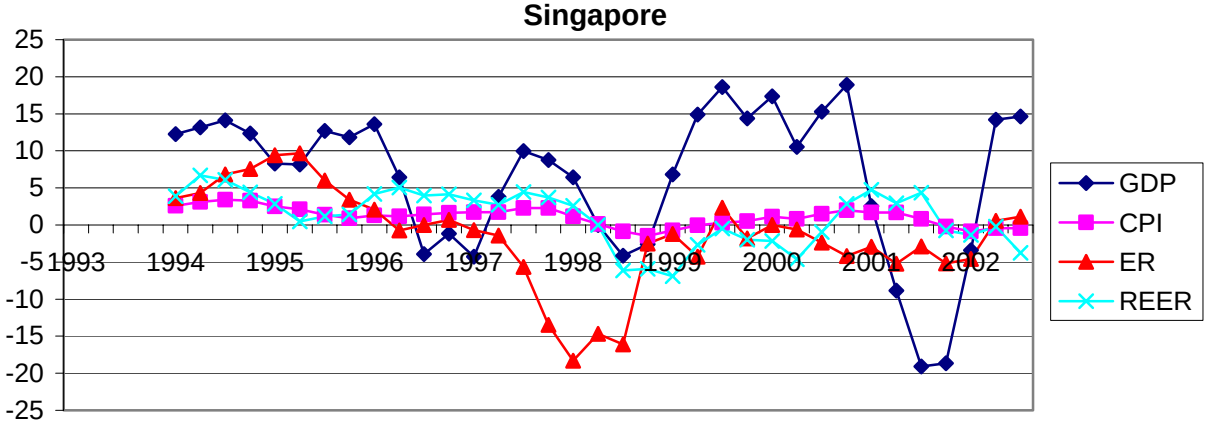
Sources: IFS and ARIC Database

Figure 1e
Philippines



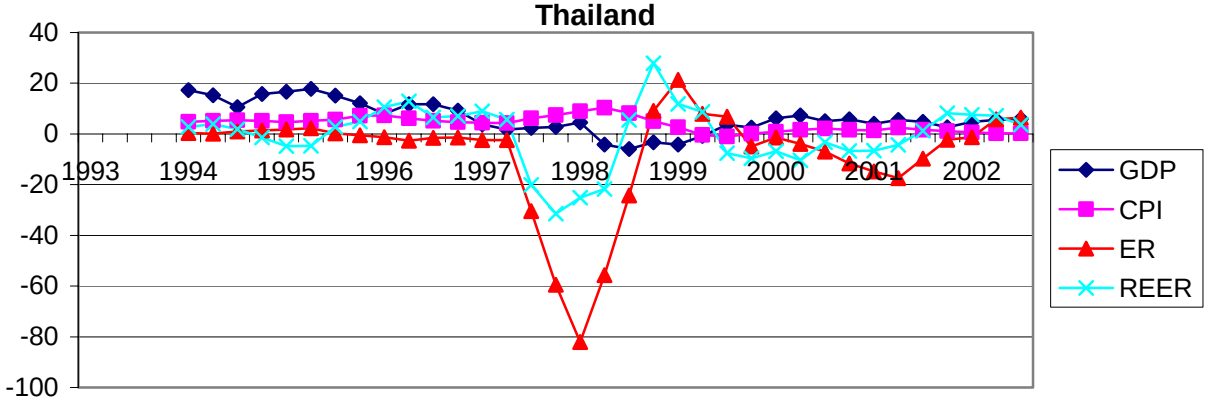
Notes: GDP is proxied by Manufacturing Production (line 66EY IFS)
Sources: IFS and ARIC Database

Figure 1f
Singapore



Note: GDP is proxied by Manufacturing Production (line 66EY IFS)
Sources: IFS and ARIC Database

Figure 1g
Thailand



Sources: IFS and ARIC Database

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