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EXCHANGE RATES IN EMERGING ECONOMIES: WHAT DO WE KNOW? WHAT DO WE NEED TO KNOW?

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ABSTRACT

Exchange rates have been at the center of economic debates in emerging economies. Issues related to the feasibility of flexible exchange rates, the relationship between exchange rate volatility and growth, and the role of exchange rate overvaluation in recent crises, among other, have been extensively discussed during the last few years. In this paper we address some of the most important exchange rate-related issues in emerging economies. In particular, we deal with: (a) the merits of alternative exchange rate regimes: (b) the extent to which purchasing power parity holds in the long run in these countries; and (c) models to assess real exchange rate overvaluation. We also discuss future areas for research on exchange rates in the emerging nations.

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I. Introduction

For the last two decades exchange rates have been at the center of policy debates in developing and transition economies. Controversies have abounded, and theoretical as well as applied questions have been discussed vehemently among academics and policy makers. Some of the policy issues that have captured analysts' interests include: Should nominal exchange rate anchors be used during the early phases of a stabilization program? Are floating exchange rates viable in emerging economies? Does real exchange rate overvaluation always precede currency crises? Recent developments have contributed to maintain these questions at the forefront of policy discussions. Some of the actors have changed, but the script remains pretty much the same. Examples of the policy questions that occupy much of the attention at present are: Should Mexico abandon its floating exchange rate and adopt a more "predictable" system? Could Russia have avoided the August 1998 devaluation of the rouble? Should the East Asian countries peg their exchange rates to restore price and output stability? Should Argentina exit its currency board and move towards a more flexible regime? There is every indication that questions of this type will remain prominent in the months and years to come.

In this paper we address some important exchange rate-related issues in developing and transition economies. We critically review the theoretical and, especially, the empirical literature that focuses on these economies, and we identify some of the areas where knowledge is still limited. Our analysis is deliberately selective, and concentrates on:

- The relationship between nominal exchange rate regimes and economic performance.

- The feasibility of adopting floating exchange rates in developing countries.
- The long-run empirical features of real exchange rates in emerging economies.
- The extent to which purchasing power parity (PPP) provides a useful yardstick for assessing exchange rate behavior in these economies.
- Models and methods commonly employed to assess real exchange rate misalignment.

We are, of course, aware that this is a partial list of issues; it would be utterly impossible to deal with every exchange rate-related question in a limited space. However, in the concluding section of this paper we address briefly some additional problems that have emerged in recent exchange rate debates.

The rest of the paper is organized as follows: Section II focuses on nominal exchange rate regimes. In it we try to explain the rather abrupt decline in the number of developing countries with formally pegged exchange rates, and we review the evidence on the relationship between exchange rate regimes and economic performance. This discussion deals with inflation and economic growth, and focuses on some of the methodological shortcomings encountered in this literature. Finally, in this section we also provide some evidence, based on Mexico's recent (post 1994) experience, on the feasibility of floating exchange rates in developing countries. In Section III we deal with the economics of real exchange rates. We start with a discussion of the empirical evidence on the time series characteristics of real exchange rates in emerging economies. The analysis focuses on stationarity issues and emphasizes the difference between short and long term analyses of purchasing power parity (PPP). We make the point that most of economists' beliefs on the subject are based on limited evidence from the advanced nations, and we argue that additional work on the developing countries is needed. In this

section we also address the issue of the relationship between productivity growth and deviations from PPP--the so-called Balassa-Samuelson effect. Section IV deals with the important issue of real exchange rate misalignment. We critically evaluate existing models for assessing whether a country's currency is misaligned, and we argue that most of the popular approaches are subject to serious methodological as well as empirical shortcomings. We argue that future work on this area should aim at integrating real exchange rate analyses with analyses of current account "sustainability." Section V presents the conclusions. We summarize our main findings and provide a brief discussion of other areas in which, in our view, the economics profession needs to (significantly) improve its knowledge about exchange rates in emerging economies.

II. Nominal Exchange Rate Regimes and Macroeconomic Performance

The modern literature on exchange rate regimes has emphasized the existence of important tradeoffs between *credibility* and *flexibility* (Frankel, 1995, Rodrik, 1992, Edwards, 1996). In doing this, however, most theoretical analyses have considered two highly simplified extreme cases: (i) a fully flexible (or floating) exchange rate with minimal central bank intervention; and (ii) an irrevocably (and credibly) fixed nominal exchange rate. According to this bipolar characterization, a flexible exchange rate regime allows a country to have an independent monetary policy, providing the economy with flexibility to accommodate domestic and foreign shocks, including changes in external terms of trade and interest rates. This flexibility, however, usually comes at the cost of some loss in credibility and, thus, tends to be associated (on average) with higher inflation. Alternatively, fixed exchange rates reduce the degree of flexibility of the system but impart (in theory) a higher degree of credibility to policy making. Since the public believes that, under fixed rates, the primary goal of monetary policy is

to preserve the exchange rate parity, they moderate their wage and price expectations, thus allowing the economy to attain a lower rate of inflation. This analysis assumes that under a fixed exchange rate regime the authorities are always more disciplined and, thus, that the fixed exchange rate is never abandoned--that is, devaluations are not an option. This, of course, is an oversimplification. In fact, as history has shown again and again, fixed exchange rates often fail to impose macroeconomic discipline and end up in major devaluation crises (see, for example, Cooper, 1971, Kamin, 1988, and Edwards, 1989). For this reason, a number of analysts that favor credibility over flexibility increasingly argue that fixed exchange rates are a necessary, but not sufficient condition for achieving macroeconomic stability, and that additional institutional constraints on policy makers--even at the constitutional level--have to be devised.

Purely floating and fixed systems are, of course, only two of the possible exchange rate regimes a country can choose. In reality, there are many layers between these two extremes. Table 1 contains a list of nine alternative exchange rate regimes, ranked according to the degree of flexibility that they impart to the economy or, in inverse order, according to the relative stability they afford to the nominal exchange rate.[1] The table describes briefly the main features of each regime, summarizes their alleged merits and shortcomings, and mentions a few relevant historical experiences. One thing the table makes clear is that the profusion of exchange rate systems and the blurred boundaries between many of them makes any attempt to empirically determine the merits of alternative regimes extremely difficult. We deal with this issue in greater detail below.

Table 1. Alternative Exchange Rate Regimes

Regime	Main Features	Main Benefits	Main Shortcomings	Key episodes /Comments
1. Free Float	-Value of foreign exchange freely determined in the market. Actual and expected changes in demand/supply of assets and goods reflected in exchange rate changes.	-Changes in nominal exchange rate shoulder bulk of adjustment to foreign and domestic shocks. -High international reserves not required.	-High nominal (and real) exchange rate volatility may distort resource allocation. -Monetary policy needs to be framed in terms of nominal anchors different from the exchange rate; scope for discretion and inflation bias may be large.	-Virtually no country has a pure float. The United States, Germany, Switzerland (and Japan, according to some) come close.
2. "Dirty" Float	-Sporadic central bank interventions in foreign exchange market. Modes and frequency of intervention vary, as do the objectives guiding the intervention . -Active intervention (sterilized and non-sterilized) results in changes in international reserves. Indirect intervention (through changes in interest rates, liquidity and other financial instruments) does not result in changes in reserves.	-Same as in a free float, except that higher international reserves may be needed. - Dampens "excessive" fluctuations of exchange rates.	-Lack of transparency of central bank behavior may introduce too much uncertainty. -Effects of intervention are typically short-lived (even when intended as a signal) and may be destabilizing.	-Many advanced economies have adopted this regime—Canada, Australia (Japan, according to others) . -Mexico adopted a system similar to this following the 1994-95 crisis. -A dirty float could be thought of as a managed float with wide bands, with the (undisclosed) position of the bands providing the criterion for intervention.
3. Floating within a Band (Target zone)	-The nominal exchange rate is allowed to fluctuate (somewhat freely) within a band. The center of the band is a *fixed rate*, either in terms of one currency or of a basket of currencies. The width of the band varies (in the ERM it was originally ± 2.25 percent). - Some band systems are the result of cooperative arrangements, others are unilateral.	-System combines the benefits of some flexibility with some credibility. -Key parameters (bands, mid-point) help guide the public's expectations. - Changes in the nominal rate within the bands help absorb shocks to fundamentals.	-In some cases (especially when the band is too narrow and when domestic macro policies are not consistent with a "horizontal" band) the system can be destabilizing and prone to speculative attacks. -Selecting the width of the band is not trivial. -Systems that allow for the possibility of realignment of the bands and central parity weaken the credibility afforded by the regime.	-The Exchange Rate Mechanism of the European Monetary System is the best known example of this type of regime. - The ERM crises of 1992-93 showed clearly that the system can be subjected to severe speculative pressures, and even collapse, when currencies become misaligned and central banks are hesitant to defend the bands.
4. Sliding Band	-There is no commitment by the authorities to maintain the central parity "indefinitely". Instead, it is clear at the outset that the central parity will be adjusted periodically (e.g., due to competitiveness considerations). -The system is an adaptation of the band regime to the case of high-inflation economies.	-The system allows countries with an ongoing rate of inflation higher than world inflation to adopt a band without having to experience a severe real appreciation.	-The fact that the timing and size of central parity adjustments are unknown, introduces considerable uncertainty, which often leads to high interest rate volatility. -As in the case of the standard band system, it is difficult to choose the appropriate width for the band.	-Israel had a system similar to this from early 1989 to December 1991. -The uncertainty and volatility associated with this system makes it less attractive than other alternatives, such as the crawling band.
5. Crawling Band	-A band system whereby the central parity crawls over time. -Different rules can be used to determine the rate of crawl. The two most common are: backward-looking crawl (e.g., based on past inflation differentials), and forward-looking crawl (e.g., based on the expected, or target, rate of inflation).	-System allows high inflation countries to adopt a band system without having to undertake (large) stepwise adjustments of the central parity.	-Choosing the criteria for setting the rate of crawl entails serious risks. A backward-looking approach can introduce considerable inflationary inertia into the system. A forward-looking approach that sets the "wrong" inflation target can produce overvaluation and give rise to speculative pressures.	-Israel adopted this system in December 1991. Chile had a widening band system from 1986 to mid-1998. Italy also had, effectively, a system of this type between 1979 and 1991.

Table 1 (Concluded). Alternative Exchange Rate Regimes

Regime	Main Features	Main Benefits	Main Shortcomings	Key Episodes/Comments
6. Crawling peg	-The nominal exchange rate is adjusted periodically according to a set of indicators (usually lagged inflation differentials) and is not allowed the fluctuate beyond a narrow range (say, two percent). -One variant of the system consists of adjusting the nominal rate by a pre-announced rate set deliberately below ongoing inflation (variant known as a "tablita" regime).	-Allows high-inflation countries to avoid severe real exchange rate overvaluation. -The "tablita" variant helps to guide the public's expectations, and buys a limited amount of credibility.	-A pure backward-looking crawling peg (where the nominal rate is mechanically adjusted according to past inflation differentials) introduces inflationary inertia and may eventually cause monetary policy to lose its role as nominal anchor. -Equilibrium changes in the real exchange rate are difficult to accommodate. -A "tablita" system will not last if fiscal and incomes policies are not supportive.	-This system became popular in the 1960s and 1970s in Chile, Colombia and Brazil. It had its longer running in Colombia, which to this date has a high degree of inflationary inertia.
7. Fixed-but-adjustable exchange rate	-The regime epitomized by the Bretton Woods system. The nominal exchange rate is fixed, but the central bank is not obliged to maintain the parity indefinitely. No tight constraints are imposed on the monetary and fiscal authorities, who can follow, if they so decide, policies that are inconsistent with preserving the parity. - Adjustments of the parity (devaluations) are a powerful policy instrument.	-Provides macroeconomic discipline by maintaining (tradable good prices) in line with foreign prices in a context of relatively low uncertainty -The built-in "escape clause" (which allows the authorities to devalue in case of need) provides the system with some flexibility.	-Realignments (devaluations) under this system have typically been large and disruptive (introducing uncertainty and inflationary pressures) rather than smooth and orderly events. -If supplemented by the right institutions (e.g., an independent central bank) the time inconsistency problems embedded in the system could be attenuated.	-The most popular regime of this century. Most developing countries held on to (variants of) it after the formal collapse of the Bretton Woods agreement in 1973. -Many emerging countries continue to subscribe to this system de facto (e.g., Mexico 1993-93, Thailand, 1997), if not de jure.
8. Currency board	-Strict fixed exchange rate system, with institutional (legal, and even constitutional) constraints on monetary policy and no scope for altering the parity. - The monetary authority only can issue domestic money when it is fully backed by inflows of foreign exchange.	-The system maximizes credibility and reduces (eliminates) problems of "time inconsistency" .	- The system is long on credibility but short on flexibility. Large external shocks cannot be accommodated through exchange rate changes but have to be fully absorbed by changes in unemployment and economic activity. - The central bank loses its role as lender of last resort.	-Historically, a number of small countries have had systems of this type. Some of them, however, have not been successful. When faced with major external shocks, countries have been forced to abandon the regime. -Currently, Hong Kong and Estonia have currency boards. Argentina and Bulgaria have (quasi)-currency boards arrangements.
9. Full 'dollarization'	-Generic name given to an extreme form of a currency board system where the country gives up completely its monetary autonomy by adopting another country's currency.	-Credibility is maximized under this regime. Monetary authorities have, in theory, no scope for "surprising" the public.	-As in the currency board, the system is long on credibility but short on flexibility. Adverse external shocks have to be absorbed fully by the real economy. -The central bank loses its role as lender of last resort. -A non trivial shortcoming of this system is that it is usually resisted on political and nationalistic grounds. Another one, is that the rules of the game can be changed under extreme circumstances.	There are few historical episodes of full dollarization. A regime similar to this has worked relatively well in Panama. However, the case of Liberia unmasked a serious shortcoming of this type of system: when faced with an emergency (civil war) politicians decided to change the rules of the game and issued a national currency.

II.1 The Shift Away from Currency Pegs

Since the late 1970s single currency pegs have become increasingly less common among developing countries. This feature of the recent evolution of the international monetary system has been amply documented and discussed in the exchange rate literature. The standard way of illustrating this gradual shift toward more flexible exchange regimes by LDCs has been to trace the evolution over time o the official exchange rate arrangements that countries are obliged to report to the IMF. Table 2 (taken from IMF, 1997) is a typical example; the table shows a steady fall over the past two decades in the number of developing countries that maintain some type of pegged exchange rates, and a concomitant ris in the number of countries with "more flexible" exchange rate regimes.

At least two broad explanations have been offered to account for this trend toward greater exchange rate flexibility. One explanation is that starting in the late 1970s a confluence of factors of exte and domestic origin prompted developing countries to rely more heavily on exchange rate changes as par of their process of macroeconomic adjustment. Those factors obviously vary from country to country (an from region-to-region) but are typically thought to include the large exchange rate fluctuations among ma currencies that followed the breakdown of the Bretton Woods system, the oil shocks of the 1970s and 1980s, the debt crisis of the 1980s, and, especially in Latin America, fiscally-driven bouts of high and chronic inflation. A key premise underlying this explanation is that exchange rate changes can (and shou play a central role in restoring and preserving external and domestic equilibrium in shock-prone developi countries (see, for example, the discussion in Corden, 1990, Aghevli et al., 1991, and Little et al., 1993).

Table 2. Developing Countries: Officially Reported Exchange Rate Arrangements

(In percent of total)

	1976	1981	1986	1991	1996
Pegged	86	75	67	57	45
U.S. dollar	42	32	25	19	15
French franc	13	12	11	11	11
Other	7	4	4	3	4
SDR	12	13	8	5	2
Composite	12	14	18	20	14
Limited flexibility	3	10	5	4	3
Single	3	10	5	4	3
Cooperative	—	—	—	—	—
More flexible	11	15	28	39	52
Set to indicators	6	3	4	4	2
Managed floating	4	9	13	16	21
Independently floating	1	4	11	19	29
Number of countries	**100**	**113**	**119**	**123**	**123**

Source: IMF, 1997.

An alternative view that has gained prominence in recent years stresses the inherent tensions that arguably exist between high capital mobility and fixed exchange rates. According to this view, the main factors behind the marked shift away from single currency pegs in developing countries have been the dramatic increase in the degree of capital mobility experienced by these economies over the last two decades, and the ensuing rise in the (output) costs of preserving and defending a fixed exchange rate system--which is seen as a key determinant of recent episodes of "currency crashes" (see, for instance, Eichengreen, 1994, Obstfeld and Rogoff, 1995a, and Leiderman and Bufman, 1996).

Both of these explanations receive some support from a number of recent studies that examine the factors behind the developing countries' shift toward more flexible exchange rate arrangements from a political economy perspective--see Collins, 1996, Edwards, 1996, and Klein and Marion, 1997. An important insight emphasized by these studies is that the switch from traditional currency pegs to "more flexible" arrangements has had the effect of lowering the (perceived and actual) political cost of exchange rate changes that is normally borne by the authorities. By "de-politicizing" exchange rate movements, the argument goes, the authorities of these countries have become better equipped to respond "flexibly" to any given shock--including those that stem from international capital markets--even though, or perhaps precisely because, the switch rarely has entailed the adoption of freely floating exchange rates and, thus, nominal exchange rates in these countries have remained under heavy administrative control (Collins, 1996).

Regardless of the relative merits of the explanations put forward thus far, the marked shift away from fixed exchange rates by developing countries has provided the opportunity to gather evidence on the ***actual*** effects of alternative nominal exchange rate regimes on the macroeconomic performance of

these economies. Of course, this option was not available under the Bretton Woods system (where all countries, developing or not, were required to maintain some type of currency peg), and only became a feasible one as the shift toward more flexible exchange rate arrangements and current account convertibility gained momentum sometime during the 1980s (Table 2).

II.2 Exchange Rate Regimes and Macroeconomic Performance: Facts and Fantasies

II.2.1 Individual Country Studies

For a number of years, the bulk of the evidence on the relationship between nominal exchange rate regimes and macroeconomic performance in LDCs stemmed from largely descriptive accounts and assessments of experiences and experiments of individual countries (or groups of countries) with various types of exchange rate arrangements. Two well-known examples of this approach are the numerous studies that examined the demise of the infamous "tablitas" adopted by Argentina, Chile and Uruguay in the late 1970s (for an overview of these episodes see Calvo, 1986, Corbo and de Melo, 1987, and Edwards, 1985, 1986), and, years later, the evaluations of the (few) experiences with crawling exchange rate bands -- a distant cousin of target zones -- in the developing world (e.g., Helpman et al., 1994, Williamson, 1996). Findings reported in some multi-country comparative studies sponsored by, or conducted at, the World Bank--notably those of Choksi et al., 1989 and Little et al., 1993--also added to the profession's collective understanding of the relationship between exchange rate regimes and macroeconomic performance in developing countries[2].

Not surprisingly, this country-specific literature found it very difficult to pin down the ***independent*** effects of the nominal exchange rate regime on the overall macro performance of developing countries. Every time the profession seemed to be reaching agreement on a feature or

regularity distinctive of a particular regime based on analyses of the experience of a group of countries, developments in another group of countries provided a devastating counter-example that needed to be reckoned with. The clearest conclusion that this literature seemed capable of reaching was that the nominal exchange rate regime provided no substitute for sound and consistent macroeconomic policies. In fact, since the early 1990s it has become customary to end every study on exchange rates in developing countries by stressing that both fixed and flexible exchange rates "can work" in those economies, provided that policy-makers show a sufficiently strong commitment to macroeconomic stability. Of course all of this is true, but trite.

II.2.2 Multi Country Studies

As the diversity of experiences increased during the 1970s, and especially during the 1980s, researchers were able to use larger samples -- both in terms of countries and years -- to evaluate performance under alternative exchange rate systems. Edwards, 1993, for example, used a sample of 52 developing countries to investigate whether a fixed exchange rate regime indeed delivered lower rates of inflation than more flexible regimes. Edwards noted that this type of cross-country analysis was potentially subject to a serious "survival bias." The problem is that only countries that have successfully defended their peg are included in the "fixed exchange rate" category. On the other hand, countries that adopted a fixed exchange rate, but failed to sustain it, are usually classified as having a "flexible regime." This means that high inflation rates generated by exchange rate "crashes" are incorrectly (or unfairly) attributed to the flexible rate system. This problem had been noted also by Aghevli, et al., 1991 who, after arguing that "the inflation performance of the countries that have operated under a fixed exchange rate regime has been, on the whole, superior to that of the group operating under more

flexible arrangements," added that this type of conclusion "neglects the experience of countries that initially adopted a pegged arrangement, but were forced to abandon it" (page 13). Edwards, 1993 attempted to address this survival bias by examining whether, after controlling for other variables, countries that had a fixed exchange rate during the first year (1980) of a ten-year period (1980-89) had a lower average rate of inflation for the decade as a whole. He found that countries with a fixed exchange rate indeed experienced a lower average rate of inflation (the regression coefficient of the dummy variable for a fixed exchange rate in 1980 was -0.7). This effect, however, seemed to depend on the country's inflation history: the inclusion of an interactive regression term suggested that at levels of past (historical) inflation equal to or higher than 20 percent, fixed exchange rates lost their macroeconomic discipline effect.

Little, Corden, Cooper and Rajapatirana, 1993 also investigated whether fixed exchange rates discouraged inflation in their comprehensive study of experiences with macroeconomic adjustment in a group of 18 developing countries. Although they recognized the "reverse causality" problem, they conducted their analysis at a simple descriptive level, without making a formal attempt at dealing with the problem. After looking at the data from different angles they came to the perhaps obvious but nonetheless valuable conclusion that it was not possible to make generalizations. While in some countries a fixed exchange rate had been associated with a lower rate of inflation, in other "episodes the exchange rate was clearly not an effective 'nominal anchor'" (page 245). In addition, they made the important point that all analyses of country performance under alternative exchange rate regimes, should take into account the role of capital mobility. In fact, they suggested that their conclusions were most relevant for countries where the degree of capital mobility was somewhat limited.

One of the most comprehensive multi-country studies to date was conducted by Ghosh et al., 1995. The study examines the effects of the nominal exchange rate regime on inflation and growth using data from 136 countries during the period 1960-89--more than 3,600 annual observations. The authors compute unconditional and conditional means for the rates of inflation and output growth in the countries in the sample grouped and classified according to the degree of flexibility of their nominal exchange rate, as well as by their level of income. The conditional means are obtained from OLS estimates of simple equations for inflation and growth that include as regressors an exchange rate regime dummy and a set of other potential determinants. The authors check whether (a subset of) their results suffer from a problem of "reverse causation" (simultaneity bias), and also examine the effects that the regime may have on the volatility of inflation and output growth.

The study finds that the ***inflation*** rate is indeed significantly ***lower*** and less volatile under pegged exchange rates than under "more flexible" arrangements, even after controlling for the effects of money growth and interest rates. When it comes to output growth, however, the study finds little systematic differences across exchange rate regimes, except for the fact that output growth (and employment) are found to be ***more*** volatile under pegged exchange rates than under flexible rates. Another interesting finding of the study is that the "inflation bias" of flexible exchange rate arrangements does not seem to be present among the "pure floaters" in the sample--especially among the high- and upper-middle-income ones; a result that suggests that the positive correlation between exchange rate flexibility and inflation detected in the study may not be monotonic.

A more recent IMF study that extends the period of analysis to the mid-1990s reports similar findings: over the past two decades, inflation has been consistently lower and less volatile in developing

countries with pegged exchange rates than in those with more flexible arrangements, but there are no clear differences in the growth performance across the two groups (IMF, 1997). Although those conclusions are based on rather crude comparisons of the evolution of the ***median*** rates of inflation and output growth in countries with "pegged" and "flexible" exchange rate arrangements from 1975 to 1996, the evidence presented in this study suggests that the main findings reported by Ghosh et al., 1995 were not greatly affected by the increased access to international capital markets gained by developing countries in the 1990s. Indeed, it appears that the differences in macroeconomic performance across nominal exchange rate regimes in developing countries continue to boil down to differences in the inflation performance of the countries in each group, and that those differences seem to be getting smaller over time.

The apparent superiority of fixed exchange rates for delivering lower and more stable rates of inflation in developing countries is tempered even further when one takes into account the methodological compromises that are common--and oftentimes unavoidable--in cross-country comparisons of nominal exchange rate regimes.[3] First of all, the majority of studies classify nominal exchange rate regimes following the countries' official description of their exchange rate system (typically the one they report to the IMF) rather than on the basis of the ***actual*** degree of flexibility of their nominal exchange rates. Discrepancies between *de jure* and *de facto* (performance-based) classification of regimes, however, are often substantial; moreover, the sign and size of those discrepancies vary across countries and over time. Furthermore, to make things tractable, studies have to condense the 20-odd *de jure* categories of exchange rate arrangements reported in IMF sources

into two or three broad types of regime (e.g., “pegged” and “flexible”), which can lead to important differences in the classification of the same regime across studies[4].

Second, and as pointed out above, many of these studies implicitly assume that all exchange rate regimes in their sample were sustainable (in the sense of being consistent with other macroeconomic policies) and that all changes in regime (often, though not always, in the direction of greater exchange rate flexibility) were voluntary. A consequence of this assumption is that the macroeconomic effects of all “regime switches” tend to be ascribed to the successor regime; in developing countries, however, changes in the exchange rate regime are rarely smooth events, and tend to have short-run adverse effects on inflation and output, especially when they involve a large devaluation (Edwards, 1989, Edwards and Montiel, 1989, Eichengreen and Masson, 1998). Another consequence is that the duration of the exchange rate regime is assumed to be immaterial for macroeconomic performance. Thus, for instance, observations corresponding to countries that somehow managed to hold on for a year or two to clearly inconsistent and unsustainable currency pegs are, for the purpose of the tests conducted in the studies, treated no different by observations pertaining to currency pegs that have been in place for several decades (e.g., the countries in the CFA zone).

And third, there is the longstanding and earlier noted problem of endogeneity of the choice of exchange rate regime or “reverse causation.” The key question is whether fixed exchange rates deliver low inflation by adding discipline and credibility to the conduct of macroeconomic policies. Or is it that countries with low inflation choose pegged exchange rates, perhaps to signal their intention to maintain their anti-inflationary stance? A similar problem arises in the case of output growth, despite the difficulties of empirical studies for finding any clear link between growth and the exchange rate regime.

Do fixed exchange rates foster economic growth--say, by delivering an environment of low inflation and low relative price variability? Or do fast-growing countries choose fixed exchange rates so as to further reduce relative price variability and, hence, increase the horizon and efficiency of investment decisions? Of course, these questions have been at the core of the debate between fixed and flexible exchange rates since the beginning. However, the expectation that more systematic analyses of the empirical evidence could shed more light on them than what could be asked from analyses of individual country experiences may have been too optimistic. Although some recent studies (notably those of Ghosh et al., 1995 and Edwards, 1993, 1996) have made serious attempts to control or check for a possible simultaneity bias in their estimates stemming from an endogenous choice of exchange rate regime, the above noted problems in the classification of those regimes and in the treatment of "regime switches" are just two of many possible sources of sample selection bias that remain largely unaddressed. All considered, it seems that a satisfactory solution to the "reverse causation" problem in studies of the relationship between exchange rate regimes and macroeconomic performance in developing countries will require, at a minimum, many more, longer, and better defined episodes of fixed and flexible exchange rates in those economies than what is currently available.

II.3 What We Need to Know

A key message of the foregoing discussion is that what the literature on exchange rate regimes in developing countries calls "flexible exchange rates" are, in reality, quite a mixed bag. The problem goes beyond the known but often downplayed fact that the great majority of nominal exchange rates considered "flexible" in empirical studies were--and in some cases remain--heavily managed and/or directly set by the authorities, and, hence, that groupings based on *de jure* classifications of regimes will

tend to exaggerate the shift towards exchange rate flexibility in those economies. It has to do also with the difficulties (some would say futility) of trying to capture the independent effects of exchange rate regimes on macroeconomic performance using data and techniques that are not up to the task. For example, empirical studies will often lump together in the "flexible exchange rate" category countries with nominal exchange rates that are as stable as *de jure* pegs (i.e., the case of many East Asian countries in the years before the 1997 crises), as well as countries undergoing high inflation, where exchange rates can do little else than move more or less in tandem with the other nominal variables of the economy (e.g., most Latin American countries in the 1980s). But there can be no presumption that the biases that these various subgroups of countries will impart to the ***average*** indicators of performance of the "flexible" category will be mutually offsetting and/or time invariant. Cross-regime comparisons of performance that rely on those average indicators are therefore likely to remain seriously flawed.

A corollary of the above is that the extensive literature on exchange rate regimes in developing countries does not really have much to offer when it comes to define and characterize a "flexible" exchange rate. What does nominal exchange rate flexibility entail in practice? What is it supposed to accomplish? And over what horizon? These are some of the important questions for which the literature on the subject has yet to provide even approximate answers. The evidence available does not shed much light either on whether floating exchange rates represent a feasible or desirable option for developing countries. Most of what has been said about this falls somewhere between *a priori* theorizing and sheer speculation. To our knowledge, there have been no serious attempts at establishing an economically-based divide between a "flexible" and a "floating" exchange rate in

developing countries. Moreover, given the dearth of episodes with floating exchange rates in those economies[5], it is not entirely clear whether such a distinction is even possible and, therefore, what countries or experiences outside the developing world should provide the yardstick for evaluating this option.

The current state of affairs is, in many ways, unsatisfactory. The newly emerging consensus on the gains that developing countries will reap from moving toward "more flexible" exchange rate regimes and on the imminent extinction of the middle-of-the-road exchange rate arrangements of the fixed-but-adjustable variety (Eichengreen, 1994, Obstfeld and Rogoff, 1995a) looks less persuasive when one tries to pin down the notion of exchange rate flexibility that underlies those conclusions. Nonetheless, it seems that the case for greater flexibility has received a further boost from the recent currency crises in Mexico, East Asia and, now, Russia. A perusal of the rapidly expanding literature on the origins and (short-run) consequences of those "currency crashes" reveals that the calls for greater exchange rate flexibility come in fact from two different camps: (I) those who continue to ascribe a key role to the exchange rate as a nominal anchor of the economy and, thus, see the increased flexibility as consistent with some form of nominal exchange rate targeting (IMF, 1997, Eichengreen and Masson, 1998) and (ii) those who stress the perils of relying on an asset price (the exchange rate) as a nominal anchor or a source of monetary policy credibility in a world of expanding global capital markets (Obstfeld, 1995, Obstfeld and Rogoff, 1995a). Of course, as is typical in exchange rate matters, there is also an influential group of dissenters who extract the exact opposite conclusions from the recent crises and argue that the time is ripe for a generalized adoption of currency board-type arrangements by

developing countries and/or for the return to some type of gold (dollar) standard for the world as a whole (e.g., Dornbusch, 1998, McKinnon, 1998).

The debate is up for grabs, and probably would be difficult to settle solely on the basis of further (and better) evidence on the relationship between nominal exchange rate regimes and aggregate macroeconomic outcomes (i.e., inflation and growth). Better theoretical models of regime choice and exchange rate determination in LDCs will of course help, but, at least in the near term, we think that the most pressing questions will remain empirical in nature. Take for example the need to give a more precise operational meaning to the concept of exchange rate flexibility that is "appropriate" for developing countries. We would argue that the differences between the two broad camps identified above lie on their differing views regarding three key features of exchange rate policy in a context of high capital mobility: (1) the scope for (and effectiveness of) sterilized and unsterilized intervention as a means for attaining (and preserving) a degree of nominal exchange rate stability; (2) the costs that "excessive" fluctuations of the nominal exchange rate may impose on the economy's performance; and (3) the ***time dimension*** of their analysis--i.e., the horizon over which monetary policy, the exchange rate, capital flows and the rest of the economy are assumed to interplay. All of these are empirical issues for which little, if anything, is known for the case of developing countries--not even for the relatively advanced ones. Unless the discussion starts to focus on those type of questions, our understanding of the effects of greater exchange rate flexibility on the economic performance of these countries will remain as tentative and speculative as it is today.

Mexico's experience after the 1994 peso crisis provides an opportunity to gain some insights on behavior of floating exchange rates in emerging economies. Of course, it is not possible to extract

general conclusions from a single episode, but in the absence of other experiences with anything that resembles a floating rate, analyses of Mexico's foray with exchange rate flexibility should prove very useful. One of the most commonly voiced objections to floating rates in developing nations is that they will be "excessively" volatile--indeed much more than in advanced countries.[6] Figure 1 presents weekly data on the nominal exchange rate of the Mexican peso vis-à-vis the U.S. dollar for the period January 1992 through May 1998; the top panel depicts the nominal peso/dollar rate, while the bottom panel presents the weekly rate of devaluation of the Mexican peso during that period. In a recent study, Edwards and Savastano, 1998, used high frequency data similar to that in Figure 1 to analyze the behavior of the Mexican peso/U.S. dollar rate during the period January 1995-November 1997. They use a series of indicators to compare the volatility of the peso/dollar rate with that of the DM, Japanese yen, British pound, Australian dollar, Canadian dollar, and New Zealand dollar/U.S. dollar rates, as well as that of the French Franc/DM rate. They showed that, with the exception of 1995, the peso had not been "excessively" volatile. More specifically, using a battery of indicators they found that the peso was more volatile than the French franc, New Zealand, Australian and Canadian dollars, and less volatile that the yen, DM and pound/dollar rates. Interestingly enough, an extension of these computations to the first five months of 1998 indicate that, in spite of all the turmoil in the emerging markets, the peso/dollar rate still was not the most volatile of these nominal exchange rates!

A particularly interesting aspect of the Mexican experience during the 1996-97 period is that the relative lack of volatility of the peso/dollar rate was not caused by direct central bank intervention in the foreign exchange market. In fact, during 1996-97, the Banco de Mexico did

not sell reserves, and only bought them through an options mechanism that did not put undue pressure on the exchange rate. According to Edwards and Savastano, however, during this period the central bank adopted a feedback rule for monetary policy that took into consideration the short-run behavior of the nominal exchange rate. More specifically, using weekly data they were able to identify a reaction function that showed that the monetary authorities tightened liquidity (base money) below its preestablished target when the peso lost value vis-a-vis the dollar, and eased liquidity when the peso appreciated. Although preliminary, and based on only a few months of the floating exchange rate experiment, these results suggest that middle-income countries can have a reasonably well functioning floating exchange rate system. As more and more developing countries join Mexico in the "flexible" rates camp, as we believe they will, it will be possible to expand on analysis of the Edwards and Savastano type, and even begin to seriously examine evidence on macroeconomic performance under alternative regimes.

III. Long-Run Real Exchange Rate Behavior in Emerging Economies

The distinction between equilibrium and disequilibrium real exchange rates (RER) is at the core of all empirical analyses of exchange rate behavior. Among the various concepts of equilibrium RER utilized in these analyses, those related to the theory of purchasing power parity (PPP), in its many variants, have proven to be the most resilient. Just a few years ago, this assertion would have seemed totally unwarranted. Models built upon (or consisting of) PPP-based definitions of the equilibrium exchange rate performed poorly when confronted with data of the early years of the post-Bretton Woods system of generalized floating among the major currencies (e.g., Frenkel, 1981, Adler and Lehman, 1983, Meese and Rogoff, 1983a, 1983b). PPP was therefore rapidly, and rightly,

discredited--at least in academic circles--as a guide for assessing the behavior of the RER both in the short and medium term.

More recently, however, the notion that PPP provides a meaningful benchmark for assessing RER developments over the (very) ***long term*** has resurfaced, at least in the case of industrial countries. A number of excellent recent surveys on the subject explain this somewhat surprising revival of PPP as the result of three related factors: "looser" interpretations of the PPP doctrine, longer data samples, and better (and more powerful) empirical tests--see Breuer, 1994, Froot and Rogoff, 1995, and Rogoff, 1996.[7] These studies further argue that the interplay of those factors has helped produce a body of evidence that exhibits a remarkable degree of conformity with four "stylized facts" of RER behavior in advanced economies: (I) the hypothesis that the (bilateral) RER follows a random walk is strongly rejected when tested over sufficiently long horizons--typically spanning 6 or 7 decades; (ii) RER series exhibit strong, but slow, mean reversion properties--with most estimates of the half-life of PPP deviations falling somewhere between 3 and 5 years; (iii) hypotheses about the existence of a long run equilibrium relationship between the nominal exchange rate and relative (domestic and foreign) prices are difficult to reject--especially when the tests do not impose restrictions of symmetry and/or proportionality; and (iv) with the exception of the yen/dollar rate, there is no compelling evidence of "permanent" deviations from PPP that can be accounted for by other (structural) factors--i.e., the Balassa-Samuelson effect is not borne out by the data (Froot and Rogoff, 1995, Rogoff, 1996).

It is not readily apparent which, if any, of the long-run regularities of the RER noted above also hold in the case of developing countries. However, this type of information could significantly enhance (and even refocus completely) the myriad of analyses and discussions of equilibrium and disequilibrium

RER that are conducted for emerging economies. In particular, knowledge of the relative validity of PPP as a (very) long-run benchmark for the equilibrium RER--or, equivalently, of the speed of convergence to long-run PPP--could help refine the ***horizon*** for which standard assessments of RER misalignment are most relevant. The review of the evidence on the main features of RER behavior in LDCs that we undertake below seeks to shed some light on that question. It also sets the stage for the critical evaluation of the literature on RER misalignment that we present in Section IV.

III.1 RER stationarity and other tests of PPP: individual country studies

The body of empirical literature on PPP focused on developing countries is quite thin, both in absolute terms and when compared to that available for industrial economies (Breuer, 1994). This is probably a consequence of the developing countries' reluctance to adopt floating exchange rates following the breakdown of the Bretton Woods system. Indeed, the fact that the majority of these countries held on for a while to fixed exchange rate arrangements--as well as to all forms of restrictions on current and capital account transactions--made it both less pressing and less meaningful to use their data to test models that relied upon (or consisted of) PPP-based notions of the equilibrium exchange rate.[8]

The situation started to change in the late 1980s. Since then, a growing number of studies has examined the time series properties of RER in various developing countries, in many cases testing explicitly for some version of PPP. Table 3 contains basic information from 13 of those studies.[9] Specifically, the table contains information on the countries and time period covered by the studies, the measures of exchange rates and (relative) prices they used, the type of test of PPP they conducted, the precise PPP hypothesis they tested, and the results they obtained. To classify the tests employed in the

studies we followed the demarcation of the various stages of tests of PPP proposed by Breuer, 1994 and Froot and Rogoff, 1995, namely: simple tests of PPP as the null hypothesis ("stage one" tests), univariate tests of the time series properties of the RER series ("stage two" tests), and cointegrating tests of PPP, both bivariate and trivariate ("stage three" tests). Notice, however, that none of the studies in the table reported results from "stage one" tests of PPP, probably because the numerous flaws of those OLS-based tests were well known before any serious empirical research on RER in developing countries was undertaken.

The table captures some interesting features of empirical studies of RER and PPP in emerging economies. First, in terms of coverage, there is far more evidence available for Latin American economies than for developing countries in other parts of the world. Of the thirteen studies summarized in the table, eight focused solely or primarily on Latin American countries and the other three on East Asian economies. Only two studies (Edwards, 1989, and Bahmani-Oskooee, 1995) examined RER data from (a few) developing countries in other regions of the world. Second, the periods covered by the studies are quite short. The majority of studies conducted tests on data series that covered less than 30 years--and four of them did so on series that covered less than 15 years. Only three studies (León and Oliva, 1992, Liu, 1992 and

Table 3. Empirical Studies of PPP in Developing Countries

	Edwards (1989)	McNown & Wallace (1989)	Abeysinghe & Kok-Hong (1992)	Leon & Oliva (1992)	Liu (1992)	Gan (1994)	Bahmani--Oskooee (1995)	Calvo-Reinhart & Vegh (1995)	Coes (1995)	Edwards (1995)	Seabra (1995)	Devereux & Connolly (1996)	Montiel (1997)
Sample													
No. of countries	32	4	1	12	9	5	22	3	1	4	11	4	5
Region	broad coverage	Lat.Am & Israel	East Asia	Latin America	Latin America	East Asia	broad coverage	Latin America	Latin America	Latin America	Latin America	Latin America	East Asia
Period covered	1965-85	1976-86	1975-90	1957-91	1948-89	1974-88	1971-90	1978-92	1964-91	1957-82	1970-89	1973-90	1960-94
No. of years	21	11	15	35	42	15	20	15	27	25	20	18	35
Data frequency	quarterly	monthly	quarterly	monthly	quarterly	monthly	quarterly	quarterly	monthly	quarterly	quarterly	quarterly	annual
No. of observations	[84]	[89,126]	[63]	[402, 418]	[120,170]	[154,174]	[80]	[52]	[324]	[101]	[78]	[72]	[35]
Exchange rate and prices													
Price ratio: CPI		X	X	X	X		X	X		X			X
WPI		X	X		X	X			X				
Mixed 1/	X										X	X	
Exchange rate: Bilateral US	X 2/	X	X 3/	X	X				X	X	X		
Multilateral	X					X	X	X				X	X
Type of test													
Univariate ("Stage 2")	**X**	**X**	**X**	**X**		**X**	**X**	**X**	**X**	**X**		**X**	**X**
DF, ADF	X	X	X	X		X	X	X	X	X		X	X
Phillips-Perron						X	X	X				X	X
Variance ratios				X		X		X					
Other	Box-Pierce Q			Ljung-Box Q						Ljung-Box Q			
Bivariate ("Stage 3")		**X**			**X**	**X**					**X**		
Engle-Granger CI test													
DF, ADF		X			X	X					X		
Phillips-Perron					X	X							
Other		ECM				BVAR							
Trivariate ("Stage 3")					**X**						**X**		
Johansen-Juselius CI test					X						X		
PPP version tested	Absolute	Absolute (w/intcpt)	Absolute	Relative	Absolute (w/intcpt)	Absolute (w/intcpt)	Absolute	Absolute	Absolute (quasi) 5/	Relative	Relative	Absolute	Absolute
Main findings													
Stationarity													
of real exchange rate	RW rejected	found in 2 cases	found for US only	RW rejected	not tested	not found	found in 8 cases	not found	not found	found in 3 cases	not tested	rejected in levels	rejected
	(19 of 32 cases)	(when p: WPI)	(when p: CPI)		(11 of 12 cases)		(PP test)					(1st diff stationary)	(exc.Singapore)
of prices, exchange rate vector	not tested	found in 3 cases	not tested	not tested	bivariate: 3 yes; 2 no	not found	not tested	not tested	not tested	not tested	bivariate: 8 yes	not tested	not tested
			(when p: WPI)		trivariate: 9 yes							trivariate: 9 yes	
Mean reversion	slow (no formal test)	not tested	not tested	strong; long run 4/	not tested	on another RER	not tested	slow (Bev-Nelson)	not tested	not tested	suggestive evidence	not tested	not tested
Symmetry (of p & p*)	imposed	imposed	imposed	imposed	found in few cases	imposed	imposed	imposed	imposed	imposed	imposed	imposed	imposed
Proportionality (between p & e)	imposed	no formal test	imposed	imposed	bivariate: 2 cases	no formal test	imposed	imposed	imposed	not applicable 6/	bivariate: 4 cases	imposed	imposed
		(apparent)			trivariate: 4 cases	(not apparent)					trivariate: 4 cases		

(Footnotes to Table 3)

1/ Ratio of foreign WPI to domestic CPI.

2/ Parallel market US dollar rate.

3/ Bilateral rates vis-à-vis US, UK, Germany, Japan and Malaysia.

4/ Less than 5 years in 5 cases; more than 5 years in 7 cases.

5/ Test applied to PPP ratio multiplied by tradables share in WPI.

6/ There were no changes in the nominal exchange rate during the sample period.

Montiel, 1997) used data series that covered 35 years or more. To overcome the "small sample problem" all studies but one used either quarterly or monthly data to test their hypotheses; this produced samples that ranged from 50 to 400 observations. Third, studies relied a bit more heavily on consumer price indices than on wholesale price indices to construct their measure of relative (domestic to foreign) prices. Three studies (Edwards, 1989, Seabra, 1995 and Devereux and Connolly, 1996) used a measure of relative prices that combined both the CPI (domestic prices) and the WPI (foreign prices).[10] Also, in striking contrast with empirical tests on PPP for industrial countries, only seven of the studies in the table used a bilateral exchange rate vis-a-vis a major currency (typically the U.S. dollar) as the measure of the nominal exchange rate[11]. The other six used a multilateral (trade-weighted) indicator--what the IMF calls the "nominal effective exchange rate."[12] Fourth, the majority of studies relied on some type of univariate ("stage two") test to examine the main properties of the RER--and the PPP hypothesis. Only four of the thirteen studies (McNown and Wallace, 1989, Liu, 1992, Gan, 1994 and Seabra, 1995) conducted bivariate cointegrating ("stage three") tests of PPP, and just two of those four also tested PPP using trivariate cointegrating techniques. And fifth, studies were generally unclear about the precise PPP hypothesis that was being tested. It could be argued, however, that the majority of them were testing for some variant of absolute PPP (in most cases using a somewhat peculiar measure of the foreign price level consisting of a weighted average of price levels in the country's main trading partners). Only three studies (León and Oliva, 1992, Edwards, 1995, and Seabra, 1995) made it clear that they were testing the hypothesis of relative PPP.

An obvious consequence of the predominance of univariate (stage two) tests of PPP is that the bulk of the findings obtained by the studies in Table 3 revolves around the stationarity of various

measures of the RER. By and large, the hypothesis that the RER is stationary in developing countries (and, thus, that some form of PPP condition holds in the long run) ***does not*** receive much support from these studies. In 40 out of 54 individual country tests of RER stationarity, the hypothesis that the RER series contained (at least) one unit root could not be rejected. Interestingly, however, the hypothesis that the RER series followed a random walk did not fare much better. In fact, Edwards, 1989 and León and Oliva, 1992 tested the random walk hypothesis for a combined total of 44 series, and rejected it in about 2/3 of the cases.

Results from the (few) studies that used cointegration tests were somewhat more supportive of the PPP hypotheses. The four studies that tested for bivariate cointegration between the nominal exchange rate and the ratio of domestic to foreign prices found that the residuals of the estimated regressions were stationary in about 50 percent of the cases (15 of 33). The two studies that conducted trivariate tests of cointegration (Liu, 1992 and Seabra, 1995) found even stronger evidence of an equilibrium relationship between the exchange rate and domestic and foreign prices (18 of 20 cases). Notably, all the support for PPP obtained from these stage-three tests stemmed from data on Latin American countries; in fact, Gan, 1994 did not find evidence of cointegration between the exchange rate and prices in any of the five East Asian countries in his sample.

A somewhat disappointing aspect of the studies in Table 3 is that they do not reveal much about the mean reversion properties of the RER series they examined (and, hence, about the speed of convergence to long-run PPP in those economies). Only three studies conducted formal tests of mean reversion--and found some evidence of its presence--and two others simply mentioned mean reversion as a feature of the RER series they used when discussing their findings. Lastly, again reflecting the

predominance of stage-two tests, the majority of studies ended up imposing rather than testing the restrictions of proportionality and symmetry on the coefficients of the price terms in the RER--or PPP--equation (Breuer, 1994).

Seeing what the studies in Table 3 have to offer, one gets the distinct feeling that our knowledge of the basic time series properties of RER in developing countries and, in particular, of the relevance of PPP as a long-run benchmark for the equilibrium RER in these economies is fairly rudimentary. The most serious shortcoming is, without question, the low power of the tests (especially of stage-two tests) to distinguish among alternative hypotheses in the short periods covered by the studies--a deficiency that cannot be fixed by the common practice of increasing the number of observations through the use of quarterly or monthly data (Froot and Rogoff, 1995, Oh, 1996). But this is hardly the only problem. The over-representation of Latin America in the sample of developing countries examined in the studies, the lack of clarity with regard to the variant of the PPP theory that is supposedly being tested, and the dearth of empirical work aimed at testing a well-defined PPP hypothesis using cointegrating techniques, both bivariate and trivariate, also contribute to the above feeling. The pervasive and severe data problems that one encounters in developing countries may well be at the root of these shortcomings, and it is quite possible that for many countries this constraint will not disappear for many years. But this does not alter the basic conclusion that the evidence on RER stationarity and long-run PPP contained in studies of individual developing countries does not enable us to discern which, if any, of the regularities of the long-run RER that have been found for industrial economies are also applicable to (or relevant for) the developing world.

III.2 Other evidence: panel estimates and cross-country studies

Recent studies that use panel data from industrial and developing countries to examine various hypotheses related to PPP (e.g., Frankel and Rose, 1996, Oh, 1996, O'Connell, 1998) provide additional insights on the time series properties of RER in emerging economies. The studies represent one of the two lines of work that emerged in the 1990s to enhance the power of conventional tests of PPP (Rogoff, 1996).[13] They achieve this by taking advantage of the cross-country variation of the data on exchange rates and prices, while at the same time reducing the (potentially serious) bias introduced by the many changes in the exchange rate regime that most countries undergo during periods of several decades (Frankel and Rose, 1996).

The results from these studies are broadly supportive of PPP as a long run benchmark for the RER. In particular, the studies reject the hypothesis that the RER follows a random walk in the sample as a whole, as well as in a wide array of sub-samples, and find estimates of convergence to PPP similar to those obtained with long-run horizon data sets--i.e., PPP deviations with a half-life of about 3 to 5 years. The link between these findings and the long run behavior of the RER in developing countries follows directly from the composition of the sample, which is amply dominated by observations from LDCs.[14] In fact, an important question is whether developing countries' data may not be influencing "too much" the overall findings of the studies. Possible sources of bias include the predominance of monetary shocks in many high-inflation developing countries (Rogoff, 1996), the cross-sectional dependence stemming from using the U.S. dollar as the base currency for all calculations (O'Connell, 1998), and the aggregation across (and frequent switches of) nominal exchange rate regimes within the sample. While the influence of those factors is fairly apparent in many results reported in the studies

(see, for example, tables 2 and 3 in Frankel and Rose, 1996 and Oh, 1996), the size of the bias that they impart to the overall findings and, hence, the extent to which those findings can be deemed representative of the behavior of the RER in developing countries remains unclear, and should be addressed in future work.

Using a completely different methodology, a recent cross-country study by Goldfajn and Valdés, 1996 represents a significant addition to the empirical literature on RER in emerging economies. The authors compile a large sample of monthly data from 93 countries during the period 1960-94 (more than 39,000 observations), and proceed to identify the main empirical regularities of episodes of RER appreciation and the mechanisms that make those appreciations disappear--i.e., the forces that explain the apparent mean reversion of real exchange rates. The episodes of appreciation (or overvaluation) are defined as one-sided, short- and medium-term departures of the actual from the "equilibrium" RER. Concretely, they are defined as the difference between the actual multilateral RER and one of two proxies for the "equilibrium" RER: one obtained from a regression of the logarithm of the RER on two time trends (linear and square), and the other from a regression that also includes as explanatory variables three RER "fundamentals" (the terms of trade, government spending and openness).[15] The authors assume, rather than test, that all the RER series are trend-stationary, stochastic processes that tend to revert to their mean, and, based on this central assumption, claim that the residuals obtained from their two PPP-based equations for the equilibrium RER provide reasonable boundaries for the "true" overvaluation of the domestic currency.

Goldfajn and Valdés combine their two regression-based estimates of overvaluation with arbitrary thresholds for the "critical" degree of appreciation (which they assume falls somewhere

between 15 and 35 percent) to identify the main regularities of episodes of RER appreciation in the 35 years covered in their sample. Specifically they calculate, for different configurations of those key parameters, the number of appreciation episodes, their average duration, and their distribution over 5-year intervals and across different exchange rate regimes. They find that, depending on the parameters they use, their sample contains between 20 and 173 episodes of appreciation which, on average, last between 1 and 2 years each; that the time profile of those episodes exhibits a pronounced asymmetry (in the sense that their "build up" phase lasts almost twice as much as their reversal phase); that episodes of appreciation have been more common in the second half of their sample (1980-94); and that they have been much less likely to occur in regimes with (*de jure*) flexible or floating exchange rates.

To identify the factors that explain the end of appreciation episodes, Goldfajn and Valdés then calculate the contribution of changes in the nominal exchange rate and changes in relative (domestic and foreign) prices to the actual depreciation of the RER that marks the end of those episodes. What they find is that in the majority of cases (between 50 and 70 percent, depending on the parameters used) the appreciations were undone primarily, when not solely, by changes in the nominal exchange rate as opposed to changes in inflation differentials.[16] Moreover, they show that the probability of undoing an appreciation without a nominal devaluation is inversely related to the size of the appreciation--i.e., changes in inflation differentials rarely suffice to make large appreciations disappear. Lastly, the authors construct transition matrices in order to examine the relationship between the size of the appreciation, the probability of its reversal, and time. They find evidence that this relationship is highly nonlinear. Specifically, they find that the probability of undoing a given appreciation is higher the longer the horizon

considered, but that, when the horizon is kept fixed, there is a U-shaped relationship between the probability of reversal and the size of the appreciation--i.e., as the size of the appreciation increases, the forces that make the RER return to its equilibrium path through a real depreciation start to dominate. Goldfajn and Valdés claim that these findings are consistent with (and supportive of) the recent results on mean reversion and long-run convergence to PPP that we have discussed earlier. Although this claim seems a bit of a stretch and, together with a few other conjectures and rough edges[17], deserves a fuller examination, on the whole we believe that the "stylized facts" documented in this study and summarized above provide fertile ground for future research on the long-run regularities of RER behavior in developing countries.

III.3 Structural deviations from PPP: the Balassa-Samuelson effect

A wholly different strand of literature has aimed at documenting and explaining the existence of "structural" (permanent) deviations from absolute PPP across countries. Building on the seminal work by Balassa, 1964, and drawing primarily on data sets constructed for the UN-sponsored International Comparison Program (ICP),[18] numerous studies have provided evidence of sizable differences between a country's exchange rate and its purchasing power parity (defined as the ratio of a country's price level to the price level in a reference country, the U.S., both constructed using the same set of weights for individual commodity groups)[19] and have examined empirically what factors may account for the differences.

Table 4 presents information for 15 of those studies.[20] The table shows clearly that up to the early 1990s the empirical approach followed by this strand of the literature consisted of estimating cross-sectional regressions of some countries' "real price level" (the PPP index defined above divided

by the nominal exchange rate) or variants thereof (e.g., “real prices” for a subset of commodity groups such as services or nontradables) on a relatively small number of explanatory variables, using samples with a length and coverage that were largely dictated by the latest ICP data available. The rationale for including as regressors a measure of per-capita income jointly with proxies for various other “structural” features of the economy (e.g., the share of primary sector output in total GDP, the openness ratio, indicators of educational attainment) was threefold: test the robustness of Balassa’s findings, increase the explanatory power of the regression equation, and ascertain the relative contribution of the competing hypotheses that were being offered to explain large and sustained deviations from absolute PPP, namely: productivity differentials between tradable and nontradable sectors (Balassa, 1964, Samuelson, 1964), differences in relative factor endowments (Bhagwati, 1984, Kravis and Lipsey, 1983), differences in the degree of factor mobility (Clague, 1985), and/or differences in consumer preferences (Bergstrand, 1991).

On the whole, the cross-country studies in Table 4 were far more successful in showing that the direct relationship between “real price levels” and per-capita income found by Balassa was robust to increases in the sample size, changes in the base year and inclusion of additional regressors than in their other two objectives. In particular, the goal of distinguishing among competing explanations for the existence of such a link between real prices and income levels proved quite elusive (see Bergstrand, 1991 and Heston et al., 1994). Also, there were indications that the results were not as strong when the sample was confined to, or dominated by,

Table 4. Cross-sectional studies of PPP Deviations (Real Price Levels)

	Balassa (1964)	Clague & Tanzi (1972)	Isenman (1980)	Salazar-Carrillo (1982)	Kravis & Lipsey (1983)	Kravis & Lipsey (1987)	Kravis & Lipsey (1988)	Clague (1986)
Sample								
Cross-section	yes	yes	yes	yes	yes	yes (3yr avges)	yes (3yr avges)	yes
No. of countries	12	17-19	16	16, 22	16, 26, 34	25	44, 60	31
o.w. developing countries	0	17-19	8	16	19	15	33	18
Year(s) covered by data	1960	1960	1970	1973, 1970	1975, 1970	1975, (1960-83) 5/	1980, (1960-84) 5/	1975
Source(s) of price data 1/	ICP (OECD)	ECLA	ICP	ICP, ECLA	ICP	ICP	ICP	ICP
Specification								
Dependent variable(s) 2/	PPP/e	PPP/e	e/PPP	PPP/e	PPP/e Pn/e; Pt/e	PPP/e Pn/e; Pt/e	PPP/e Pn/e; Pt/e	PPP/e
No. of regressors 3/ Min	1	3	2	1	1	3	1	2
Max	1	4	5	1	4	4	4	8
Per capita income								
expected sign	yes	yes	yes	yes	yes	yes	OECD: yes,: LDCs: no	no
statistical significance	(?)	yes	yes	1 of 2	yes	yes	yes	no
(Pseudo) dynamics	no	no	no	no	yes 4/	yes 4/	yes 6/	no

	Clague (1988 a)	Clague (1988 b)	Officer (1989)	Bergstrand (1991)	Falvey & Gemmel (1991)	Heston, Nuxoll & Summers (1994)	Connolly & Devereaux (1995)	Dollar (1992)
Sample								
Cross-section	yes	yes	yes	yes	yes	yes	no (panel) 9/	no (panel) 10/
No. of countries	19	59	31	21	52	16, 34, 61, 64	17	117
o.w. developing countries	13	32	n.a.	9	49	n.a.	17	95
Year(s) covered by data	1970	1980	1975	1975	1980	1970,1975,1980,1985	1960-85	1976-85
Source(s) of data 1/	ICP	ICP	ICP	ICP	ICP	ICP	S&H (PWT)	S&H (PWT)
Specification								
Dependent variable(s) 2/	PPP/e	PPP/e	PPP/e Pn/Pt	Pn/Pt	Pn,j/Pn,us 7/ Ps,j/Ps,us	Pt/Pn Pt/PPP; Pn/PPP	PPP/e	PPP/e
No. of regressors 3/ Min	1	2	2	1	7	1	13	1
Max	4	6	5	3	8	1	14	6
Per capita income								
expected sign	yes	yes	yes	yes	some	most	yes	yes
statistical significance	yes	yes	yes	yes	yes	yes	yes	yes
(Pseudo) dynamics	no	no	no	no	no	yes 8/	year dummies	?

1/ ICP: International Comparison Program. Country coverage increased over time (several "phases"). Latest phase: Penn World Tables Mark 5 (PWT5), Summers & Heston (1991)

2/ PPP/e: real price level; ratio of "purchasing power parities" to the official exchange rate. Purchasing power parity defined as the ratio of the national price level in country j to the national price level in the US.

Pn/e : US dollar price of nontradables in country j.

Pt/e : US dollar price of tradables in country j.

All price categories (Pn, Pt) derived from national accounts data compiled for the ICP .

3/ Excluding the intercept.

4/ Compares coefficients obtained from estimating the same equation using data for different periods (years). Includes as regressor in the equation for period T, the residuals obtained in the estimation for period T-1 to assess the "persistence" of PPP deviations.

5/ Annual price data for individual years (and 3-year averages) obtained by interpolation.

6/ Computes trend regressions for prices and per capita income, and gauges the relation between trend changes in those variables.

7/ Pn,j/Pn,us [Ps,j/Ps,us]: relative price of nontradables [services] in country j to nontradables [services] in the US.

8/ Compares per capita income coefficient obtained from estimating the same equation with data for different samples and periods.

9/ Six observations per country, each of them representing a 5-year period.

10/ Ten annual observations per country (from Penn World Tables Mark 4)

observations from developing countries (Salazar-Carrillo, 1982, Kravis and Lipsey, 1988) but the data constraints proved too severe to deal with this problem satisfactorily.

Findings of large and seemingly "structural" deviations from absolute PPP like those obtained from the cross-country studies in Table 4 are essentially of a static nature and, hence, have only a limited value as benchmarks for the medium- and long-run behavior of the real exchange rate in a given country or group of countries. That gap has to be filled with time series evidence and/or with more systematic analyses of the origin (and duration) of those deviations from PPP, preferably using data not taken from (or related to) the ICP.[21] For many OECD economies such analyses exist.[22] For developing countries, however, that type of evidence is quite rare.

Wood (1991) was among the first (and few) to examine systematically the factors behind "secular" movements in the real exchange rates of a large group of developing countries. Using World Bank data, measures of the real exchange rate and its "structural" determinants closely related to those employed by the studies on the "real price level" in Table 4, and a peculiar empirical methodology (wherein, for example, all variables were expressed in terms of the ratio of their average value in the years 1980-84 to their average value in the years 1960-64), Wood's study showed that from the early 1960s to the early 1980s the real exchange rates of LDCs had ***depreciated*** relative to those of industrial countries by an amount that ranged from 20 to 40 percent, depending on the developing countries' level of income. He then concluded, based on the results obtained from several cross-country regressions, that the main cause for the common trend in the real exchange rates of LDCs during those 25 years was "an unusually large trend increase in the price of nontraded to traded goods

within the developed countries" (page 331)--i.e., a strong Balassa-Samuelson effect in the real exchange rates of the industrial economies.

Isard and Symansky, 1996 followed a more conventional approach to examine the long run movements in the real exchange rates of the countries that are members of APEC.[23] They constructed four measures of the bilateral RER (one based on ICP data and the other three consisting of exchange rate-adjusted ratios of GDP deflators, consumer price indices and export price indices) and showed that, from 1973 to 1993, only Japan, Korea and Taiwan experienced substantial real appreciations vis-a-vis the U.S. dollar; most of the other fast-growing APEC countries experienced a ***depreciation*** of their real exchange rate--which was particularly large in the cases of China and Indonesia. Isard and Symansky interpreted these results as *prima-facie* evidence of lack of robustness of the relationship between output growth and real appreciation commonly associated with the Balassa-Samuelson hypothesis.

To identify the causes for the absence of a Balassa-Samuelson effect in the majority of APEC countries, Isard and Symansky used national account data from the World Bank to decompose the ratio of real GDP deflators (their preferred measure of the RER) into five "proximate determinants": the relative price of domestic and foreign tradable goods (proxied by the price of manufactures); the domestic and foreign ratio of nontradable goods prices (proxied by the price of services) to tradable goods prices; and the shares of nontradables in the domestic and foreign price indices. They examined the behavior of those "determinants" over the sample period, and computed their cumulative changes from 1973 to 1993. They found that the relative price of ***tradables*** "explained" rather well the year-to-year variation of the RER in the majority of APEC countries, and accounted for the bulk of the trend

changes in the real exchange rate in about half of the cases. For the other half, they found that the trend movements in the RER over the 20-year period had been driven by large changes in the relative price of nontradable to tradable goods that were of the opposite sign from what the Balassa-Samuelson hypothesis would have predicted. Isard and Symansky advanced three possible explanations for their finding of trends in the relative price of tradable goods across APEC countries: changes in the composition of tradable goods, changes in the terms of trade across different categories of tradable goods and changes over time in the costs of "goods arbitrage", but offered no formal test of these conjectures. Nonetheless, they claimed that their results provide a number of clear counter-examples to the Balassa-Samuelson hypothesis among the APEC countries which, in their view, challenged the presumption that fast-growing economies should generally be expected to experience sustained real appreciations of their currencies.

All in all, a review of this literature makes it rather easy to fully endorse Rogoff's, 1996 critique of the empirical evidence on "structural" deviations from PPP and the Balassa-Samuelson effect for OECD economies. Support for the various hypotheses offered to explain "permanent" deviations from absolute PPP is even weaker for the case of emerging economies and stems mostly from static comparisons between rich and poor countries obtained from ICP-based data, rather than from analyses focused on more homogeneous groups of LDCs or on long time series data for individual countries. The few studies that follow these alternative approaches (Wood, 1991, Isard and Symansky, 1996) suffer from a number of shortcomings but nonetheless obtain results that cast further doubts about the presence of a strong Balassa-Samuelson effect in developing countries during the last two to three decades. Until this evidence is refuted, we think that it would be prudent not to take for granted any

assumption or conjecture about the relationship between output or income (growth) and real exchange rates (changes) in emerging economies.

III.4 What We Need to Know

The main finding of this review of the literature on the long-run properties of real exchange rates in emerging economies has been amply foreshadowed. Briefly put, the evidence in support of various hypotheses related to PPP is generally weaker for LDCs than for industrial countries; at the same time, however, the evidence on "structural" deviations from PPP--the Balassa-Samuelson effect and related hypotheses--is as flawed and inconclusive for developing countries as it is for industrial economies, with the exception of Japan. As noted before, for the case of industrial countries a consensus has been reached in recent years regarding the (approximate) answer to questions such as: Does PPP hold in the long run? How long is the long run? What is the half-life of PPP deviations? And, Which are the effects of productivity differentials on the RER? For developing countries, individually or as a group, no such consensus exists. Severe data problems have undoubtedly contributed to this outcome, but other factors (such as the heavy concentration on Latin American experiences to the detriment of other regions of the world) also have played a role. In any event, the agenda is quite clear: we need to know much more than we currently do about the long-run properties of real exchange rates in emerging economies.

A better grasp of the long-run regularities of RER behavior in developing countries, and, in particular, of the relative validity of PPP as a (very) long run benchmark for the real exchange rate, would help give the appropriate ***time dimension*** to the assessments of RER misalignment that, as we show in the following section, have become commonplace in emerging economies. In this regard, it is

important to stress that firmer evidence of long-run convergence to PPP in developing countries (say, comparable to that available for industrial economies) need not be incompatible with the notion of a time-varying equilibrium RER determined by the interplay of a set of foreign and domestic "fundamentals," nor would it make less pressing the need to improve the methods currently used to assess RER misalignment in those countries. Evidence of (slow) convergence to PPP would, at best, provide support for an "ultra-long-run" concept of the equilibrium RER--i.e., the rate that would result after all real and (transitory) nominal shocks have dissipated, a process that may take *several decades* (Breuer, 1994). The relevant yardstick for the medium to long run, however, will continue to be a time-varying, fundamentals-driven RER consistent with the attainment of internal and external balance. Some notion of the ***horizon*** over which the equilibrating forces pertaining to each of these dynamic processes should be expected to dominate the other one is precisely what is missing from our collective understanding of RER behavior in developing countries.

IV. Assessing Real Exchange Rate Misalignment

Questions related to the appropriateness of real exchange rates have for a number of years been at the center of discussions on emerging economies. In particular, analysts have been interested in understanding whether, at a given moment in time, a country's RER is (roughly) in equilibrium, or if it is facing a situation of misalignment. There are at least two reasons why these issues have become increasingly prominent in recent times: first, persistent overvaluation is seen as providing a powerful early warning for currency crises (Kaminsky et al., 1998, Merrill Lynch 1998). And second, situations of protracted or recurrent real exchange rate misalignment have been associated with lower economic growth over the medium and long run.[24]

Assessing whether a country's RER is out of line with its long run equilibrium is not easy, however. In fact, attempts to construct misalignment indices have tended to be highly controversial in both academic and policy circles. First, as we argued in the preceding section, PPP-based models of exchange rate misalignment are, more often than not, highly misleading in short- and medium-term horizons. Second, the equilibrium RER is not an observable variable. And third, more sophisticated models are difficult to interpret and, many times, lack a minimal degree of robustness. Mexico provides a clear illustration of these problems. When, in 1994, independent analysts argued that the peso had become dangerously overvalued, the authorities replied that the strong real appreciation experienced by the peso during the previous four years was fully justified by changes in "fundamentals." From there they went on to argue emphatically that the substantial strengthening of the peso should not be a cause for concern, and that there would be no crisis. As it turned out, they were wrong.[25]

In this section we evaluate the empirical literature on real exchange rate misalignment. We begin with a discussion of single equation models for evaluating long run RER sustainability. We then review an approach based on general equilibrium simulation models that has been associated with Williamson's, 1985 "fundamental equilibrium exchange rates" (FEER). As in previous sections, we end with the question: "Given what this literature has to offer, what do we need to know?"

IV.1 Single-Equation Models of Real Exchange Rate Misalignment

Most empirical approaches to assessing real exchange rate misalignment are based on small--usually single equation--econometric models. In these models the real exchange rate is defined as the relative price of tradable to nontradable goods that, simultaneously, is compatible with the attainment of internal and external equilibrium.[26]

As a backdrop for those analyses many authors develop theoretical models (representative agent, intertemporal frameworks, with price flexibility, perfect competition and rational expectations have become the most popular ones), from which a reduced form for the equilibrium RER is derived.[27] This reduced form relates the long-run equilibrium real exchange rate to a set of variables, called the RER "fundamentals." These "fundamentals" usually include the terms of trade, output growth (or productivity differentials), the country's openness to international trade, import tariffs and government spending. While some authors have tried to use a relatively large number of "fundamentals" in their regression equations, others have restricted their analyses to a small number of variables.

In this framework the RER is said to be "misaligned" if its actual value exhibits a (sustained) departure from its long run equilibrium. This situation can arise, for example, when there are changes in fundamentals that trigger a change in the equilibrium RER, but that are not reflected in changes in the actual RER. A different type of misalignment takes place when macroeconomic policies become incompatible with maintaining internal and external equilibrium, and give rise to a sustained appreciation of the actual RER.[28] From a theoretical standpoint, the concept of misalignment requires assuming that there exist institutional or other type of rigidities that prevent the RER from adjusting rapidly towards its medium- to long-run equilibrium level.[29]

The majority of single equation models follow a four steps approach for assessing RER misalignment.[30] In the first step, historical data are used to estimate a (reduced form) RER equation.[31]

(1) $$RER_t = \sum a_i x_{it} + \varepsilon_t ,$$

where the x_{it}'s are the "fundamentals", the a_i's are their corresponding regression coefficients, and $,_t$ is an error term. Most recent studies that estimate equations like (1) have done so using cointegration techniques.

The second step usually (but not always) consists of computing "normal" or "sustainable" values for the fundamentals. This is typically done by decomposing the x_{it}'s into "permanent" and "transitory" components using various techniques, including the methodology suggested by Beveridge and Nelson, 1981.

(2) $$x_{it} = xp_{it} + xt_{it},$$

where xp_{it} and xt_{it} are the permanent and transitory components of fundamental i in period t. Baffes, Elbadawi and O'Connell, 1997 have argued that because deficiencies in the data of many developing countries make it problematic to apply the Beveridge-Nelson decomposition, analysts should rely on alternative procedures, including *ex-ante* (that is, judgment-based) estimates of the sustainable level of the "fundamentals".

The third step consists of using the xp_{it}'s--which are interpreted as the long-run sustainable values of the fundamentals, and the estimated regression coefficients $\hat{a}_i$ to construct an "equilibrium" path for the RER.

(3) $$RER^*_t = \sum \hat{a}_i xp_{it}.$$

An important property of equation (3) is that, in contrast with simple PPP-based calculations, it generates an estimated equilibrium RER that does not have to be constant over time. Indeed, to the extent that there are changes in fundamentals, the estimated index of the equilibrium RER obtained from equation (3) will vary through time.[32]

In the fourth, and final, step the degree of misalignment is computed as the difference, at any moment in time, between the equilibrium and the actual (or observed) RER.

(4) $MIS = RER^*_t - RER_t$.

If $RER^*_t > RER_t$, the model would suggest that the currency is ***overvalued***; conversely, if $RER^*_t < RER_t$, the model would indicate that the domestic currency is ***undervalued***.

Table 5 presents information on 16 empirical studies that have used the single equation approach to assess the extent of misalignment in a score of developing and transition economies.[33] The second column of the table indicates the countries and time period covered by each study; the third column provides a list of the fundamentals; the fourth column describes the techniques used to calculate the equilibrium RER; and the last column contains some general comments about each study. A number of features emerge from this table. First, the interest on assessments of RER misalignment has gone well beyond academic circles, and has captured the attention of the multilateral institutions, government agencies and the private sector. Second, most studies have relied on cointegration techniques to estimate the long-run equilibrium real exchange rate. Third, as noted, the studies have used as regressors a wide variety of "fundamentals." However, almost all of them included as regressors the terms of trade and a measure of net capital flows, and about half of the studies included in their set of fundamentals measures of government spending, openness and output growth--i.e., the determinants of the equilibrium RER typically suggested by variants of the "dependent economy model." Fourth, the studies have followed very different approaches to decompose the RER fundamentals into "permanent" and "transitory." For example, in their study on Chile, Soto and Valdés, 1998 use four alternative decomposition techniques; Warner, 1997, in contrast, did not attempt to

decompose the fundamentals in his analysis of Mexico's real exchange rate. Fifth, whereas some studies have tried to capture the short-run dynamics of RERs through the estimation of error-correction models, or other type of dynamic specifications that allow nominal variables to play a role in explaining the real exchange rate, other have concentrated exclusively on medium- to long-term "real" determinants of the equilibrium RER. And finally, and perhaps not surprisingly, the studies have obtained all types of results concerning the degree and direction of RER misalignment across countries and over time, and often have reached opposite conclusions in their ex-post assessments of misalignment of a particular currency. For example, Montiel's 1997 estimates suggest that the Thai baht was significantly *overvalued* from 1981 to 1987, and then again from 1992 to 1994, whereas the model of Ades, 1996 shows that the baht was persistently *undervalued* from 1985 to 1993. Similarly, the estimates of Broner et al., 1997 suggest that the overvaluation of the Mexican peso that preceded the 1994 crisis started around 1990, and those of Ades, 1996 that it had started even earlier, in 1988; however, the results obtained by Warner, 1997 indicate that the peso was slightly *undervalued* until mid-1993.

Figure 2 depicts estimates of the equilibrium and the actual real exchange rate for 24 countries obtained from the Goldman-Sachs model developed by Ades, 1996.[34] The figure captures a number of interesting features. For instance, the estimates from this model indicate quite clearly that the Mexican peso was overvalued in the period prior to the 1994 crisis. The same estimates show that following the devaluation Mexico's RER overshot its equilibrium level, but only for a brief period. The estimates of this model also suggest that since the third quarter of 1996 the currencies of all East Asian countries were overvalued, albeit the size of their misalignment was rather small.

Table 5. Empirical Studies of Real Exchange Rate Misalignment in LDCs

AUTHOR	COUNTRIES / PERIOD	FUNDAMENTALS	TECHNIQUE	COMMENTS
Edwards (1989)	Twelve countries -Brazil, Colombia, El Salvador, Greece, India, Israel, Malaysia, Philippines, South Africa, Sri Lanka, Thailand, Yugoslavia 1962-84	Terms of trade, capital flows, import tariffs, government spending, productivity differentials (trend), excess domestic credit, nominal devaluation.	-Panel data; fixed-effect instrumental variables. -Dynamic adjustment equation that allows short-run effects of nominal variables, including the rate of devaluation. Long run RER only influenced by "real" fundamentals -Beveridge-Nelson technique used to calculate permanent and transitory components of fundamentals	-Equilibrium RERs calculated -No attempt made to compute misalignment due to "benchmark" problem. -Compares estimated equilibrium RER with simple PPP extrapolations.
Cottani, Cavallo and Khan (1990)	Twenty -four countries, including: Argentina, Bolivia, Chile, Colombia, Jamaica, Peru, Uruguay, Cote d'Ivoire, Ethiopia, Mali. Somalia, Sudan & Zambia 1960-83	Terms of trade, openness (inverse), net capital flows, excess domestic credit, GDP growth, foreign inflation, time trend.	-Pooled OLS estimation -Three-year moving average for some fundamentals as proxy for permanent component.	-Compute RER misalignment from three sources: degree of openness, sustainable capital inflows, and domestic credit creation (internal equilibrium). -Composite measure of RER misalignment used as regressor in equations of economic performance.
Ghura and Grennes (1993)	Thirty-three countries from Sub-Saharan Africa 1970-87	Terms of trade, capital inflows, openness (inverse), excess domestic credit, nominal devaluation, time trend.	-Instrumental variables estimation of pooled time-series and cross section data; includes country specific dummies (fixed-effect).	- Compute three measures of misalignment: one based on excess money creation and excess government borrowing; another one based on a measure of " sustainable" capital inflows, and a third one based on the black market premium. - Composite measures of RER misalignment used as regressor in equations of economic performance.
Elbadawi (1994)	Three countries -Chile, Ghana, and India 1967-90	Terms of trade, capital inflows, openness, government spending, import tariffs, productivity differentials (trend), domestic credit, nominal devaluation.	-Cointegration and error correction models -Beveridge-Nelson technique used to calculate permanent component of some fundamentals; for others, five-year moving average.	-Misalignment is calculated as the difference between the estimated "equilibrium" RER and the actual RER. -RER assumed to be, on average, in equilibrium during sample period.
Calvo, Reinhart and Végh (1995)	Three countries -Brazil, Chile and Colombia 1978-92 (quarterly)	Terms of trade, GDP per-capita, inflation tax.	-Beveridge-Nelson technique to obtain permanent and transitory components of fundamentals. -Cointegration between permanent components of RER and fundamentals	-No estimate of equilibrium RER or of misalignment is provided. -Compare cyclical and permanent component of RER and fundamentals with predictions of an optimizing model.
Ades (1996)	Twelve countries -Argentina, Brazil, Chile, Colombia, Ecuador, Indonesia, Mexico, The Philippines, Thailand, Turkey, South Africa and Venezuela. 1980:1-1996:4 (quarterly)	Long-run fundamentals: terms of trade, openness, capital inflows, government spending, foreign interest rate, technology (trend). Short-run determinants: transitory changes in terms of trade, monetary conditions relative to those abroad, risk premium, international reserves coverage	-Cointegration -Dynamic error correction model -Exponential moving-average procedure to obtain permanent and transitory components.	-Compares estimates of equilibrium RER with simple PPP extrapolations. -Stresses differences between long run and short run determinants of the equilibrium RER
Soto (1996)	Chile 1978:1-1994:4 (quarterly)	Terms of trade, government spending, capital inflows, import tariffs, external debt, financial distortion index, interest rate differential.	-Beveridge-Nelson decomposition of fundamentals. -Cointegration and error correction model. -Model of endogenous transition	-Tries to capture non-linear behavior of RER -Compares linear and non-linear models; concludes that linear models tend to over-react to shocks to fundamentals. -Misalignment is computed as the percentage difference between the actual and the equilibrium RER

Table 5 (Concluded). Empirical Studies of Real Exchange Rate Misalignment in LDCs

AUTHOR	COUNTRIES / PERIOD	FUNDAMENTALS	TECHNIQUE	COMMENTS
Montiel (1997)	Five countries -Indonesia, Malaysia, Philippines, Singapore and Thailand 1960-94	Terms of trade, openness, government spending, public investment, foreign interest rate, foreign inflation, dependency ratio, time trend.	-Non-stationarity used as criterion to classify "fundamentals" as permanent -Cointegration (modified Johansen) -Error correction model	-Estimation procedure allows sum of residuals between actual and estimated RER to be different from zero. -Compares estimated with actual RER over sample and sub-samples using confidence intervals
Warner (1997)	Mexico 1979:1-1997:1 (quarterly)	Crude oil price, government spending, import tariffs, interest rate on external debt, ratio of non-tradable to tradable prices, capital account balance, relative money supplies (Mexico vs US) , relative GDP growth, interest rate differential.	-OLS, Stock and Watson. -Cointegration (Johansen)	-Stresses the importance of capital flows for determining the equilibrium RER. - Compares monetary model with "real" model; finds little improvement from the addition of " monetary fundamentals".
Soto (1997)	Chile 1960-97 (annual) 1978-97 (quarterly) 1986-97: (monthly)	Terms of trade, government spending, public investment, TFP, capital inflows, openness, import tariffs, interest rate differentials.	-Three methods for decomposing permanent and temporary components: Beveridge-Nelson, Hodrick-Prescott and moving average. - Cointegration - Error correction model	-Defines a "benchmark" case by computing a three-period moving average of normalized differences between permanent and temporary components of fundamentals.
Razin and Collins (1997)	Ninety-three countries (Penn World Tables data) 1975-92	Terms of trade, long-term capital inflows, resource balance, growth of output per worker, excess money growth. Short run shock to output, absorption and money supply.	-Panel data; fixed effect.	-Misalignment constructed as the difference between the RER and the linear combination of variables that proxy a "flex-price" RER.
Broner, Loayza and Lopez (1997)	Seven Latin American countries (Argentina, Brazil, Chile, Colombia, Mexico, Peru and Venezuela) and the U.S. 1960-95	Ratio of relative prices of non-tradable to tradable goods (CPI/WPI); net foreign assets.	-OLS, GLS, and Instrumental Variables. -Gonzalo-Granger decomposition - Cointegration (Johansen)	-Misalignment constructed as the difference between actual RER and estimates from cointegrating vector.
Elbadawi and Soto (1997)	Seven countries -Cote d' Ivoire, Ghana, Kenya, Mali , India, Chile and Mexico 1960-93	Terms of trade, openness, long run capital inflows, government spending, public investment, foreign interest rate, country risk	-Newbold's version of Beveridge-Nelson technique. -Cointegration -Phillips-Loretan's error correction model.	-Scale estimates of equilibrium RER by a scoring function, based on the distance of fundamentals to their sustainable level. -For Chile, they compare reduced form estimate of equilibrium RER with forward RER projections.
Halpern and Wyplosz (1997)	Six transition economies -Croatia, the Czech and Slovak Republics Hungary, Poland, and Slovenia. 1990-95 (Sample size varies depending on data availability).	Real aggregate producer wages, marginal productivity in tradable sector, unemployment, rate of exchange rate appreciation, interest rate differentials.	-Error correction model. -Fixed country effect in constant, and in constant and slope.	-Use three measures of RER: doubly deflated nominal exchange rate, ratio of nontraded to traded goods prices, and dollar wages.
Baffes, Elbadawi and O'Connell (1997)	Two countries -Cote d'Ivoire, Burkina Faso.	Terms of trade, openness, resource balance, investment share, foreign price level.	-Error correction model. -Three step procedure: order of integration, estimation (Engle-Granger, Johansen), calculation of equilibrium RER using Beveridge-Nelson,	-Both countries members of CFA zone.
Soto and Valdes (1998)	Chile 1977:1-1997:4 (quarterly)	Terms of trade, productivity differentials between tradable and non-tradable sector, net foreign assets, public absorption.	-Three decomposition techniques: Beveridge-Nelson, Hodrick-Prescott, and Gonzalo-Granger. - Cointegrated VARs	-Use net foreign assets as proxy for terminal condition on foreign indebtedness; do not take into account " supply" effects. -No "benchmark" considerations.

In spite of its relative simplicity and popularity, the single equation approach sketched above is subject to some important limitations that may, in specific historical circumstances, generate highly misleading results. For example, as noted above, many of the indices of RER misalignment calculated in the studies presented in Table 5 suggest disequilibrium patterns that contradict each other or do not conform with what historical and/or episodic analyses of the country (or countries) in question have concluded. Soto's 1996 study of Chile's RER behavior in the 1990s is a good example of this problem: Soto's estimates suggest that the Chilean peso was overvalued between 1987 and 1989, a period when according to almost every scholar that has analyzed Chile's recent economic history, the RER was, in fact, substantially *undervalued*.[35]

Another problem shared by most single equation-based assessments of RER misalignment in Table 5 is that they do not take into account the large (short term) swings in RERs that take place in periods immediately following large nominal devaluations. From an econometric perspective, (large) nominal devaluations generate a break in the time series similar to the one examined by Perron, 1989 for the case of the price of oil. Those structural breaks will introduce a bias if the cointegrating equation is estimated by methods that ignore the fact that many large RER jumps are induced by major nominal disturbances unrelated to "real," as opposed to macroeconomic, fundamentals.

A third shortcoming is that by using residuals-based estimates of misalignment, most of these single equation models assume that the RER has been, on average, in equilibrium during the estimation period. This, of course, needs not be the case. It is perfectly possible to estimate a model covering a period when the RER has been persistently overvalued or undervalued. Nonetheless, in order for these models to be operationally useful, they need to define, either implicitly or explicitly, an in-sample

"benchmark" or "base period (year)" for the equilibrium RER. On this issue, Edwards, 1989 pointed out: "It is important to notice that although these estimated series provide important information regarding the behavior of equilibrium real exchange rates, they have a somewhat limited use in directly computing RER misalignment. The problem, of course, is that we have to "anchor" the actual RER at some point in the past. Only if we are willing to assume that the actual and equilibrium rate were equal some x years back can we talk about RER misalignment (page 158)." Soto, 1997 and Elbadawi and Soto, 1997 acknowledged this "benchmark" problem, and addressed it by adjusting the intercept of the cointegration equation using a score function that assumes that the actual and equilibrium RERs coincide when the cyclical components of the fundamentals are minimized. Halpern and Wyplosz 1997 also recognized this problem in their estimation of RER indices for a group of transition economies.

A fourth limitation of these models is that they are based on analytical frameworks that do not incorporate explicitly the sources of rigidities, and thus do not provide convincing stories on why, in the first place, the RER should ever be misaligned. Future work on the subject, then, would benefit from explicitly introducing (non tradable) price stickiness, and thus providing testable hypotheses on the (potential) sources of RER misalignment.[36]

A fifth problem of the models summarized in Table 5 is that they do not establish a clear link between the "equilibrium" real exchange rate and the current (or capital) account, nor do they specify a direct relationship between the estimated RER* and measures of internal equilibrium, including the level of unemployment. This lack of formal connection between RER* and external and internal equilibrium represents, in fact, a violation of the definition of RER used in the theoretical models employed to derive the empirical RER equation.

Sixth, the majority of these models use regression specifications that concentrate on "flow" variables, hence ignoring the role of stocks, such as the international (net) portfolio demand for the country's assets. Even studies such as those of Soto and Valdes, 1998 and Broner et al., 1997, which have explicitly tried to incorporate both stock and flow considerations in their theoretical discussions, suffer from this shortcoming.[37]

Finally, and related to the above, because they rely on historical data from each country to construct the permanent and transitory components of the fundamentals, studies based on this approach run the risk of missing some important changes in the equilibrium RER. Consider, for example, the case of a country that, for some reason (say, because it has undertaken a successful reform program) experiences an easing of its external credit constraint towards the end of the estimation period. In this case, the country will be able to "sustain" an equilibrium net foreign assets ratio (and a RER*) that is larger (lower) than what would have been observed during the sample period.

Not every study on real exchange rates--not even all those included in Table 5--has aimed at assessing whether the actual RER in a country or group of countries is in line with its long run equilibrium. In fact, a number of studies have calculated indices of real exchange rate misalignment as an intermediate step in analyses of economic performance, or currency crises.[38] Edwards 1988a, for example, used a misalignment index constructed with panel data for 12 countries to analyze the effect of RER misalignment on economic growth. Dollar, 1992 used deviations from a PPP-based RER equation as a generated regressor in his analysis of growth in a score of countries, and many others (Cottani et al., 1990, Ghura and Grennes, 1993, Razin and Collins, 1997) computed misalignment

indices to include them as regressors in their analyses of the determinants of growth in developing countries.

IV.2 General Equilibrium Simulation Models

In an effort to capture the complex interactions between different variables, some authors (notably Williamson, 1985, 1991) have built general equilibrium simulation models (GESM) to analyze real exchange rate behavior. These models define the equilibrium RER--oftentimes called the Fundamental Equilibrium Exchange Rate (FEER)-- as the relative price of tradables to non tradables compatible with the achievement of internal and external equilibrium. The former is defined as a situation where output is equal to potential output, while the latter is "defined in terms of a sustainable level of the current account" (Bayoumi et al., 1994, page 23).

In a recent review of RER misalignment analyses for the G-3 countries, Clark and MacDonald, 1998 have characterized the basic GESM model by the following set of equations:

(5) $CA = - KA,$

(6) $CA = b_0 + b_1 q + b_2 y_d + b_3 y_f = - KA^*$

(7) $FEER = (-KA^* - b_0 - b_2 y_d - b_3 y_f) / b_1,$

Where CA is the current account; KA* is the ***exogenously given*** equilibrium capital account; q is the real exchange rate; and y_d and y_f are domestic and foreign aggregate demand levels compatible with full employment (or internal equilibrium). Equation (7) determines the equilibrium RER as a function of the exogenous capital account and of domestic and foreign aggregate demands. In this setting the more traditional "fundamentals", such as terms of trade, government spending and import tariffs, play a role only to the extent that they affect KA*, y_d or y_f.

Although the model represented by equations (5)-(7) is a highly simplified version of the GESM approach, it does capture some important features of most efforts in that tradition. First, the sustainable level of the capital account is determined exogenously. In most practical applications the researcher chooses a value for K* on the basis of historical evidence. This means that, as in the case of the single equation models, many GESM models require defining some type of "base period" (year) linked to the country's past experience. And second, most GESM models are largely based on flow considerations, and say little about the stock demand for net foreign assets, or the evolution of capital flows over time.

Dejavaran, 1996 developed a small GESM to assess the degree of RER misalignment in Africa's CFA Franc zone in the early 1990s. In this model the equilibrium RER is defined as the rate "which is consistent with a particular current account target" (page 6), and depends, fundamentally, on the terms of trade. The analysis starts by defining a base year in which the current account, and thus the RER, were in equilibrium in each of the twelve CFA countries. Next, the divergence between this backward-looking "equilibrium" current account and the actual current account at the moment of the evaluation is calculated. Finally, the change in the RER required to restore current account equilibrium is computed under a set of assumptions regarding a number of relevant elasticities. Dejavaran then extends this simple model to the case where there are changes in the sustainable level of capital flows, and in import tariffs. His results suggest that by early 1993, the RER was overvalued in eleven of the twelve CFA countries; the only exception being Chad.

In many ways Dejavaran's model is an extension of the basic elasticities approach, and its appeal resides on its simplicity. On the other hand, it has a number of shortcomings that seriously limits its wider applicability. First, as Dejavaran himself recognizes, the results are highly sensitive to the

choice of the base year. In the case of Benin, for example, if 1981 is chosen as the base year, the calculations indicate an *undervaluation* of 22 percent if, on the other hand, 1984 is the base year the calculations suggest an *overvaluation* in excess of 10 percent! Second, as in most GESM analyses this model ignores stocks considerations and concentrates exclusively on the role of flows. It should be noted, however, that although ignoring asset equilibrium may generate misleading results, the ensuing bias is likely to be relatively small in countries with limited access to international capital markets (as is the case of most African nations, which continue to rely almost exclusively on official capital flows).

In an ambitious undertaking, Serven and Schmidt-Hebbel, 1996 developed a dynamic general equilibrium model to analyze the behavior of the RER in Chile. Although their main interest was to identify and understand the effects of fiscal policy on the real exchange rate, their model is general enough to address a battery of policy questions, including assessing whether a country's RER is in equilibrium. The model considers an economy that produces one good, which is an imperfect substitute for foreign goods, and can be consumed domestically or exported. There are four assets, and a fraction of consumers is subject to a borrowing constraint. Due to the existence of rigidities, labor markets do not clear and there is unemployment. Agents have rational expectations, and government spending falls entirely on domestic goods. An appealing feature of this model is that, in contrast with most of the studies in this tradition, it allows for an explicit interaction between stocks and flows. For example, in steady state equilibrium the "current account deficit is equal to the exogenous flow of foreign investment which, in turn, is equal to the level required to maintain the stock of foreign-held assets constant" (page 99). Additionally, this model has the virtue of tracing the dynamic adjustment of the RER and other variables of interest following a specific shock.

After calibrating the model for the case of Chile, Serven and Schmidt-Hebbel use it to evaluate the effect of changes in fiscal policy on the real exchange rate and other macroeconomic variables. In particular, they study the effects of a "balanced budget" reduction in fiscal spending equivalent to 2 percentage points of GDP. The cases of both a temporary and a permanent fiscal adjustment are considered. The results obtained suggest that this change in fiscal policy will have a very small effect on the real exchange rate: a reduction in government spending of one percentage point of GDP will induce a *one percent* depreciation of the RER, and will result in a small deterioration of the current account deficit. Interestingly enough, these results are not very different from those obtained in other studies based on different (and simpler) methodologies, and suggest that, from a political economy perspective, fiscal policy may not be the most effective tool for altering the equilibrium real exchange rate.

IV.3 What We Need to Know

The vast majority of the papers reviewed in this section --Serven and Schmidt-Hebbel being the main exception--emphasize the estimation of misalignment at a specific moment in time, and are subject to a number of limitations, including the "base year problem", the limited attention to dynamic issues, and the fact that stock equilibrium issues are largely ignored. An additional limitation of the papers reviewed in this section is that they do not deal in detail with the relationship between capital flows and real exchange rates. This issue, however, has become increasingly important in debates on the optimal strategy for economic reform. Some authors have argued that in considering the sequencing of reform, policy makers should consider the fact that capital inflows generate a real exchange rate appreciation. This, in turn, reduces the degree of competitiveness of exports, and has important political economy effects. In fact, to the extent that exporters are usually among the early supporters of

a reform effort, a reduction in exports' competitiveness may frustrate the whole reform effort itself (see Edwards 1992 for a discussion in these issue). In the aftermath of the East Asian currency crises a number of authors have argued that controls on capital inflows, similar to those implemented by Chile during 1991-98, would help avoid the inflows-induced real exchange rate appreciation. Although this issue is still not fully resolved either at the theoretical or empirical levels, recent evidence suggests that in those countries were they have been implemented, controls on capital mobility -- and in particular controls on inflows --, have not been effective in reducing the extent of real exchange rate appreciation (See Edwards 1999 for this discussion).

Another limitation of most of the misalignment models reviewed in this section is the lack of a well-defined relationship between the equilibrium real exchange rate and the current account balance. While the single equation models completely ignore the issue, those in the "general equilibrium simulation" tradition tend to deal with it in a rather simplistic and mechanical way. Future policy analysis and evaluation would greatly benefit, however, by an explicit understanding of the way in which these two key variables interact. Two aspects of this problem are particularly important: first, the intertemporal implications of the way in which the current account and the real exchange rate interact. Second, the role played (if any) by real exchange rates in analyses on current account sustainability (see Milesi-Ferreti and Razin 1998).

V. Summary and Conclusions

In this paper we have discussed some of the most important exchange-rate related issues in emerging economies. We have concentrated our discussion on three broadly defined issues: (A) the relative performance of alternative exchange rate regimes; (B) the long run behavior of real exchange

rates, including whether there is any evidence suggesting that there is long-run convergence to PPP in emerging economies; and (C) the assessment of situations of real exchange rate misalignment.

Throughout the paper we have argued that, although, the field has experienced tremendous progress in the last few years, there are still a number of unresolved issues. In particular, we argue that the debate on the optimal exchange rate regime in emerging countries has been hampered by the lack of genuine experiences with floating exchange rates. In fact, most exchange rate regimes classified as "floating" correspond to some kind of managed system. We have also argued that there are still major gaps in our understanding of the long run behavior of real exchange rates in the emerging countries. In contrast with the case of the advanced nations, the time series available for the emerging countries are relatively short and, in many cases, the quality of the data is suspect. An issue that has been the subject of considerable debate refers to whether there is a (negative) relationship between productivity differentials and real exchange rate behavior -- the so-called Balassa-Samuelson effect. The works reviewed in this paper provide some preliminary (and weak) evidence in support of this effect. Better measures of productivity differentials would greatly benefit our understanding of this issue. Our analysis in section III dealt with alternative methods for assessing real exchange rate misalignment in developing countries. Here, as in the previous sections, we argued that in spite of evident progress in the last few years, existing models are still subject to a number of limitations. Chief among these are the absence of explicit intertemporal considerations in empirical applications of these models, a (still) superficial understanding of the effects of capital inflows on real exchange rates, and the lack of a general equilibrium connection between the equilibrium real exchange rate and the current account position of a particular country.

As we stated in the introduction, in writing this paper we have been forced to be selective, concentrating only on a subset of exchange rate-related issues. Some of the important issues that we have not covered include: (a) the relationship between real exchange rates -- both misalignment, as well as volatility -- and economic performance, including growth. (b) The role of nominal exchange rate anchors in stabilization programs. (c) The economics of "dollarization," or optimal currency areas. (D) The role of exchange rates -- both nominal and real -- in the spreading of crises across countries. And, (E) the anatomy of currency crises in emerging economies. While there is an extensive literature on some of these subjects, such as currency crises, other are only beginning to attract attention among scholars.

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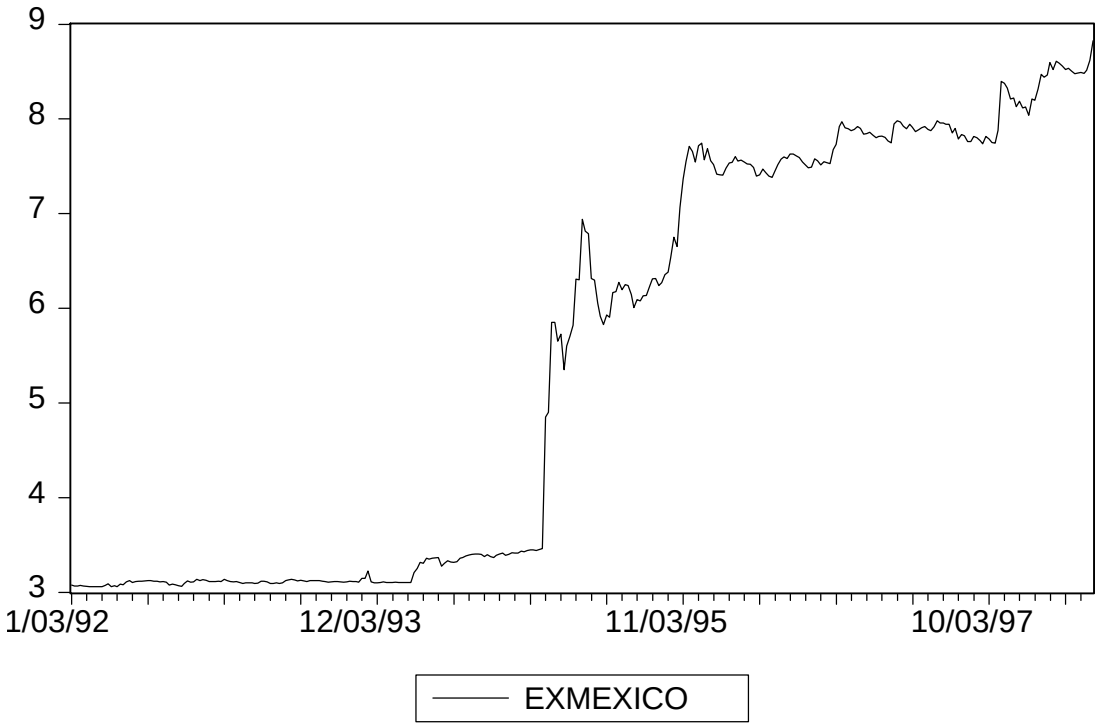
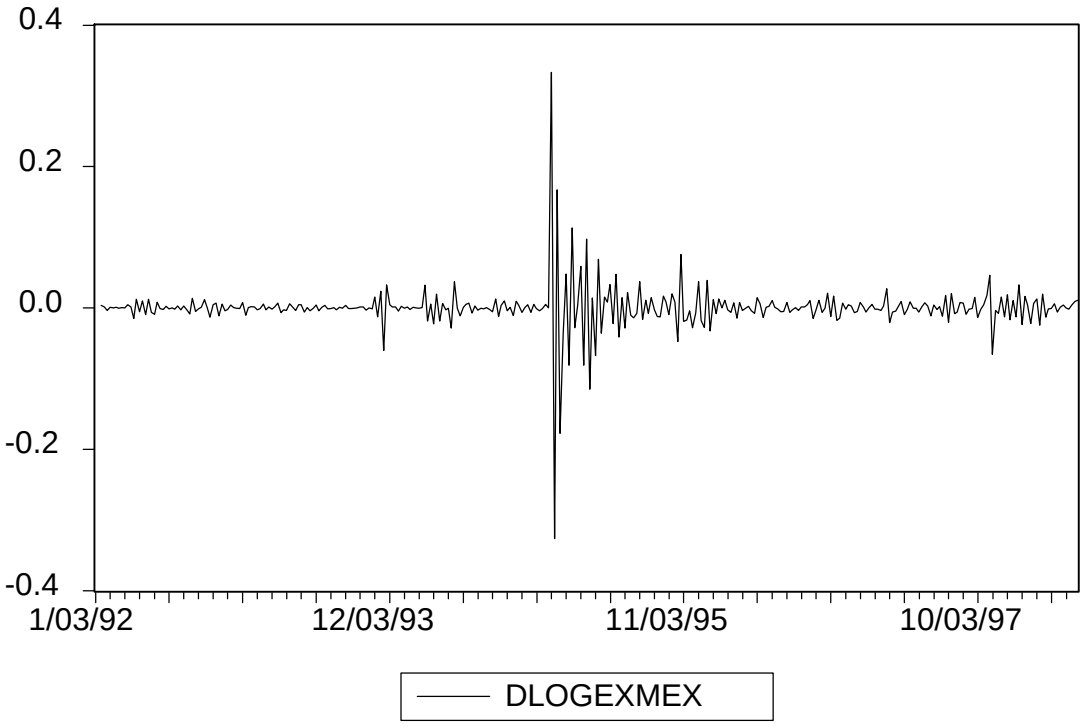
Figure 1. Mexico: Nominal Exchange Rate, 1992-1998





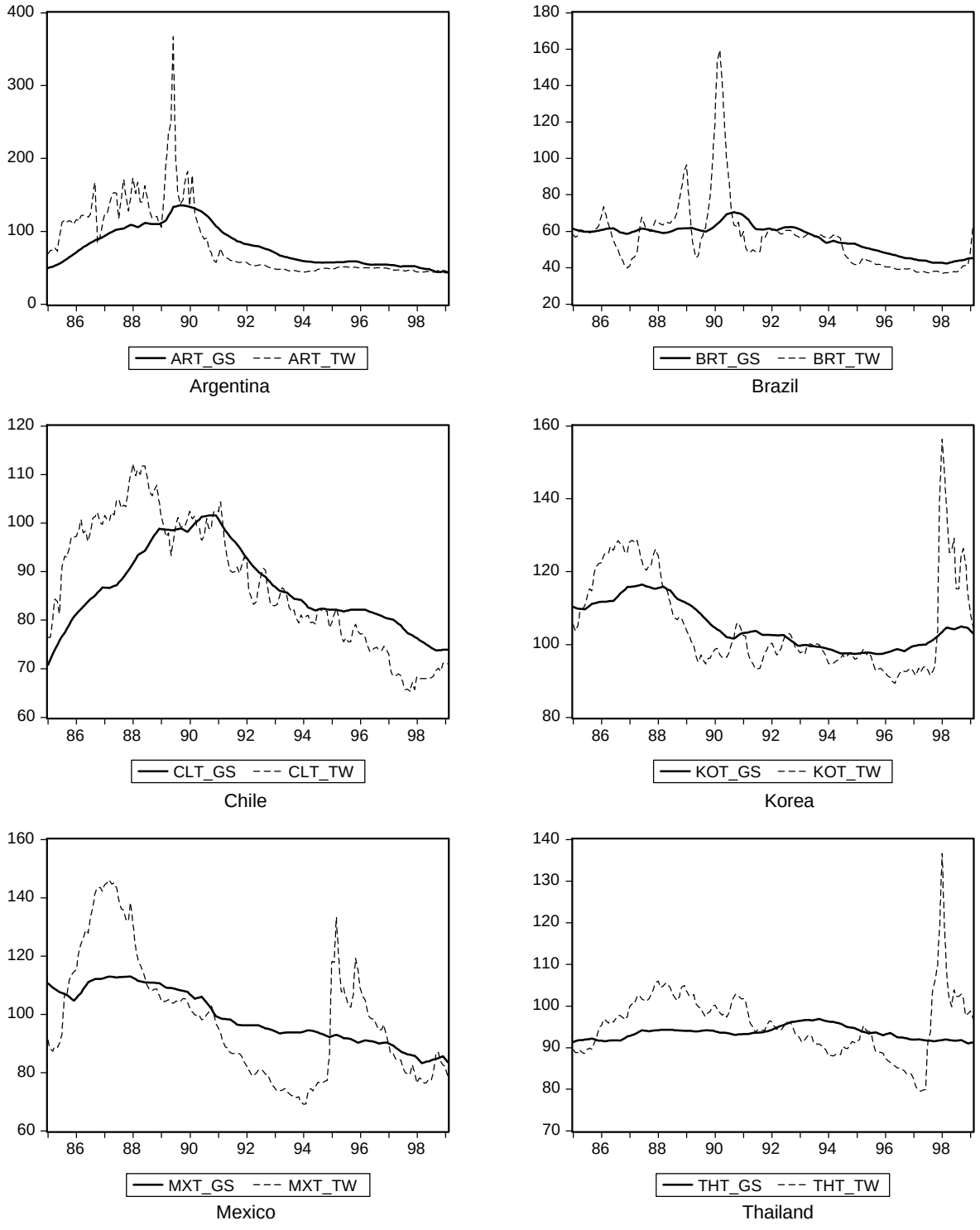


Figure 2: Equilibrium and Actual Real Exchange Rates, Goldman-Sachs Estimates

ENDNOTES

1. Of course, the table presents one of many possible taxonomies of exchange rate regimes. For alternative classifications along the criteria advanced in the (earlier) literature on the choice of exchange rate regimes see Isard, 1995 (chapter 11) and Eichengreen and Masson, 1998.

2. See Edwards, 1997, for a related evaluation of the World Bank's contribution to the profession's understanding of the processes of trade liberalization and structural reform in LDCs.

3. This applies both to studies that focus on the relationship between nominal exchange rate regimes and macroeconomic performance, as well as to those mentioned earlier that attempt to explain the increased demand for "more flexible" exchange rate arrangements from a political economy angle.

4. For example, countries with a *de jure* exchange rate system of "single currency peg with frequent changes in parity" are classified as "pegged" by Ghosh et al., 1995 and as "flexible" in a related study by Cottarelli and Giannini, 1997.

5. For an early analysis of a brief episode of floating exchange rates in a developing country (Peru) during the Bretton Woods years see Edwards, 1983; see also Lyons, 1992.

6. For a brief discussion of the feasibility and viability of floating exchange rates in developing and transition economies see Corden, 1990, IMF, 1997 and Eichengreen and Masson, 1998.

7. Officer, 1976 and Dornbusch, 1987 provide two earlier and influential surveys on the theory and evidence on PPP up to the mid-1970s and mid-1980s, respectively.

8. See, however, Edwards and Losada, 1994 and Edwards, 1995 for analyses of the time series properties of inflation differentials (and the RER) in four Central American economies with long-lived fixed exchange rate systems.

9. The sample is intended to be representative, though not exhaustive. In particular, we do not try to present a comprehensive list of all the studies that apply unit root tests to RER series from LDCs as a prior step for conducting other tests unrelated to PPP.

10. This measure is commonly used in empirical work as a proxy for the relative price between tradable and nontradable goods, i.e., the concept of the RER that follows from the "dependent economy model" (see Edwards, 1989, Corden, 1990).

11. Counting the study by Edwards, 1995, which focused on countries that maintained a fixed exchange rate vis-a-vis the U.S. dollar during the sample period.

12. Edwards, 1989 also constructed a RER series that used the parallel market exchange rate vis-a-vis the U.S. dollar instead of the official exchange rate as the indicator of the value of the domestic

currency.

13. The other approach, testing PPP using several decades of data on exchange rates and prices, is not a realistic option for the great majority of LDCs. However, see Froot and Rogoff, 1995 for an illustrative application of this approach to Argentine data covering the period 1913-1988. See also Edwards and Losada, 1994.

14. The share of developing countries' data in the panels goes from 50 percent of the observations (Oh, 1996, Table 3) to about 90 percent (Parsley and Popper, 1998, Table 1).

15. To use these annual-frequency "fundamentals" in their monthly regressions the authors interpolated yearly observations using June as the base month. Of interest for our discussion of RER misalignment in the following section is that the authors allude to the joint determination of the RER and the current account as the reason for not including a measure of capital flows as an additional "fundamental" in the RER regression.

16. Edwards, 1989 (chapter 7) obtained similar results for a sample of 39 devaluation episodes in developing countries during the period 1960-1982.

17. These would include, in our view, the lack of explicit tests of the hypotheses of non-stationarity of the RER series, not reporting a breakdown by income level and/or geographical location of the countries driving the main results of the study, and several issues related to the choice and construction of RER "fundamentals."

18. See Kravis et al., 1975, 1982, and Summers and Heston, 1988, 1991 for discussions of the objectives, methodology, and data coverage of the ICP.

19. Formally, the purchasing power of any given country is defined as $PPP = \Gamma d_i (p_i / p_i^*)$ where p_i and p_i^* are prices for individual commodity group *i* in the home country and the reference country measured in each country's currency, and d_i are a set of weights.

20. Not counting Balassa's study which is included solely for comparative purposes.

21. Despite the extended coverage and other methodological improvements of the later phases of the ICP--i.e., the Penn World Tables Marks 4 and 5--that data continues to suffer from a number of limitations that are particularly serious for time series analyses, such as the reliance on methods of extrapolation to calculate observations from non-benchmark years and countries and the fixed 5-year frequency of the benchmark surveys (Summers and Heston, 1988, 1991, Rogoff, 1996). Results from studies that use those time series for panel estimations of PPP hypotheses (e.g., Dollar, 1992, Connolly and Devereux, 1995, Oh, 1996) should, therefore, be interpreted with caution and, to the extent possible, cross-checked with evidence obtained from other data sets.

22. The standard references are Hsieh, 1982 (for Japan and Germany) and Marston, 1987 (for Japan). More recent studies that examine deviations from PPP in a larger sample of OECD countries (using OECD data) include Asea and Mendoza, 1994 and de Gregorio et al., 1994; see Froot and Rogoff, 1995 for a fuller list of references.

23. The APEC (Asian-Pacific Economic Cooperation Council) comprises 18 Pacific Basin countries including Japan and the U.S.; Australia, Canada and New Zealand; China; the (former) East Asian "tigers" and Chile and Mexico from Latin America. Isard and Symansky analyses of RER trends excluded Brunei, for lack of data, and the U.S., which was used as the numeraire country.

24. See, for example, Edwards, 1988a, Cottani et al., 1990, and Ghura and Grennes, 1993.

25. On the debates surrounding the Mexican 1994 devaluation see, for example, the essays collected in Edwards and Naim, 1997.

26. A concept of the RER that, as noted earlier, has its theoretical foundation in the "dependent economy model."

27. On theoretical models of RER behavior see, for example, Edwards, 1989 and Obstfeld and Rogoff, 1996. On the derivation of reduced forms to derive the long run equilibrium real exchange rate see Hinkle and Montiel, 1997.

28. See Dornbusch, 1991, Edwards, 1989, and Hinkle and Montiel, 1997.

29. Most authors, however, either ignore or do not specify clearly the source of these rigidities. See the discussion below.

30. This methodology was suggested in Edwards, 1988a and applied in Edwards 1988b. In a related discussion Baffes, Elbadawi and O'Connell, 1997 identify three steps in the single equation methodology.

31. We have chosen a linear functional form for equation (1) for expositional purposes. Naturally, this needs not be the case. Baffes et al., 1997 also consider a linear representation of the equilibrium RER in their analysis.

32. As is argued below, however, computations based either on the single equation approach (equation (3)) or on some version of PPP require defining a within-sample benchmark for the equilibrium RER.

33. As in the case of the empirical literature on PPP presented in Table 3, the list of studies in Table 5 is intended to be representative, not exhaustive. In particular, we do not include studies that estimate an equation for the RER for a given country (or countries) but do not produce, assess or use for other purposes a measure of RER misalignment. Also, we have not included the study by Goldfajn and

Valdés, 1996 (which we discuss extensively in Section III) even though it conforms with "steps" 1, 3 and 4, because the scope of that study (i.e., identify the "stylized facts" of appreciation episodes using the largest database available) is much broader than that of the "typical" study on RER misalignment.

34. The figure presents estimates of the model as of the first quarter of 1997. RER is the actual exchange rate, while GDDEEMER is the estimated equilibrium exchange rate; a higher value represents a real depreciation.

35. See for example Fontaine, 1992, and Dornbusch and Edwards, 1994. Also, notice that the estimates for Chile in Ades, 1996 do indicate that the RER was undervalued during 1987-89.

36. Small economy versions of models in the spirit of Obstfeld and Rogoff, 1995b could be used to analyze these issues.

37. These analyses are (partially) based on the flow-stock approach suggested by Faruqee, 1995.

38. Some authors, however, have relied on crude estimates of misalignment in their analyses of currency crises. For instance, some have focused on straightforward PPP-based estimates; others, such as Sachs et al., 1996 and Milesi-Ferretti and Razin, 1998 have defined misalignment as the difference between the actual RER and some in-sample average or base period.