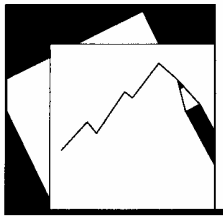
WP/03/223



IMF Working Paper

Are Pegged and Intermediate Exchange Rate Regimes More Crisis Prone?

Andrea Bubula and Inci Otker-Robe

INTERNATIONAL MONETARY FUND

 WP/03/223

IMF Working Paper

Monetary and Financial Systems Department and Policy Development and Review Department

Are Pegged and Intermediate Exchange Rate Regimes More Crisis Prone?

Prepared by Andrea Bubula and Inci Otker-Robe[1]

Authorized for distribution by Shogo Ishii and Timothy Lane

November 2003

Abstract

This paper provides evidence on the susceptibility of different types of exchange rate regimes to currency crises during 1990–2001. It explores the incidence of crises, identified as episodes of severe exchange market pressure, to seek evidence on whether pegged regimes are more crisis prone than floating regimes and on whether certain types of pegged regimes are more crisis prone than others. The paper finds that pegged regimes, as a whole, have been characterized by a higher incidence of crises than floating regimes, for countries that are more integrated with international capital markets; and that intermediate regimes (mainly soft pegs and tightly-managed floating regimes) have been more crisis prone than both hard pegs and other floating regimes—a view consistent with the bipolar view of exchange rate regimes. The degree of crisis proneness seems to be broadly similar across different types of intermediate regimes.

JEL Classification Numbers: F31, F33

Keywords: bipolar view, pegged regimes, hard pegs, soft pegs, floats, intermediate regimes, currency crises, exchange market pressure

Author's E-Mail Address: ab510@columbia.edu, iotker@imf.org

---

[1] This paper was mainly written while Inci Otker-Robe was with the IMF's Monetary and Financial Systems Department and Andrea Bubula was with Columbia University. The authors are grateful to Shogo Ishii and Timothy Lane for many useful comments and suggestions. Valuable comments and input from Mitali Das, Rex Ghosh, and Paola Valenti are also greatly appreciated. The authors are responsible for any errors and omissions.

Contents Page

I. INTRODUCTION

The major currency crises of the past decade have brought about a growing tendency among many observers to view pegged exchange rate regimes as crisis prone.[2] Rigid exchange rates have been argued to be susceptible to speculative attacks and devaluations, and the intensity and scope of the crisis episodes have called into question the viability of these regimes in a world of highly integrated international capital markets (see e.g., Fischer, 2001; Obstfeld and Rogoff, 1995; Schuler, 1999; and Williamson, 2001, 2002). Such regimes have been seen as "too costly for a government to maintain when its promises not to devalue lack credibility and when developing and maintaining credibility has become increasingly difficult" (Obstfeld and Rogoff, 1995). In fact, only a handful of exchange rate pegs survived longer than five years; the median duration of pegs was found to be a year at most.[3]

Not all rigid exchange rate regimes are equally susceptible to crises, however; some rigid rates have lasted for decades or even centuries (Schuler, 1999). However, intermediate regimes between hard pegs and floating rates—that is, soft peg regimes and tightly-managed floats—have been at center stage in most major crises in recent years. In this light, there has been growing support for the view that such regimes will not be viable for any lengthy period of time, particularly for countries highly integrated with international capital markets—the so-called bipolar view of exchange rate regimes.[4,5] The viability of soft peg regimes in particular

---

[2] These include the ERM crisis of 1992–93, the Mexican crisis of 1994–95, the Asian crises in 1997–98 involving Indonesia, Korea, Malaysia, the Philippines, and Thailand, and the crises in Russia in 1998, Brazil and Ecuador in 1999, and Argentina and Turkey in 2001. These countries maintained some kind of a pegged or a tightly managed exchange regime prior to the crises.

[3] Klein and Marion (1997) find that the median duration of a dollar peg was only ten months in a sample of 16 Latin American countries and Jamaica in 1957–1990. In a sample of 32 developed, emerging, and non-emerging market countries over the 1985–2002 period, Duttagupta and Otker-Robe (2003) find that the median duration of a peg was four quarters for a variety of pegged regimes ranging from currency boards to crawling bands.

[4] See Eichengreen (1994), Fischer (2001), Goldstein (1999), Mussa and others (2000), Obstfeld and Rogoff (1995), and Summers (1999).

[5] We define the "intermediate regimes" to include soft pegs (such as conventional fixed and crawling pegs, horizontal and crawling bands) and tightly managed floats (where authorities heavily manage exchange rate movements, attempting to keep the exchange rate path under control without precommitting to a particular path), "hard pegs" to include formal dollarization, currency unions, and currency boards, and "other floating regimes" to include other managed or freely floating regimes. Some studies consider all regimes between the free floats and hard pegs as intermediate regimes (i.e., all managed floats are included among the intermediate regimes).

has been questioned: in many instances, soft pegs broke down as the authorities directed monetary policy toward domestic goals in an environment with high capital mobility.[6] The proponents of the bipolar view hence argued that pegs could not be maintained under high capital mobility unless the country makes an irrevocable commitment to the peg (as in hard peg regimes) and is prepared to support it with necessary policies and institutions. The only feasible alternative to such commitment would be to float, putting the country under the discipline of the markets on a continuous basis. Hard peg commitments or floating regimes hence have been argued to be the only regimes compatible with increased capital mobility.

The bipolar view has been challenged on several grounds, notwithstanding the gradual decline in the share of countries with intermediate regimes since 1990 (see Bubula and Otker-Robe, 2002). These include, in particular, the lack of solid empirical evidence that intermediate regimes will eventually vanish (see Masson, 2001; and Bubula and Otker-Robe, 2002), and the view that corner solutions too can be subject to market pressures (Williamson, 1999, 2001, 2002)–as illustrated by the speculative attacks on the currency boards of Hong Kong, SAR and Argentina during the Asian and Mexican crises, respectively, and the collapse of Argentina's board in end-2001. Some observers argued for a continued role for intermediate regimes, noting that no single regime would be right for all countries at all times (Frankel, 1999), or that certain types of intermediate regimes (e.g., band, basket, crawl) could help prevent misalignments and provide greater flexibility to cope with shocks; some corner regimes, on the other hand, could generate misalignments that could damage their sustainability (Williamson, 1999, 2000a,b).

Some of these views have been acknowledged by the proponents of the bipolar view. Arguably, the trend toward one of the two poles is more prominent for countries that are fully or relatively open to international capital markets, while for others a variety of regimes remain feasible. As Fischer (2001) argued, the intent of the bipolar view was "not to rule out everything but the two corners, but rather to pronounce as unsustainable a segment of that line representing a variety of soft pegging exchange rate arrangements." The types of exchange rate regimes considered unsustainable were those adopted by a country open to capital flows, in which the government would be viewed as being committed to defending a particular value or a narrow range of the exchange rate, but has not made the institutional commitments that would require implementing policies devoted solely to the exchange rate objective. These, in essence, referred to conventional fixed pegs, adjustable pegs, and narrow band systems.[7]

---

[6] This has been seen as an implication of the principle of impossible trinity, which states that only two of the three goals of a typical central bank—exchange rate stability, capital market integration, and monetary policy independence—can be attained simultaneously (see Fischer, 2001, and Frankel, 1999).

[7] Also see Obstfeld and Rogoff (1995), who argue that adopting systems such as target zones or crawling pegs would not help reduce susceptibility to speculative attacks.

The objective of this paper is to contribute to the "bipolarism" debate by providing statistical evidence on the frequency of currency crises under different types of exchange rate regimes. The incidence of currency crises, identified as episodes of severe exchange market pressures, during the period 1990–2001 is explored across IMF members to identify the regimes under which crises occurred most often. In particular, the paper attempts to answer the following two main questions based on pure statistical evidence: first, whether currency crises have been associated more with pegged regimes (including both hard and soft pegs) than floating regimes; second, which types of pegged regimes were more prone to crises. The hope is that these two findings together will provide empirical support for or against the bipolar view, that is, whether the two poles of the exchange rate regime spectrum are indeed the regimes least prone to crises compared with intermediate regimes. The paper also explores whether certain types of intermediate regimes are more crisis prone than others.

A similar analysis was conducted in an earlier study (IMF, 1997), which grouped currency crises during 1975–96 by the prevailing exchange regime prior to the crises based on the IMF's de jure regime classifications. Defining crises as currency crashes (sharp changes in the exchange rate), the study found that close to half of the currency crashes occurred under floating regimes, implying that crises could arise under both pegged and floating regimes. It was recognized, however, that the results may have been biased by the fact that many developing countries use the exchange rate as a policy instrument while maintaining a floating regime. It was also recognized that focusing only on episodes associated with sharp exchange rate changes in identifying the crises may have influenced the results. A more recent study by Ghosh, Gulde, and Wolf (2003) finds that pegged regimes (defined to include only fixed pegs, including hard pegs) have the lowest probability of a currency crisis. The authors use the currency crises identified by Glick and Hutchinson (1999) (slightly augmented at the end of the dataset), and an exchange regime classification that adjusts the IMF's de jure classification for actual exchange rate behavior.

To evaluate the degree of crisis proneness under alternative regimes, the present paper uses de facto exchange rate regime classifications, which attempt to capture countries' actual, rather than officially announced, exchange rate policies and distinguish between very rigid forms of pegged regimes (hard pegs) and softer pegs.[8] It defines currency crises as severe exchange market pressure episodes associated with sharp movements in both exchange rates and interest rates, so as to capture also those attacks successfully resisted by the authorities. It measures the crisis proneness of alternative regimes by computing the frequency under which crises occurred under each regime, as opposed to calculating simply the share of each regime in the total number of crisis episodes; the latter measure could be affected by the prevalence of a given regime over the sample period.

[8] The de facto exchange rate regime database covers all IMF members from 1990–2001, backdating the IMF's current nomenclature adopted in 1999 (see Bubula and Otker-Robe, 2002, for a more detailed description of the database).

The paper finds that pegged regimes as a whole have been more prone to crises compared with floating regimes. This is particularly so for developed and emerging market countries that are more integrated with international capital markets. The paper also provides some support for the proponents of the bipolar view. In particular, it finds that during 1990–2001, the frequency of crisis episodes has been higher for intermediate regimes as compared with the two poles, although the latter have also not been free of pressures. The greater degree of crisis proneness of intermediate regimes, however, holds across all country groups and does not seem to be particularly more apparent for the developed and emerging market countries that are more open to international markets than for other developing countries. Between the two poles, the frequency of crises has been much less under hard pegs than under floating regimes, except for the group of developed and emerging market countries, for which one cannot reject statistically that hard pegs have been at least as crisis prone as other floating regimes. The paper finds broadly no significant differences between the crisis proneness of different types of intermediate regimes.

The rest of the paper is organized as follows. Section II provides a description of the classification of the exchange rate regimes used in the analysis; outlines the methodology to identify crisis episodes; and presents the results of the analysis of crisis proneness of alternative exchange rate regimes. Section III provides a summary of the results and discusses some policy implications.

II. Exchange Rate Regimes and Currency Crises

This section analyzes statistically the frequency of currency crises across alternative exchange rate regimes over the IMF membership, to seek evidence on whether pegged regimes have been more susceptible to crises compared with floating regimes. It also analyzes whether certain types of pegged regimes have been more crisis prone than others, in an attempt to seek support for the bipolar view. It first describes the exchange rate regime data used in the analysis, then provides a description of the methodology used to identify currency crises, and subsequently analyses whether the frequency of crises differs under alternative exchange rate regimes.

A. Classification of Exchange Rate Regimes

Characterizing exchange rate policies actually implemented by countries has been one of the greatest challenges to empirical analyses of exchange rate regimes. Most previous studies relied on the former IMF classification system, which categorized, from 1975 to 1998, members' exchange rate regimes based on their official notifications to the IMF. This de jure classification system had two major shortcomings, namely its failure to capture the countries' actual policies,[9]

[9] For example, some countries with pegged regimes engineered frequent devaluations, using the exchange rate to safeguard export competitiveness, thereby making their regimes less distinct from a flexible one. Others, classified under floating regimes, pegged or managed their exchange rates along a predetermined path (including by maintaining an informal fixed peg vis-

(continued…)

and to distinguish between various types of pegged regimes that permit different degrees of monetary policy autonomy. An appropriate characterization of countries' regimes is important in making inferences about whether certain regimes have been more susceptible to crises. When, for example, the currency of a country pursuing a peg under an officially announced floating regime comes under speculative pressure, the use of the de jure classification system may result in a potentially misleading conclusion that floating regimes are as vulnerable to crises as pegged regimes.[10]

This paper uses de facto exchange rate regimes of the IMF members in analyzing the crisis proneness of various exchange rate regimes. It uses a database provided in Bubula and Otker-Robe (2002), which covers on a monthly basis all IMF members' de facto exchange rate regimes from 1990 to end-2001.[11] The de facto classifications have been based primarily on the information obtained from IMF documents and regular contacts with IMF desk economists. The views drawn from these documents have been supplemented with other information, including an analysis of the observed movements in exchange rates. The use of this database also makes it possible to examine the crisis proneness of different types of pegged and floating regimes, encompassing formal dollarization, currency unions, currency boards, different types of soft peg regimes, tightly managed and other managed floats with no predetermined exchange rate path, and freely floating rates.

B. Identifying "Crisis" Episodes

Most empirical work defines "currency crises" as episodes of sharp changes in some indicator of pressure in the foreign exchange market. Typically, crises are defined to occur when the value of an exchange market pressure (EMP) index exceeds some threshold value (e.g., when the value of the index in a given period exceeds its mean by a certain multiple of its standard

---

à-vis a currency or a currency basket, by allowing the currency to depreciate periodically, or by limiting the fluctuations of the exchange rate within a margin around a fixed or a crawling parity) (see IMF, 1999, and Bubula and Otker-Robe, 2002, for more details).

[10] For example, the Philippines maintained a de facto fixed peg to the U.S. dollar from late 1995 to July 1997 while the de jure regime was a free float. The presence of such a peg became evident during the Asian crisis, when the peso was let to depreciate in the face of speculative pressures. Similarly, Indonesia had a crawling band, and Korea and Malaysia had tightly managed exchange rates vis-à-vis the U.S. dollar under the de jure policy of a managed float.

[11] This database backdates the IMF's current nomenclature adopted in 1999, replacing the de jure based classification system to address the major shortcomings of the latter. A number of other papers also attempted to improve upon the de jure based classification of countries' exchange rate regimes, including, for example, Ghosh, Gulde, Ostry, and Wolf (1995), Levy-Yeyati and Sturzenegger (1999), and Reinhart and Rogoff (2002) (see Bubula and Otker-Robe, 2002, for a more detailed discussion of these databases).

deviation over the sample period).[12] In computing the index, some studies have focused only on episodes of large depreciation of (nominal or real) exchange rates (i.e., currency crashes), while others have attempted to include additional variables to capture not only ("successful") speculative attacks that end up with a sharp change in the exchange rate, but also those "unsuccessful" attacks resisted by the authorities without a change in the value of the currency. In the latter set of studies, the EMP index typically included reserve losses to reflect foreign exchange market intervention, while interest rate changes were usually excluded in view of the lack of reliable historical data on comparable interest rates for all countries included in respective samples. Some studies excluded the reserves variable due to the noise contained in such data in measuring exchange market intervention.[13] When the pressure index included more than one variable, it was computed as a weighted average of the variables, where the weights were chosen to equalize the sample volatility of each component.[14]

This paper attempts to capture both successful and unsuccessful attacks on the currencies of all IMF members during the period 1990−2001.[15] Since the objective is to identify the exchange rate regimes that have been more prone to crises, it is important to capture both the episodes that end up with a sharp change in the exchange rate, as well as those successfully withstood by the authorities, and to recognize that the absence of a significant movement in the exchange rate (or a regime change) would not imply that the prevailing regimes are not susceptible to speculative pressures. Accordingly, crisis episodes were identified by using the implications of an EMP index computed as a weighted average of exchange rate and interest rate changes when data existed on both variables. In particular, crises were identified as periods in which the EMP index ($I_{e,i}$) exceeded its sample mean by at least three standard deviations, that is:[16]

---

[12] In identifying the large changes in the pressure index, some authors used a threshold common to all countries in the analysis, while others defined the threshold value in terms of country specific moments. A number of authors treated hyper-inflationary episodes separately in identifying the extreme pressure episodes so as to avoid distorting the historic means by the impact of high inflation episodes on the variables measuring market pressure, while others integrated it in the formula identifying the crises (Appendix I summarizes earlier work).

[13] Reserves data may be affected, for example, by debt or reserves management strategies, valuation changes, or reserves movements associated with official borrowing or repayments. Such data also do not capture intervention through swap/forward operations, or indirect intervention that may take the form of administrative controls or moral suasion.

[14] An unweighted average would be driven mainly by movements in the most volatile variable.

[15] Several countries that had no sufficient or reliable data (Afghanistan, Iraq, Liberia, Somalia, former Yugoslavia, and Rwanda) were excluded from the analysis.

[16] The use of the three standard deviation cut-off in identifying the extreme changes in the pressure index falls within the range of values used in the crisis literature (see Appendix I).

Crisis = 1 when $I_{e,i} \geq \bar{I}_{e,i} + 3\sigma_{I_{e,i}}$, where $I_{e,i} = A + \frac{\sigma_A}{\sigma_B} * B$,

and where the EMP index is computed as a weighted average of the monthly variation in nominal bilateral exchange rates vis-à-vis the anchor currency (A)[17] and the monthly variation in domestic interest rates in percentage points (B);[18] the weights are chosen so as to equalize the sample variation of each weighted index component, and the index is normalized by the weight of the first component of the index (i.e., A). The symbols σ_A and σ_B represent the sample standard deviations of A and B, respectively, computed across all countries in the sample, and $\bar{I}_{e,i}$ and $\sigma_{I_{e,i}}$ denote the country specific sample mean and standard deviation, respectively, of the pressure index.[19] The index rises with a sharp depreciation of the exchange rate and a rise in the interest rate.[20]

A drawback of this approach, of course, is that it excludes from the analysis a nontrivial number of countries (about 23—see Appendix III) for which no interest rate data are available for a sufficiently long period, and hence misses several pressure episodes that are well known to have led to devaluations or regime shifts (e.g., Mali and Niger's CFA franc devaluation in 1994,

---

[17] The deutsche mark was used as the anchor currency for most European countries and the U.S. dollar for all others unless the domestic currency was pegged to a third currency (e.g., the Indian rupee for Bhutan and Nepal, the French franc for the CFA franc countries, etc.). In cases where the currency was (formally or informally) pegged or managed with respect to a currency basket, the anchor selected was the currency with the largest weight in the basket or the currency vis-à-vis which the country's currency had the lowest sample volatility. When countries modified their anchors during the sample period (e.g., due to a switch in the pegged currency), exchange rate depreciation was calculated against the previous anchor up to the month of the shift, and with respect to the new anchor subsequently.

[18] Money market rates were used for all countries when available, and t-bill rates, bank lending or deposit rates otherwise; in a number of cases, discount rates were used, when no other interest rate data were available, provided that data were available for most of the sample period and showed reasonable variation throughout the sample.

[19] See Appendix II for the derivation of the pressure index and Appendix III for the list of the anchors and interest rates used for the countries in the sample.

[20] In identifying the crises episodes, sample means and standard deviations for hyperinflation episodes (when annual inflation exceeded 80 percent) were computed separately so as to avoid distorting the historical means and standard deviations by the impact of very high inflation on exchange rate depreciations and interest rates. If a single pressure index were to be used, the presence of sub-periods with hyperinflation would inflate the sample moments and miss sizable depreciations or interest rate changes during moderate inflation periods.

devaluations by the Comoros, Libya, Sudan, Suriname, Turkmenistan, and Uzbekistan). Moreover, since the interest rate data do not cover the whole sample period in a number of countries that have been included in the analysis, some well-known pressure episodes that are apparent in the movements of the exchange rate (e.g., step devaluations) are also missed.[21] The analysis, however, has been based mainly on the pressure index computed as a weighted average of exchange rate and interest rate variations, as described above, so as not to introduce a potential bias by adding the episodes captured entirely on the basis of exchange rate changes (i.e., for countries where there are no interest rate data, as well as those for which data are unavailable during a part of the sample period). The qualitative results nevertheless remain robust when such episodes based purely on exchange rate movements are also included.[22,23]

Some refinements have been made in identifying the crisis episodes and the exchange rate regime associated with a particular episode. In identifying the crises, all pressure episodes within nine months from the first crisis date have been excluded so as to avoid double counting; such procedures were used in a number of other works as well, with the length of the windows varying from 6 months to 3 years. Moreover, in some cases, a crisis episode was picked up by a jump in the pressure index soon after a regime shift had occurred. In order to avoid assigning a given pressure episode to the post-crisis regime, rather than the regime prevailing before the pressure, the following procedure was adopted: in case of a shift in regime, for the first six

---

[21] As examples, these episodes include Egypt's March 1991 devaluation, Haiti's September 1991 devaluation and float, devaluations by Morocco and Mozambique in 1990 and 1991, respectively, and Romania's several devaluations in 1990–91.

[22] When the EMP index relied only on the exchange rate variable (not reported here), a crisis episode was identified to occur when (i) in any given month, the depreciation of the nominal exchange rate vis-à-vis the previous month was at least five percent, and deviated from the previous month's depreciation rate by at least three percentage points, and (ii) the monthly depreciation rate exceeded its country-specific mean by at least three standard deviations. This hybrid condition was used to ensure that any large depreciation was counted as a crisis, provided that these changes were sufficiently large relative to the country specific changes in the exchange rate, and to avoid identifying as crises the events that were the result of very small fluctuations under a nearly fixed exchange rate regime (see Frankel and Rose, 1996; and Glick and Hutchison, 1999, for similar treatments).

[23] Adding reserves data to the pressure index identified several peculiar pressure episodes for countries that belong to a currency union (even if there is no report that those countries experienced a crisis), likely reflecting a variety of technical factors other than pressure on the currency. The main results of the paper regarding crisis proneness of intermediate regimes nevertheless remain robust to the use of pressure indices calculated as a weighted average of exchange rate, interest rate, and reserves changes. While foreign reserves data have not been explicitly incorporated in computing the EMP index, the information contained in reserve movements has nevertheless been used to confirm the pressure episodes picked up by exchange rates and interest rates.

months after the regime change, the regime associated with a particular crisis episode was taken as the one prevailing before the change. The failure to make such adjustment would, for example, associate a crisis misleadingly with a floating regime when the exchange rate overshoots with a short delay after the shift in regime, while in fact the pressure has been initiated under the pegged regime prevailing prior to the crisis episode.[24]

The crisis episodes listed in Appendix IV show that the pressure indices have captured relatively well the most well-known crisis episodes during the sample period as well as the unique events surrounding the crisis episodes (e.g., devaluations, sharp reserve losses, interest rate changes, regime shifts, etc.).[25] It is also interesting to note that only close to one third of all crisis episodes identified resulted in a change in the exchange rate regime.

C. Crisis Proneness of Various Exchange Rate Regimes

There is some evidence for the claims that pegged regimes as a whole (i.e., the group of hard and soft pegged regimes) have been more prone to crises than floating regimes (including tightly-managed floats). On average, close to three quarters of the crisis episodes during the period from 1990–2001 occurred under pegged regimes,[26] and the frequency of crises under pegged regimes has been somewhat higher than under floating regimes (1.1 percent, compared with 0.8 percent) (the first panel of Figure 1 and the second and third columns of Table 1). The difference between the crisis frequencies associated with pegged and floating regimes is statistically significant at the 5 percent level across the group of all countries (1.1 percent vs. 0.8 percent, respectively), as well as across the group of developed and emerging market

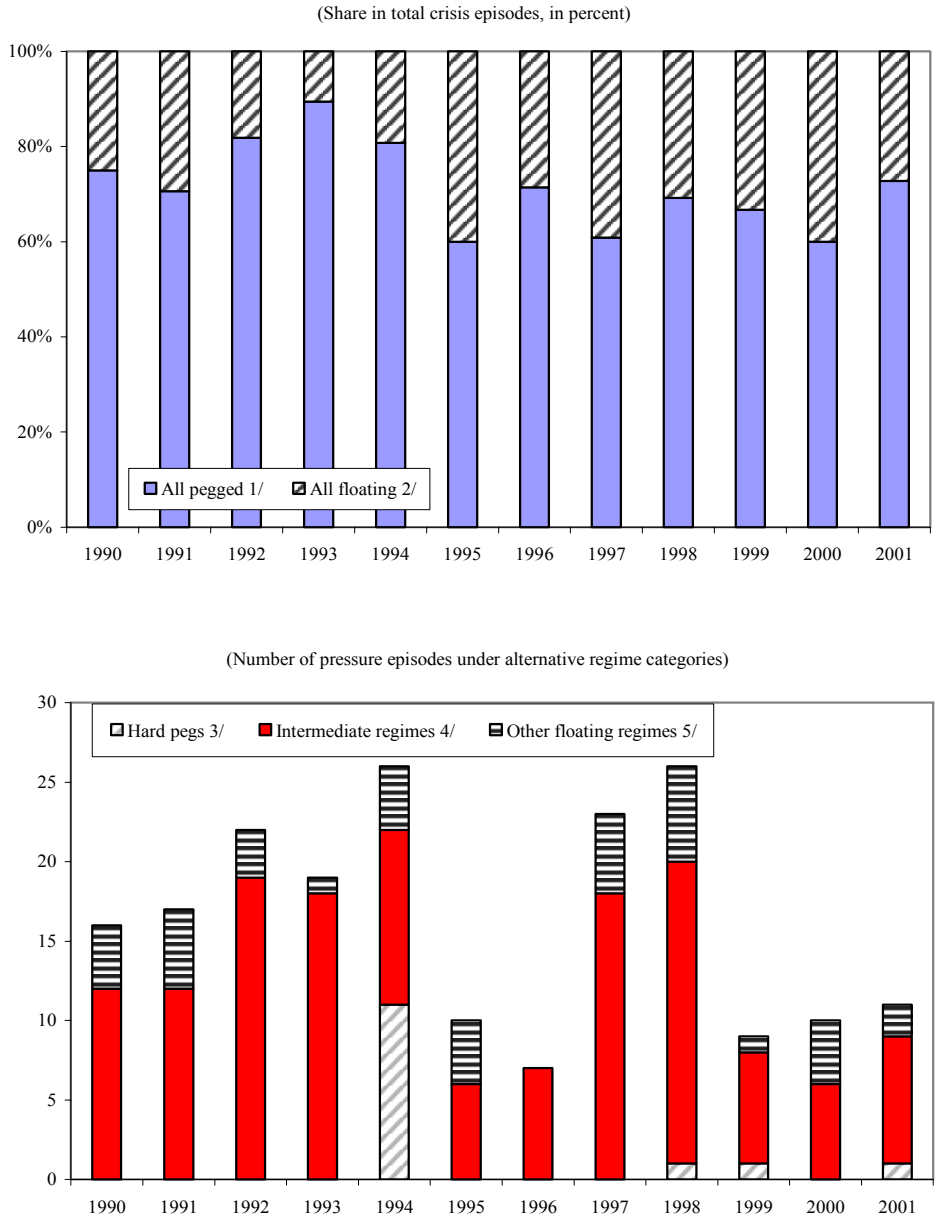
---

[24] In other words, the association to the contemporaneous exchange rate regime would involve some endogeneity problems.

[25] The results are robust to the use of different measures of interest rate variation (e.g., using variation of the interest rate differential against the anchor currency, as opposed to the percentage point increase in domestic interest rates). These measures capture most of the episodes listed in Appendix IV, except for some minor differences (e.g., some can capture the 1999 crisis episode of Ecuador, late 1997 episode of Brazil, and 1995 ERM pressure episode in France, while missing, e.g., Colombia's 1998 episode, Portugal's 1993 and 1995 episodes).

[26] This share is much higher than that found in IMF (1997) for the comparable period 1990–96. IMF (1997) found that only about 44 percent of all currency crashes that occurred during that period were associated with pegged regimes. The higher percentage found in this paper could in part be attributed to the use of de facto regimes, as opposed to de jure regimes; under the de facto classifications, the countries that had been pegging their currencies under officially declared floats have been classified in the pegged group. The difference could also be attributed to the definition of crisis used in IMF (1997). Identifying crises as currency crashes that involve sharp exchange rate depreciation may have missed many pressure episodes weathered by the authorities, for example, through interest rate defense.

Figure 1. All Countries: Distribution of Crisis Episodes by Year and Pre-Crisis Exchange Rate Regime



Source: The authors' calculations.
1/ All pegged regimes = Hard pegs (dollarization, currency unions, currency boards) and soft pegs (conventional fixed and crawling pegs, horizontal and crawling bands).
2/ All floating regimes = Tightly managed floats, other managed floats, independently floating regimes.
3/ Hard pegs = Dollarization, currency unions, currency boards.
4/ Intermediate regimes = Soft pegs (conventional fixed and crawling pegs, horizontal and crawling bands) and tightly managed floats.
5/ Other floating regimes = Other managed floats and independently floating regimes.

Table 1. Distribution of Severe Exchange Market Pressure Episodes Across Different Exchange Rate Regimes, 1990-2001
(in percent unless otherwise specified)

		Frequency of Crises Under Each Exchange Rate Regime 1/		
	Share of crises under each regime (in percent of total)	All Countries in the Sample	Emerging Market and Developed Countries	Developing Countries (excluding emerging markets)
Hard peg regimes	**7.14**	**0.41**	**0.29**	**0.44**
Dollarization	0.00	0.00	0.00	0.00
Currency union	5.61	0.40	0.00	0.45
Currency board	1.53	0.55	0.64	0.44
Intermediate regimes	**72.96**	**1.30**	**1.21**	**1.36**
Conventional fixed peg to a single currency	23.47	1.54	1.08	1.70
Conventional fixed peg to a basket	16.33	1.41	2.38	1.22
Horizontal band	11.22	1.26	1.19	1.47
Crawling peg	10.20	1.18	1.21	1.16
Forward looking crawling peg	3.57	1.18	1.81	0.38
Backward looking crawling peg	6.63	1.18	0.61	1.42
Crawling band	4.59	0.90	0.95	0.77
Forward looking crawling band	2.55	0.70	0.76	0.52
Backward looking crawling band	2.04	1.44	1.42	1.49
Tightly managed floating	7.14	1.04	0.99	1.09
Other floating regimes	**19.90**	**0.72**	**0.52**	**0.88**
Other managed floating	8.67	0.66	0.36	0.80
Independently floating	11.22	0.78	0.60	0.98
	100.00			
Memorandum items:				
All pegged regimes 2/	72.96	1.09	1.10	1.09
All floating regimes 3/	27.04	0.79	0.61	0.92
Number of observations	19,853	19,853	7,485	12,368
Number of pressure episodes	196	196	68	128

Source: Authors' calculations.

1/ The frequency of crises under each regime is computed as the number of severe pressure episodes under each regime as a ratio of the total number of observations in which that regime was in effect over the sample period.
2/ Includes hard peg regimes and soft pegs (conventional fixed pegs vis-à-vis a single currency or a basket, horizontal bands, crawling pegs and crawling bands).
3/ Includes tightly and other managed floating and independently floating regimes.

countries (1.1 percent vs. 0.6 percent) (the first two tests in Table 2—second and third columns). For non-emerging market developing countries which are relatively close to capital markets (as well as the whole group of developing countries), however, one cannot reject the null hypothesis that floating regimes are as crisis prone as pegged regimes (tests 1 and 2 and the fourth and fifth columns of Table 2).[27]

[27] Including year fixed effects to capture any year-specific unobservables leaves the results broadly unchanged. Country fixed effects were not included in the analysis since this would have removed from the sample the countries that did not experience any pressure episode during the sample period.

Table 2. Selected Statistical Tests on the Differences Between the Crisis Proneness of Alternative Regime Categories and Country Groups[1,2]

Hypothesis Tested	All Countries	Developed Countries and Emerging Markets	Developing Countries (excluding emerging markets)	All Developing Countries
Test 1 H_0: "All pegged" and "All floating" regimes categories have the same probability of a crisis	$\chi^2(1)=4.18$ Prob> χ^2 = 0.041**	$\chi^2(1)=4.16$ Prob> χ^2 = 0.0413**	$\chi^2(1)=0.73$ Prob> χ^2 = 0.3933	$\chi^2(1)=2.28$ Prob> χ^2 = 0.1313
Test 2 $H_0: P_C(\text{All floating}) \geq P_C(\text{All pegged})$ Odds ratio:[6]	-0.3227** [3] (0.16) 1.381	-0.563**[3] (0.28) 1.756	-0.17[3] (0.20) 1.185	-0.259*[3] (0.172) 1.29
Test 3 H_0: Hard pegs, intermediate and other floating regimes have the same probability of crisis	$\chi^2(2)=25.34$ Prob> χ^2 = 0.0000***	$\chi^2(2)=11.21$ Prob> χ^2 = 0.0027***	$\chi^2(2)=15.44$ Prob> χ^2 = 0.0004***	$\chi^2(2)=20.49$ Prob> χ^2 = 0.0000***
Test 4 $H_0: P_C(\text{Hard pegs}) \geq P_C(\text{Intermediate})$ Odds Ratio:[7]	-1.19*** [4] (0.28) 3.29	-1.59** [4] (0.72) 4.92	-1.13***[4] (0.30) 3.10	-1.127***[4] (0.28) 3.08
Test 5 $H_0: P_C(\text{Other floating}) \geq P_C(\text{Intermediate})$ Odds Ratio:[7]	-0.59***[4] (0.18) 1.80	-0.86***[4] (0.32) 2.36	-0.438**[4] (0.22) 1.55	-0.53**[4] (0.20) 1.70
Test 6 $H_0: P_C(\text{Hard pegs}) \geq P_C(\text{Other floating})$ Odds Ratio:[8]	-0.60**[5] (0.31) 1.82	-0.73[5] (0.77) 2.08	-0.69**[5] (0.35) 2.00	-0.60**[5] (0.32) 1.81

[1] The regimes are defined as in Table 1:
All pegged regimes: Hard pegs and soft pegs; All floating regimes: tightly managed floating, other managed floating, and independently floating regimes; Hard pegs: dollarization, currency unions, and currency boards; Soft peg regimes: conventional fixed and crawling pegs and horizontal and crawling bands; Intermediate regimes: soft pegs plus tightly managed floats; Other floating regimes: other managed floats and independently floating regimes (i.e., excludes tightly managed floats).

[2] The symbols ***, **, and * indicate that the null hypothesis can be rejected at 1 percent, 5 percent, and 10 percent levels, respectively.

[3] Point estimates (standard errors in parenthesis) from a logit specification where the crisis variable is regressed on a constant and the "All Floating" dummy. The estimates represent the difference in logits between "All floating" and "All pegged" regimes and indicate the impact on the dependent variable of having a floating regime compared to a pegged regime. P_c = crisis probability.

[4] Point estimates (standard errors in parenthesis) from a logit specification where the crisis variable is regressed on a constant, the "Other floating" dummy and the "Hard Pegs" dummy in Test 4 and Test 5, respectively. The estimates represent the difference in logits between the corresponding polar regime and intermediate regimes and indicate the impact on the dependent variable of having one of the two polar regimes compared to an intermediate regime. P_c = crisis probability.

[5] The estimates are derived from the same specification described in footnote 4. The point estimates represent the difference in logits between "Hard Pegs" and "Other Floating" regimes and indicate the impact on the dependent variable of having a "Hard Peg" regime compared to an "Other Floating" regime. P_c = crisis probability.

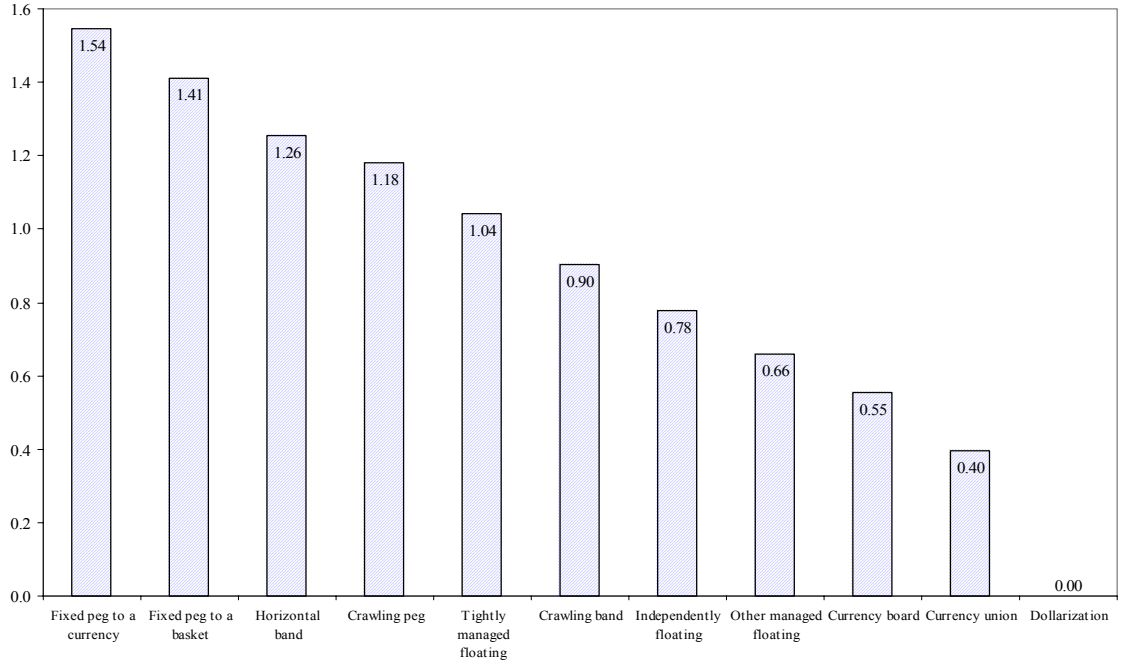
[6] Point estimate. The odds ratio denotes the estimated ratio between the probability of a crisis in pegged regimes and in floating regimes.

[7] Point estimate. The odds ratio denotes the estimated ratio between the probability of a crisis in intermediate regimes and in a polar regime.

[8] Point estimate. The odds ratio denotes the estimated ratio between the probability of a crisis in other floating regimes and in hard pegs.

The analysis provides some statistical support for the bipolar view after distinguishing between hard and soft peg regimes. The three broad categories of regimes, that is, intermediate regimes as a whole (soft pegs plus tightly managed floats), hard pegs, and other floating regimes (excluding tightly-managed floats) have different frequencies of crises; the differences are statistically significant at the 1 percent level for all countries, as well as across various groups of countries (test 3 in Table 2). Compared with other floating and hard peg regimes, proneness to crises has been greater under intermediate regimes over the period from 1990–2001—with a 95 percent or higher confidence level (Table 1, Figure 2, and tests 4 and 5 in Table 2). In fact, the chances of having a crisis under intermediate regimes are about three times higher than under hard pegs across all countries and for other developing countries, and close to five times higher for the group of developed and emerging market countries. Intermediate regimes have also been more susceptible to crises than floating regimes across all country groups; even within the group of non-emerging market developing countries, one can reject the hypothesis that floating regimes are at least as prone to crises as intermediate regimes. Between the two poles, hard pegs seem to have been less crisis prone than other floating regimes, except for the group of developed and emerging market economies; for the latter, one cannot reject that hard pegs are at least as crisis prone as other floating regimes (test 6, Table 2).

Figure 2. All Countries: Frequency of Crises Under Alternative Exchange Rate Regimes, 1990-2001
(in percent)



The results overall suggest that there is indeed some statistical support for the bipolar view of exchange rate regimes: free floating, other managed floating, and hard peg regimes are indeed associated with fewer crisis episodes than the intermediate regimes. At the same time, the extreme regimes have also not been crisis-free: in particular, the currency board arrangement of Argentina came under severe pressure in 2001, ending up with a float at end-2001; Hong Kong SAR's currency board came under attack during the Asian crisis in 1998; and that of Bosnia and Herzegovina in 1999. Moreover, the CFA franc was devalued in 1994 under the currency union.[28] It is worth noting, however, that the frequency of crises has been significantly higher under the most rigid form of soft pegs (1.54 percent under conventional fixed pegs to a single currency) than under fixed pegs with a hard commitment (e.g., 0.55 percent under currency boards). It is also important to note that the findings on the crisis proneness of intermediate regimes compared to the two poles appear in both developing and emerging market countries.[29]

The results also suggest that proneness to crises has been broadly similar across different types of intermediate regimes. While the crisis frequencies appear to differ across different intermediate regimes (see Table 1 and Figure 2), the differences are in general not statistically significant (Table 4); in particular, the hypothesis that all types of intermediate regimes have the same frequency of crisis cannot be rejected across any country group. The frequency of crisis under single currency fixed pegs—the highest among all intermediate regimes across all countries in the sample—is not statistically different from those of fixed basket pegs, crawling pegs, horizontal bands or tightly-managed floats. One can reject the hypothesis that crawling bands (the intermediate regime with the lowest crisis frequency) are at least as crisis prone as single currency fixed pegs—suggesting that the latter is more crisis prone than the former—but at the 10 percent level. The lack of statistically significant differences across different types of intermediate regimes is perhaps not very surprising, given that the precise degree of flexibility of the regimes depends of the particular parameters of the regime (e.g., a horizontal band regime with a wide margin may provide greater exchange rate flexibility compared with a crawling band regime with a very narrow margin).

[28] Taking the 11 CFA franc devaluations as one incidence reduces the crisis frequency of currency unions from 0.40 to 0.074 percent, and of hard pegs from 0.41 to 0.201 percent.

[29] This finding is also supported by the fact that a relatively similar percentage of crises occurred under intermediate regimes for different groups of countries: about 79 percent across developed and emerging countries group, compared with about 70 percent for the group of other developing countries (see Table 3).

Table 3. Distribution of Crisis Episodes Across Country Groups and Exchange Rate Regimes, 1990-2001

	All Countries in the Sample		Emerging Market and Developed Countries		Developing Countries (excluding emerging markets)	
	Number	In percent	Number	In percent	Number	In percent
Hard peg regimes	**14**	**7.1**	**2**	**2.9**	**12**	**9.4**
Dollarization	0	0.0	0	0.0	0	0.0
Currency union	11	5.6	0	0.0	11	8.6
Currency board	3	1.5	2	2.9	1	0.8
Intermediate regimes	**143**	**73.0**	**54**	**79.4**	**89**	**69.5**
Conventional fixed peg to a single currency	46	23.5	8	11.8	38	29.7
Conventional fixed peg to a basket	32	16.3	9	13.2	23	18.0
Horizontal band	22	11.2	16	23.5	6	4.7
Crawling peg	20	10.2	8	11.8	12	9.4
Forward looking crawling peg	7	3.6	6	8.8	1	0.8
Backward looking crawling peg	13	6.6	2	2.9	11	8.6
Crawling band	9	4.6	7	10.3	2	1.6
Forward looking crawling band	5	2.6	4	5.9	1	0.8
Backward looking crawling band	4	2.0	3	4.4	1	0.8
Tightly managed floating	14	7.1	6	8.8	8	6.3
Other floating regimes	**39**	**19.9**	**12**	**17.6**	**27**	**21.1**
Other managed floating	17	8.7	3	4.4	14	10.9
Independently floating	22	11.2	9	13.2	13	10.2
Total	**196**	**100.0**	**68**	**100.0**	**128**	**100.0**
Memorandum items:						
All pegged regimes 1/	143	73.0	50	73.5	93	72.7
All floating regimes 2/	53	27.0	18	26.5	35	27.3
Total	196	100	68	100	128	100

Source: Authors' calculations.

1/ Includes hard peg regimes and soft pegs (conventional fixed pegs vis-à-vis a single currency or a basket, horizontal bands, crawling pegs and crawling bands).
2/ Includes tightly and other managed floating and independently floating regimes.

Table 4. Are All Types of Intermediate Regimes Equally Crisis Prone?

Hypothesis Tested	All Countries
H_0: All intermediate regimes have the same probability of a crisis[1]	$\chi^2(5)=3.68$ Prob> χ^2 =0.59
$H_0 : P_C$ (Fixed Basket Peg) ≥ P_C (Fixed Single Currency Peg) Odds Ratio:[3]	-0.09[2] (0.23) 1.09
$H_0 : P_C$ (Horizontal band) ≥ P_C (Fixed Single Currency Peg) Odds Ratio:[3]	-0.21[2] (0.26) 1.23
$H_0 : P_C$ (Crawling peg) ≥ P_C (Fixed Single Currency Peg) Odds Ratio:[3]	-0.27[2] (0.27) 1.31
$H_0 : P_C$ (Crawling band) ≥ P_C (Fixed Single Currency Peg) Odds Ratio:[3]	-0.54*[2] (0.37) 1.71
$H_0 : P_C$ (Tightly managed float) ≥ P_C (Fixed Single Currency Peg) Odds Ratio:[3]	-0.40[2] (0.31) 1.49

[1] The main types of intermediate regimes are fixed pegs to a single currency, fixed pegs to a currency basket, horizontal bands, crawling pegs, crawling bands, and tightly managed floats.
[2] Point estimates (standard errors in parenthesis) from a logit specification where the crisis variable is regressed on a constant and a dummy variable for each intermediate regime (excluding "fixed peg to a single currency"). The estimates represent the difference in logits between the indicated intermediate regime and the "fixed peg to a single currency" regime and indicate the impact on the dependent variable of having the indicated regime compared to a fixed peg to a single currency. P_c = crisis probability. The symbol * indicates that the null can be rejected at 10 percent significance level, respectively.
[3] Point estimate. The odds ratio denotes the estimated ratio between the probability of a crisis under a fixed peg to a single currency regime and the indicated regime.

III. Concluding Remarks

This paper has presented a statistical analysis of the frequency of currency crises under alternative types of exchange rate regimes pursued by IMF members during the period 1990–2001. It identified those regimes under which crises occurred most often, so as to seek evidence on crisis proneness of pegged and intermediate exchange rate regimes—an argument that has been made frequently in view of the severe currency crises experienced by many countries in recent years under such regimes. Crisis episodes were defined to be the periods in which an exchange market pressure index, computed as a weighted average of exchange rate depreciations and interest rate increases, exceeded its threshold level. The main objective of the analysis was to find out (i) whether the two poles of the regime continuum have indeed been least prone to crises compared with intermediate regimes, and (ii) whether certain types of intermediate regimes have been more susceptible to crises than others.

The statistical analyses of crisis incidence under alternative regimes provide some support for the bipolar view, although the support is not as overwhelming as one would expect. During the sample period, the frequency of crises was significantly higher for intermediate regimes than both for hard pegs and floating regimes. At the same time, the two poles of the regime spectrum have also not been crisis free, supporting the arguments of some of the bipolar view opponents. Moreover, proneness to crises was broadly similar across different types of intermediate regimes, with the exception of some weak support that certain types of intermediate regimes, such as conventional fixed pegs, were significantly more crisis prone than others, particularly crawling bands.

One should be cautious in interpreting the findings on the crisis proneness of pegged and intermediate regimes based purely on a statistical analysis. Many other factors than the nature of the prevailing exchange rate regime affect the likelihood of currency crises and it would be incorrect to blame the prevailing exchange rate regime alone for incidence of crises. Differences between the durability of various rigid regimes can in general be attributed to the nature of the accompanying monetary system and consistency between exchange rate policy and other macroeconomic policies. Regimes where such inconsistencies exist would be more prone to speculative attacks. In fact, while some aspects of the prevailing exchange rate regimes certainly contribute to the crises in the past decade,[30] contagion, as well as failure to implement sound macroeconomic and structural policies, including to strengthen financial systems, was among

[30] These include, for example, the choice of a pegged currency that is not representative of the country's trading partners and high level of predictability of the exchange rate; the latter tends to encourage excessive unhedged borrowing and short-term capital inflows that are vulnerable to sudden reversals and subsequent depreciations of the exchange rate, particularly where there are weaknesses in the prudential regulation and supervision of the banking systems.

the key factors in precipitating financial crises in many countries.[31] It is also worth noting that the magnitude of the differences in crisis proneness of alternative regimes is such that other considerations (e.g., flexibility to cope with shocks or need to achieve rapid disinflation, etc.) may be relevant in choosing a particular regime.

[31] See, for example, IMF (2003) and Duttagupta, Ishii, Karasulu, and Otker-Robe (2003) for a synthesis of experiences with exchange rate regimes in 13 emerging market countries that experienced foreign exchange market stress in recent years. In an empirical analysis of exits from pegged regimes for 32 diverse developed and emerging market countries, Duttagupta and Otker-Robe (2003) also show that crisis exits from pegged regimes were associated with a deterioration of economic health.

Survey of Methodologies to Identify Crises Through the Market Pressure Index

Author(s)	Variables included in the market pressure index (I)	Definition of currency crises	Crisis window to avoid double counting	Separate treatment of hyperinflations	Data features
Frankel and Rose (1996), IMF (1997)	Depreciation of the nominal bilateral US$ exchange rate (e_t)	$I_t \geq 25\%$ and $I_t - I_{t-1} \geq 10\%$, where, $I_t = \ln (e_t - e_{t-1})$	3-year window around the crises	No	• Annual data over 1975–96 • 105 developing countries.
Kumar, Moorthy and Parraudin (1998)	Depreciation of the nominal bilateral US$ exchange rate (e_t) adjusted for difference between domestic and foreign interest rates of maturity Δ (r,r*) **or** Depreciation of the nominal bilateral US$ exchange rate (e_t)	$I_{t1} = 100\ [(e_{t+\Delta} - e_t)/ e_t]\ [(1+r_t)/(1+r_t^*)] > \gamma_1$ where, γ_1= 5%, 10% (crash cut-off point), **or** $I_{t2} = 100\ [(e_{t+\Delta} - e_t)/ e_t] > \gamma_2$ and $[(e_{t+\Delta} - e_t)/ e_t] > (1+ \gamma_3)\ [(e_t - e_{t-\Delta})/ e_{t-\Delta}]$ where, γ_2= 5%, 10%, 15% and γ_3= 100%	n.a.	n.a.	• Monthly data over 1985:1-1998:3 • 32 emerging market countries.
Caramazza, Ricci and Salgado (2000)	Weighted average of detrended exchange rate (e) changes (relative to U.S. or Germany) and reserve (R) changes. Interest rates (measured by the money market rate, lending rate, or discount rate) or stock market prices for a smaller set of countries	$I_t > \bar{I}_p + K\ \sigma_{IP}$ where, $I_t = \alpha_1\ \Delta e_t + \alpha_2\ \Delta R_t$ $\bar{I}_p$ = pooled mean of I σ_{IP} = pooled standard deviation of I K = 1.645, 1.96, 1.28 α_i , i=1,2 are respective weights	n.a.	Excludes periods in which 12-month inflation exceeds 100%	• Monthly data for 1990–98 • 20 industrial (excl. Germany and the U.S.) and 41 emerging market countries.
Edison (2000)	Weighted average of % change in the bilateral nominal exchange rate (vis-à-vis US$ or DM) (e) and % change in foreign reserves (R)	$I_t > \bar{I} + 2.5\sigma_I$ where, $I_t = \alpha_1\ \Delta e_t + \alpha_2\ \Delta R_t$ $\bar{I}$ = sample mean of I σ_I = standard deviation of I α_i , i=1,2 are respective weights	n.a.	I is calculated for each sub-sample of hyper-inflation periods (when inflation in the past 6 months exceeds 150%).	• Monthly data over 1970–99 • 20 countries of which 15 are emerging market economies.
Glick and Hutchison (1999)	Weighted average of % changes in real exchange rates (RER) and foreign reserves	If $I_t > \bar{I} + 2\sigma_I$ where, $I_t = \alpha_1\ \Delta RER_t + \alpha_2\ \Delta R_t$ α_i , i=1,2 are respective weights $\bar{I}$ = country specific sample mean of I σ_I = country specific standard deviation of I, **or** If $\%\Delta$ in RER_t > 15%, provided that the depreciation rate is also substantially higher than in the previous month; and If $\%\Delta$ in RER_t >country specific mean+2σ of the RER growth rate, provided it is also ≥5%.	24 month window after the crises	No	• Monthly data over 1975–97 • 21 industrial countries, 32 emerging markets, 37other developing &transition economies.

Author(s)	Variables included in the market pressure index (I)	Definition of currency crises	Crisis window to avoid double counting	Separate treatment of hyperinflations	Data features
Kaminsky and Reinhart (1999)) Kaminsky, Lizondo, and Reinhart (1998)	Weighted average of the monthly depreciation of bilateral nominal exchange rate (vis-à-vis the US$ or DM) (e) and monthly rate of change of gross international reserves (R)	$I_t \geq \bar{I} + 3\sigma_I$ $I_t = \alpha_1 \Delta e_t + \alpha_2 \Delta R_t$ α_i, i=1,2 are respective weights $\bar{I}$ = sample mean of I σ_I = Standard deviation of I	n.a.	I is calculated for each sub sample of hyperinflation periods (i.e., when inflation in the past 6m exceeds 150%).	• Monthly data for 1970–mid-1995. • 20 countries in Asia, Latin America, and the Middle East.
Eichengreen, Rose, and Wyplosz (1994)	Weighted average of exchange rate (e) changes, interest rate (r) increases, and reserves (R) losses, where all variables are measured relative to those prevailing in the anchor country (Germany)	Exchange market crises are identified as periods in which the pressure index reaches extreme values.	n.a.	n.a.	• Monthly data for 22 mostly OECD countries.
Eichengreen, Rose, and Wyplosz (1995)	Weighted average of changes in exchange rates, interest rates, and reserves, where all variables are measured relative to those prevailing in the reference country (*) (in this case, Germany).	$I_t \geq \bar{I} + 2\sigma_I$ $I_t = \alpha_1 \Delta e_t + \alpha_2 \Delta(r_t - r^*_t) + \alpha_3 \Delta(i_t - i^*_t)$ α_i, i=1,2,3 are respective weights $\bar{I}$ = sample mean of I σ_I = Standard deviation of I	2 quarters	n.a.	• Quarterly data • Industrial countries with pegged exchange rates.
Sachs, Tornell, and Velasco (1996)	Weighted average of the depreciation rate of bilateral nominal exchange rates (vis-à-vis the US$) and percentage change in reserves	The crisis index is used to measure the extent of crises as a continuous index (not as binomial index) and rank the extent of crises in sample countries, with Nov 1994 taken as reference period (focus is on contagion from Mexico).	n.a.	n.a.	• Monthly data • 20 emerging markets in Asia, Middle East, Africa, Latin America.
Moreno (1999a,b)	Annualized monthly depreciation of the nominal bilateral US$ exchange rate.	$I_t \geq 25\%$ and $I_t - I_{t-12} \geq 10$ percentage points $I_t = \ln(e_t - e_{t-12})*100$	1 year	n.a.	• Annualized monthly data over 1975–96. • East Asian countries.
Moreno (2000)	Annualized depreciation of the nominal bilateral exchange rate (e) vis-à-vis the currency identified by the authors as the anchor currency	$I_t \geq \bar{I}_{12m} + 3\sigma_{I,12m}$ and $I_t \geq 25\%$ $I_t = \ln(e_t - e_{t-1})*100$ $\bar{I}_{12m}$ = the lagging 12-month mean % change $\sigma_{I,12m}$ = standard deviation of I rolling over the same lagging 12-month period	n.a.	No	• Monthly data over 1974–99. • 7 East Asian countries.
Glick and Moreno (1999)	Large depreciations of the US$ nominal exchange rate (e); assesses whether reserves contain any useful information in signaling episodes of sharp depreciation	$I_t \geq \bar{I} + 2\sigma_I$ $I_t = \% \Delta e_t$ $\bar{I}$ = Full sample mean of I σ_I = Full sample standard deviation of I	12 months after each episode of crisis	Hyperinflation episodes are dealt with as in Kaminsky and Reinhart (1996)	• Monthly data over the period 1997:10. • 6 East Asia, 7 Latin American countries.

COMPUTATION OF THE EXCHANGE MARKET PRESSURE (EMP) INDEX

Let α_1 and α_2 be the weights for exchange rate and interest rate variations, respectively, in an EMP index calculated as a weighted average of monthly percentage change in exchange rate vis-à-vis the anchor country and monthly variation in percentage points in the domestic interest rate:

$$I = \alpha_1 A + \alpha_2 B$$

where, $A = \%\Delta e$ and $B = \Delta i$

The weights α_1 and α_2 are set so that the volatility of each weighted-component is equal and their sum is equal to 1:

$$\begin{cases} \alpha_1^2 * \text{var}(A) = \alpha_2^2 * \text{var}(B) \\ \alpha_1 + \alpha_2 = 1 \end{cases}$$

Taking the square root of the first condition, and rearranging gives:

$$\begin{cases} \alpha_2 = \dfrac{\sigma_A}{\sigma_A + \sigma_B} \\ \alpha_1 = \dfrac{\sigma_B}{\sigma_A + \sigma_B} \end{cases}$$

where σ_A and σ_B are the respective sample standard deviations of A and B. The EMP index could then be written as:

$$I = \frac{\sigma_B}{\sigma_A + \sigma_B} * A + \frac{\sigma_A}{\sigma_A + \sigma_B} * B \text{ or } I = A + \frac{\sigma_A}{\sigma_B} * B$$

when the index is normalized by the weight of the first component. The index, hence, increases in both the depreciation of the exchange rate and interest rate changes.

DESCRIPTION OF DATA AND SOURCES

Exchange Rate Regimes

Monthly data characterizing the IMF members' de facto exchange rate regimes have been obtained from Bubula and Ötker-Robe (2002), who assign each country one of the following 13 categories of regimes over the period 1990–2001: (1) another currency as legal tender (i.e., formal dollarization), (2) currency union, (3) currency board, (4) conventional fixed peg to a single currency, (5) conventional fixed peg to a currency basket, (6) horizontal band, (7) forward looking crawling peg, (8) forward looking crawling band, (9) backward looking crawling peg, (10) backward looking crawling band, (11) tightly managed floating, (12) other managed floating, and (13) independently floating. Under the de facto regime classifications, emphasis is given on the formal or informal commitment towards a particular exchange rate policy, rather than entirely on exchange rate movements. The primary source in identifying de facto policies is the information obtained through bilateral consultation discussions and provision of technical assistance to member countries, and regular contacts with IMF desk economists. These views are supplemented with other sources of information, including an analysis of exchange rate and reserves behavior to reach a final view on the de facto regime.

Bilateral Nominal Exchange Rates

Monthly depreciations of the exchange rates for each country have been calculated by using the nominal bilateral exchange rates vis-à-vis an appropriate anchor currency. All exchange rate data has been obtained from the IFS, except for a few countries for which data obtained from desk economists have been used when no monthly data was available (e.g., Congo Dem. Rep. of, Eritrea). For a few countries (e.g., Syria, Myanmar, Nigeria), data from the secondary market exchange rates were used. The anchor is chosen as the currency or a currency basket vis-à-vis which the country is known to keep the value of its currency pegged or managed. In cases where the currency is (formally or informally) pegged or managed with respect to a currency basket, the anchor has been selected as the currency with the largest weight in the basket or the currency vis-à-vis which the country's currency had the lowest sample volatility. Accordingly, the U.S. dollar has been used as the anchor for all countries, except in the following cases:

- **The Australian dollar** for Kiribati;
- **The Belgian franc** for Luxembourg;
- **The deutsche mark** for Austria, Belgium, Bosnia and Herzegovina, Bulgaria, Croatia, Cyprus, the Czech Republic, the Slovak Republic, Denmark, Estonia, Finland, France, Greece, Hungary, Iceland, Ireland, Italy, Macedonia FYR, Malta, Netherlands, Norway, Portugal, Romania, Slovenia, Spain, Sweden;
- **The escudo** for Cape Verde;
- **The French franc** for Benin, Burkina Faso, the Central African Republic, Cameroon, Chad, Cote D'Ivoire, Congo, Republic of, Equatorial Guinea, Gabon, Mali, Niger, Senegal, Togo, the Comoros, Madagascar, and Morocco;
- **The euro** (or ECU before 1999) for Burundi, Germany, Mauritius, Tunisia, and the United States;

- **The Indian rupee** for Bhutan and Nepal;
- **The Italian lira** for San Marino;
- **The Singapore dollar** for Brunei Darussalam;
- **The South African rand** for Lesotho, Swaziland, Namibia, and Botswana;
- **SDR** for Latvia and Libya.

Some countries modified their anchor currency during the sample period, for example, due to a switch in the pegged currency. These countries and their respective anchors are: Armenia (the Russian ruble until June 1993 and the U.S. dollar thereafter); Azerbaijan (starting December 1994); Burundi (SDR until February 1992 and the U.S. dollar thereafter); Guinea Bissau (the escudo until November 1992, the U.S. dollar until April 1997, and the French franc from May 1997); Iran, I.R. of (SDR until February 1993, and the U.S. dollar thereafter); Mauritania (the euro until December 1995, and the U.S. dollar thereafter); Mauritius (the euro until June 1994 and the U.S. dollar thereafter); Moldova (the Russian ruble until July 1993, and the U.S. dollar thereafter); Myanmar (SDR until November 1995 and the U.S. dollar thereafter); Seychelles (SDR until January 1997 and the U.S. dollar thereafter); Tonga (the Australian dollar until January 1991 and the U.S. dollar thereafter); the United Kingdom (the deutsche mark until September 1992 and the U.S. dollar thereafter); and Uzbekistan (the Russian ruble until March 1994 and the U.S. dollar thereafter).

Interest Rates

Monthly short-term interests rate data obtained from IFS (unless otherwise indicated) have been used in the computation of the EMP index. In a number of countries, there were no interest rate data, in which case they were excluded from the analysis. These countries included: Brunei Darussalam, Comoros, Djibouti, Eritrea, Guinea, Iran, I.R. of, Kiribati, Libya, Mali, Marshall Islands, Mauritania, Micronesia, Niger, Oman, Palau, Qatar, San Marino, Sudan, Suriname, Tajikistan, Turkmenistan, United Arab Emirates, and Uzbekistan. The interest rates that were used for the corresponding countries are listed below, with the time period of data availability indicated in parenthesis:

- **Money market rates** were used whenever they were available: Argentina (1/90 to 11/01), Australia (1/90 to 12/01), Austria (1/90 to 12/01) (the interest variation from 1/99 to 12/01 is based on the 3-month interbank rate—source: DRI), Bahrain (1/90 to 11/01), Brazil (1/90 to 12/01), Bulgaria (1/91 to 12/01), Canada (1/90 to 12/01), Croatia (1/93 to 12/01), Denmark (1/90 to 12/01), Fiji (1/90 to 12/01), Finland (1/90 to 12/01), Germany (1/90 to 12/01), Hong Kong, SAR (1/90 to 12/01) (based on 1-month interbank rate—source: DRI), Iceland (1/90 to 10/01), Indonesia (1/90 to 11/01), Ireland (1/90 to 12/01), Italy (1/90 to 12/01), Japan (1/90 to 12/01), Korea (1/90 to 10/01), Latvia (9/93 to 11/01), Luxembourg (1/90 to 12/01) (the interest variation from 5/99 to 12/01 is based on the 3-month Eurocurrency deposit rate—source: DRI), Malaysia (1/90 to 11/01), Maldives (1/90 to 10/01), Mauritius (1/90 to 11/01), Mexico (1/90 to 12/01), Morocco (2/94 to 11/01), Norway (1/90 to 12/01), Pakistan (1/90 to 9/01), Paraguay (11/90 to 11/01), Poland (1/91 to 9/01), Portugal (1/90 to 12/01) (the interest variation from 4/00 to 12/01 is based on the 3-month Eurocurrency deposit rate—source: DRI), Russia (1/95 to 12/01), Singapore (1/90 to 11/01), South Africa (1/90 to 11/01), Spain (1/90 to 12/01), Swaziland (1/90 to 11/01), Sweden (1/90 to 12/01), Switzerland (1/90 to 12/01), Thailand (1/90 to 12/01), Tunisia (1/90 to 8/01), Turkey (1/90 to 11/01), the United Kingdom (1/90 to 10/01), United States (1/90 to 12/01), Vanuatu (1/90 to 11/01), Yemen Republic (1/96 to 11/01), and Zimbabwe (1/90 to 12/01).

- **T-bill rates** were used when money market rates were unavailable: Armenia (10/95 to 12/01), Bahamas (1/90 to 11/01), Barbados (1/90 to 6/01), Belgium (1/90 to 12/01), Belize (1/90 to 12/01), Dominica (1/90 to 10/01), Ethiopia (1/90 to 11/01), France (1/90 to 12/01), Ghana (1/90 to 12/01), Grenada (1/90 to 10/01), Guyana (1/90 to 10/01), Hungary (1/90 to 11/01), Jamaica (1/90 to 12/01), Kazakhstan (5/94 to 5/98 and 1/99 to 5/01), Kenya (1/90 to 10/01), Kyrgyz Republic (1/94 to 11/01), Laos (1/95 to 9/96 and 10/97 to 11/01), Lebanon (1/90 to 9/01), Lesotho (1/90 to 12/01), Malawi (1/90 to 12/01), Malta (1/90 to 11/01), Moldova (9/95 to 10/01), Namibia (10/91 to 11/01), New Zealand (1/90 to 12/01), Papua New Guinea (1/90 to 11/01), Philippines (1/90 to 12/01), Romania (7/95 to 11/01), Seychelles (1/90 to 11/01), Sierra Leone (1/90 to 11/01), Solomon Islands (1/90 to 10/01), Sri Lanka (1/90 to 9/97 and 2/98 to 12/01), St. Kitts and Nevis (1/90 to 10/01), St. Lucia (1/90 to 10/01), St. Vincent and the Grenadines (1/90 to 10/01), Trinidad and Tobago (1/90 to 9/01), and Uganda (1/90 to 11/01).

- **Bank lending rates** were used when neither money market rates nor t-bill rates were available: Angola (1/95 to 10/01), Antigua and Barbuda (1/90 to 10/01), Bhutan (1/90 to 4/96), Bolivia (1/90 to 12/01), Botswana (1/90 to 11/01), Cambodia (6/94 to 10/01), Cameroon (1/90 to 11/01), Cape Verde (1/90 to 11/01), Central African Republic (1/90 to 11/01), Chad (1/90 to 11/01), Congo Republic of (1/90 to 11/01), Costa Rica (1/90 to 12/01), the Czech Republic (1/93 to 10/01), Ecuador (1/90 to 11/01), Egypt (1/90 to 12/90 and 6/91 to 7/01), Equatorial Guinea (1/90 to 11/01), Estonia (10/92 to 12/01), Gabon (1/90 to 11/01), Honduras (1/90 to 10/01), India (1/90 to 8/01), Israel (1/90 to 11/01), Jordan (1/92 to 6/01), Macedonia (1/94 to 8/01), Netherlands (1/90 to 12/01), Peru (1/90 to 11/01), Samoa (1/90 to 12/01), Sao Tomé and Principe (1/90 to 12/01), Slovak Republic (1/93 to 9/01), Slovenia (1/93 to 12/01), Tanzania (6/92 to 11/01), Ukraine (1/93 to 11/01), Uruguay (1/90 to 12/01), and Venezuela (1/90 to 11/01).

- **Bank deposit rates** were used when neither money market rates nor t-bill rates nor lending rates were available or when the variability of deposit rates were higher than the lending rates: Albania (1/92 to 9/01), Algeria (1/90 to 11/01), Aruba (1/90 to 11/01), Bangladesh (1/90 to 10/01), Belarus (10/95 to 11/01), Bosnia and Herzegovina (10/98 to 4/01), Chile (1/90 to 11/01), China (1/90 to 12/01), Colombia (1/90 to 11/01), Dominican Republic (1/96 to 12/01), Georgia (1/96 to 11/01), Greece (1/90 to 11/01), Guatemala (1/90 to 12/01), Guinea-Bissau (1/90 to 12/01), Haiti (11/96 to 11/01), Kuwait (1/90 to 7/90 and 5/91 to 10/01), Lithuania (1/93 to 11/01), Madagascar (1/92 to 9/01), Mongolia (1/93 to 3/96 and 10/96 to 11/01), Mozambique (1/94 to 11/01), Myanmar (1/90 to 11/01), Netherlands Antilles (1/90 to 10/01), Nicaragua (1/90 to 11/01), Nigeria (1/90 to 4/01), Panama (1/90 to 12/01), Saudi Arabia (1/97 to 11/01), Tonga (1/90 to 11/01), Vietnam (12/92 to 12/93 and 2/97 to 9/01), and Zambia (1/90 to 6/91 and 11/91 to 12/01).

- **Discount rates** were used when no other interest rate data were available: Azerbaijan (6/96 to 12/01), Benin (1/90 to 12/01), Burkina Faso (1/90 to 12/01), Burundi (1/90 to 12/01), Congo Democratic Republic (1/90 to 5/01), Cote d'Ivoire (1/90 to 12/01), Cyprus (1/90 to 12/01), El Salvador (1/90 to 11/01), Gambia (1/90 to 5/01), Nepal (1/90 to 6/91 and 11/91 to 8/01), Senegal (1/90 to 12/01), Syria (1/90 to 3/01), and Togo (1/90 to 12/01).

List of Countries and Crisis Episodes Identified by the EMP Index 1/

Country	Crisis episodes	Regime Prevailing Within Six Months Prior to the Crisis Episode	Regime Moved to within 9 Months After the Episode	Some Events Surrounding the Pressure Episodes
Albania	Jul-92	fixed peg to a currency	independently float	Exchange rate and interest rate pressure associated with exchange rate unification, followed by a float
	Jan-97	independently float	no change in the regime	
Algeria	Jan-91	fixed peg to basket	no change in the regime	Sharp depreciation and reserve loss
	Apr-94	fixed peg to basket	other managed float	Sharp depreciation and reserve loss
Angola	May-95	other managed float	fixed peg to a currency/ other managed float/back to fixed peg to a currency	Sharp depreciation and rise in interest rate
	Mar-96	fixed peg to a currency	other managed float/return to fixed peg within 5 months	Sharp depreciation and reserve loss
	May-99	fixed peg to a currency	independently float	Sharp depreciation and reserve loss
Argentina	Feb-90	independently float	no change in the regime	Sharp depreciation, interest rate rise, and sharp reserve loss
	Jul-01	currency board	other managed float	Sharp rise in interest rates and reserve loss, followed with a float
Armenia	Oct-96	tightly managed float	other managed float	Interest rate hike and reserve loss in past few months
Aruba	Sep-98	fixed peg to a currency	no change in the regime	Rise in interest rate
Austria	Dec-90	fixed peg to a currency	no change in the regime	Small depreciation and interest rate rise
Azerbaijan	Jul-99	tightly managed float	no change in the regime	Sharp depreciation of the exchange rate
Bahamas	Apr-92	fixed peg to a currency	no change in the regime	Some interest rate rise and reserve loss in past several months
Bahrain	Sep-90	fixed peg to a currency	no change in the regime	Some increase in interest rate
	Dec-94	fixed peg to a currency	no change in the regime	Some increase in interest rate and reserve loss in past several months
	Jan-00	fixed peg to a currency	no change in the regime	Some increase in interest rate
Bangladesh	Mar-90	fixed peg to a currency	no change in the regime	Depreciation of the exchange rate and reserve loss
	Oct-98	tightly managed float	fixed peg to a currency	Interest rate increase and moderate depreciation
	Aug-00	fixed peg to a currency	no change in the regime	Devaluation and reserve losses in previous several months
Barbados	Dec-93	fixed peg to a currency	no change in the regime	Successive rise in interest rate and reserve loss in past several months
	Nov-97	fixed peg to a currency	no change in the regime	Successive rises in interest rate and reserve losses
Belarus	Jan-97	backward looking crawling peg	no change in the regime	Sharp devaluation and reserve loss
	Dec-98	backward looking crawling peg	no change in the regime	Sharp devaluation and interest rate rise
Belgium	Jul-93	horizontal band	no change in the regime	Widening of ERM bands, interest rate rise, moderate depreciation in the band, and some reserve loss
Benin	Jan-94	currency union	no change in the regime	CFA franc devaluation, interest rate rise, and reserve loss
Bhutan	Jan-92	fixed peg to a currency	no change in the regime	Interest rate rise and reserve loss
Bolivia	Nov-99	forward looking crawling peg	no change in the regime	Contagion from Brazil, sharp rise in interest rate
Bosnia	Sep-99	currency board	no change in the regime	Sharp increase in interest rate
Botswana	Jan-91	fixed peg to basket	no change in the regime	Depreciation of the exchange rate
Brazil	Jan-99	forward looking crawling peg	independently float	Sharp reserve loss, interest rate rise in previous months, and float followed by a sharp depreciation
Bulgaria	Feb-91	fixed peg to basket	independently float	Sharp interest rate rise, followed by a float and sharp depreciation
	Mar-94	tightly managed float	no change in the regime	Sharp depreciation, reserve loss, interest rate rise in previous months, continued pressure till late 1994
	May-96	tightly managed float	independently float	Depreciation, sustained reserve losses and interest rate increases, followed by a float
Burkina Faso	Jan-94	currency union	no change in the regime	CFA franc devaluation, interest rate rise, and a sharp reserve loss

Country	Crisis episodes	Regime Prevailing Within Six Months Prior to the Crisis Episode	Regime Moved to within 9 Months After the Episode	Some Events Surrounding the Pressure Episodes
Burundi	Aug-91	fixed peg to basket	no change in the regime	Devaluation
	Nov-97	fixed peg to basket	no change in the regime	Devaluation, interest rate rise, and reserve losses in previous months
	Aug-99	fixed peg to basket	other managed float	Sharp depreciation, reserve losses in previous months, and float
	Jul-00	other managed float	no change in the regime	Sharp depreciation, reserve loss, and interest rate rise
Cambodia	May-98	other managed float	no change in the regime	Depreciation to narrow spread with free market rate, and some reserve loss
Cameroon	Jan-94	currency union	no change in the regime	CFA franc devaluation, reserve losses in previous months, and some rise in interest rate
Canada	Sep-92	other managed float	no change in the regime	Sharp reserve loss, interest rate rise and depreciation
Cape Verde	May-95	fixed peg to basket	no change in the regime	Some reserve loss and depreciation
	Oct-00	fixed peg to a currency	no change in the regime	Devaluation and reserve loss
Central African R.	Jan-94	currency union	no change in the regime	CFA franc devaluation and some interest rate rise
Chad	Jan-94	currency union	no change in the regime	CFA franc devaluation, reserve losses in previous months, and some interest rate rise
Chile	Oct-90	backward looking crawling band	no change in the regime	Some depreciation of the exchange rate and successive rises in interest rate
China	Jan-94	other managed float	no change in the regime	Sharp devaluation and unification of dual exchange rates
Colombia	Sep-98	forward looking crawling band	no change in the regime	Sharp depreciation within the band and some reserve loss, followed by a float after a year
Congo, D. R. of	Dec-93	other managed float	no change in the regime	Sharp depreciation and huge reserve loss
	May-01	fixed peg to a currency	independently float	Sharp devaluation and float followed by interest rate hike
Congo, R. of	Jan-94	currency union	no change in the regime	CFA franc devaluation, some interest rate rise, and reserve loss in the previous month
Costa Rica	Nov-90	backward looking crawling peg	no change in the regime	Interest rate increase, some depreciation, and reserve loss in previous months
Côte d'Ivoire	Jan-94	currency union	no change in the regime	CFA franc devaluation and interest rate rise
Croatia	Apr-97	horizontal band	no change in the regime	Sharp depreciation and successive interest rate increases in previous months
	Aug-01	tightly managed float	no change in the regime	Depreciation of the exchange rate, interest rise, and reserve loss
Cyprus	Sep-92	fixed peg to basket	horizontal band	Some depreciation of the exchange rate and reserve loss
	Aug-93	horizontal band	no change in the regime	Some depreciation of the exchange rate
Czech R.	May-97	horizontal band	other managed float	Depreciation, large interest rise and reserve loss followed by float
	Aug-98	other managed float	no change in the regime	Depreciation of the exchange rate
Denmark	Feb-93	horizontal band	no change in the regime	Sharp interest rise, reserve loss following ERM crisis
Dominican R.	Apr-97	other managed float	no change in the regime	Depreciation of the exchange rate
Ecuador	Sep-92	forward looking crawling peg	fixed peg to a currency/ horizontal band	Sharp devaluation, interest rate rise, and some reserve loss in previous months
Egypt	Jul-90	fixed peg to a currency	horizontal band	Sharp devaluation
El Salvador	May-90	fixed peg to a currency	other managed float/tightly managed float	Sharp devaluation and reserve loss followed by float and exchange rate unification at the free market rate
Equatorial Guinea	Jan-94	currency union	no change in the regime	CFA franc devaluation reserve loss in previous month, and some interest rate rise
Ethiopia	Oct-92	fixed peg to a currency	other managed float	Sharp devaluation and a rise in interest rate
Fiji	Jan-98	fixed peg to basket	no change in the regime	Sharp devaluation
Finland	Nov-91	horizontal band	no change in the regime	Devaluation, reserve loss and interest rate rises in previous months
	Sep-92	horizontal band	independently float	Reserve loss, interest rate rise, followed by a float
Gabon	Jan-94	currency union	no change in the regime	CFA franc devaluation, reserve losses in previous months, and some interest rate rise
Gambia	Mar-91	independently float	no change in the regime	Sharp exchange rate depreciation
	Sep-00	independently float	no change in the regime	Sharp exchange rate depreciation

Country	Crisis episodes	Regime Prevailing Within Six Months Prior to the Crisis Episode	Regime Moved to within 9 Months After the Episode	Some Events Surrounding the Pressure Episodes
Georgia	Jan-99	tightly managed float	independently float	Sharp depreciation and interest rate rise and reserve losses in previous months
Ghana	Nov-99	other managed float	no change in the regime	Exchange rate depreciation and interest rate rise
Greece	Mar-98	forward looking crawling peg	horizontal band	Exchange rate depreciation; entry to ERM
Guatemala	Apr-90	independently float	tightly managed float	Sharp exchange rate depreciation and interest rate rise
Guinea-Bissau	Jul-92	backward looking crawling peg	no change in the regime	Sharp depreciation and reserve loss
	Aug-96	backward looking crawling peg	no change in the regime	Sharp depreciation, reserve loss, and interest rate rise
Guyana	Jun-90	fixed peg to a currency	other managed float	Devaluation
Haiti	Sep-00	independently float	no change in the regime	Sharp depreciation, reserve loss, interest rate rise
Honduras	Apr-90	fixed peg to a currency	forward looking crawling band/fixed peg to a currency	Sharp depreciation and interest rate rise
Hong Kong, SAR	Jul-98	currency board	no change in the regime	Contagion from Asian crisis, sharp interest rate rises during Apr─Aug-98
Hungary	Jan-91	fixed peg to basket	no change in the regime	Devaluation
	Sep-93	fixed peg to basket	no change in the regime	Devaluation and sharp rises in interest rate in consecutive months
	Aug-94	fixed peg to basket	horizontal band/forward looking crawling band	Devaluation, and reserve loss and increase in interest rates in past few months
Iceland	Feb-01	horizontal band	independently float	Sharp rise in interest rate and some depreciation within the band before moving to a float
India	Jul-91	horizontal band	fixed peg to a currency	Devaluation
	Mar-93	fixed peg to a currency	no change in the regime	Devaluation and exchange rate unification
Indonesia	Aug-97	backward looking crawling band	independently float	Sharp depreciation, interest rate rise followed by float during the Asian crisis
Ireland	Nov-92	horizontal band	no change in the regime	Sharp reserve loss, interest rate hike during ERM crisis, followed by a devaluation in early-93
Israel	Mar-91	horizontal band	forward looking crawling band	Devaluation (to correct competitiveness loss)
	Oct-98	forward looking crawling band	no change in the regime	Depreciation within the band during the Russian crisis
Italy	Sep-92	horizontal band	independently float	Depreciation, reserve loss, and interest rise followed by a float
	Feb-95	independently float	no change in the regime	Depreciation, reserve loss, interest rise during ERM tensions
Jamaica	Aug-91	other managed float	independently float	Depreciation, reserve loss, interest rise in successive months, followed by free float
Japan	Aug-95	independently float	no change in the regime	Sharp depreciation
Jordan	Jun-93	fixed peg to a basket	no change in the regime	Some depreciation, reserve loss, and interest rate rise
	Aug-95	fixed peg to a basket	no change in the regime	Some depreciation
Kazakhstan	May-94	independently float	other managed float	Interest rate increase and depreciation
	Apr-99	backward looking crawling peg	independently float/tightly managed float	Sharp depreciation and reserve loss, followed by a float
Kenya	Mar-93	fixed peg to basket	other managed float	Sharp depreciation, interest rise followed by float in 6 months
Korea	Nov-97	tightly managed float	independently float	Depreciation reserve loss, and successive interest rate rises, followed by a move to a free float during Asian crisis
Kuwait	Jan-92	fixed peg to a basket	no change in the regime	Exchange rate depreciation and reserve losses in past several months
Laos	Dec-97	fixed peg to a currency	other managed float	Sharp depreciation and reserve losses in successive months, followed by a float
Lebanon	Aug-90	other managed float	no change in the regime	Sharp depreciation and reserve loss
	Feb-92	other managed float	independently float/other managed float	Depreciation, reserve loss, and interest rate rise

Country	Crisis episodes	Regime Prevailing Within Six Months Prior to the Crisis Episode	Regime Moved to within 9 Months After the Episode	Some Events Surrounding the Pressure Episodes
Lesotho	Jul-98	fixed peg to a currency	no change in the regime	Sharp interest rate rise, and some reserve loss in previous months, associated with pressure on the S.A. rand
	Oct-01	fixed peg to a currency	no change in the regime	Sharp reserve loss and interest rate increase associated with pressure on the S. A. rand
Luxembourg	Aug-93	fixed peg to a currency	no change in the regime	Interest rate increase , widening of ERM bands
Macedonia, FYR	Jul-97	fixed peg to a currency	no change in the regime	Devaluation
Madagascar	May-94	fixed peg to basket	independently float	Sharp depreciation and float
Malawi	Feb-94	fixed peg to basket	independently float	Sharp depreciation with float, following reserve losses
	Aug-98	other managed float	no change in the regime	Sharp depreciation
Malaysia	Dec-97	tightly managed float	other managed float	Reserve losses, interest rate rise and depreciation following a halt in intervention defense during Asian crisis
Maldives	Jan-91	other managed float	no change in the regime	Depreciation and some reserve loss in previous few months
	Jul-01	fixed peg to a currency	no change in the regime	Devaluation
Malta	Nov-92	fixed peg to basket	no change in the regime	Devaluation and reserve loss
	May-97	fixed peg to basket	no change in the regime	Devaluation and reserve loss
Mauritius	Jan-97	other managed float	independently float	Reserve loss, interest rise, depreciation, followed by free float
	Nov-98	independently float	other managed float	Sharp depreciation, reserve loss in previous months
Mexico	Dec-94	forward looking crawling band	independently float	Reserve loss, interest rise, devaluation followed by a float during the Mexican crisis
Moldova	Nov-98	tightly managed float	other managed float/ independently float	Reserve loss, interest rise, depreciation, followed by a move to free float in a few months
Mongolia	Jan-93	fixed peg to a currency	independently float	Reserve loss, interest rise, and devaluation followed by a float within six months
	Apr-01	fixed peg to basket	no change in the regime	Devaluation
Mozambique	Jun-94	independently float	no change in the regime	Sharp interest rate rise and some consecutive depreciation
Myanmar	Dec-95	fixed peg to basket	other managed float	Sharp depreciation associated with the legalization of the free secondary market, accompanied with reserve losses
Namibia	May-96	fixed peg to a currency	no change in the regime	Interest rate rise related to pressure on the S.A. rand
	Jun-98	fixed peg to a currency	no change in the regime	Interest rate rise and reserve loss related to pressure on the S.A. rand
Nepal	Feb-93	fixed peg to a currency	no change in the regime	Depreciation vis-à-vis the Indian rupee
Netherlands	Apr-91	fixed peg to a currency	no change in the regime	Depreciation and reserve losses in previous months
New Zealand	Sep-01	Independently floating	no change in the regime	Sharp depreciation
Nicaragua	Mar-91	backward looking crawling peg	fixed peg to a currency	Devaluation
	Jan-93	fixed peg to a currency	forward looking crawling peg	Devaluation and reserve loss
Nigeria	Mar-92	tightly managed float	no change in the regime	Devaluation and exchange rate unification, reserve loss
	Feb-95	fixed peg to a currency	tightly managed float	Sharp depreciation associated with a switch of more transactions to a freely floating rate
Norway	Sep-92	horizontal band	independently float/tightly managed float	Some depreciation, reserve loss, and interest hike followed by a float in ERM crisis
Papua New Guinea	Jul-98	independently float	no change in the regime	Depreciation reserve losses, and interest rate rise
Peru	Aug-90	forward looking crawling peg	other managed float/independently float	Sharp devaluation and float
	Jun-92	independently float	other managed float	Depreciation and interest rate rise
Philippines	Sep-97	fixed peg to a currency	independently float/other managed float	Depreciation, reserve loss, and interest rise followed by a float during the Asian crisis
Poland	Feb-92	fixed peg to basket	forward looking crawling peg	Devaluation, four months after a move from a basket peg to a forward looking crawling peg

Country	Crisis episodes	Regime Prevailing Within Six Months Prior to the Crisis Episode	Regime Moved to within 9 Months After the Episode	Some Events Surrounding the Pressure Episodes
Portugal	Sep-92	horizontal band	no change in the regime	Reserve loss, interest hike, devaluation during the ERM crisis
	Jul-93	horizontal band	no change in the regime	Sharp depreciation; widening of ERM bands
	Mar-95	horizontal band	no change in the regime	Devaluation within the ERM, interest rate rise
Romania	Jan-97	tightly managed float	backward looking crawling peg	Depreciation, reserve loss, and interest rises
	Sep-98	forward looking crawling peg	other managed float	Sharp reserve loss, interest rate rises, devaluation, and capital controls, followed by a float during the Russian crisis
Samoa	Dec-90	fixed peg to basket	no change in the regime	Some depreciation and interest rate rise
	Mar-98	fixed peg to basket	no change in the regime	Depreciation and reserve loss
Sao Tomé & Principe	Sep-91	fixed peg to basket	backward looking crawling peg	Devaluation and move to crawling peg
	Dec-94	backward looking crawling peg	other managed float	Pressure followed by a sharp depreciation and float
	Jul-97	independently float	no change in the regime	Sharp depreciation and interest rate rise, following a move (in Jan-97) from a managed float to a free floating regime
Senegal	Jan-94	currency union	no change in the regime	CFA franc devaluation, interest rate rise, and successive reserve losses in previous months
Seychelles	Nov-00	fixed peg to basket	no change in the regime	Devaluation and reserve loss
Sierra Leone	May-90	fixed peg to a currency	independently float	Sharp devaluation followed by float
	Aug-97	independently float	no change in the regime	Sharp depreciation and reserve loss
Singapore	Dec-97	tightly managed float	other managed float	Depreciation, reserve loss and interest rate rise during the Asian crisis
Slovak R.	Jul-93	fixed peg to a currency	horizontal band	Sharp depreciation within the band
	Aug-98	horizontal band	other managed float	Depreciation, reserve loss, and interest rise followed by a float in a few months
Slovenia	Feb-93	backward looking crawling peg	no change in the regime	Sharp interest rate rise and some reserve loss
Solomon Islands	Dec-97	backward looking crawling peg	no change in the regime	Devaluation and reserve loss
South Africa	Jun-98	independently float	no change in the regime	Sharp depreciation, reserve loss, interest rise
	Nov-01	independently float	no change in the regime	Successive depreciation for a few months
Spain	Sep-92	horizontal band	no change in the regime	Devaluation and reserve loss during ERM crisis
Sri Lanka	Jun-00	backward looking crawling band	horizontal band/backward looking crawling band/other managed float	Depreciation, reserve loss and interest rate rises, followed by a brief move to a horizontal band, then to a float in Jan-01; tightening of FX regulations
Swaziland	Jun-98	fixed peg to a currency	no change in the regime	Reserve loss and interest rate increase related to pressure on the S.A. rand
Sweden	Sep-92	horizontal band	independently float	Sharp rise in interest rate, and depreciation followed by float
Switzerland	Mar-91	Independently floating	no change in the regime	Sharp depreciation
Syria	Jan-96	fixed peg to a currency	no change in the regime	Devaluation to approach the free market rate
	Jan-97	fixed peg to a currency	no change in the regime	Devaluation to approach the free market rate
	Jan-98	fixed peg to a currency	no change in the regime	Devaluation to approach the free market rate
Tanzania	Jul-93	tightly managed float	independently float	Reserve loss and interest rate rise
	May-95	independently float	no change in the regime	Depreciation, reserve loss, and interest rate rise
Thailand	Jul-97	fixed peg to basket	other managed float	Depreciation, reserve loss, and interest rise followed by float and introduction of exchange and capital controls
Togo	Jan-94	currency union	no change in the regime	CFA franc devaluation, reserve loss, and interest rate rise
Tonga	Aug-98	fixed peg to basket	horizontal band	Devaluation and some reserve loss
	Sep-00	horizontal band	no change in the regime	Exchange rate depreciation, successive adjustments of the band width, reserve losses in previous months
Trinidad and Tobago	Apr-93	fixed peg to a currency	independently float	Sharp devaluation followed by a float
Tunisia	Aug-93	backward looking crawling peg	no change in the regime	Devaluation

Country	Crisis episodes	Regime Prevailing Within Six Months Prior to the Crisis Episode	Regime Moved to within 9 Months After the Episode	Some Events Surrounding the Pressure Episodes
Turkey	Mar-94	backward looking crawling peg	other managed float/forward looking crawling peg	Depreciation, successive reserve losses, and sharp interest rate rise; move to a float
	Feb-01	forward looking crawling peg	independently float	Depreciation, reserve loss, sharp interest rate rise and float
Uganda	Jun-90	other managed float	no change in the regime	Sharp depreciation
	Jul-91	other managed float	no change in the regime	Sharp depreciation and reserve loss
Ukraine	Oct-94	fixed peg to a currency	other managed float	Sharp depreciation associated with exchange rate unification
	Sep-98	horizontal band	no change in the regime	Reserve loss, interest rise, and devaluation of the band
United Kingdom	Sep-92	horizontal band	independently float	Reserve loss in ERM crisis followed by float and depreciation
	May-00	independently float	no change in the regime	Exchange rate depreciation
Uruguay	Dec-01	forward looking crawling band	independently floating	Sharp depreciation within the band, interest rate hike, and reserve losses, followed by a float in Jun-02
Vanuatu	May-98	fixed peg to basket	no change in the regime	Pressure through reserve loss and interest rate rise since early 98
Venezuela	May-94	backward looking crawling peg	independently float/fixed peg to a currency	Depreciation, reserve loss, and interest rise followed by float and a subsequent peg, along with the introduction of exchange controls
	Dec-95	fixed peg to a currency	other managed float/forward looking crawling band	Reserve losses in previous months, followed by a sharp devaluation and a float in a few months, subsequent introduction of a crawling band regime and removal of exchange controls
Vietnam	Feb-98	horizontal band	no change in the regime	Exchange rate depreciation and some reserve loss
	Jan-96	fixed peg to a currency	independently float	Sharp devaluation followed by a float in a few months
Zambia	Mar-94	Independently float	no change in the regime	Sharp depreciation
Zimbabwe	Sep-91	fixed peg to basket	no change in the regime	Sharp devaluation and interest rate increase
	Dec-97	backward looking crawling band	other managed float	Interest rate rise and a sharp reserve loss in the previous month, followed by a float and sharp depreciation

1/ The episodes were identified by computing an exchange market pressure index for each country as a weighted average of monthly percentage changes in nominal exchange rates vis-à-vis the anchor currency and the percentage point monthly differences in short-term interest rates as indicated in Appendix III. Periods in which the index exceeded its country specific sample mean by at least 3 standard deviations were identified as pressure episodes. The weights were chosen to make the sample variation of each component of the index equal.

REFERENCES

Bubula, A. and I. Otker-Robe, 2002, "The Evolution of Exchange Rate Regimes Since 1990: Evidence from De Facto Policies," IMF Working Paper, No. 02/155 (Washington: International Monetary Fund).

Caramazza, F., L. Ricci, and R. Salgado, 2000, "Trade and Financial Contagion in Currency Crises," IMF Working Paper, No. 00/55 (Washington: International Monetary Fund).

Dueker, M. and A. M. Fischer, 2001, "The Mechanics of a Successful Exchange Rate Peg: Lessons for Emerging Markets," unpublished, Federal Reserve Bank of St. Louis and Swiss National Bank.

Duttagupta, R. and I. Otker-Robe, 2003, "Exits Form Pegged Regimes: An Empirical Analysis," IMF Working Paper, No. 03/147 (Washington: International Monetary Fund).

Duttagupta, R., S. Ishii, M. Karasulu, and I. Otker-Robe, 2003, "Country Experiences with Exchange Rate Regimes and Market Stress," Mimeo (Washington: International Monetary Fund).

Edison, H., 2000, "Do Indicators of Financial Crises Work? An Evaluation of an Early Warning System," unpublished, Board of Governors of the Federal Reserve System, *International Finance Discussion Papers*, No. 675 (July).

Eichengreen, B., 1994, *International Monetary Arrangements for the 21st Century* (Washington: Brookings Institution).

_____, A. Rose, and C. Wyplosz, 1995, "Exchange Market Mayhem: The Antecedents and Aftermath of Speculative Attacks," *Economic Policy*, Vol. 21 (October), pp. 249–312.

Fischer, S., 2001, "Exchange Rate Regimes: Is the Bipolar View Correct?," Distinguished Lecture on Economics in Government, *Journal of Economic Perspectives*, Vol. 15, No. 2 (Spring), pp. 3–24.

Frankel, J., 1999, "No Single Currency Regime is Right for All Countries or at All Times," *Essays in International Finance*, No. 215 (August) (Princeton: Princeton University Press).

_____, and A. Rose, 1996, "Currency Crashes in Emerging Markets: An Empirical Treatment," *Journal of International Economics*, Vol. 41 (November), pp. 351–366.

Ghosh, A. R., A. Gulde, J. Ostry, and H. C. Wolf, 1995, "Does the Nominal Exchange Rate Regime Matter?," IMF Working Paper 95/121 (Washington: International Monetary Fund).

Ghosh, A.R., A. Gulde, and H. C. Wolf, 2003, *Exchange Rate Regimes: Choices and Consequences*, the MIT Press (Cambridge: Massachusetts).

Glick R. and M. Hutchison, 1999, "Banking and Currency Crises: How Common Are Twins?, Federal Reserve Bank of San Francisco, *Center for Pacific Basin Studies Working Paper* No. PB99-07 (December).

Glick, R. and R. Moreno, 1999, "Money and Credit, Competitiveness, and Currency Crises in Asia and Latin America," Federal Reserve Bank of San Francisco, *Center for Pacific Basin Studies Working Paper* No. PB99-01 (March).

Goldstein, M., 1999, *Safeguarding Prosperity in a Global Financial System: The Future International Financial Architecture* (Washington: Institute of International Economics).

Grier, K., B. and R. M. Grier, 2001, "Exchange Rate Regimes and the Cross-Country Distribution of the 1997 Financial Crisis," *Economic Inquiry*, Vol. 39, No. 1, pp. 139–148 (January).

IMF, 1997, World Economic Outlook, Chapter IV, pp.78–97, *World Economic and Financial Surveys* (Washington: International Monetary Fund).

_____, 2003, Exchange Arrangements and Foreign Exchange Markets—Developments and Issues, *World Economic and Financial Surveys* (Washington: International Monetary Fund).

Kaminsky G., and C. Reinhart, 1999, "The Twin Crises: The Causes of Banking and Balance of Payments Problems," *The American Economic Review*, Vol. 89, No. 3, pp. 473–500.

Kaminsky, G., S. Lizondo, and C. Reinhart, 1998, "Leading Indicators of Currency Crises," *IMF Staff Papers*, Vol. 45 (March), pp. 1–48 (Washington: International Monetary Fund).

Klein, M., and N. Marion, 1997, "Explaining the Duration of Exchange Rate Pegs," *Journal of Development Economics,* Vol. 54, No. 2 (December), pp. 387–404.

Kumar, M., U. Moorthy, and W. Parraudin, 1998, "Predicting Emerging Market Currency Crashes," *The Institute for Financial Research Working Paper*, No. 51 (August).

Levy-Yeyati, E., F. Sturzenegger, 1999, "Classifying Exchange Rate Regimes: Deeds vs. Words," unpublished paper.

Masson, P., R., 2001, "Exchange Rate Regime Transitions," *Journal of Development Economics*, Vol. 64, pp. 571–586.

Moreno, R., 1999a, "Was There a Boom in Money and Credit Prior to East Asia's Recent Currency Crisis?," Federal Reserve Bank of San Francisco *Economic Review*, No. 1.

_____, 1999b, "Depreciation and Recessions in East Asia," Federal Reserve Bank of San Francisco *Economic Review*, No. 3, pp/ 27–40.

_____, 2000, "Pegging and Macroeconomic Performance in East Asia," Working Paper No. PB00-03, Center for Pacific Basin Monetary and Economic Studies, Federal Reserve Bank of San Francisco.

Mussa, M., and others, 2000, Exchange Rate Regimes in an Increasingly Integrated World Economy, *IMF Occasional Paper* 193.

Obstfeld, M. and K. Rogoff, 1995, "The Mirage of Fixed Exchange Rates," *Journal of Economic Perspectives*, Vol. 9, No. 4 (Fall), pp. 73–96.

Reinhart, C. M. and K. Rogoff, 2002, "The Modern History of Exchange Rate Arrangements: A Reinterpretation," *NBER Working Paper* No. 8963, National Bureau of Economic Research, Cambridge, MA, May.

Sachs, J., A. Tornell, and A. Velasco, 1996, "Financial Crises in Emerging Markets: The Lessons from 1995," *Brookings Papers on Economic Activity*, No. 1, pp. 147–215.

Schuler, K., 1999, "The Problem With Pegged Exchange Rates," *Kyklos*, Vol. 52, Fasc. 1, pp. 83–102.

Summers, L., 1999, Testimony Before the Senate Foreign Relations Subcommittee on International Economic Policy and Export/Trade Promotion, U.S. Senate 106th Congress 1st Session (January 27).

Williamson, J., 1999, "Are Intermediate Regimes Vanishing?," Speech Given at the *International Conference on Exchange Rate Regimes in Emerging Market Economies*, Tokyo, Japan (December 17–18).

_____, 2000a, *Crawling Bands or Monitoring Bands: How to Manage Exchange Rates in a World of Capital Mobility,* International Finance 1.1 (October), pp.59–79.

_____, 2000b, *Exchange Rate Regimes for Emerging Markets: Reviving the Intermediate Options,* Policy Analyses in International Economics 60 (Washington: Institute for International Economics) (September).

_____, 2001, "From Bretton Woods to Bipolarity: The Evolution of Thought in Exchange Rate Regimes, 1971–2001," Paper Prepared for Presentation to the *30th Anniversary Conference of the Monetary Authority of Singapore* (July 20).

_____, 2002, "The Evolution of Thought on Intermediate Exchange Rate Regimes, *Annals of the American Academy of Political and Social Science*, Vol. 579 (January), pp. 73–86.