

Exchange Rate Management and Crisis Susceptibility: A Reassessment[†]

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Abstract

This paper revisits the bipolar prescription for exchange rate regime choice and asks two questions: are the poles of hard pegs and pure floats still safer than the middle? And where to draw the line between safe floats and risky intermediate regimes? Our findings, based on a sample of 50 EMEs over 1980-2011, show that macroeconomic and financial vulnerabilities are significantly greater under less flexible intermediate regimes—including hard pegs—as compared to floats. While not especially susceptible to banking or currency crises, hard pegs are significantly more prone to growth collapses, suggesting that the security of the hard end of the prescription is largely illusory. Intermediate regimes as a class are the most susceptible to crises, but “managed floats”—a subclass within such regimes—behave much more like pure floats, with significantly lower risks and fewer crises. “Managed floating,” however, is a nebulous concept; a characterization of more crisis prone regimes suggests no simple dividing line between safe floats and risky intermediate regimes.

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I. INTRODUCTION

“Whatever exchange rate system a country has, it will wish at some times that it had another one.”
- Stanley Fischer (1999)

The choice of exchange rate regime is a perennial question facing emerging market economies (EMEs). In a world of increasingly volatile capital flows, even if the ultimate decision depends on a variety of historical, political, and economic factors, any rational calculus on regime choice must take into account its crisis susceptibility. While a voluminous literature on regime vulnerabilities grew out of the EME crises of 1990s and early 2000s, the changing trends in regimes since then (most notably, toward managed floats), the large output drops experienced by EMEs under a variety of regimes during the global financial crisis (GFC), and more recently the impact of “tapering talk” on EME currencies, makes pertinent the question of which regimes are the most vulnerable to crisis, and why.

Conventional wisdom, articulated by Fischer (2001), is the bipolar prescription: countries should adopt floats or hard pegs (monetary union, dollarization, currency board) and avoid intermediate regimes, as they tend to be more susceptible to crisis. While the arguments in favor of free floats are well known, it is less clear why hard pegs—the least flexible regime—should be equally resilient to crisis. Certainly the experience of emerging Europe and some eurozone countries during the GFC suggests that hard pegs may be more prone to growth declines and painful current account reversals, in which case the hard end of the bipolar prescription may be largely illusory.

But the soft end of the prescription is also problematic, a key question there being where to draw the line between floats and more risky intermediate exchange rate regimes. Clearly, occasional interventions during periods of market turbulence or extreme events do not turn a float into an intermediate regime; but how much management of the exchange rate is too much? This is the policy question confronting many EME central banks, an increasing number of which have switched to “managed floats”—i.e., regimes where the central bank does not (at least explicitly) target a particular parity—as they decide in real time how (or whether) to respond to various shocks. Even central banks intending to float freely may find themselves straying toward increasing management of the exchange rate as they react to unfolding events, in turn generating expectations that a de facto intermediate exchange rate regime is in place.

The existing literature provides limited, and generally contradictory, guidance on how much management of the exchange rate is too much. In his seminal work, Fischer (2001, 2008) put “managed floats” with free floats—that is, at the safe pole—rather than with the risky intermediate regimes. More generally, for countries with open capital accounts, he considers “a wide range of arrangements running from free floating to a variety of crawling bands with wide ranges” to be appropriate. But most other studies (e.g., Eichengreen, 1994; Obstfeld and Rogoff, 1995; Frankel, 1999; Masson, 2000; Rogoff et al., 2004), adopt a more extreme version of the bipolar view—lumping managed floats (or regimes with wide bands) with

other intermediate exchange rate regimes. Rogoff et al. (2004), for example, find that managed floats are significantly more prone to financial crisis than free floats, arguing that EMEs would benefit from “learning to float.” And in the context of the broad-band regime (± 15 percent around a central rate) adopted by the European Monetary System (EMS) after the crisis of 1992-93, Obstfeld and Rogoff (1995) argue that such systems pose difficulties, and that “there is little, if any, comfortable middle ground between floating rates and the adoption by countries of a common currency.”

In this paper, therefore, we examine two related questions: Does the bipolar prescription still hold in the sense that the extremes are safer than the middle? And, at the flexible end, where to draw the line between a safe float and a risky intermediate regime? For our analysis, we go beyond the usual three-way fixed, intermediate and float categorization, and adopt the IMF’s detailed de facto classification—which allows us to differentiate among the various intermediate exchange rate regimes—supplementing it with the IMF de jure and Reinhart and Rogoff’s (2004) de facto classifications. For each regime, we examine both the underlying vulnerabilities (macro imbalances, financial-stability risks) and the frequency of banking, currency, and sovereign debt crises (following the literature’s standard definitions for each of them). Ultimately, however, we are interested in crises because of their impact on welfare, the simplest yardstick of which is output growth. While growth indeed declines sharply during these crises, it is possible that certain regimes are associated with growth collapses that are independent of—or at least not manifested in—one of these crises. To address this possibility, we round out our crisis definitions by adding growth collapses—i.e., sharp decelerations of growth relative to the country’s historical norm.

Turning to the line between safe floats and risky intermediate regimes, we find that different regime classifications yield sharply different results for the “managed float” category. We therefore need to go beyond “canned” classifications and instead identify the more crisis prone regimes in terms of their primitive characteristics such as nominal exchange rate flexibility (across various horizons) and degree, direction, and circumstances of foreign currency (FX) intervention.¹ For this purpose, we adopt an innovative decision-theoretic technique, known as binary recursive tree (BRT) analysis, which allows for arbitrary thresholds and interactive effects among the explanatory variables (e.g., exchange rate flexibility; degree of FX intervention; overvaluation of the real exchange rate, etc.) in determining crisis susceptibility.

Our results, based on a dataset of 50 major EMEs over 1980-2011, may be summarized briefly. First, when it comes to financial vulnerabilities (rapid credit expansion; excessive foreign borrowing; FX-denominated domestic currency lending), and macroeconomic vulnerabilities (currency overvaluation; delayed external adjustment), less flexible intermediate regimes (pegs, bands, and crawls) are significantly more vulnerable than pure

¹ While the IMF de facto classification tends to incorporate information on intervention, as discussed below, it involves some subjective judgment. It is also not sufficiently granular in terms of taking into account direction/circumstances of intervention.

floats—but so are hard pegs. Second, intermediate exchange rate regimes as a class are indeed the most susceptible to banking and currency crisis, but de facto managed floats—a subclass within intermediate regimes—behave much more like pure floats, with significantly lower risks and fewer crises. The vulnerabilities under hard pegs however tend to be manifested in growth collapses rather than in banking or currency crises—perhaps because the high cost of exiting the regime makes the authorities reluctant to abandon it, opting instead for long and painful adjustment. Third, at the soft end, we find that there is no simple uni-dimensional dividing line (e.g., according to nominal exchange rate flexibility) between safe floats and risky intermediate regimes. Rather, the key to avoiding crises is to ensure that the real exchange rate does not become overvalued—and what makes for a “safe” managed float is that the central bank intervene in the face of overvaluation pressures and refrain from intervening to defend an overvalued exchange rate.

Our paper contributes to the existing literature in three respects. First, by going beyond existing studies and looking at underlying macroeconomic and financial vulnerabilities, we establish that the hard end of the bipolar spectrum is the most vulnerable—but that these vulnerabilities are manifested mainly in the form of growth crises, implying that the hard end of the bipolar prescription is largely illusory.² Second, by using a finer exchange rate regime classification than the usual three-way categorization, we are able to establish that not all intermediate exchange rate regimes are alike: managed floats (as defined by the IMF’s de facto classification) are significantly less susceptible to banking crisis than basket pegs, crawls and bands, or to growth collapses than single currency and basket pegs. Third, by using the BRT analysis to get around the ambiguity across existing regime classifications, we are able to identify the more crisis-prone intermediate regimes according to such characteristics as the degree of nominal exchange rate flexibility and circumstances of FX intervention, which is likely to be more useful for policy purposes than how a canned classification categorizes the regime.

The remainder of this paper is structured as follows. Section II describes the IMF’s de facto regime classification used in the analysis, and documents the evolution of exchange rate regimes in EMEs over the past three decades. Section III briefly reviews why certain regimes may be more crisis-prone, and then examines the empirical evidence on their vulnerabilities and susceptibility to banking, currency, sovereign debt, and growth crises. Section IV further explores the characteristics of more crisis-prone intermediate regimes through the use of binary recursive tree analysis. Section V concludes.

² Some earlier studies have analyzed macroeconomic or financial vulnerabilities associated with different exchange rate regimes individually. E.g., Goldfajn and Valdes (1999) and Ghosh et al. (2010) look at the extent of real exchange rate misalignment under different exchange rate regimes, while more recently, Angkinand and Willett (2011) and Magud et al. (2012) analyze the impact of exchange rate regimes on financial-stability risks.

II. TRENDS IN EXCHANGE RATE REGIMES IN EMEs

As in any empirical study of exchange rate regimes, our first task is to choose a classification scheme. Early studies (e.g., Ghosh et al., 1995) used de jure classifications—the regime declared by the central bank—but since the bias of these classifications, whereby EME central banks typically claim to follow more flexible exchange rate arrangements than they actually do (characterized as “fear of floating;” Calvo and Reinhart, 2002), has become apparent, subsequent studies generally use de facto classifications (e.g., Ghosh et al., 2003; Reinhart and Rogoff, RR, 2004; Shambaugh, 2004; Levy-Yeyati and Sturzenegger, LYS, 2005).³ There is, however, little agreement among the various de facto classifications, and they often produce conflicting results in macroeconomic studies.⁴

Here we mainly use the IMF’s de facto classification, which combines statistical methods with qualitative judgment based on IMF country team analysis and consultations with the central bank.⁵ Compared to other de facto classifications, the IMF classification provides wider and more up-to-date coverage (including the period since the GFC), exhibits the greatest consensus across de facto classifications, and makes clearer distinctions between hard pegs and conventional pegs, and between managed floats and pure floats. Moreover, by combining (often confidential) information on the central bank’s intervention policy with actual exchange rate volatility, it avoids the occasional anomalies from which purely mechanical algorithm inevitably suffer.⁶

Three phases can be discerned in the evolution of EME exchange rate regimes over the past couple of decades (Figure 1[a]). The 1997-98 Asian crisis, and its immediate aftermath, saw a “hollowing out of the middle”—countries abandoning single currency or other “soft” pegs (mostly in favor of free floats)—consistent with the bipolar prescription.⁷ This trend came to an end around 2004, however, with the proportion of intermediate exchange rate regimes rising in the runup to the GFC, mainly because of the increased adoption of managed floats

³ E.g., in our sample of EMEs (see Appendix A), about 48 percent of de jure pure floats are de facto classified as managed floats, while about 17 percent are de facto classified as other intermediate regimes.

⁴ See Frankel et al. (2000), Ghosh et al. (2010), Klein and Shambaugh (2010), and Rose (2011) for a discussion.

⁵ The IMF’s original eight-way de facto classification comprises arrangements with no separate legal tender (monetary union, dollarization), currency boards, conventional pegs (single currency and basket), horizontal bands, crawling pegs, crawling bands, managed floats, and pure floats. The classification categories have been revised slightly since 2008 (see IMF, 2008). For our empirical analysis, we first map the new categories into the old ones to create a consistent series for the full sample period (1980-2011). We then combine the first two categories into hard pegs, combine all crawling arrangements into a single category, and differentiate between single currency and basket pegs—thereby arriving at a seven-way classification.

⁶ E.g., the LYS de facto classification includes an “inconclusive” category (where reserves variability is irrelevant for exchange rate movements). Ghosh et al. (2010) show that the IMF’s de facto classification is also less idiosyncratic than other classifications in the sense that, observation by observation, it agrees more with the popular de facto classifications (LYS, RR, Shambaugh) than any other individual de facto classification.

⁷ Formal statistical tests of the bipolar hypothesis over that period—based on Markov transition matrices—however, reject it as a positive prediction (see, e.g., Masson, 2001; Bubula and Otker-Robe, 2002).

by EMEs (Figure 1[b]). In the third phase, the GFC and beyond, the move toward intermediate exchange rate regimes, especially managed floats, has accelerated markedly.⁸

The intervention patterns underlying the move to greater exchange rate management pre- and post-GFC are, however, quite different. In the runup to the crisis, most EMEs worried that capital inflows would make their exports uncompetitive and therefore sought to limit the appreciation of their currencies. During the crisis, when EMEs were facing a sudden stop or even sharp capital outflows, intervention was to support the currency. Thereafter, the ebbs and flows of capital to these countries have resulted in alternating phases of concern about currency appreciation and depreciation—but in any case, concern about exchange rate volatility, hence the desire to manage exchange rates.

But is this trend of EMEs moving toward managed floats likely to continue? If the bipolar view held as a positive prediction, then Markov transition matrices would imply that hard pegs and free floats would be absorbing states, and together form a closed set.⁹ Estimated transition probabilities for the full sample period (1980-2011) using the three-way classification show that this is not the case: while regimes tend to be highly persistent, none of the off-diagonal probabilities is zero, implying that transitions from every regime to another are possible (Table 1[a]). The floating regime is the least persistent, with many more transitions from floats to intermediate regimes (about 20 percent) than to hard pegs (2 percent). Consistent with earlier findings by Masson (2000) and Bubula and Ötker-Robe (2002), formal tests reject the bipolar view as a positive prediction (Table 1, last row). In fact, according to the steady-state distribution—assuming historical transition probabilities remain unchanged in the future and there are no major shocks to the system—intermediate regimes will be the most prevalent, with about 70 percent of EMEs opting for them in the long-run, and a further 20 percent opting for hard pegs.¹⁰ Similar results are obtained using a more recent sample (2000-11), except that it is not possible to reject the hypothesis that hard pegs are an absorbing state (though the bipolar prediction itself is strongly rejected).¹¹

Turning to transitions among intermediate regimes, Table 2 reports Markov matrices using the finer regime classification. In the full sample, basket pegs are the most persistent regime, followed by crawling pegs/bands, managed floats, and single currency pegs. In the more recent sample, however, while basket pegs remain the most persistent regime, crawls are less

⁸ These broad trends are also apparent using the IMF's de jure and RR's classifications (see Appendix A).

⁹ That is, countries would never revert to an intermediate regime from a hard peg or pure float (Masson, 2000).

¹⁰ The long-run (limiting) distribution of regimes is given by $\pi = \lim_{n \rightarrow \infty} \pi_0 P^n$, where π_0 is some initial distribution of exchange rate regimes, and P is the transition probability matrix.

¹¹ Despite the somewhat different transition probability matrix obtained from the subsample as compared to the full sample, a formal test of stability of the transition matrix for 2000-11 versus 1980-2011 fails to reject the hypothesis of structural stability (LR test-statistic=4.18, p-value=0.78). (The test-statistic is given by

$$\sum_{i=1}^m \sum_{j=1}^m \frac{n_i (P_{ij} - P_{ij}^0)^2}{P_{ij}^0},$$

where P_{ij} and P_{ij}^0 are the transition probability matrices obtained for the sub and full

samples, respectively; and a chi-squared distribution with $m(m-1)$ degrees of freedom.)

persistent, while managed floats and single currency pegs become more persistent. Exits from both hard pegs and floats are much more likely to be toward managed floats in both samples than to any other intermediate regime. The full-sample steady state distribution implies that managed floats would be the most dominant regime in the long-run, with a share of about 31 percent, followed by hard pegs (20 percent), crawling pegs/bands (17 percent), single currency pegs (14 percent) and floats (11 percent). Restricting estimation to the more recent sample suggests an equal split between hard pegs and managed floats of about 30 percent each, followed by single currency pegs (15 percent) and pure floats (10 percent).¹²

Overall, these findings strongly reject the bipolar hypothesis as a positive prediction. On the contrary, EMEs seem to favor intermediate exchange rate regimes—and managed floats in particular. Hard pegs may also be more prevalent as several emerging European countries are likely to join the eurozone. Determining the crisis risks of these regimes is therefore a pressing policy question.

III. EXCHANGE RATE REGIMES AND CRISIS VULNERABILITY

Underlying most crises is some form of vulnerability (unsustainable imbalances, excessive balance sheet exposures), and there are several reasons why these vulnerabilities would be worse under less flexible exchange rate regimes than under floats. First, the loss (or limit) of the exchange rate as an adjustment tool makes it more difficult to correct external imbalances, often to the point that the real exchange rate becomes overvalued and large imbalances build up, whose unwinding precipitates a currency crisis (often anticipated by a self-fulfilling speculative attack).¹³ Second, relatedly, regaining competitiveness without nominal exchange rate flexibility puts deflationary pressures on the economy, which in turn may undermine output growth. Third, the exchange rate guarantee implicit in the peg can encourage excessive foreign borrowing by banks (and other domestic entities), especially when there is a favorable interest rate differential for FX borrowing (Rosenberg and Tirpak, 2008; Magud et al., 2011). In turn, open FX limits on banks force them to lend in foreign currency, which is of particular concern when the ultimate borrowers (e.g., households) lack a natural FX hedge. Fourth, to the extent that intervention is not sterilized (e.g. due to the fiscal cost), there may be excessive credit expansion, exacerbated by the implicit exchange rate guarantee that attracts nonresident deposits and expands bank balance sheets (Montiel

¹² The increase in the steady-state distribution of hard pegs in the 2000-11 sample is a result of both the greater persistence of hard pegs, and a higher transition probability from horizontal bands to hard pegs (the latter reflects Slovakia's entry into the Eurozone). In fact, if the sample is restricted to 2005-11, the probability of exiting hard pegs is zero, and they constitute 100 percent of the regimes in the long-run. Excluding hard pegs from the sample and re-computing transition probabilities for 2005-11, we find that intermediate regimes and floats constitute 95 and 5 percent of the steady-state distribution, respectively.

¹³ In a recent paper, Chinn and Wei (2013) find that the nominal exchange rate regime does not matter for external adjustment. Several studies, however, question their results on methodological and definitional grounds, and find that less flexible exchange rate regimes are significantly associated with slower external adjustment (e.g., Hermann, 2009; Ghosh et al., 2013).

and Reinhart, 2001).¹⁴ Finally, by temporarily suppressing the effects of lax fiscal policy on inflation, less flexible exchange rate regimes may impose less fiscal discipline than flexible regimes (Tornell and Velasco, 2000).

The different types of vulnerabilities may also interact and amplify each other: sharp declines in growth can worsen debt sustainability and impair the quality of bank assets; greater foreign borrowing can lead to large swings of the exchange rate in the event of a sudden stop; but sharp currency movements can strain unhedged domestic balance sheets and result in growth slowdowns.¹⁵ But even if less flexible exchange rates are likely to be more vulnerable, the form of crisis in which the vulnerability is manifested is likely to depend on the type of exchange rate regime. In particular, the high cost of exiting a hard peg—and therefore the policy discipline and market credibility engendered by the regime—makes currency crises less likely. The same features may also result in smaller fiscal deficits, and therefore, lower risk of debt sustainability problems under hard pegs (though by reducing the scope for inflationary finance, they may make discrete default more likely) than under other less flexible regimes.¹⁶

By contrast, the very determination of the authorities to maintain the parity means that growth crises are more likely (while the larger imbalances and exposures means that the output cost of any eventual currency crisis will be all the greater—as the collapse of Argentina’s currency board amply demonstrated). This suggests that in assessing the resilience of exchange rate regimes, it is important to go beyond the traditional currency and banking crises and also consider other types of crisis such as debt crises and growth collapses. Moreover, since crises are rare events (requiring both an underlying vulnerability and crisis trigger; see Ghosh et al., 2008), and may—serendipitously—not be realized in the sample, it is important to consider both underlying vulnerabilities and crisis realizations.¹⁷

A. Financial and Macroeconomic Vulnerabilities

We begin by examining the relationship between the exchange rate regime and various financial and macroeconomic vulnerabilities by estimating the following model:

¹⁴ Backe and Wojcik (2008) highlight another channel through which pegs could fuel domestic credit expansion—for countries with an increasing trend in productivity growth that peg their exchange rate to an advanced economy (with constant productivity growth) currency, the peg may lead to lower interest rates and higher domestic credit compared to a flexible exchange rate regime.

¹⁵ In countries where the banking sector has borrowed heavily from abroad, a banking crisis is often followed by a currency crisis (Kaminsky and Reinhart, 1999).

¹⁶ Frankel et al. (2000) argue that intermediate regimes, mainly basket pegs and bands, inspire less credibility because they are not easily verifiable.

¹⁷ Analyzing vulnerabilities is also useful because crisis observations are coded on the basis of commonly used, yet arbitrary, thresholds of what constitutes a crisis; complementing the analysis with a look at vulnerabilities can therefore yield more robust conclusions. Moreover, identifying vulnerabilities may be a first step to mitigating them, thus making the regime less crisis-prone.

$$V_{jt} = x'_{jt}\beta_1 + z'_{jt}\gamma_1 + \eta_{jt} \quad (1)$$

where V_{jt} is the financial (rapid credit expansion; excessive foreign borrowing; FX-denominated lending) or macroeconomic (fiscal and current account deficits; real exchange rate overvaluation) vulnerability in country j in time t ; x is a vector of binary variables indicating the IMF's de facto exchange rate regime in place; z includes relevant control variables; and η is the random error term. We estimate (1) using Ordinary Least Squares (OLS), and cluster the standard errors at the country level to address the possibility of correlation in the error term. To address potential endogeneity concerns of the exchange rate regime and control variables in (1), we follow existing literature (e.g., Rogoff et al., 2004) and substitute current values of these variables by lagged values. Since exchange rate regimes are slow moving variables, we do not include country-fixed effects, but control for region-specific effects and a range of country characteristics.¹⁸

Financial vulnerabilities

Empirical studies generally find that less flexible exchange rate arrangements are more likely to be associated with higher credit to the private sector (Magud et al., 2011) or credit booms (Mendoza and Terrones, 2008; Dell'Ariccia et al., 2012). The same is true in our data set, where change in domestic credit (defined as the 3-year cumulative change in the ratio of private sector credit-to-GDP) is almost twice as large under hard pegs as under intermediate regimes, and almost four times as large as under floats (Table 3, col. [1]). The aggregate statistic for intermediate regimes, however, masks important differences across them: for instance, change in credit is more than twice as large under basket pegs than under single currency pegs—and almost eight times as large as under managed floats.

More formal analysis confirms these results: the change in credit-to-GDP ratio or credit expansion (i.e., restricting the sample to positive changes in credit-to-GDP ratio) is statistically significantly greater under hard pegs, single currency pegs, basket pegs, or horizontal bands than under pure floats (Table 4, cols. [2], [5]). While the control variables included in the estimation—based on earlier literature (e.g., Mendoza and Terrones, 2008; Magud et al., 2011)—such as real GDP growth, net capital inflows, and foreign borrowing by the banking system are all significant contributors to domestic credit expansion, the association between less flexible exchange rate regimes and private sector credit mostly survives their inclusion in the regression (cols. [3], [6]). Notably, change in credit/credit expansion under other less flexible intermediate regimes (single currency pegs, basket pegs, or horizontal bands) is also statistically significantly higher than under managed floats (as indicated by the test for coefficient equality reported in the last row, Table 4).

¹⁸ We exclude off-shore financial centers (such as Panama) from the sample in all estimations. Sample size varies across estimations depending on data availability of different variables. See Appendix B for a description of variables and data sources.

As discussed above, the exchange rate guarantee implicit in a peg (or less flexible arrangements more generally) might also encourage excessive foreign borrowing by the banking system and, given open FX limits, corresponding FX-denominated lending to the private sector. The raw statistics reported in Table 3 (cols. [2]-[3]) suggest that this is indeed the case: both foreign borrowing (measured as foreign liabilities of the banking system, in percent of GDP) and FX-denominated domestic lending (share of domestic FX-denominated loans in total loans of the banking system) are twice as large under hard pegs as under floats, with intermediate exchange rate regimes somewhat closer to the latter.

Regression analysis shows that foreign borrowing by the banking system is significantly greater under less flexible exchange rate regimes than under pure floats; and also under hard and single currency pegs as compared to managed floats (Table 5, col. [2]). These results generally continue to hold for hard pegs and single currency pegs when controlling for other explanatory variables (Table 5, cols. [3]-[6]). Hard pegs and basket pegs are also associated with a significantly greater proportion of FX-denominated lending in total bank lending as compared to free floats (Table 6, col. [2]), though the results weaken when we control for net capital flows and bank foreign liabilities, which suggests that less flexible regimes induce greater FX-denominated lending by encouraging funds from abroad (cols. [3]-[6]).¹⁹

The regressions reported in Tables 5 and 6 also point to policy measures that can help reduce these risks. For instance, consistent with the findings of Ostry et al. (2012), controls on capital inflows are associated with significantly lower banking system external liabilities (Table 5, col. [4]) and, more surprisingly, with a lower proportion of FX-denominated domestic bank lending (Table 6, col. [4]).²⁰ Likewise, restrictions on FX-denominated lending naturally reduce the proportion of such loans in total bank lending (Rosenberg and Tirpak, 2008; Ostry et al. 2012), while open FX-limits have a stronger impact on foreign borrowing by the banking system (Tables 5 and 6, cols. [5]-[6]).

Macroeconomic vulnerabilities

Beyond financial vulnerabilities, less flexible exchange rate regimes may be associated with greater macroeconomic vulnerabilities: fiscal deficits, current account deficits, and real exchange rate overvaluation. What is the formal empirical evidence? Fiscal deficits are lower under hard pegs than under most other less flexible exchange rate regimes—with the exception of basket pegs (Table 3, col. [4])—but the differences are not statistically significant from free floats (again, except for basket pegs, which have significantly higher fiscal balances than free floats; Table 7, cols. [2]-[3]). Both hard pegs and intermediate regimes are associated with significantly greater overvaluation of the real exchange rate (measured simply as the deviation of real effective exchange rate from trend) than pure

¹⁹ Dollarized economies are excluded from the sample when computing the share of FX-denominated loans in total bank lending since, by the very nature of the regime, all loans would be classified as FX-denominated.

²⁰ Ostry et al. (2012) explain this result by noting that inflow controls on the banking system will imply fewer FX-liabilities and hence, given open FX-limits, less FX-denominated lending.

floats—and this holds regardless of controlling for capital inflows (which is itself significantly associated with overvaluation). The fine classification, however, shows that it is hard pegs and single currency, basket, and crawling pegs that are susceptible to (statistically significant) overvaluation: managed floats do not exhibit greater overvaluation than pure floats (Table 7, cols. [4]-[6]).

Less flexible exchange rate regimes do appear to impede external adjustment—on average, current account imbalances tend to be larger under hard pegs and intermediate regimes than under floats (Figure 2). Prior to reversals—defined as large reductions in the current account imbalances—surpluses and deficits also tend to be larger under these regimes relative to pure floats (Table 8, cols. [1]-[3]). While nothing forces adjustment on surplus countries, deficit countries can lose financing abruptly especially when large imbalances have built up. Accordingly, the (unconditional) reversal probability is significantly greater for hard pegs and (almost) all intermediate exchange rate regimes (col. [4]).

B. Crisis Propensity

The findings above suggest that less flexible exchange rate regimes may be much more vulnerable to crisis. But do these vulnerabilities translate into actual crises? And are all less flexible regimes equally prone to different types of crisis? In this section, we empirically explore these questions with regard to banking, currency, and sovereign debt crises, as well as general growth collapses, by estimating models of the following form:

$$\Pr(Crisis_{jt} = 1) = F(x'_{jt}\beta_2 + z'_{jt}\gamma_2) \quad (2)$$

where $Crisis_{jt}$ is an indicator variable of whether a crisis (banking, currency, debt, or growth) occurs in country j in period t ; x indicates the exchange rate regime in place (before the onset of the crisis), and z includes various relevant control variables (lagged). We estimate (2) using the probit model, and as before, include region-specific effects, and cluster the standard errors at the country level.

To define the various types of crisis, we follow the existing literature. Systemic banking crises are those where there are significant signs of financial distress in the banking system, requiring significant policy intervention methods in response to significant losses (Laeven and Valencia, 2012). Currency crises are depreciations of the nominal exchange rate against the US dollar of at least 30 percent that is also at least 10 percentage points greater than the depreciation in the previous year (Frankel and Rose, 1996). External debt crises are identified as events of sovereign debt default and/or restructuring.²¹ Growth collapses are defined as those that are in the bottom fifth percentile of growth declines (current year relative to the average of the three previous years), and correspond to a fall in the growth rate of real GDP of about 7.5 percentage points.

²¹ Our source for all three types of crisis (banking, currency and debt) is Laeven and Valencia (2012).

An initial snapshot shows that currency and banking crises are the most common form of financial crisis in EMEs, while sovereign debt crises the least common (Table 9). Large growth declines are also quite common, and not all of them are accompanied by another type of crisis. For example, only about one-third of growth collapses occur with or within three years of a banking or currency crisis (and fewer than 10 percent occur in the context of a debt crisis). Banking crises seem to be drivers of currency and debt crises—around one-half of which occur within three years of a banking crisis, whereas some 15-30 percent of banking crises happen within three years of a debt or currency crisis.

Banking and currency crises

A number of studies have documented the higher propensity of banking (Domaç and Peria; 2003; Ghosh et al., 2003; Rogoff et al., 2004; Angkinand and Willett, 2011) and currency (Bubula and Ötker-Robe, 2003; Ghosh et al., 2003; Rogoff et al., 2004) crises in countries with less flexible exchange rate regimes. Our own empirics (Table 3, col. [6]) suggest that less flexible exchange rate arrangements are indeed associated with more banking crises, but that the relationship is not monotonic. Intermediate exchange rate regimes are about twice as likely to experience a banking crisis as a hard peg and about four times as likely as a float. Delving deeper into the intermediate regimes, it is crawling arrangements and horizontal bands that are the most crisis-prone (with about 7 percent of them experiencing a banking crisis), followed by basket pegs; while managed floats are the least likely to experience a banking crisis—and no more likely than pure floats.

Results from the probit model confirm these casual observations and show that intermediate exchange rate regimes are statistically significantly more likely to experience banking crises than pure floats (Table 10, col. [1]). Among intermediate regimes, it is basket pegs, horizontal bands, and crawling pegs that have a significantly greater propensity to banking crises; the coefficients on single currency pegs and managed floats are statistically insignificant (col. [2]).

If we add other variables that have been identified as important determinants of banking crisis in earlier literature (e.g., Demirgüç-Kunt and Detragiache, 1998; Angkinand and Willet, 2011) such as real exchange rate overvaluation, banking system foreign liabilities, domestic credit expansion, and net capital flows (in percent of GDP), we find the estimated coefficients of these variables to be statistically significant and of the expected signs. Thus, an increase in overvaluation, faster domestic credit expansion, excessive foreign borrowing, and larger inflows are associated with a higher banking crisis probability. Since these variables may themselves be influenced by the regime (Tables 4-7), the addition of these explanatory variables can have three possible effects on the magnitude of the estimated coefficients of the regime variables in (2): leave them unchanged, decrease them, or increase them. To the extent that the regime coefficients remain unchanged, it means that the greater crisis propensity of some regimes is unrelated to these risks. If the coefficient declines (*a fortiori*, becomes insignificant), then the crisis susceptibility of the regime is through these

channels only (if it turns negative, then the regime is less susceptible to crisis than would be expected on the basis of how it scores on these vulnerabilities); and if it increases, then the regime is more susceptible to crisis than its risks would imply.

The estimated coefficients on basket pegs, horizontal bands, and crawling pegs diminish in magnitude, and become statistically insignificant in the case of basket pegs, with the inclusion of the additional variables (Table 10, col. [3]). The result is not surprising since, as discussed above, these regimes tend to have the largest financial-stability and macroeconomic vulnerabilities; controlling for them, the regimes become less important. More surprising is that hard pegs score significantly worse on most of these risks (Table 3, cols. [1]-[5]), yet suffer fewer banking crises. One reason may be that, knowing the strictures imposed by the hard peg, including on LOLR operations (Angkinand and Willet, 2011), banking supervision is tighter, and other compensatory mechanisms are built into the design of the regime.²² Another reason may be that around one-third of banking crises are preceded by currency crises (Table 9) and, hard pegs tend to have fewer of these, as shown in Table 3.

Looking at currency crisis, these are almost five times as likely under an intermediate regime than under a hard peg, and twice as likely as under a pure float (Table 3, col. [7])—though the differences are not statistically significant (Table 10, col. [5]). Within intermediate exchange rate regimes, only crawling pegs exhibit a statistically significantly higher frequency of crisis than pure floats (col. [6]). Controlling for real exchange rate overvaluation, banking system foreign liabilities, the current account balance, and foreign exchange reserves (all of which are statistically significant with the expected signs), the coefficient on crawling pegs becomes insignificant, while the coefficient on hard pegs becomes *negative* and statistically significant at the 10 percent level (col. [6]). In other words, hard pegs have fewer currency crises than would be expected given their macroeconomic and financial vulnerabilities. Presumably, the greater policy discipline imposed by the hard peg together with the reluctance of speculators to take on a central bank committed to defending the parity, enables hard pegs to handle these risks without experiencing a currency crisis.

Sovereign debt crises and growth collapses

Unconditionally, the likelihood of a sovereign debt crisis is the same under hard pegs and intermediate exchange rate regimes (2 percent of the observations)—and around four times as large as under a pure float (Table 3, col. [8]). Among the intermediate exchange rate regimes, single currency and crawling pegs exhibit the highest crisis probability, roughly twice that under managed floats. None of these differences are statistically significant, however, regardless of whether other control variables (real exchange rate overvaluation,

²² E.g., Bulgaria's currency board arrangement incorporates a pre-funded "banking department" as a precaution against banking crises.

reserves, fiscal balance, real GDP growth, inflation—each of which is statistically significant with the expected sign) are included in the probit (Table 11, cols. [1]-[3]).

Ultimately, we are interested in crises that *matter*—the simplest yardstick of which is whether output growth suffers. On average, during banking, debt, or currency crises, growth slows by some 2½ to 4 percentage points (comparing the year of the crisis to the previous three years).²³ But obviously not all these crises have an appreciable impact on growth, and at the same time, there may be other types of crisis that negatively affect growth but that are not covered here. This suggests that it may be interesting to see whether general growth collapses, controlling for exogenous and external shocks, vary by regime.

Unconditionally, such growth collapses are far more common under hard pegs than under either intermediate or floating regimes, with more than 10 percent of hard pegs experiencing a sharp decline in real GDP growth (Table 3, col. [9]). The aggregate classification confirms that hard pegs are significantly more prone to growth collapses than pure floats, while the finer classification shows that hard, single currency, and basket pegs are all more prone to such crises than managed or pure floats (Table 11, cols. [4]-[5]). The association between these regimes and growth crises holds controlling for other explanatory variables such as growth in major trading partners, the current account balance, and the stock of reserves—all of which are statistically significant with the expected signs (Table 11, col. [6]).

The results also hold controlling for banking, currency, or debt crises (col. [6]). Why might the less flexible exchange rate arrangements be associated with growth collapses beyond the effects of other crises? One reason is the loss of the nominal exchange rate as an adjustment mechanism. For instance, a sharp curtailment of foreign financing (even if it does not result in a currency crisis) will require a larger decline in activity and output to elicit a given improvement in the current account when the exchange rate cannot adjust. This is certainly the story behind some of the growth collapses in the pegged exchange rate regime sample (e.g., Argentina in 2000s, and Estonia and Latvia in the GFC).

C. Sensitivity Analysis

To check the robustness of our estimates reported above, we conduct a range of sensitivity tests with alternate specifications and different exchange rate regime classifications, and discuss relevant endogeneity issues.

Alternate specifications

The results reported in Tables 10 and 11 consider the different types of crisis individually, but if all these crises are pooled together, we find that almost all types of less flexible exchange rate regimes, except for managed floats (and basket pegs), are significantly more

²³ Restricting sample to crises associated with at least a slowdown in real GDP growth yields similar results.

susceptible to crisis than pure floats (Table B2, col. [1]). This result holds regardless of whether other control variables (including macroeconomic and financial vulnerabilities) are added to the model or not (col. [2]). The results are generally also robust to the inclusion of additional control variables (that may be correlated both with regime choice as well as crisis susceptibility) such as trade openness, institutional quality, capital account openness index, crisis contagion variables, year effects, and to using different proxies for bank foreign borrowing (such as bank net foreign assets to GDP ratio; cols. [3]-[7], [10]-[14]). In the case of currency crisis, controlling for hyper inflation (annual inflation rate ≥ 40 percent; col. [8]), or adding the lagged banking crisis variable also does not change the results significantly (though, as in Kaminsky and Reinhart (1999), we find that banking crisis significantly raise the likelihood of a currency crisis by about 6 percentage points; col. [9]).

Endogeneity

One concern with any study of performance under alternative exchange rate regimes is the possibility of regime endogeneity or reverse causality. Following earlier literature, e.g., Reinhart et al. (2004), we always use the one year lag of the regime classification to capture the regime that was in place at the time of the crisis, thereby mitigating endogeneity concerns (and since regimes tend to be persistent while crises are discrete and rare events, endogeneity concerns are anyway less likely to be pertinent here than for some other studies such as the link between fixed exchange rates and low inflation). For reverse causality to be driving our finding that less flexible regimes are more crisis prone would then require that countries switch toward less flexible regimes in the *runup* to a crisis (or more generally, as they become more vulnerable to crisis).²⁴ But empirically, that is not the case. In less than a quarter of the crisis cases in our sample does the de facto regime switch between years $t-2$ and $t-1$, and of these switches, there is an almost equal split between moves toward less flexibility and moves toward greater flexibility.

More generally, not only is it difficult to establish a link between (subsequent) crises and regime switches, it is also difficult to find evidence that underlying macroeconomic and financial vulnerabilities prompt switches in the exchange rate regime. For example, Table B3 shows that there is no statistically significant difference in the current account balance (to GDP), net financial flows (to GDP), credit expansion, FX-denominated domestic lending, or bank foreign borrowing between exchange rate regime switches toward greater flexibility and regime switches away from flexibility. Real exchange rate overvaluation is the only variable for which we find the difference to be statistically significant—countries with more overvalued exchange rates opt for more flexible regimes.²⁵ These observations are consistent

²⁴ Conversely, if there is endogeneity such that countries opt for greater flexibility in anticipation of the crisis, it would tend to downward bias the coefficients on less flexible exchange rate regimes. In this respect, since we mostly find a statistically significant effect of less flexible exchange rate regimes on crisis probability, our estimates could be treated as presenting a lower bound.

²⁵ This strengthens our results since the finding of an association between less flexible regimes and vulnerabilities is then despite, not because of, potential endogeneity. The statistical significance of the coefficient however disappears once we exclude crisis observations from the regime switches.

with earlier studies (e.g., Rogoff et al., 2004; Klein and Shambaugh, 2010), who are unable to find robust (observed) predictors of exchange rate regime choice. As such, it appears implausible for reverse causality to be driving our results.²⁶

Other classifications

The overall picture that emerges from the results obtained above is that managed floats are no more prone to crisis than pure floats, and significantly less so than other less flexible exchange rate regimes. Despite greater macroeconomic and financial vulnerabilities, hard pegs are as prone to financial crisis as pure floats, although they are significantly more prone to growth crises than either pure or managed floats. In broad brush terms, a similar picture is obtained using alternative regime classifications, though there are some differences. Using the de jure classification, for example, the main difference is that managed floats rather than crawling pegs have a statistically significantly higher probability of banking crises (Table B4, cols. [2]-[3]); this result is likely the outcome of a large proportion of de jure “managed floats” being in fact a tightly managed regime that are de facto identified as crawling arrangements. Other results—specifically, that hard pegs have fewer currency crises and more growth collapses; and that managed floats are no more prone to currency and debt crises, or growth collapses than pure floats—carry through (cols. [4]-[12]).

As for RR’s de facto classification, their category of “collapsing currencies” corresponds almost exactly to currency crisis observations, so it is not meaningful to examine whether their other regimes are associated with currency crises (all the coefficients are statistically insignificant; Table B5). On growth crises, as with the IMF classification, hard pegs come out to be significantly more prone to growth collapses than pure floats (cols. [11]-[12]). The key difference between earlier results and those with RR’s classification is again for the managed float category, where using the latter, there is a significantly positive association between these regimes and debt and banking crises. This is consistent with the finding of Rogoff et al. (2004) who, using RR’s classification, also find that banking crisis are more likely under managed floats than free floats.

Thus, while our findings on hard pegs and most other intermediate regimes are robust to the use of alternative classifications, the robustness of the results across regimes appears to break down at the flexible end of the spectrum, notably for the “managed float” category. Using the IMF de facto classification, managed floats are no more prone to crisis than pure floats; using the IMF’s de jure or the RR’s de facto classifications, they are closer to other intermediate regimes in terms of crisis susceptibility. We attempt to address this issue rigorously below.

²⁶ As Rogoff et al. (2004) note “This problem [endogeneity] cannot be fully resolved but is mitigated by the relatively long duration of the typical regime under the Natural [i.e., de facto] classification, implying that temporary changes in performance do not influence the choice of regime. The problem is also mitigated by using as an explanatory variable the regime prevailing in the previous one or two years....”

IV. WHERE TO DRAW THE LINE?

The finding that the RR managed floats are almost as risky as other intermediate regimes, whereas managed floats as defined by the IMF classification are almost as safe as pure floats, implies that different classifications are capturing different regimes under the rubric of managed floating—an admittedly nebulous category. That the IMF’s de facto managed float category captures the contours that define a relatively safe regime begs the question of what really constitutes “safe” managed floating—something that presumably Fischer (2001) had in mind when describing the floating pole as constituting “a managed float with no specified central rate, or as independently floating.”

Like the IMF’s de facto classification, RR’s managed float category explicitly excludes regimes targeting a specific exchange rate parity, while in terms of nominal exchange rate volatility (short- and long-run) the relative ranking of regimes also looks similar (Figure B1). So where does the difference lie? To address this question, we need to go beyond canned classifications and instead *characterize* the more risky intermediate regimes along various relevant dimensions (e.g., exchange rate flexibility; degree of FX intervention; overvaluation of the real exchange rate; financial-stability risks, etc.). To this end, we use an innovative decision-theoretic technique, known as binary recursive tree (BRT) analysis that allows for arbitrary thresholds and interactive effects among the explanatory variables. Since the ambiguity pertains to intermediate regimes, in what follows we exclude observations that are coded as hard pegs or pure floats under both the IMF and RR classifications.

Formally, a binary recursive tree is a sequence of rules for predicting a binary variable, y , (i.e., crisis vs. noncrisis) on the basis of a vector of explanatory variables, x_j , where $j=1 \dots J$, such that at each level, the sample is split into two sub-branches according to some threshold value of one of the explanatory variables, \hat{x}_j . The threshold value \hat{x}_j is chosen as the value that best discriminates between crisis and noncrisis observations based on a specific criterion.²⁷ The splitting is repeated along the various sub-branches until a terminal node is reached. This technique thus establishes a hierarchy among variables such that an explanatory variable that appears toward the top of the tree may be considered more important in distinguishing between the crisis and noncrisis cases than one appearing on a lower sub-branch. For example, if the main characteristic that mattered for crisis susceptibility was exchange rate flexibility, then the tree would split on some threshold value of flexibility, and could further split based on this or some other variable.

In our application, the dependent variable is 1 if the country experiences a banking or currency crisis and 0 otherwise, and the candidate variables are the vulnerability indicators used above (credit expansion, real exchange rate overvaluation, banking system foreign

²⁷ While several algorithms are available to search for the best split (e.g., minimizing the sum of type I and type II errors) we employ the Improved Chi-squared Automatic Interaction Detector (CHAID), which uses a chi-squared test to determine the best split (Kass, 1980 provides the details). Implementation of CHAID is undertaken using the SIPINA classification tree software.

liabilities, share of FX credit) together with flexibility of the nominal exchange rate and degree of intervention as characteristics of the exchange rate regime, and both the IMF de facto and RR regime classifications.²⁸

Figure 3 presents the resulting binary recursive tree, with conditional probabilities of a crisis indicated at each node.²⁹ The first variable used for splitting the sample turns out to be real exchange rate overvaluation at the threshold value of 5 percent: the conditional probability of a crisis in countries with real exchange rate overvaluation greater than this threshold (the right branch of the tree) is 30 percent, whereas that for countries with overvaluation below this threshold is only 4 percent. Continuing along the right branch, the second node depends on credit expansion such that countries with a 3-year cumulative change in domestic credit to GDP ratio in excess of 30 percentage points are more than thrice as likely to have a crisis than those without such a credit boom. Further down the branch, it is overvaluation that matters again, with countries whose currencies are more than 12 percent overvalued having a 55 percent conditional probability of crisis compared to 20 percent for countries whose currencies are not as overvalued. Of the highly overvalued countries (overvaluation in excess of 12 percent), however, those that intervene heavily are much more likely to experience a crisis than those that do not; while when overvaluation is below the 12 percent threshold, it is nominal exchange rate flexibility that matters, with countries that have less flexible exchange rates almost four times as likely to experience a crisis than those with more flexible exchange rates. Note that nothing prevents the algorithm from further splitting the tree (using any of the regressors); however, given the stopping rule for the algorithm, the improvement in the fit is not sufficient to justify the additional complexity of the tree.

Moving on to the left branch of the tree (i.e., countries whose real exchange rates are less overvalued than 5 percent), we see that it is also credit expansion that matters—countries with a 3-year cumulative change in domestic credit to GDP ratio in excess of about 32 percentage points are much (i.e., 15 times) more likely to have a crisis than those without such a boom. Continuing down the branch of countries with relatively less credit expansion, it is countries with more flexible exchange rates with a higher likelihood to experience a crisis. The final node makes clear why: of these countries with more flexible exchange rates, those that are more overvalued are 6 times more likely to experience a crisis than those without overvalued currencies.

²⁸ Intervention is defined as $I = |\Delta R| / (|\Delta R| + |\Delta E|)$ where ΔR is the annual percentage change in reserves (where change in reserves is measured as reserve flows from the Balance of Payments, rather than change in the stock of reserves, to avoid valuation changes), and ΔE is the annual percentage change in the nominal effective exchange rate (NEER). Results remain essentially similar if the nominal exchange rate against the major anchor currency (such as the US dollar or euro) is used instead. I ranges from zero (no intervention; free float) to one (full intervention; fixed exchange rate). Exchange rate flexibility is defined in terms of monthly NEER volatility—i.e., rolling standard deviation of monthly percentage changes in the NEER over 6, 12 or 36 months.

²⁹ All variables used for classification are lagged one period. The tree correctly classifies about 94 percent of the sample; 29 and 99 percent of the crisis and noncrisis observations, respectively.

It is noteworthy that neither the IMF nor the RR classifications appears anywhere in the tree; that is, the other explanatory variables (including exchange rate flexibility and intervention) are better at discriminating between crisis and noncrisis cases. The BRT analysis thus makes clear that there is no simple dividing line (e.g., according to nominal exchange rate flexibility) between “safe” and “risky” intermediate exchange rate regimes. Rather, what determines whether the regime is safe or risky is a complex confluence of factors, including exchange rate flexibility, degree of intervention, and, of course, economic and financial vulnerabilities—of which real overvaluation features as the most important variable. The only way to make the regime classifications enter the tree is to drop the overvaluation, intervention, and exchange rate flexibility variables. With this more restricted set of explanatory variables, the IMF classification does enter the tree at the second branch, with a threshold at the managed float category such that countries with pure or managed floats have a conditional probability of crisis of 4 percent, compared to 9 percent for countries that have less flexible regimes.³⁰ Thus, while the IMF de facto classification does enter the tree, it is not particularly very good at discriminating between crisis and noncrisis cases. As for the RR classification, even with the restricted set of explanatory variables, it does not enter the tree at all, and is unsuccessful in discriminating between safe and risky intermediate regimes.

To delve deeper into how exchange rate overvaluation, flexibility and intervention interact, we restrict the sample to observations where the real exchange rate is overvalued by at least 5 percent (the threshold of the first node), and refine the intervention variable to capture (i) cases where the central bank is buying FX, thus helping to prevent (further) overvaluation; (ii) cases where the central bank is selling FX, thus defending (an overvalued) exchange rate (these may not be perfect complements because there could be cases where the central bank is not intervening in either direction).

Figures 4 and 5 plot the resulting binary recursive trees using the two intervention variables, respectively. Again, the first node of the tree splits according to overvaluation of the exchange rate: countries whose currencies are more than 12 percent overvalued have a conditional probability of crisis of 55 percent compared to 23 percent for countries with currencies less overvalued than 12 percent. The further nodes split according to exchange rate flexibility and intervention. Countries where intervention is against the wind—that is, central banks buy FX in the face of overvaluation—have a conditional probability of crisis of only 4 percent compared to 24 percent for countries where the central bank is not intervening against the wind (Figure 4). Conversely, when the central bank sells FX (i.e., seeks to defend) an overvalued currency, the conditional probability of crisis is 83 percent compared to 44 percent when it does not (Figure 5).

In other words, it is not intervention per se that makes the regime risky. On the contrary, intervention to prevent (further) overvaluation can reduce the risk of crisis, while intervention to defend an overvalued exchange rate makes the regime more crisis prone.

³⁰ This tree is not reported here for brevity but is available upon request.

These results help explain why managed floats under the IMF classification are relatively safer than the managed floats as defined by the RR classification. First, about 40 percent of the cases where the real exchange rate is overvalued are classified as managed floats by RR, compared to 25 percent under the IMF's de facto classification. Second, 26 percent of the cases where the central bank is defending an overvalued exchange rate are classified as managed floats by RR, compared to 20 percent under the IMF's de facto classification. The IMF de facto classification thus better captures the safer management of the exchange rate, but still cannot fully capture it since there is no simple dividing line between the characteristics that are relevant for crisis propensity.

V. CONCLUSION

Writing in the aftermath of the Asian crisis, Fischer (2001) gave a bipolar prescription for regime choice, whereby EMEs should adopt floats or hard pegs, but avoid intermediate regimes as they are more prone to crisis. In this paper, we draw on a large sample of EMEs over the period 1980-2011 to examine whether this prescription has an empirical basis. Consistent with the bipolar prescription, we find that free floats are indeed the least vulnerable to crisis. At the other end of the spectrum, however, we find that hard pegs exhibit some of the greatest vulnerabilities in terms of external imbalances, real exchange rate overvaluation, banking system's foreign liabilities, domestic credit expansion, and FX-denominated domestic lending. Given the high costs of exiting hard pegs, and the central bank's corresponding reluctance to abandon the regime, these vulnerabilities typically do not translate into banking or currency crises, but they do imply that hard pegs are significantly more susceptible to growth crises. The security of the hard end of the bipolar prescription thus turns out to be largely illusory.

Ambiguous in the bipolar prescription is where to place managed floats. While Fischer placed them at the safe pole with free floats, others would place them in the risky intermediate regime category. Empirically, different classifications give starkly different answers, which is especially problematic as managed floats are becoming increasingly popular among EMEs. Using binary recursive tree analysis, we establish that there is no simple dividing line—for instance, according to exchange rate flexibility—between safe and risky managed floats. Rather, what distinguishes safe from risky management of the exchange rate is whether the central bank intervenes to limit overvaluation, and refrains from intervening to defend an overvalued exchange rate.

While this insight is probably more useful for policy purposes than canned regime classifications, there remain numerous challenges for central banks opting for managed floats. In particular, they need to assess, in real time, whether capital flows are likely to be temporary or persistent, and accordingly, whether the exchange rate is becoming overvalued relative to its equilibrium value. What this paper has shown is that managed floats can be a relatively resilient regime, but more research is necessary to define more completely the contours of safe managed floats.

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Figure 1. Distribution of Exchange Rate Regimes in EMEs: IMF's De Facto Classification 1980-2011 (In percent)

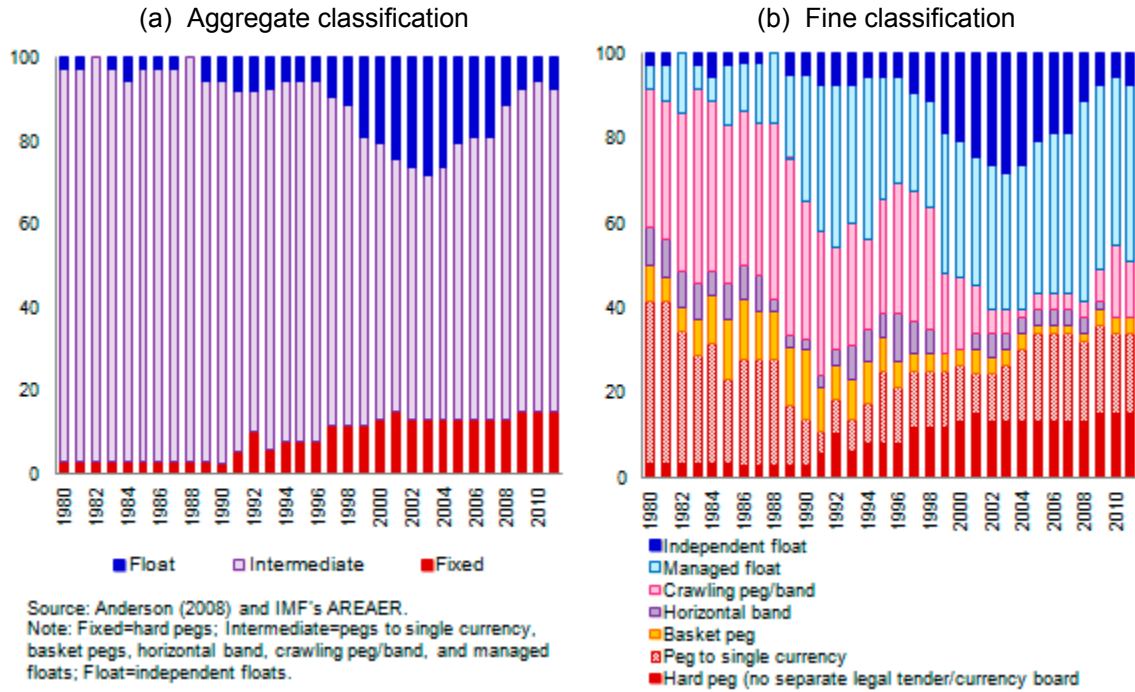


Figure 2. Current Account Balance in EMEs: IMF's De Facto Classification 1980-2011 (In percent)

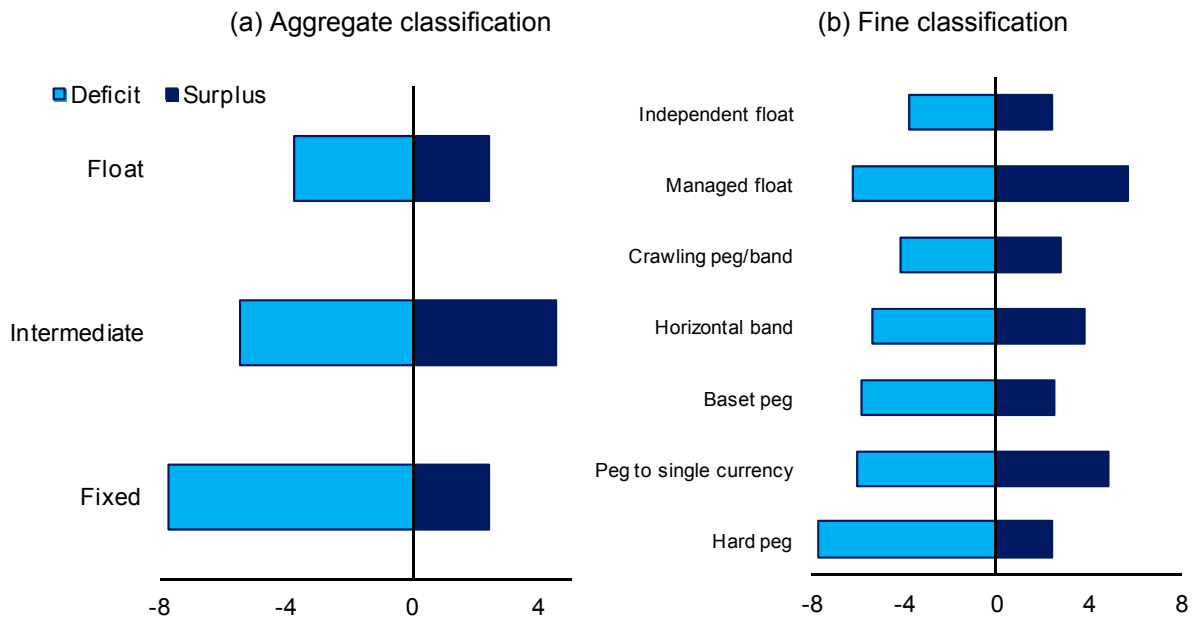
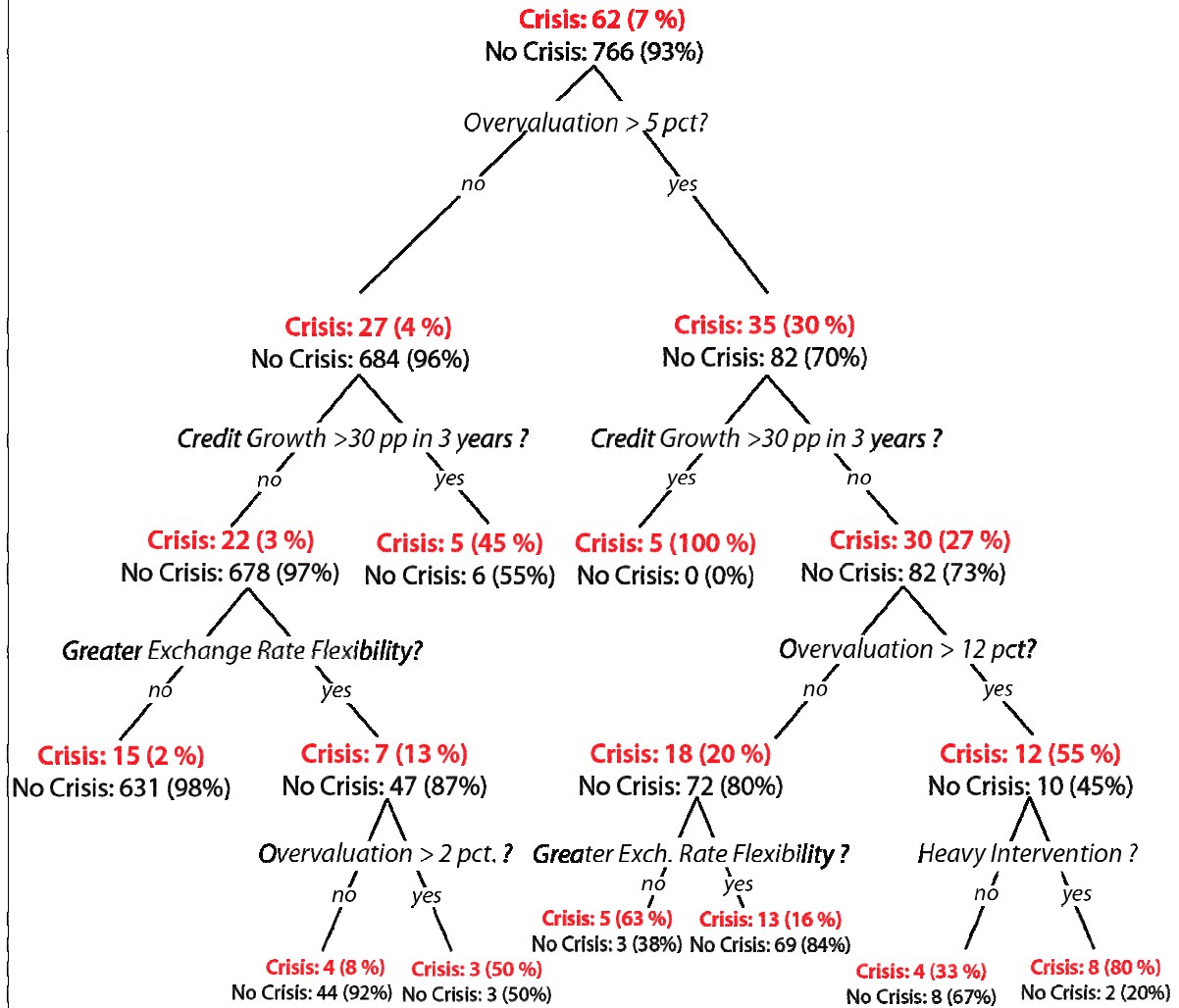
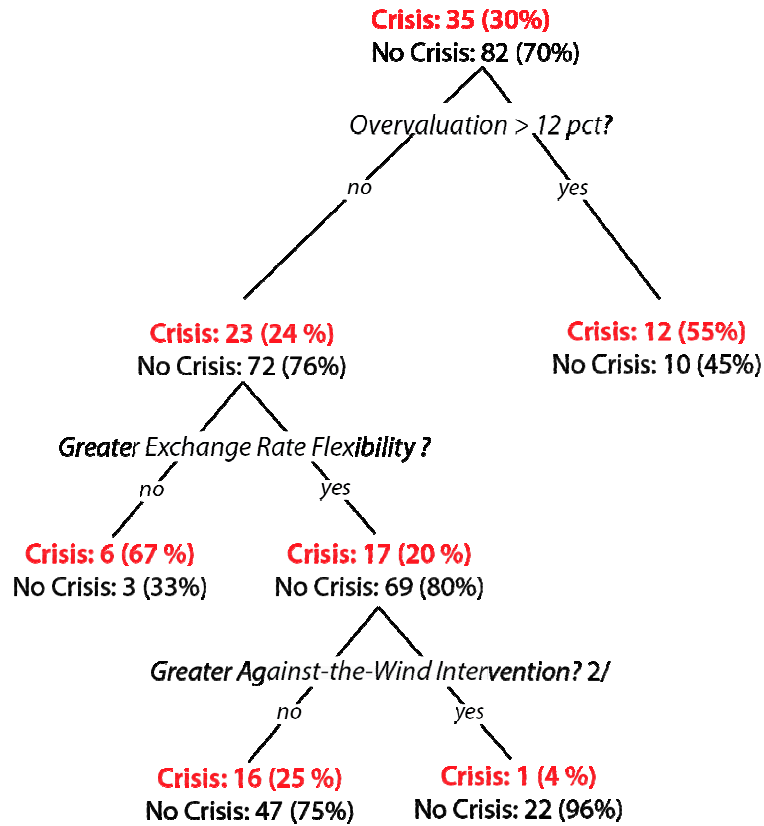


Figure 3. Binary Recursive Tree: Banking or Currency Crisis 1/



1/ The sample excludes observations that are identified as hard pegs or pure floats under both the IMF and RR classifications. The tree is constructed using the Improved CHAID algorithm in SAPINA software (with minimum size of nodes to split and leaves specified as 10 and 5 observations respectively, and the p-level for merging and splitting nodes specified as 0.05).

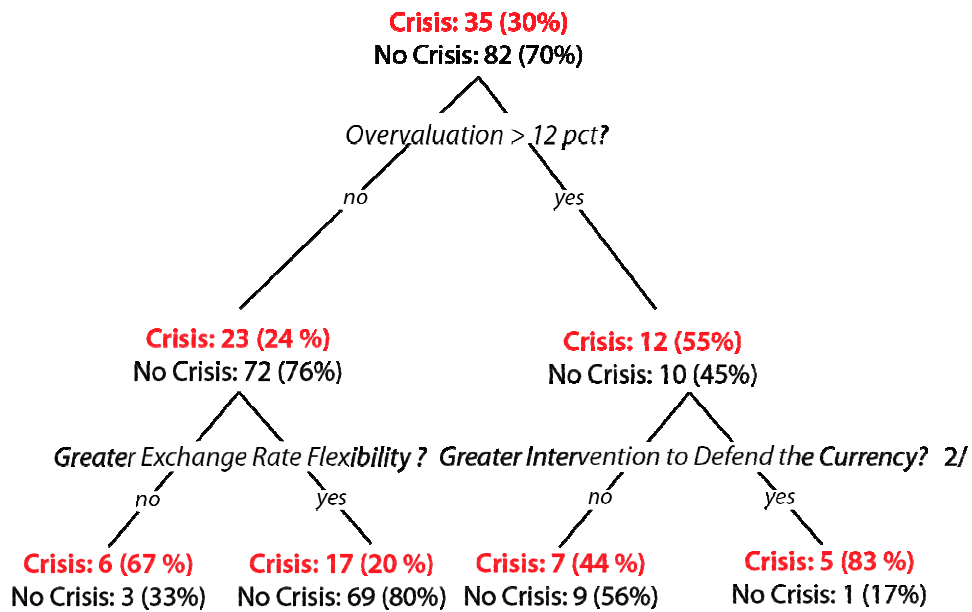
Figure 4. Binary Recursive Tree: Banking or Currency Crisis
(countries with overvalued exchange rates) 1/



1/ Sample includes observations with overvalued exchange rates (REER deviation from trend in excess of 5 percent), excluding those observations identified as hard pegs or pure floats under both the IMF and RR classifications. The tree is constructed using the Improved CHAID algorithm in SAPINA software (with minimum size of nodes to split and leaves specified as 10 and 5 observations respectively, and the p-level for merging and splitting nodes specified as 0.05).

2/ Purchase of FX in the face of overvalued currency

Figure 5. Binary Recursive Tree: Banking or Currency Crisis
(countries with overvalued exchange rates) 1/



1/ Sample includes observations with overvalued exchange rates (REER deviation from trend in excess of 5 percent), excluding those observations identified as hard pegs or pure floats under both the IMF and RR classifications. The tree is constructed using the Improved CHAID algorithm in SAPINA software (with minimum size of nodes to split and leaves specified as 10 and 5 observations respectively, and the p-level for merging and splitting nodes specified as 0.05).

2/ Sale of FX to defend overvalued currency.

Table 1. Transition Probabilities Matrix for EMEs: IMF's De Facto Aggregate Classification

(a) 1980-2011

	Fixed	Intermediate	Float
Fixed	0.977	0.015	0.008
Intermediate	0.004	0.965	0.031
Float	0.018	0.195	0.787
Steady-state regime distribution	0.194	0.697	0.108
Regime distribution in 2011	0.151	0.774	0.075
LR test statistic (fixed as an absorbing state)	5.931 (p-value=0.084)		
LR test statistic (float as an absorbing state)	61.934 (p-value=0.000)		
LR test statistic (fixed and float being a closed set)	61.274 (p-value=0.000)		

Note: Fixed=hard pegs (no separate legal tender/currency board); Intermediate=pegs to single currency, basket pegs, horizontal band, crawling peg/band, and managed floats; Float=independent floats.

(b) 2000-2011

	Fixed	Intermediate	Float
Fixed	0.988	0.012	0.000
Intermediate	0.005	0.967	0.028
Float	0.008	0.140	0.851
Steady-state regime distribution	0.311	0.580	0.109
Regime distribution in 2011	0.151	0.774	0.075
LR test statistic (fixed as an absorbing state)	1.988 (p-value=0.635)		
LR test statistic (float as an absorbing state)	33.179 (p-value=0.000)		
LR test statistic (fixed and float being a closed set)	33.479 (p-value=0.000)		

Table 2. Transition Probabilities Matrix for EMEs: IMF's De Facto Fine Classification

(a) 1980-2011

	Hard peg	Peg to single currency	Basket peg	Horizontal band	Craw ling peg/band	Managed float	Independent float
Hard peg	0.977	0.000	0.000	0.000	0.000	0.015	0.008
Peg to single currency	0.008	0.751	0.016	0.012	0.080	0.120	0.012
Basket peg	0.000	0.043	0.871	0.032	0.022	0.022	0.011
Horizontal band	0.014	0.056	0.000	0.732	0.070	0.113	0.014
Craw ling peg/band	0.000	0.055	0.003	0.010	0.846	0.048	0.039
Managed float	0.002	0.067	0.007	0.015	0.037	0.827	0.044
Independent float	0.018	0.018	0.000	0.000	0.000	0.177	0.787
Steady-state distribution	0.195	0.142	0.040	0.034	0.169	0.307	0.114
Regime distribution in 2011	0.137	0.196	0.039	0.000	0.137	0.412	0.078

(b) 2000-2011

	Hard peg	Peg to single currency	Basket peg	Horizontal band	Craw ling peg/band	Managed float	Independent float
Hard peg	0.988	0.000	0.000	0.000	0.000	0.012	0.000
Peg to single currency	0.010	0.819	0.010	0.010	0.067	0.086	0.000
Basket peg	0.000	0.048	0.905	0.048	0.000	0.000	0.000
Horizontal band	0.056	0.056	0.000	0.667	0.111	0.056	0.056
Craw ling peg/band	0.000	0.094	0.000	0.019	0.717	0.113	0.057
Managed float	0.000	0.061	0.004	0.013	0.013	0.874	0.035
Independent float	0.008	0.000	0.000	0.000	0.000	0.140	0.851
Steady-state distribution	0.315	0.152	0.029	0.024	0.060	0.315	0.105
Regime distribution in 2011	0.137	0.196	0.039	0.000	0.137	0.412	0.078

Table 3. Vulnerabilities and Crisis in EMEs: IMF's De Facto Classification, 1980-2011
(In percent)

	Financial vulnerabilities			Macro vulnerabilities		Crisis ^a			
	Credit boom ^b	Foreign borrowing	FX lending	Fiscal balance	REER deviation	Bank	Currency	Debt	Growth
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Hard pegs	6.1	14.3	58.9	-2.7	0.3	3.0	1.0	2.0	10.5
Intermediate	2.4	9.4	36.1	-3.6	0.2	4.7	5.2	1.9	4.4
Peg to single currency	3.5	12.3	34.9	-4.6	0.9	3.6	5.2	2.8	6.9
Basket peg	8.8	10.7	49.2	-1.9	-0.2	5.4	1.1	1.1	8.3
Horizontal band	5.1	9.9	44.5	-4.5	0.6	7.0	2.8	1.4	3.4
Craw ling peg/band	1.1	8.3	35.1	-3.4	0.8	7.4	7.4	2.3	3.1
Managed float	1.2	8.0	35.4	-3.5	-0.7	2.7	4.9	1.5	3.3
Independent float	0.8	7.3	29.4	-3.2	-1.6	1.2	2.4	0.6	3.8

a/ In percent of exchange rate regime observations.

b/ In percentage points.

Table 4. Domestic Credit: IMF's De Facto Classification, 1980-2011

	Change in domestic credit			Change in domestic credit (expansion)		
	(1)	(2)	(3)	(4)	(5)	(6)
Hard peg	4.332*	4.345	2.614	4.086*	4.023*	0.736
	(2.509)	(2.664)	(2.304)	(2.194)	(2.274)	(1.703)
Intermediate	2.432			3.104**		
	(2.133)			(1.313)		
Peg to single currency		2.588	2.372		5.214***	0.537
		(2.643)	(2.528)		(1.764)	(1.447)
Basket peg		10.263**	9.201**		8.843***	5.367***
		(4.112)	(3.519)		(1.946)	(1.209)
Horizontal band		5.051**	4.913**		3.041**	1.907
		(2.473)	(2.362)		(1.512)	(1.489)
Crawling peg/band		2.322	1.021		2.780	-0.130
		(2.580)	(2.495)		(1.694)	(1.341)
Managed float		1.490	0.398		1.490	-0.252
		(2.171)	(2.039)		(1.497)	(1.265)
Real GDP growth			0.418***			0.288***
			(0.141)			(0.105)
Inflation			-0.062			0.170
			(0.068)			(0.111)
Initial domestic credit/GDP			-0.162***			0.111***
			(0.035)			(0.040)
Net financial flows/GDP			0.287**			0.333***
			(0.126)			(0.117)
Bank foreign liabilities/GDP			0.165**			0.146**
			(0.067)			(0.063)
Real GDP per capita (log)	-0.302	-0.486	1.097	1.312	1.239	-1.383*
	(0.925)	(0.947)	(1.000)	(1.225)	(1.159)	(0.808)
Region-fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Year effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,010	1,010	1,010	646	646	646
R-squared	0.129	0.151	0.276	0.185	0.227	0.391
No. of countries	51	51	51	51	51	51
Test of coeff. equality with managed float (p-value):						
Hard peg		0.227	0.235		0.243	0.543
Peg to single currency		0.605	0.322		0.027	0.643
Basket peg		0.057	0.016		0.002	0.000
Horizontal band		0.079	0.013		0.397	0.198
Crawling peg/band		0.636	0.703		0.416	0.909

Notes: Dependent variable is cumulative change in private sector credit to GDP ratio over 3 years (i.e., difference between t and t-3) in cols. [1]-[3]. Sample restricted to only positive changes in columns (4)-(6). The reference category is free float. All variables (except for initial credit/GDP ratio) are lagged one period. See Appendix B for variable definitions and data sources. Constant included in all specifications. Clustered standard errors at country level reported in parentheses. ***, ** and * indicate significance at 1, 5 and 10 percent levels, respectively.

Table 5. Bank Foreign Borrowing: IMF's De Facto Classification, 1980-2011

	(1)	(2)	(3)	(4)	(5)	(6)
Hard peg	7.795** (3.117)	7.828** (3.137)	6.628** (2.554)	5.376* (2.831)	4.881* (2.806)	3.034 (3.495)
Intermediate	4.131** (1.855)					
Peg to single currency		8.277** (4.092)	6.062 (3.642)	9.176* (4.606)	8.206* (4.606)	10.001** (4.569)
Basket peg		5.646 (6.006)	3.513 (5.972)	5.409 (10.434)	5.266 (10.887)	5.916 (10.003)
Horizontal band		3.660* (1.988)	2.785 (2.007)	1.864 (2.621)	1.267 (2.746)	-0.348 (3.112)
Crawling peg/band		4.348** (1.941)	4.281* (2.145)	3.261 (2.359)	2.276 (2.516)	3.641 (2.508)
Managed float		1.879 (1.244)	1.765 (1.319)	2.434 (1.732)	1.957 (1.694)	2.858 (1.802)
Real GDP growth			-0.062 (0.101)	-0.101 (0.155)	-0.118 (0.177)	-0.177 (0.171)
REER deviation			-1.136 (2.675)	2.107 (3.981)	4.724 (4.083)	1.862 (4.824)
Domestic credit/GDP			0.156*** (0.043)	0.147*** (0.047)	0.153*** (0.049)	0.124** (0.048)
Inflow controls index				-6.594* (3.714)		-3.578 (3.490)
Restrictions on FX lending						-1.261 (2.673)
Restrictions on purchase of locally issued FX securities						-2.821 (1.860)
Differential treatment of FX deposit accounts						-1.557 (2.482)
Open FX position limits					-5.223** (2.560)	-4.058* (2.190)
Real GDP per capita (log)	5.708*** (1.560)	5.964*** (1.582)	3.542** (1.427)	4.239** (1.871)	4.492** (1.895)	4.928** (2.042)
Region-fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Year effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,237	1,237	1,237	761	729	664
R-squared	0.208	0.242	0.327	0.417	0.404	0.437
No. of countries	50	50	50	50	50	50
Test for coefficient equality with managed float (p-value):						
Hard peg		0.070	0.076	0.316	0.317	0.963
Peg to single currency		0.094	0.198	0.106	0.136	0.079
Basket peg		0.509	0.756	0.770	0.758	0.754
Horizontal band		0.330	0.546	0.789	0.762	0.250
Crawling peg/band		0.167	0.153	0.658	0.872	0.704

Notes: Dependent variable is bank foreign liabilities to GDP (in percent). The reference category is free float. All variables are lagged one period. See Appendix B for variable definitions and data sources. Constant included in all specifications. Clustered standard errors at country level reported in parentheses. ***, ** and * indicate significance at 1, 5 and 10 percent levels, respectively.

Table 6. FX Lending: IMF's De Facto Classification, 1995-2011

	(1)	(2)	(3)	(4)	(5)	(6)
Hard peg	20.379** (9.286)	20.505** (9.549)	9.645 (8.983)	4.154 (9.450)	2.360 (9.430)	2.351 (9.614)
Intermediate	3.485 (5.822)					
Peg to single currency		0.252 (8.715)	-8.945 (6.236)	-6.837 (6.360)	-7.641 (5.554)	-6.480 (6.190)
Basket peg		14.842** (7.282)	-5.925 (6.588)	-10.436 (7.423)	-13.978* (7.137)	-13.371* (7.439)
Horizontal band		-3.020 (6.858)	-5.926 (5.979)	-8.194 (5.771)	-9.681 (6.033)	-9.538 (6.961)
Crawling peg/band		4.537 (7.255)	2.625 (6.447)	2.430 (5.667)	-1.687 (5.801)	-2.540 (5.740)
Managed float		4.188 (5.860)	1.666 (5.202)	2.141 (5.105)	0.631 (4.951)	0.651 (4.915)
Real GDP growth			-0.144 (0.308)	-0.181 (0.308)	-0.141 (0.324)	-0.193 (0.325)
Inflation			-0.148 (0.161)	-0.131 (0.160)	-0.017 (0.171)	-0.086 (0.185)
Net financial flows/GDP			0.671*** (0.222)	0.671*** (0.240)	0.681*** (0.233)	0.681*** (0.229)
Bank foreign liabilities/GDP			0.716*** (0.189)	0.676*** (0.202)	0.686*** (0.181)	0.668*** (0.176)
Inflow controls index				-13.791* (8.036)		-9.055 (8.301)
Restrictions on FX lending					-13.805** (5.399)	-11.362* (5.966)
Restrictions on purchase of locally issued FX securities						0.020 (4.665)
Differential treatment of FX deposit accounts						4.271 (4.818)
Open FX position limits						1.267 (5.222)
Real GDP per capita (log)	-4.476 (4.362)	-4.625 (4.323)	-9.733*** (3.551)	-10.029** (3.504)	-10.268*** (3.309)	-9.769*** (3.164)
Region-fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Year effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	571	571	571	548	539	516
R-squared	0.351	0.360	0.507	0.534	0.571	0.570
No. of countries	44	44	44	43	44	43
Test for coefficient equality with managed float (p-value):						
Hard peg		0.093	0.351	0.828	0.857	0.858
Peg to single currency		0.593	0.052	0.130	0.083	0.172
Basket peg		0.154	0.199	0.079	0.041	0.050
Horizontal band		0.204	0.110	0.024	0.051	0.082
Crawling peg/band		0.953	0.853	0.952	0.657	0.532

Notes: Dependent variable is bank lending in FX to total bank lending (in percent). Dollarized countries are excluded from the estimation. The reference category is free float. All variables are lagged one period. The sample size drops as data on FX lending is available from 1995 onward. See Appendix B for variable definitions and data sources. Constant included in all specifications. Clustered standard errors at country level reported in parentheses. ***, ** and * indicate significance at 1, 5 and 10 percent levels, respectively.

Table 7. Fiscal Balance and REER Deviation: IMF's De Facto Classification, 1980-2011

	Fiscal Balance			REER overvaluation		
	(1)	(2)	(3)	(4)	(5)	(6)
Hard peg	1.328 (1.124)	1.285 (1.130)	0.984 (1.184)	1.743** (0.763)	1.744** (0.748)	1.637** (0.793)
Intermediate	0.289 (0.771)			1.820** (0.714)		
Peg to single currency		-0.779 (1.027)	-0.946 (1.042)		2.386** (0.961)	2.319** (1.085)
Basket peg		3.035** (1.294)	2.585* (1.342)		1.837** (0.852)	1.693** (0.821)
Horizontal band		-0.488 (1.154)	-0.886 (1.265)		2.474** (0.932)	2.361** (0.951)
Crawling peg/band		0.398 (0.954)	0.167 (1.070)		2.741*** (0.901)	2.295** (0.998)
Managed float		0.524 (0.827)	0.433 (0.889)		0.973 (0.749)	0.848 (0.764)
Real GDP growth			0.099 (0.059)			0.138 (0.100)
Inflation			-0.023 (0.017)			0.020 (0.014)
Trade openness			0.001 (0.008)			-0.008 (0.006)
Terms of trade change			0.055*** (0.019)			
Net financial flows/GDP						0.070* (0.038)
Real GDP per capita (log)	0.381 (0.741)	0.274 (0.734)	0.226 (0.733)	0.269 (0.177)	0.225 (0.178)	0.324 (0.257)
Region-fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Year effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,277	1,277	1,277	1,262	1,262	1,262
R-squared	0.116	0.149	0.175	0.076	0.083	0.094
No. of countries	52	52	52	51	51	51
Test for coefficient equality with managed float (p-value):						
Hard peg		0.408	0.537		0.145	0.137
Peg to single currency		0.098	0.061		0.067	0.073
Basket peg		0.057	0.091		0.113	0.131
Horizontal band		0.334	0.223		0.042	0.041
Crawling peg/band		0.874	0.748		0.018	0.059

Notes: Dependent variable is general government fiscal balance to GDP (in percent) in cols. [1]-[3] and REER deviation from trend (in percent) in cols. [4]-[6]. The reference category is free float. All variables (except for terms of trade change) are lagged one period. Constant included in all specifications. Clustered standard errors at country level reported in parentheses. ***, ** and * indicate significance at 1, 5 and 10 percent levels, respectively.

Table 8. Current Account Reversals: IMF's De Facto Classification, 1980-2011
(In percent of GDP)

		Prior balance	Upper quartile	Lower quartile	Reversal probability
		(1)	(2)	(3)	(4)
Surplus					
	Fixed	4.0	4.0	4.0	0.9
	Intermediate	10.3	11.9	5.3	3.2
	Peg to single currency	10.1	11.5	7.2	3.5
	Basket peg	6.6	6.6	6.6	1.1
	Horizontal band	6.9	9.2	4.6	5.6
	Crawling peg/band	7.6	10.1	5.1	2.2
	Managed float	12.6	17.3	5.5	3.7
	Float	6.9	11.9	4.2	1.8
Deficit					
	Fixed	-15.9	-7.1	-19.2	9.3***
	Intermediate	-11.5	-6.4	-13.1	7.3***
	Peg to single currency	-11.4	-8.5	-13.6	8.5***
	Basket peg	-11.0	-9.8	-11.6	5.3
	Horizontal band	-9.3	-7.4	-12.3	9.9***
	Crawling peg/band	-8.9	-5.6	-9.2	7.2**
	Managed float	-14.5	-5.5	-19.8	6.6**
	Float	-6.7	-4.2	-9.9	1.8

Note: Reversals defined as in Freund (2005). Prior balance indicates the maximum surplus or deficit prior to the reversal (in percent of GDP). Reversal probability indicates the frequency of reversal as a proportion of exchange rate regime observations. ***, ** and * indicate statistical significance of difference in proportions from the (independent) float category at the 1, 5, and 10 percent levels, respectively.

Table 9. Crisis Occurrence in EMEs: 1980-2011
(In percent of crisis observations)

	Bank	Currency	Debt	Growth	Total no. of crisis observations
Bank	...	27.6	13.8	19.0	58
Currency	43.8	...	21.9	29.7	64
Debt	56.0	68.0	...	12.0	25
Growth	31.1	32.8	8.2	11.5	61

Note: Table depicts the percentage of crisis observations preceded (in the last two years) or accompanied by other types of crises, along with the total number of crisis observations for each type of crisis.

Table 10. Banking and Currency Crises: IMF's De Facto Classification, 1980-2011

	Banking Crisis			Currency Crisis		
	(1)	(2)	(3)	(4)	(5)	(6)
Hard peg	0.473 (0.568)	0.502 (0.568)	0.243 (0.599)	-0.390 (0.401)	-0.389 (0.405)	-0.696* (0.374)
Intermediate	0.803** (0.393)			0.351 (0.224)		
Peg to single currency	0.641 (0.434)		0.472 (0.473)	0.296 (0.262)		0.173 (0.330)
Basket peg	0.734* (0.446)		0.491 (0.527)	-0.124 (0.350)		-0.326 (0.452)
Horizontal band	1.366*** (0.419)		1.197*** (0.444)	0.219 (0.368)		0.212 (0.425)
Crawling peg/band	0.985** (0.384)		0.750* (0.414)	0.494** (0.251)		0.194 (0.303)
Managed float	0.533 (0.422)		0.463 (0.467)	0.276 (0.225)		0.240 (0.271)
REER deviation	3.584*** (1.068)			4.157*** (1.466)		
Reserves/GDP	-0.026** (0.012)			-0.082*** (0.016)		
Bank foreign liabilities/GDP	0.013** (0.005)			0.015* (0.008)		
Domestic credit expansion	0.013* (0.007)					
Net financial flows/GDP	0.023* (0.014)					
Current account balance/GDP				-0.029** (0.012)		
Real GDP growth	-0.017 (0.021)			-0.004 (0.019)		
Inflation	0.002 (0.003)			-0.001 (0.003)		
Real GDP per capita (log)	0.094 (0.083)	0.104 (0.084)	0.088 (0.101)	0.014 (0.081)	0.004 (0.083)	0.153 (0.119)
Constant	-3.549*** (0.787)	-3.596*** (0.797)	-3.266*** (0.878)	-2.386** (0.692)	-2.235*** (0.699)	-2.822*** (1.010)
Region-fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,063	1,063	1,063	1,258	1,258	1,258
R-squared	0.033	0.064	0.160	0.042	0.051	0.228
No. of countries	50	50	50	50	50	50
Test for coefficient equality with managed float (p-						
Hard peg	0.946		0.635	0.064		0.002
Peg to single currency	0.653		0.970	0.915		0.779
Basket peg	0.500		0.935	0.205		0.158
Horizontal band	0.003		0.013	0.863		0.938
Crawling peg/band	0.008		0.151	0.221		0.807

Note: Dependent variable is a binary variable with one indicating a banking crisis in cols. [1]-[3] and a currency crisis in cols. [4]-[6], and zero otherwise. See Appendix B for variable definitions and data sources. All regressors are lagged one period. All specifications are estimated using the probit model. Constant included in all specifications. Statistics in parentheses reflect standard errors clustered at the country level. ***, **, and * indicate statistical significance at the 1, 5 and 10 percent levels, respectively.

Table 11. Sovereign Debt Crisis and Growth Collapses: IMF's De Facto Classification, 1980-2011

	Debt Crisis			Growth collapse		
	(1)	(2)	(3)	(4)	(5)	(6)
Hard peg	0.480 (0.429)	0.487 (0.427)	0.254 (0.328)	0.410** (0.197)	0.416** (0.195)	0.447* (0.241)
Intermediate	0.323 (0.407)			0.186 (0.197)		
Peg to single currency		0.341 (0.430)	-0.057 (0.372)		0.563** (0.233)	0.821*** (0.256)
Basket peg		0.327 (0.459)	0.022 (0.441)		0.698** (0.333)	0.841** (0.396)
Horizontal band		0.587 (0.585)	0.349 (0.504)		0.106 (0.393)	0.128 (0.432)
Craw ling peg/band		0.341 (0.443)	0.063 (0.361)		-0.030 (0.241)	0.090 (0.258)
Managed float		0.263 (0.427)	0.093 (0.321)		-0.012 (0.234)	0.019 (0.265)
External debt/GDP			0.630 (0.398)			0.093 (0.251)
Current account balance/GDP			-0.006 (0.014)			-0.045*** (0.014)
REER deviation			1.846* (1.081)			0.635 (0.765)
Reserves/GDP			-0.061** (0.024)			-0.045*** (0.009)
Fiscal balance/GDP			-0.055*** (0.015)			
Real GDP growth			-0.062*** (0.023)			
Inflation			-0.014* (0.007)			
Advanced trading partner growth						-0.279*** (0.069)
Banking crisis						0.910*** (0.225)
Currency crisis						0.220 (0.351)
Debt crisis						0.125 (0.475)
Real GDP per capita (log)	-0.162 (0.141)	-0.151 (0.132)	-0.021 (0.169)	0.309*** (0.085)	0.357*** (0.083)	0.511*** (0.104)
Region-fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,193	1,193	1,193	1,220	1,220	1,220
R-squared	0.048	0.051	0.219	0.059	0.092	0.237
No. of countries	51	51	51	51	51	51
Test for coefficient equality with managed float (p-value):						
Hard peg		0.301	0.565		0.028	0.044
Peg to single currency		0.742	0.507		0.011	0.000
Basket peg		0.824	0.827		0.014	0.017
Horizontal band		0.476	0.554		0.714	0.764
Craw ling peg/band		0.771	0.908		0.931	0.746

Note: Dependent variable is a binary variable with one indicating a sovereign debt crisis in cols. [1]-[3] and growth collapse in cols.[4]-[6], and zero otherwise. See Appendix B for variable definitions and data sources. All regressors (except for trading partner growth) are lagged one period. All specifications are estimated using the probit model. Constant included in all specifications. Statistics in parentheses reflect standard errors clustered at the country level. ***, **, and * indicate statistical significance at the 1, 5 and 10 percent levels, respectively.

APPENDIX A: EXCHANGE RATE REGIMES: DE JURE AND RR CLASSIFICATIONS

Figure A1. Distribution of Exchange Rate Regimes in EMs: IMF's De Jure Classification 1980-2011, (In percent)

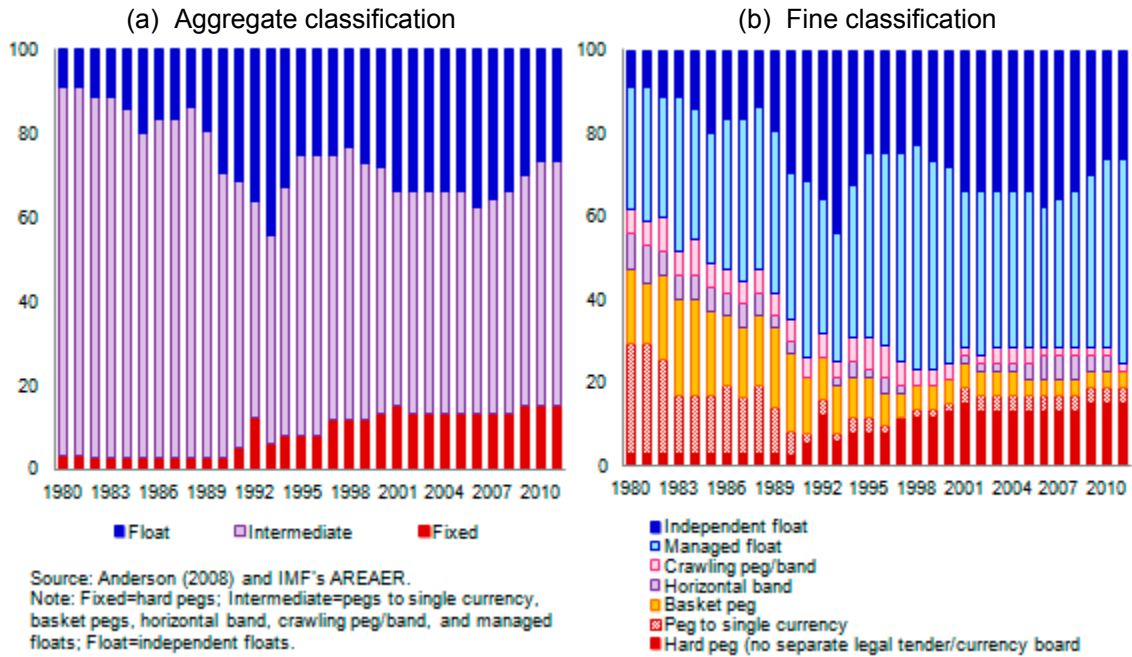


Figure A2. Distribution of Exchange Rate Regimes in EMs: RR's De Facto Classification 1980-2010, (In percent)

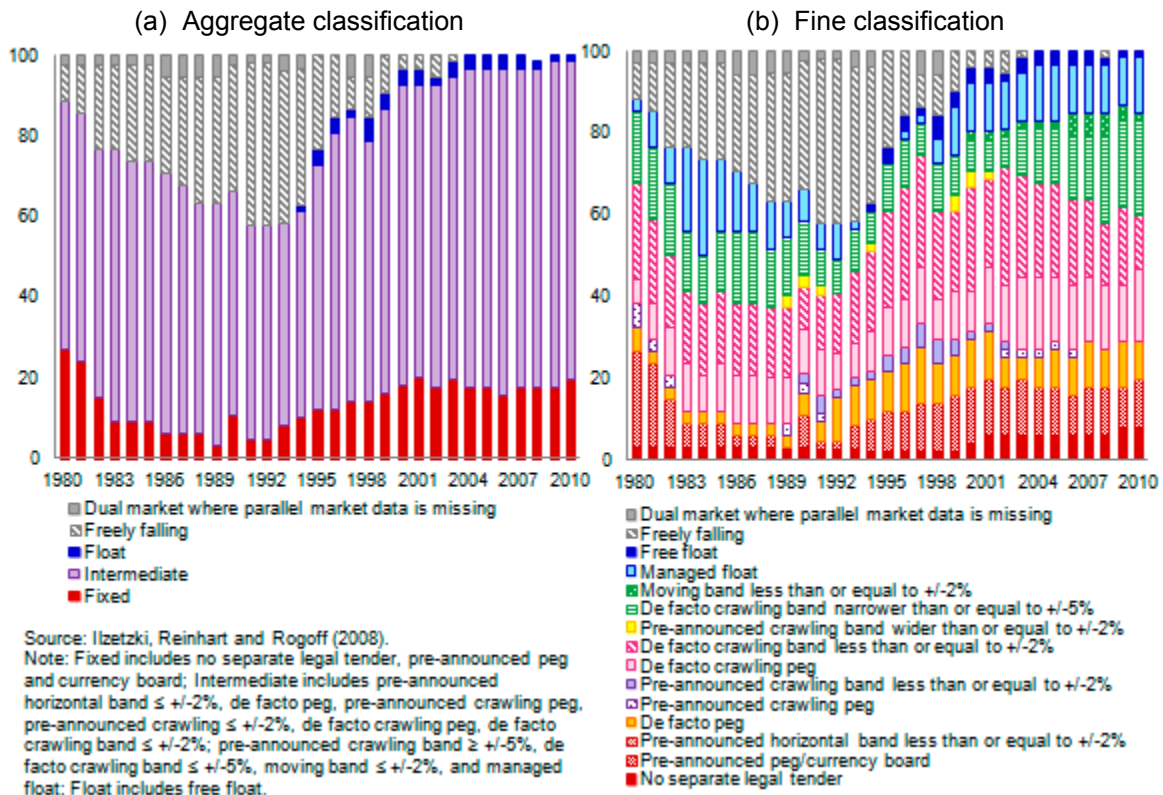


Table A1. List of Countries in the Sample

Albania	Estonia	Panama
Algeria	Georgia	Peru
Argentina	Guatemala	Philippines
Armenia	Hungary	Poland
Belarus	India	Romania
Bosnia & Herzegovina	Indonesia	Russian Federation
Brazil	Jamaica	Serbia, Republic of
Bulgaria	Jordan	Slovak Republic
Chile	Kazakhstan	South Africa
China	Korea, Republic of	Sri Lanka
Colombia	Latvia	Thailand
Costa Rica	Lebanon	Tunisia
Croatia	Lithuania	Turkey
Czech Republic	Macedonia, FYR	Ukraine
Dominican Republic	Malaysia	Uruguay
Ecuador	Mexico	Venezuela
Egypt	Morocco	Vietnam
El Salvador	Pakistan	

Table A2. Transition Probabilities Matrix for EMS: IMF's De Jure Classification, 1980-2011

(a) Aggregate classification

	Fixed	Intermediate	Float
Fixed	0.970	0.008	0.023
Intermediate	0.004	0.959	0.037
Float	0.008	0.067	0.925
Steady-state regime distribution	0.157	0.534	0.309
Regime distribution in 2011	0.151	0.585	0.264

Note: Fixed=hard pegs (no separate legal tender/currency board); Intermediate=pegs to single currency, basket pegs, horizontal band, crawling peg/band, and managed floats; Float=independent floats.

(b) Fine classification

	Hard peg	Peg to single currency	Basket peg	Horizontal band	Craw ling peg/band	Managed float	Independent float
Hard peg	0.970	0.000	0.000	0.000	0.000	0.008	0.023
Peg to single currency	0.010	0.771	0.010	0.000	0.010	0.125	0.073
Basket peg	0.000	0.022	0.914	0.014	0.000	0.043	0.007
Horizontal band	0.021	0.000	0.021	0.792	0.021	0.125	0.021
Craw ling peg/band	0.000	0.016	0.000	0.031	0.875	0.063	0.016
Managed float	0.004	0.014	0.002	0.004	0.004	0.932	0.041
Independent float	0.008	0.000	0.003	0.000	0.005	0.059	0.925
Steady-state distribution	0.153	0.031	0.025	0.014	0.030	0.424	0.323
Regime distribution in 2011	0.137	0.039	0.039	0.000	0.020	0.490	0.275

Table A3. Transition Probabilities Matrix for EMs: RR's De Facto Classification, 1980-2010**(c) Aggregate classification**

	Fixed	Intermediate	Float
Fixed	0.95	0.05	0.00
Intermediate	0.01	0.99	0.00
Float	0.04	0.07	0.89
Steady-state regime	0.17	0.82	0.01
Regime distribution in 2010	0.19	0.79	0.02

Note: Fixed includes no separate legal tender, pre-announced peg and currency board; Intermediate includes pre-announced horizontal band $\leq \pm 2\%$, de facto peg, pre-announced crawling peg, pre-announced crawling $\leq \pm 2\%$, de facto crawling peg, de facto crawling band $\leq \pm 2\%$; pre-announced crawling band $\geq \pm 5\%$, de facto crawling band $\leq \pm 5\%$, moving band $\leq \pm 2\%$, and managed float; Float includes free float. The categories of freely falling and dual market where parallel data is missing are excluded from the computations.

(d) Fine classification

	No separate legal tender/ Pre announced peg/ Currency board	De facto peg	Pre announced crawling peg	Pre announced crawling band $\leq \pm 2\%$	De facto crawling peg	De facto crawling band $\leq \pm 2\%$	Pre announced crawling band $\geq \pm 2\%$	De facto crawling band $\leq \pm 5\%$	Moving band $\leq \pm 2\%$	Managed floating	Free float
No separate legal tender/ Pre announced peg/ Currency board	0.953	0.006	0.000	0.000	0.012	0.012	0.000	0.012	0.000	0.006	0.000
De facto peg	0.009	0.889	0.000	0.000	0.028	0.009	0.009	0.028	0.009	0.019	0.000
Pre announced crawling peg	0.000	0.200	0.800	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Pre announced crawling band $\leq \pm 2\%$	0.053	0.000	0.000	0.842	0.053	0.000	0.053	0.000	0.000	0.000	0.000
De facto crawling peg	0.013	0.019	0.000	0.013	0.906	0.050	0.000	0.000	0.000	0.000	0.000
De facto crawling band $\leq \pm 2\%$	0.011	0.011	0.004	0.000	0.040	0.879	0.004	0.029	0.004	0.015	0.004
Pre announced crawling band $\geq \pm 2\%$	0.000	0.000	0.000	0.000	0.125	0.125	0.500	0.250	0.000	0.000	0.000
De facto crawling band $\leq \pm 5\%$	0.000	0.024	0.000	0.000	0.006	0.047	0.012	0.882	0.000	0.030	0.000
Moving band $\leq \pm 2\%$	0.059	0.059	0.000	0.000	0.000	0.000	0.000	0.000	0.882	0.000	0.000
Managed floating	0.000	0.008	0.000	0.000	0.008	0.033	0.000	0.025	0.008	0.917	0.000
Freely floating	0.037	0.000	0.000	0.000	0.000	0.000	0.000	0.074	0.000	0.000	0.889
Steady-state distribution	0.173	0.119	0.004	0.014	0.182	0.200	0.009	0.143	0.024	0.125	0.007
Regime distribution in 2010	0.192	0.096	0.000	0.000	0.173	0.135	0.000	0.231	0.019	0.135	0.019

Note: The categories of freely falling and dual market where parallel data is missing are excluded from the computations.

APPENDIX B: DATA AND ADDITIONAL ESTIMATION RESULTS

Table B1. Data Description and Sources

Variable	Description	Data sources
<u>IMF's de facto and de jure exchange rate regime classification</u>		
Fine	1: Hard peg (No separate legal tender/currency board); 2: Peg to single currency; 3: Basket currency peg; 4: Horizontal band; 5: Crawling peg/band; 6: Managed float; 7: Independent float	Anderson (2008) ¹ ; IMF's AREAER (various issues)
Aggregate	Fixed: 1, Intermediate: 2-6, Float: 7	
<u>Reinhart and Rogoff's de facto exchange rate regime classification</u>		
Fine	1: No separate legal tender; 2: Pre announced peg/currency board; 3: Pre announced band $\leq \pm 2\%$; 4: De facto peg; 5: Pre announced crawling peg; 6: Pre announced crawling band $\leq \pm 2\%$; 7: De facto crawling peg; 8: De facto crawling band $\leq \pm 2\%$; 9: Pre announced crawling band $\geq \pm 2\%$; 10: De facto crawling band $\leq \pm 5\%$; 11: Moving band $\leq \pm 2\%$; 12: Managed float; 13: Freely floating; 14: Freely falling; 15: Dual market (missing parallel data)	Izetzki et al. (2010) ² Available online at http://personal.lse.ac.uk/izetzki/data.htm
Aggregate	Fixed: 1-2, Intermediate: 3-12, Float: 13	
<u>Crisis variables</u>		
Banking, currency, and debt	Binary variable (1=equals crisis; 0 otherwise)	Laeven and Valencia (2012) ³
Growth crisis	Binary variable (1=equals crisis defined as bottom 5th percentile of the growth decline distribution calculated as the difference between real GDP growth in t and the average growth in t-1, t-2 and t-3; 0 otherwise)	Authors' estimates
<u>Macroeconomic variables</u>		
Inflation	Annual change in average consumer price index (transformed as $x/(100+x)$ if $x \geq 0$; and $x/(100-x)$ if $x < 0$; ln pct.)	IMF's WEO database
Current account balance to GDP	In percent	IMF's WEO database
Net financial flows to GDP	Excluding reserves (ln percent)	IFS database
External debt to GDP	Foreign debt liabilities to GDP (ln percent)	Updated and extended version of Lane and Milesi-Ferretti (2007) ⁴
Fiscal deficit to GDP	General govt. net lending/borrowing (ln percent)	IMF's WEO database
Real effective exchange rate (REER) deviation	Deviation of the REER from trend (obtained from HP filter; smoothing parameter=100)	Authors' estimates based on REER data obtained from INS
Real GDP growth rate	Transformed as $x/(100+x)$ if $x \geq 0$; and $x/(100-x)$ if $x < 0$ (ln pct.)	IMF's WEO database
Real GDP per capita	In logs	World Bank's WDI
Reserves to GDP	In percent	IFS database
Terms of trade change	Change in terms of trade index (ln percent)	IMF's WEO database
Trade openness	Sum of exports and imports to GDP (ln percent)	IMF's WEO database
Trading partner growth	Export-share weighted average of real GDP growth of top 3 advanced trading partners (ln percent)	Authors' estimates based on IMF's WEO and DOTS databases
<u>Financial variables</u>		
Bank loans in foreign currency to total bank loans	In percent	IMF Staff Reports and staff estimates.
Bank foreign liabilities to GDP	In percent	IFS database
Private sector credit to GDP	In percent	IFS database
Domestic credit boom	3-year change in private sector credit to GDP (ln percentage points)	Authors' estimates
Initial domestic credit to GDP	3-year avg. of private credit to GDP at the start of the boom (ln pct.)	Authors' estimates
<u>Other variables</u>		
Capital account openness index	Index (higher values indicating greater openness)	Extended version of Chinn and Ito (2006) ⁵
Capital controls on inflows index	Index (higher values indicating lower openness)	Schindler (2009) ⁶
Institutional quality	Index (average of 12 political risk components with higher values indicating better institutional quality)	ICRG. Available online at: http://www.prsgroup.com/ICRG.aspx
Reserve requirements	Index (higher values indicating lower requirements)	Detragiache et al. (2008) ⁷
Contagion	Proportion of other EMEs in a (banking or currency) crisis	Authors' estimated based on Laeven and Valencia (2012)
Foreign currency related prudential measures	Binary variable (1=restriction in place; 0 otherwise)	IMF's AREAER (various issues)
Fiscal rules	Binary variable (1=rule exists; 0 otherwise)	IMF's FAD Fiscal Rules database

1/ Anderson, H., 2008, "Exchange Policies before Widespread Floating (1945-89)," mimeo, International Monetary Fund.

2/ Izetzki, E., C. Reinhart and K. Rogoff, 2010, "Exchange Rate Arrangements Entering the 21st Century: Which Anchor Will Hold?" mimeo, UMD.

3/ Laeven, L., and F. Valencia, 2012, "Systemic Banking Crises Database: An Update," IMF Working Paper WP/12/163.

4/ Lane, P., and G.M. Milesi-Ferretti, 2007, "The External Wealth of Nations Mark II: Revised and Extended Estimates of Foreign Assets and Liabilities, 1970-2004," *Journal of International Economics*, 73(2), pp. 223-250.5/ Chinn, M., and H. Ito, 2006, "What Matters for Financial Development? Capital Controls, Institutions, and Interactions," *Journal of Development Economics*, 81(1): 163-192.6/ Schindler, M., 2009, "Measuring Financial Integration: A New Dataset," *IMF Staff Papers*, 56(1), pp. 222-238.

7/ Detragiache, E., A. Abiad, and T. Tresselt, 2008, "A New Database of Financial Reforms," IMF Working Papers 08/266.

Table B2. Robustness Analysis: IMF's De Facto Regime Classification, 1980-2011

	All crisis		Banking crisis				Currency crisis				Debt crisis		Growth crisis	
	Baseline ^a	With controls ^b	Add. Controls ^c	Bank NFA ^d	Bank contagion ^e	Year-effects ^f	Add. Controls ^c	Hyper inflation ^g	Banking crisis ^h	Year-effects ^f	Add. Controls ^c	Year-effects ^f	Add. Controls ^c	Year-effects ^f
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Hard peg	0.506*	0.427	0.521	0.243	0.253	0.471	-0.602	-0.697*	-0.682**	-0.711**	0.030	0.321	0.256	0.529**
	(0.270)	(0.287)	(0.584)	(0.592)	(0.602)	(0.626)	(0.369)	(0.371)	(0.336)	(0.346)	(0.260)	(0.262)	(0.267)	(0.262)
Peg to single currency	0.682***	0.750***	0.458	0.491	0.489	0.522	0.096	0.173	0.282	0.254	0.023	0.223	0.854***	0.739***
	(0.252)	(0.283)	(0.479)	(0.472)	(0.474)	(0.608)	(0.334)	(0.330)	(0.331)	(0.344)	(0.399)	(0.389)	(0.256)	(0.270)
Basket peg	0.198	0.105	0.346	0.488	0.481	0.516	-0.433	-0.326	-0.345	-0.229	0.043	0.335	0.920**	0.794*
	(0.267)	(0.326)	(0.494)	(0.518)	(0.533)	(0.644)	(0.457)	(0.452)	(0.436)	(0.476)	(0.440)	(0.394)	(0.436)	(0.416)
Horizontal band	0.715**	0.607*	1.219***	1.205***	1.179***	1.414**	0.198	0.212	0.290	0.149	0.467	0.479	0.113	0.055
	(0.312)	(0.367)	(0.455)	(0.446)	(0.448)	(0.565)	(0.414)	(0.425)	(0.437)	(0.478)	(0.526)	(0.488)	(0.415)	(0.554)
Crawling peg/band	0.616**	0.460*	0.770*	0.736*	0.742*	0.868*	0.121	0.193	0.362	0.226	-0.021	0.218	0.063	-0.003
	(0.263)	(0.262)	(0.417)	(0.417)	(0.418)	(0.523)	(0.309)	(0.302)	(0.285)	(0.293)	(0.365)	(0.398)	(0.262)	(0.292)
Managed float	0.329	0.399	0.479	0.447	0.464	0.531	0.224	0.241	0.362	0.268	0.161	0.239	0.021	-0.181
	(0.245)	(0.277)	(0.462)	(0.470)	(0.471)	(0.597)	(0.264)	(0.271)	(0.272)	(0.269)	(0.344)	(0.328)	(0.263)	(0.306)
Region-fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,012	1,012	1,031	1,063	1,063	1,063	1,192	1,258	1,258	1,258	1,135	1,193	1,103	1,220
R-squared	0.048	0.21	0.192	0.160	0.163	0.342	0.235	0.228	0.262	0.270	0.236	0.276	0.262	0.371

Note: Dependent variable is a binary variable with one indicating a: crisis (banking, currency, debt or growth) in cols. [1]-[2]; banking crisis in cols. [3]-[6]; currency crisis in cols. [7]-[9]; debt crisis in cols. [10]-[11]; and growth crisis in cols. [12]-[13]. All specifications are estimated as a probit model, with all regressors lagged one period, and constant and region-specific effects included. Clustered standard errors at the country level reported in parentheses. ***, ** and * indicate statistical significance at the 1, 5, and 10 percent levels, respectively.

^a Control variable includes (log) real GDP per capita.

^b Control variables include (log) real GDP per capita, real GDP growth, inflation, net capital flows/GDP, bank foreign liabilities to GDP, domestic credit expansion, real exchange rate overvaluation, reserves/GDP, current account balance/GDP, external debt/GDP, and fiscal balance/GDP.

^c Control variables include those in Tables 10 and 11, and trade openness/GDP, institutional quality, and capital account openness index.

^d Bank foreign liabilities to GDP ratio replaced with bank's net foreign assets to GDP ratio as a control variable.

^e Bank contagion measure (defined as the proportion of other EMEs in the sample experiencing a banking crisis) included in the regression with other control variables.

^f Year effects included in the specification with other controls variables.

^g A binary variable for hyper inflation (equal to one for inflation rates higher than 40 percent) included in the estimation to control for high inflation cases.

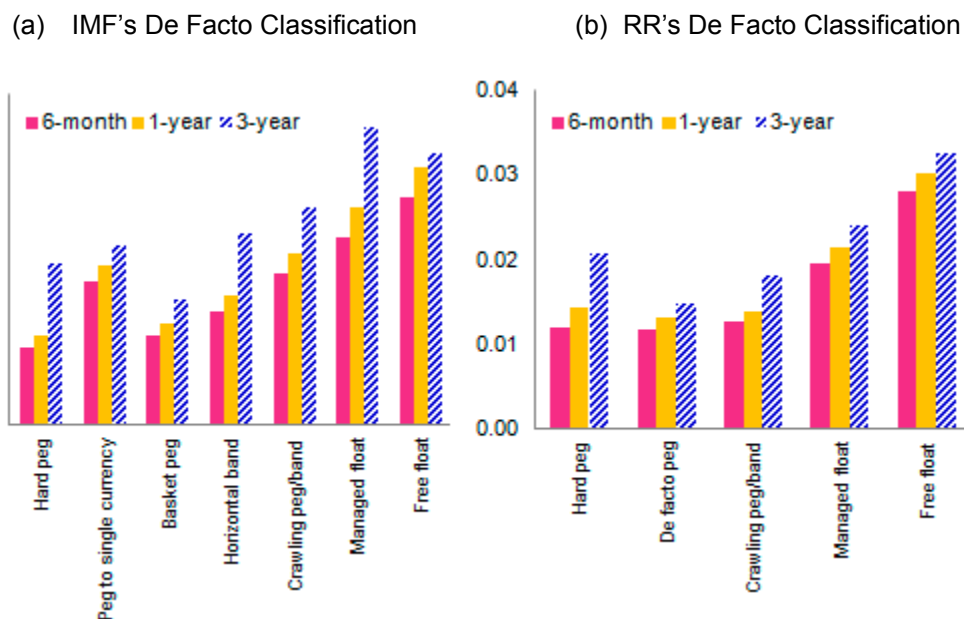
^h A binary variable for banking crisis (lagged) included in the estimation with other control variables.

Table B3: Economic Characteristics and Exchange Rate Regime Switches: IMF's De Facto Classification, 1980-2011

	Switch to less flexible regimes	Switch to more flexible regimes
Net capital flows/GDP (in pct.)	2.2	3.3
FX loans/total loans (in pct.)	37.5	38.9
Domestic credit change (in ppt.)	2.6	1.7
Current acct. balance/GDP (in pct.)	-3.9	-4.4
REER overvaluation (in pct.)	-2.2	2.0**
Real GDP growth (in pct.)	2.0	1.8
Institutional quality index	0.6	0.6
Capital account openness index	-0.1	-0.4
Trade openness (in pct.)	73.1	73.7

Note: Statistics reflect average in year before the exchange rate regime switch. ** indicate that the difference in means between those switching toward more flexible regimes and those toward less flexible regimes is statistically significant at the 5 percent level.

Figure B1. NEER Volatility and Exchange Rate Regimes
(In percent)



Source: Authors' calculations.

Note: Volatility is defined as average (for the corresponding year) of rolling standard deviation of monthly percentage change in nominal effective exchange rate (NEER) over horizon n (where n=6, 12 and 36 months).

Table B4. Crisis Susceptibility: IMF's De Jure Classification, 1980-2011

	Banking 1/			Currency 2/			Debt 3/			Growth 4/		
	Baseline	Baseline	With controls	Baseline	Baseline	With controls	Baseline	Baseline	With controls	Baseline	Baseline	With controls
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Hard peg	0.122 (0.467)	0.125 (0.457)	-0.022 (0.457)	-0.595 (0.377)	-0.594 (0.377)	-0.776*** (0.293)	0.542* (0.314)	0.535* (0.311)	0.365 (0.286)	0.447** (0.187)	0.432** (0.187)	0.473** (0.205)
Intermediate	0.465*** (0.177)			0.138 (0.146)			0.435 (0.273)			0.253 (0.177)		
Peg to single currency		0.289 (0.366)	0.054 (0.411)		0.425** (0.189)	0.329 (0.251)		0.675** (0.312)	0.155 (0.327)		0.731*** (0.224)	1.017*** (0.272)
Basket peg		0.514* (0.278)	0.385 (0.305)		0.026 (0.305)	-0.081 (0.304)		0.285 (0.407)	0.101 (0.387)		0.493* (0.294)	0.685** (0.312)
Horizontal band		0.807*** (0.297)	0.745** (0.311)		0.210 (0.310)	0.268 (0.275)		0.781* (0.438)	0.592 (0.366)		0.540 (0.399)	0.612 (0.395)
Crawling peg/band		-0.014 (0.440)	-0.052 (0.450)		-0.293 (0.339)	-0.180 (0.332)					-0.241 (0.476)	0.046 (0.492)
Managed float		0.507*** (0.176)	0.452** (0.186)		0.126 (0.157)	0.037 (0.189)		0.452 (0.287)	0.258 (0.252)		0.090 (0.171)	0.230 (0.176)
Region effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,063	1,063	1,063	1,258	1,258	1,258	1,193	1,140	1,140	1,220	1,220	1,220
R-squared	0.030	0.039	0.150	0.0382	0.0487	0.229	0.059	0.076	0.221	0.0622	0.0873	0.229
No. of countries	50.00	50.00	50.00	50	50	50	51	51	51	51	51	51

Note: Dependent variable is a binary variable with one indicating a crisis and zero otherwise. Baseline specification includes (log of) real GDP per capita and region-specific effects. Missing estimated coefficients corresponding to exchange rate regimes indicate that such regimes (and corresponding observations) are dropped from the estimation as they predict failure perfectly. All regressors (except for trading partner growth) are lagged one period. See Appendix B for variable definitions and data sources. Constant included in all specifications. Standard errors reported in parentheses are clustered at country level. ***, **, * indicate statistical significance at 1, 5, and 10 percent levels, respectively.

1/ Controls include (log of) real GDP per capita, real GDP growth rate, inflation, net financial flows/GDP, domestic credit boom, bank foreign liabilities/GDP, REER deviation from trend, and reserves/GDP.

2/ Controls include (log of) real GDP per capita, real GDP growth rate, inflation, current account balance/GDP, bank foreign liabilities/GDP, REER deviation

3/ Controls include (log of) real GDP per capita, real GDP growth rate, inflation, current account balance/GDP, fiscal balance/GDP, external debt/GDP, REER

4/ Controls include (log of) real GDP per capita, current account balance/GDP, external debt/GDP, trading partner growth, REER deviation from trend, reserves/GDP, and indicators for banking, currency, and debt crises.

Table B5. Crisis Susceptibility: RR's De Facto Classification, 1980-2010

	Banking 1/			Currency 2/			Debt 3/			Growth 4/		
	Baseline	Baseline	With controls	Baseline	Baseline	With controls	Baseline	Baseline	With controls	Baseline	Baseline	With controls
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Hard peg	3.397*** (0.313)	3.365*** (0.312)	3.771*** (0.391)	0.002 (0.536)	-0.002 (0.543)	-0.408 (0.696)	3.756*** (0.249)	3.744*** (0.249)	3.961*** (0.428)	0.480 (0.471)	0.377** (0.171)	0.409** (0.161)
Intermediate	3.548*** (0.155)			-0.205 (0.536)			3.247*** (0.196)			0.103 (0.473)		
De facto peg		3.761*** (0.242)	4.249*** (0.294)		-0.071 (0.562)	0.077 (0.710)						
Crawling peg/band		3.574*** (0.156)	4.079*** (0.194)		-0.279 (0.534)	-0.551 (0.655)		3.247*** (0.212)	3.558*** (0.299)			
Managed float		3.381*** (0.240)	3.896*** (0.246)		-0.168 (0.582)	-0.286 (0.651)		3.327*** (0.253)	3.647*** (0.369)		-0.103 (0.473)	0.094 (0.555)
Region effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	922	922	922	1,052	1,052	1,052	1,020	907	907	1,038	1,038	1,038
R-squared	0.017	0.025	0.138	0.0270	0.0294	0.372	0.035	0.031	0.278	0.0750	0.0750	0.265
No. of countries	49	49	49	49	49	49	50	50	50	50	50	50

Note: Dependent variable is a binary variable with one indicating a crisis and zero otherwise. Baseline specification includes (log of) real GDP per capita and region-specific effects. RR's fine classification is grouped as follows: Fixed= 1-2; Intermediate=3-12; Float=13 (Hard peg=1-2; Horizontal band=3; De facto peg=4; Crawling peg/band=5-9; Managed float=10-12; Float=13). Missing estimated coefficients corresponding to exchange rate regimes indicate that such regimes (and corresponding observations) are dropped from the estimation as they predict failure perfectly. All regressors (except for trading partner growth) are lagged one period. See Appendix B for variable definitions and data sources. Constant included in all specifications. Standard errors reported in parentheses are clustered at country level. ***, **, * indicate statistical significance at 1, 5, and 10 percent levels, respectively.

1/ Controls include (log of) real GDP per capita, real GDP growth rate, inflation, net financial flows/GDP, domestic credit boom, bank foreign liabilities/GDP, REER deviation from trend, and reserves/GDP.

2/ Controls include (log of) real GDP per capita, real GDP growth rate, inflation, current account balance/GDP, bank foreign liabilities/GDP, REER deviation from trend, and reserves/GDP.

3/ Controls include (log of) real GDP per capita, real GDP growth rate, inflation, current account balance/GDP, fiscal balance/GDP, external debt/GDP, REER deviation from trend, and reserves/GDP.

4/ Controls include (log of) real GDP per capita, current account balance/GDP, external debt/GDP, trading partner growth, REER deviation from trend, reserves/GDP, and indicators for banking, currency, and debt crises.