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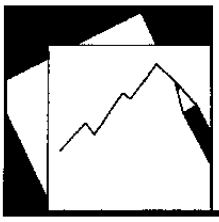

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Exits from Pegged Regimes: An Empirical Analysis

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Exits from Pegged Regimes: An Empirical Analysis

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Abstract

Using countries' de facto exchange rate regimes during 1985–2002, this paper analyzes the determinants of exits from pegged regimes, where exits involve shifts to more or less flexible regimes, or adjustments within the existing regime. Distinguishing episodes characterized by "exchange market pressure" from orderly exits, the estimated probabilities of alternative exit episodes indicate that crises are preceded by a deterioration of economic conditions. In contrast, orderly exits to less flexible regimes are preceded by long regime duration, a decline in foreign liabilities of the banking system, and an increase in official reserves. Exits to more flexible regimes are associated with both emerging market and other developing countries, and an increase in trade openness and government borrowing from banks. The results are robust to alternative sensitivity analyses and have reasonable predictive performance, confirming that economic and financial conditions and regime duration play important roles in determining the future course of exchange rate regimes.

JEL Classification Numbers: F3, F31

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I. INTRODUCTION

Over the last decade, global exchange rate arrangements have undergone momentous changes, with many countries revising their exchange rate policies, either voluntarily in an orderly fashion or because of exchange market pressures. Thus, in the course of the 1990s, some countries exited pegged exchange rate regimes and adopted floating regimes (e.g., Mexico in December 1994, Thailand in late 1997, and Brazil in January 1999—all yielding to downward pressures on their currencies). At the same time, others moved in the opposite direction (e.g., the members of the European Union adopted the euro in January 1999 as part of a long-planned political and economic integration, while Ecuador dollarized in 2000 to revive market confidence in the authorities' macroeconomic policies). Still others adjusted the flexibility of their exchange rate paths within a given pegged regime (e.g., Israel widened its currency band within the crawling band regime in several steps starting from the early 1990s). Such exchange rate policy dynamics pose a central question—what determines the *nature* of exit from a pegged exchange rate regime?[2]

Several empirical studies have attempted to analyze a part of the above question by identifying the determinants of a currency crisis that typically results in a significant depreciation of the currency under attack or an exit to an alternative exchange rate regime. Klein and Marion (1997), in particular, analyze for a sample of mostly Latin American countries the roles of economic indicators and the duration of time spent within a fixed dollar-peg in determining the probability that the peg would be dissolved. The authors find that the probability of devaluation increases with a decline in the stock of international reserves and appreciation of the real exchange rate, and decreases with an increase in duration within a pegged spell and an increase in trade openness of the economy. However, the authors do not consider exits out of alternative types of pegged regimes (e.g., currency boards, pegs against baskets, crawling pegs, crawling bands, etc.) and also do not distinguish between alternative types of exits, such as disorderly exits caused by exchange market pressure, or orderly exits involving shifts to more flexible or less flexible exchange rate regimes.

Eichengreen, Rose, and Wyplosz (1995) analyze the determinants of shifts across exchange rate regimes for a sample of industrial countries using information on countries' officially announced (or de jure) exchange rate policies described in the IMF's *Annual Report on Exchange Arrangements and Exchange Restrictions*. The authors find that devaluations are preceded by deterioration in economic and political fundamentals while revaluations are mirror images. They also find that many regime transitions—such as revaluations and shifts to floating regimes—are largely idiosyncratic and cannot be distinguished from periods of tranquility when there is no market pressure and no change in the exchange rate regime. Like

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[2] This evolution is also reflected in the gradual decline in the share of pegged regimes among IMF members, from about 80 percent to 56 percent, during 1990–2001 (see Bubula and Otker-Robe, 2002).

Klein and Marion (1997), however, the authors do not attempt to identify factors underlying exits of a common nature, such as shifts across exchange rate regimes intended to alter the flexibility of the exchange rate regime in question.

While the above studies provide a rich understanding of exchange rate regime dynamics, some natural questions remain relatively unexplored. For example, how do the determinants of exits from pegged regimes differ between crises-driven exits and orderly exits? What are the broad economic characteristics underlying orderly shifts to more flexible or less flexible regimes? What information is contained in regime duration regarding the nature of exit from them? This paper attempts to address these questions by extending the analyses by Klein and Marion (1997) and Eichengreen, Rose, and Wyplosz (1995) in several dimensions.

First, it uses in its analysis countries' de facto exchange rate regimes (as opposed to de jure regimes officially stated by the authorities) for a sample of 34 emerging market countries, other developing countries, and industrial countries from 1985 to mid-2002. Second, it analyzes the duration properties of spells within pegged regimes, where exits could involve adjustments within the same regime or shifts to more or less flexible regimes relative to the prevailing one. Third, in analyzing the determinants of exits, the paper distinguishes orderly exits from disorderly ones driven by exchange market pressure, and estimates the probability of five alternative exit modes as a function of regime duration and other economic and financial indicators. The exit modes include (i) periods of exchange market pressure or "crises," (ii) orderly exits involving adjustments within the same regime, (iii) orderly shifts to more flexible regimes, (iv) orderly shifts to less flexible regimes, and (v) orderly shifts to other regimes that cannot be unambiguously compared with the prevailing regime in terms of flexibility.[3] For the purpose of this analysis, all types of pegged regimes are considered (e.g., hard pegs such as currency boards, and soft pegs such as fixed or crawling pegs, and horizontal and crawling bands).

The empirical results, based on a database of countries' de facto regimes and a heterogeneous sample of countries, establish a significant link between deterioration of economic health and crises episodes, and also confirm that economic and financial variables and duration within a pegged spell play an important role in determining the nature of the future exchange rate regime. In particular, crises episodes are associated with a decline in export growth and official foreign reserves, appreciation of the real exchange rate (relative to its trend), and with emerging market economies. The first three indicators proxy for "economic health," confirming that deterioration in economic conditions increases the probability of crises. Emerging markets could be characterized with volatile cross border capital flows, which could affect the sustenance of pegged regimes and precipitate disorderly exits.

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[3] The criteria used to distinguish between exits to "more," "less," and other regimes are discussed in Section III.

As for orderly exits, shifts to more flexible regimes are associated with emerging market economies, increases in trade openness and a measure of monetary relaxation proxied by growth in government borrowing from banks. While emerging markets could be more exposed to volatile capital flows, increased trade openness could increase exposures to terms of trade shocks. These results support the view that financial and trade shocks could be absorbed better by shifting to more flexible regimes. Monetization of government spending could challenge the maintenance of an exchange rate anchor, inducing a shift to a more flexible regime.

Shifts to less flexible exchange rate regimes are overall negatively related to a fall in the foreign liabilities of the banking system relative to their foreign assets and an increase in official reserves. They do not appear to be associated with emerging market and other developing economies. A decline in banks' foreign liabilities could be indicative of a decline in their vulnerability to exchange rate risk, thus supporting a shift to a less flexible exchange rate regime. Similarly, high levels of official reserves would support the maintenance of an exchange rate anchor.[4]

Other interesting results are that the length of time spent in the pegged spell is a significant determinant of the probability of exits and the nature of specific exit episodes.[5] In particular, the probability of exiting to a less flexible exchange rate regime increases with spell duration, while the probability of an adjustment within the same regime declines with duration (the latter result supports Klein and Marion, 1997). The duration variable can be interpreted as a proxy for the consistency of the overall policy mix. Thus, long spell duration could indicate that the exchange rate anchor is "serving the economy well," making it more feasible to shift to a more rigid regime. However, the probability of market pressures also increases with duration, suggesting that any existing vulnerabilities associated with the pegged regime may worsen with time spent in the pegged spell, thereby inducing a currency crisis. These results are robust to a variety of sensitivity tests and the model has reasonable predictive performance.

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[4] One surprising result is that the probability of an exit to a less flexible regime increases with an appreciation of the real effective exchange rate relative to its trend. However, to the extent that an appreciation of the real exchange rate is indicative of an improvement in economic productivity (reflecting Balassa-Samuelson effects), this would support an orderly shift to any type of exchange rate regime, including less flexible ones.

[5] Although the terms "regime duration" and "spell duration" are used interchangeably in this paper, in effect, duration within a regime could be longer than that within a spell. For instance, a spell within a fixed peg regime would end as soon as there is an adjustment within the regime (e.g., devaluation), although the fixed pegged regime would end only if there is a shift out of that regime to any other exchange rate regime.

The paper is organized as follows. Section II provides an overview of the related literature. Section III describes the sample underlying the empirical analysis, establishes the duration properties of the pegged regimes, and describes the manner of exits from them. It then discusses the estimation technique and presents the empirical results. Section IV concludes the analysis.

II. Literature Survey

The empirical literature on exchange rate regime transitions primarily focuses on statistically testing the theories of currency crises. Three broad categories of models provide underlying causes of currency crises: The first generation models of currency crises (pioneered by Krugman, 1979) argue that weak domestic fundamentals reflected in excessive monetary and fiscal expansion, large current account deficits, loss of international reserves, and loss of external competitiveness are key to currency crises. Second generation models (e.g., Obstfeld, 1986) focus on multiple equilibria where self-fulfilling speculative attacks are triggered by the expectation that the government will be forced to follow expansionary fiscal and monetary policies (and hence abandon the exchange rate system); the resulting crises in turn validate these expectations. Third generation models focus on "balance sheet" factors, whereby financial sector weaknesses trigger speculative attacks (e.g., Kaminsky and Reinhart, 1999). Another factor underlying currency crises is contagion, which could be triggered by global shocks or herding behavior of investors (see Calvo, 1998).[6] As summarized in Kaminsky, Lizondo and Reinhart (1997), empirical studies on exchange rate crises cater to one of the following methodologies.

The "descriptive approach" presents stylized facts comparing the behavior of economic variables in the precrisis period with their behavior during noncrisis periods or with the behavior of the same variables in noncrises countries.[7] The following characteristics are identified in the period prior to crises—appreciation of the real exchange rate, deterioration of export performance, higher inflation (relative to noncrisis periods), reversal of capital inflows, decline in international reserves, monetary expansion, fiscal and current account deficits, increasing unbacked banking sector liabilities, a sharp rise in global interest rates and deterioration in terms of trade. Eichengreen, Rose, and Wypolsz (1995) also identify the analogous behavior prior to revaluation (i.e., faster growth of reserves, stronger export growth, tighter monetary and fiscal policies, and stronger external current accounts).

The "signals approach" uses a nonparametric methodology to rank across economic variables with respect to their signaling power for an impending crisis, with the signals triggered by

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[6] See Flood and Marion (1998) for an analysis of the leading theories of currency crises.

[7] See Eichengreen, Rose and Wypolsz (1995), Edwards (1989), Edwards and Santaella (1993), Frankel and Rose (1996), Kaminsky and Reinhart (1999), Moreno (1995), IMF (1998), Kaminsky, Lizondo, and Reinhart (1997).

deviations in the values of these variables beyond a certain threshold value.[8] Using this approach, official international reserves, domestic credit, credit to the public sector, the real exchange rate and domestic inflation appear to be most useful in signaling crises.

The third approach uses discrete dependent variable models to estimate the determinants of a currency crisis in the period ahead, where currency crises are identified by severe foreign exchange market pressure episodes. The general conclusion emanating from these studies is that currency crises are associated with an increase in domestic credit growth, real exchange rate appreciation, and a decline in official international reserves.[9]

While the above body of literature provides a rich understanding of the incidence of currency crises, some natural questions remain relatively unexplored. Do the determinants of exchange market pressure experiences within pegged regimes differ from those of orderly exits? What are the broad economic characteristic underlying orderly shifts to more flexible or less flexible regimes? What information is contained in regime duration regarding the nature of exit from them? This paper attempts to address these questions.

This paper also relates to the studies that analyze the "hollowing out syndrome" or "bipolar view."[10] While the latter literature examines whether there is a marked shift away from soft peg regimes (to hard pegs and floating regimes), this paper focuses entirely on the characteristics of pegged regimes and the factors underlying the transitions within and out of pegged regimes. Thus, exits from floating regimes are not analyzed in this paper.

The two studies that stand out as most relevant for this paper are Klein and Marion (1997) and Eichengreen, Rose, and Wyplosz (1995). Klein and Marion analyze the role of domestic macroeconomic and political variables and the duration within a fixed dollar-peg regime in determining the probability that the peg will be dissolved, for a sample of 16 Latin American countries and Jamaica during late 1950s until 1991. Using data on nominal exchange rates, the authors analyze 102 fixed dollar peg "spells" and identify exits as a change in the value of the peg (either through devaluation or floating) without focusing on the nature of the exit. Using a binary logit model, the authors find that the probability of devaluation increases with an appreciation of the real exchange rate, a decline in foreign reserves, and a change in the political regime, and decreases in trade openness of the economy and duration of the peg spell. Like Klein and Marion, this paper also analyzes the roles of economic and financial variables and spell duration in determining the probability of an exit from the peg. Unlike

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[8] See Kaminsky and Reinhart (1999), Kaminsky, Lizondo and Reinhart (1997), and Goldstein (1996).

[9] See Berg and Pattillo (1998), and Kaminsky, Lizondo, and Reinhart (1997), and the references within for a comprehensive discussion of the relevant studies.

[10] See Fischer (2001), Masson (2001), and Bubula and Otker-Robe (2002).

Klein and Marion, however, it considers exits from a variety of pegged regimes and distinguishes between exits that involve adjustments within the same regime and those that result in a change in the flexibility of the exchange rate relative to the prevailing regime. Moreover, this paper also distinguishes between orderly and crises-driven exits, whereas Klein and Marion do not make this distinction.

Eichengreen, Rose, and Wyplosz (1995) estimate the causes behind and the consequences of currency crises for a sample of 20 industrial countries from 1959 to1994. Crises are defined as periods when a pressure index composed of the weighted sum of changes in international reserves, interest rate, and exchange rate exceeds a threshold value. Using the de jure or officially announced exchange rate regimes of IMF members, the authors identify six alternative types of exchange rate changes: devaluation, revaluation, fixing, floatation, other exchange rate regime events, and a "failed attack.[11] Estimating the probability of the alternative exit modes using a multi-nomial logit model, the authors find that past crises, monetary expansion, past inflation, and deterioration in the current account balance are important determinants of current crises. The authors also find that while failed attacks and devaluations differ from periods of tranquility, neither exchange rate flotation episodes nor other changes in exchange rate regimes can be statistically distinguished from periods of tranquility. The authors hence conclude that regime transitions are largely idiosyncratic.

This paper is close to Eichengreen, Rose, and Wyplosz (1995) in spirit, but some important differences need to be emphasized. First, this paper focuses on a mix of industrial countries and emerging market and other developing countries to allow the estimation results to be generalized across more diverse economies, instead of focusing on industrial countries only. Second, this paper uses data on exchange rate regimes that are identified according to the IMF's de facto exchange rate regime classification. The latter, based on the assessment of countries' actual exchange rate policies, could significantly differ from members' officially stated exchange rate regimes.[12] Third, Eichengreen, Rose, and Wyplosz do not distinguish between exits according to a common objective behind the exit (e.g., whether exits are aimed to increase or decrease the flexibility of the exchange rate regime, or to adjust the exchange rate level within the prevailing regime)—the main focus of this paper. Instead of analyzing the causes behind exits to different types of regimes, this paper analyzes whether the manner of exit (e.g., shifts to more flexible or less flexible regimes, or adjustments within the same regime) is guided by changes in economic or financial indicators.

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[11] Failed attacks include a subset of crisis events when the episode is not accompanied by a change in the exchange rate regime.

[12] These differences have been discussed widely elsewhere (see Bubula and Otker-Robe, 2002, and the references therein).

III. Empirical Analysis

A. Data and Stylized Facts on Pegged Spells

Quarterly data during the period between 1985 and mid-2002 are used to estimate the determinants of alternative types of exits from a pegged regime for a sample of 34 countries.[13] The data on the dependent variable draw on the Bubula and Otker-Robe (2002) database of IMF members' de facto exchange rate regimes.[14] Using this database, the following exchange rate arrangements are identified: (1) foreign currency as legal tender (i.e., formal dollarization), (2) currency union, (3) currency board, (4) conventional fixed peg to a single currency, (5) conventional fixed peg to a currency basket, (6) crawling peg (forward or backward looking), (7) horizontal band, (8) crawling band (forward or backward looking), (9) tightly managed floating, (10) other managed floating, and (11) independently floating. Regimes (1)-(3) are considered as hard pegs, regimes (4)-(8) as soft pegs, and regimes (9)-(11) as floats.

Following the Klein and Marion (1995) convention, an exchange rate "spell" is defined as the time spent (or duration) with a given peg. The duration of a spell is measured in quarters, and the peg must last for at least one quarter to constitute a spell. Starting from a given pegged regime, the dependent variable, D_{it} (in country i at time t), is a qualitative variable that can take five possible values:

$D_{it} = 0$ if there is no change in the pegged regime.

$D_{it} = 1$ if the exchange rate is adjusted within the prevailing exchange rate regime.

$D_{it} = 2$ if there is a shift to a more flexible regime relative to the prevailing regime.

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[13] The sample countries are Argentina, Belgium, Brazil, Chile, the Czech Republic, Ecuador, Egypt, El Salvador, Finland, France, Germany, Greece, Hungary, Iceland, India, Indonesia, Ireland, Israel, Italy, Jordan, Mexico, Norway, the Philippines, Peru, Poland, Portugal, Russia, the Slovak Republic, Spain, Sri Lanka, Thailand, Turkey, the United Kingdom, and Venezuela.

[14] Under the de facto classification emphasis is given on the formal or informal commitment towards a particular exchange rate policy, rather than solely on exchange rate movements. As discussed in Bubula and Otker-Robe (2002), the primary source in identifying de facto policies is the information obtained through IMF's bilateral consultation discussions and provision of technical assistance to member countries, along with regular contacts with IMF desk economists. These views are then supplemented with other sources of information, including an analysis of exchange rate and reserves movements, to reach a final view on the de facto regime.

$D_{it} = 3$ if there is a shift to a less flexible regime relative to the prevailing regime.

$D_{it} = 4$ if there is a shift to another regime that cannot be ranked unambiguously in terms of flexibility relative to the prevailing regime.

An exit characterizing an adjustment of the exchange rate within the prevailing pegged regime includes episodes of devaluation or revaluation. An exit to a more flexible exchange rate regime includes the following: (i) a shift from any pegged regime to a floating regime, (ii) a shift from a hard peg to a soft peg, (iii) a shift from a fixed peg to a band (horizontal or crawling), (iv) a shift from a crawling peg or horizontal band to a crawling band, and (v) a widening of the band within a band regime. Conversely, an exit to a less flexible exchange rate regime includes (i) a shift from a soft peg to a hard peg, (ii) a shift from any band to a fixed peg, (iii) a shift from a crawling band to a crawling peg or horizontal band, and (iv) narrowing of the band within a band regime. When the degree of flexibility of the exited regime relative to the prevailing regime is uncertain, the shift is not ranked in terms of flexibility. Such cases may include shifts between certain soft pegged regimes (e.g., between alternative types of conventional fixed pegs, between fixed pegs and crawling pegs, etc.). These exits are termed as shifts to "other regimes." Appendix I provides a description of the pegged spells in the sample, the duration of the spells, and the nature of exits from them.

The selection of the sample countries was guided by the objective of having as many pegged spells as possible, as well as by the availability of data for the explanatory variables. Some countries that had several pegged spells (such as Angola) could not be included owing to the lack of data on explanatory variables. Others were excluded in order to avoid the two-ended censoring problem arising from incomplete spells (e.g., Austria and Malaysia were excluded because the starting period of their first pegged spell began prior to 1985, while Hong Kong SAR was excluded because its pegged spell continued after the end of the sample in mid-2002). Including such exchange rate spells would not correctly estimate the probability of an exit.[15] Thus, the pegged spells of all the sample countries start at or after the start of the sample and the spells that have not ended as of mid-2002 are not included in the sample.

Table 1 provides summary statistics of the pegged spells. Using the 11 exchange rate regime categories identified above and the information on regime transitions from 1985 to 2002, a total of 125 pegged spells are identified, of which 37 involve adjustments within the same regime (with 32 devaluations and 5 revaluations), 58 exits to more flexible regimes (with 30 exits to floating regimes and 28 exits to other soft pegs), 14 exits to less flexible regimes (of which 10 exits to hard pegs and 4 exits to other soft pegs), and 16 exits to other regimes.

[15] The probability of an exit would be overestimated if the spell started before the start of the sample or underestimated if the spell did not end before or at the end of the sample.

Table 1. Summary Statistics of Spells

Nature of exit episodes:	
Total number of pegged spells	125
Number of spells with exit involving adjustment within the same regime	37—of which 32 devaluations and 5 revaluations
Number of episodes to more flexible regimes	58 episodes—of which 30 exits to floating regimes and 28 exits to soft pegs
Number of episodes to less flexible regimes	14—of which 10 exits to hard pegs and 4 exits to soft pegs
Number of spells with exit involving shift to other regime (that could not be ranked relative to the prevailing regime in terms of flexibility)	16
Duration of pegged spells:	
Mean duration of all spells in quarters (standard deviation of duration), and median duration	8.2 quarters (9.0 quarters), 4 quarters
Mean duration of spells in which exit involved an adjustment within the regime (standard deviation of duration), and median duration	3.8 quarters (4.7 quarters) , 2 quarters
Mean duration of spells that exited to more flexible regimes (standard deviation of duration), and median duration	9.1 quarters (10.2 quarters), 6 quarters
Mean duration of spells that exited to less flexible regimes (standard deviation of duration), and median duration	15.5 quarters (8.7 quarters), 18 quarters
Mean duration of spells that exited to other regimes (standard deviation of duration), and median duration	8.8 quarters (7.7 quarters), 4.5 quarters
Number of exit episodes and duration of pegged spells under alternative types of pegged regimes:	
Number and nature of exit from fixed pegs to a single currency	15—of which 7 exits to more flexible regimes, 1 exit to a less flexible regime, 3 adjustments within the same regime and 4 exits to other regimes
Mean and median duration of spells that exited from fixed pegs to a single currency	7.1 quarters, 4 quarters
Number and nature of exit from a fixed peg to a basket of currencies	10—of which 2 exits to more flexible regimes, 6 adjustments, and 2 exits to other regimes
Mean and median duration of spells that exited from conventional fixed peg to a basket	10.1 quarters, 2.5 quarters
Number and nature of exit from crawling pegs	18—of which 10 exits to more flexible regimes, 3 adjustments within the same regime and 5 exits to other regimes
Mean and median duration of spells that exited from crawling pegs	9.3 quarters, 8 quarters
Number and nature of exit from horizontal bands	49—of which 21 exits to more flexible regimes, 11 exits to less flexible regimes, 3 adjustments within the same regime and 14 exits to other regimes

Table 1. Summary Statistics of Spells (continued)

Mean and median duration of spells that exited from horizontal bands	8.7 quarters, 5 quarters
Number and nature of exit from crawling bands	32—of which 16 exits to more flexible regimes, 2 exits to less flexible regime, 10 adjustments within the same regime and 4 exits to other regimes
Mean and median duration of spells that exited from crawling bands	5.6 quarters, 4 quarters
Duration of exit from a hard peg (1 exit, to a more flexible regime)	43 quarters
Memorandum items:	
Country with longest pegged spell when exit occurred to a more flexible regime	Thailand (50 quarters) exited from a fixed peg to an undisclosed basket to an independent float in 1997:Q3
Country with longest pegged spell when exit occurred to a less flexible regime	El Salvador (32 quarters) exited from a fixed peg to the U.S. dollar by adopting the dollar as legal tender in 2002:Q1.

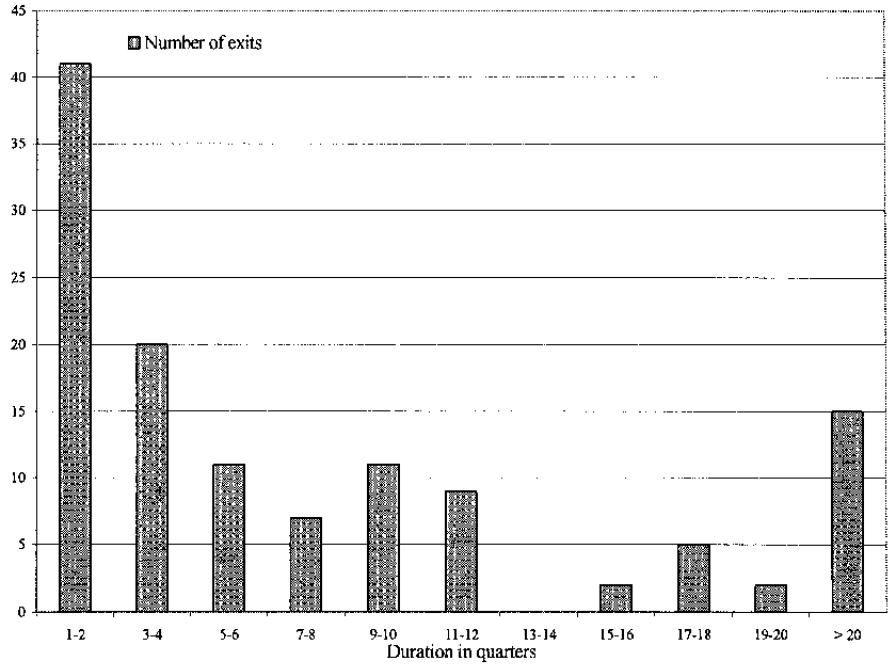
Table 1 indicates that the pegged spells in the sample were relatively short lived. Although the average duration of all spells taken together was slightly over two years (8.2 quarters), the median duration was 4 quarters (i.e., about 50 percent of the spells lasted for at most a year only). In fact, 41 spells ended before or at 6 months, about 20 lasted longer than 6 months but ended before or at one year, and about 15 pegged regimes lasted more than 5 years (Figure 1).[16] When distinguished by type of exit, the average and median duration of spells that exited to less flexible regimes (15.5 and 18 quarters, respectively) are longer than duration of spells that adjusted within the same regime (3.8 and 2 quarters, respectively), or shifted to more flexible exchange rate regimes (9.1 and 6 quarters, respectively) or other regimes (8.8 and 4.5 quarters, respectively). Thus, spells that lasted relatively longer ended in general by shifting to less flexible regimes, while spells with relatively short durations ended through adjustments within the prevailing regime. The analytical exercise in the following subsection confirms this observation.

There is a wide variation in the duration properties of spells among different types pegged regimes, however. The average duration of conventional fixed pegs to a currency basket is the longest (10.1 quarters), while that of crawling bands is the shortest (5.6 quarters). The former result is primarily led by the duration of the basket peg regime of the Thai baht (50 quarters) prior to its exit to a floating regime. Thus, when distinguished by median

[16] Compared with these results, the average duration of the dollar pegged spells analyzed by Klein and Marion (1995) was relatively longer (32 months), although median duration was relatively shorter (10 months).

duration, fixed pegs to a basket appear to have the shortest duration (2.5 quarters), while crawling pegs have the longest duration (8 quarters).

Figure 1. Exits by Duration



Figures 2–4 present other interesting findings on pegged spells in the sample. Figure 2 illustrates the number of spells by country, providing some indication of variation across different countries in the frequency of regime shifts. Out of a total of 125 spells, Israel seems to have experienced the largest number of spells (11). Figure 3 presents the longest duration of spells by country, suggesting again a significant variation in the ability to maintain a given pegged spell. Thailand experienced the longest spell (lasting 50 quarters, or 12 ½ years) followed by Argentina, both of which exited to more flexible regimes. Finally, Figure 4 shows that the year 1992 had the largest number of exits (mostly accounting for the parity adjustments and exits during the exchange rate mechanism (ERM) crisis, including the collapse of the Nordic countries' pegs), followed by 1998 (when several emerging market crises occurred and resulted in regime shifts to floating) and 1999 (when the euro was adopted in Western Europe). The figure also shows that the number of exit episodes increased significantly in the 1990s.

Figure 2. Number of Spells by Country

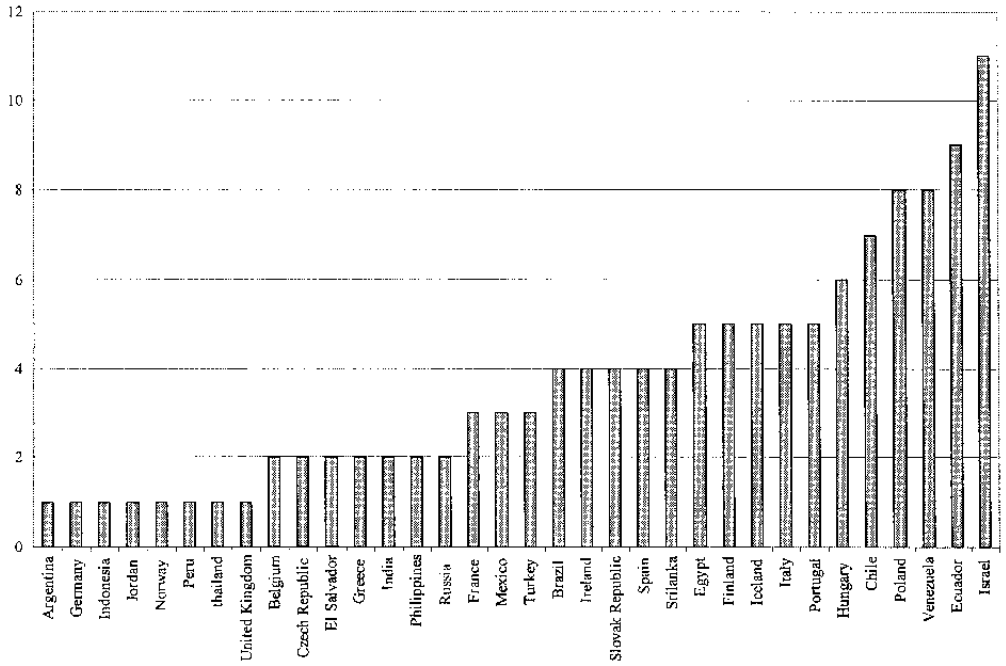


Figure 3. Duration of Longest Spell by Country

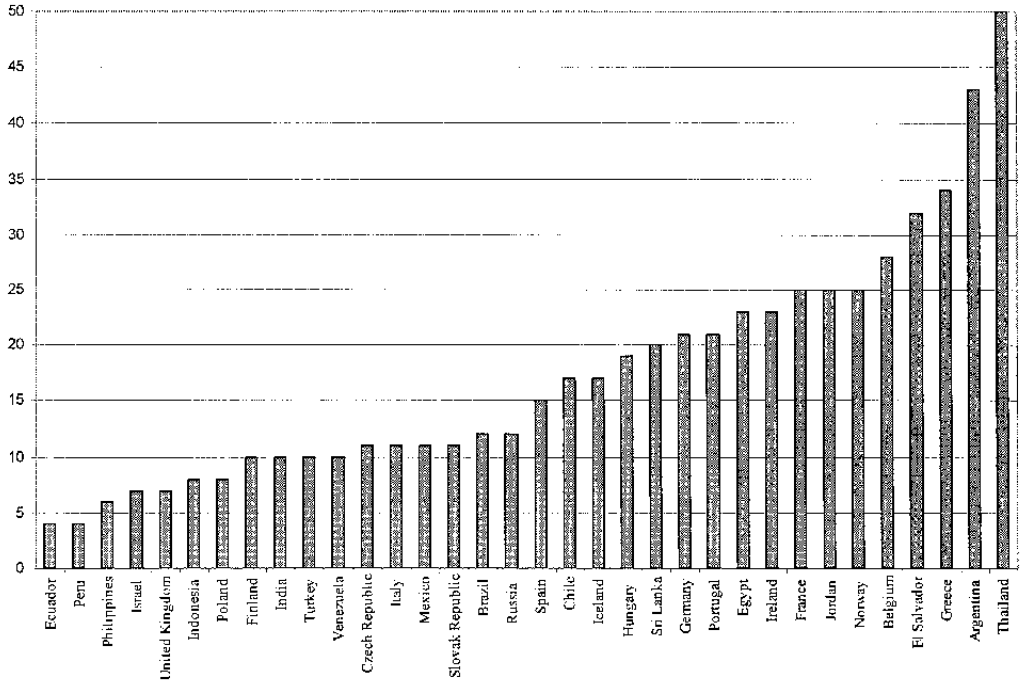
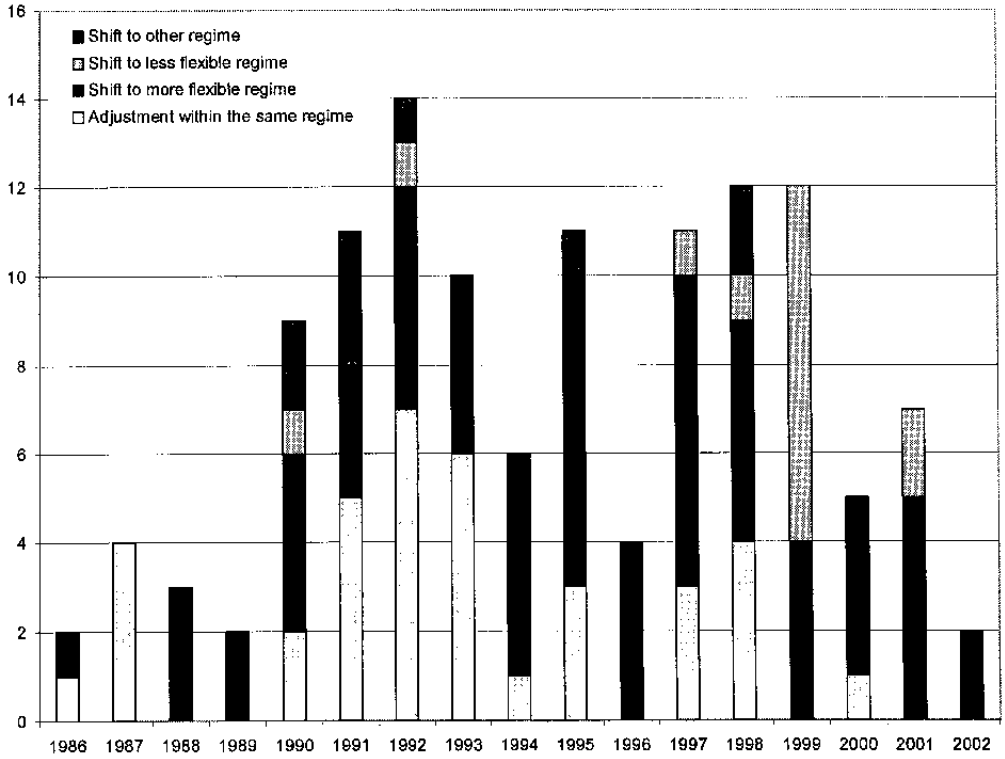


Figure 4. Exits by Year and Nature



B. Estimating the Determinants of Exit

The Basic Model

This subsection analyzes the determinants of an exit from a pegged spell, by computing the probability that the regime variable, D_{t+1}, takes the value j in the following period (t+1), based on the information available up to the current period (t). Assuming that there are J+1 possible outcomes given by $D_t = 0, 1, \ldots, J$, the probability of these events occurring in the following period can be expressed as:

$$(1) \qquad \text{Prob}\,(D_{t+1} = 0 \mid X_t) = \frac{1}{(1+\sum_{j=1}^{J}\exp(X_t\beta^j))}, \text{ and}$$

$$(2) \qquad \text{Prob}\,(D_{t+1} = j \mid X_t) = \frac{\exp(X_t\beta^j)}{(1+\sum_{j=1}^{J}\exp(X_t\beta^j))}, \text{ for } j = 1,2,\ldots,J,$$

where, X_{it} is the vector of variables used to explain the determinants of the alternative events and β is the associated vector of coefficients. The probability of a particular exit episode j relative to the continuation of the spell would hence be given by:

$$(3) \qquad (\frac{\text{Prob}(D_{t+1} = j)}{\text{Prob}(D_{t+1} = 0)} \mid X_t) = \exp(X_t \beta^j) .$$

The expression on the left hand side of Equation (3) is called the odds ratio for exit episode j (probability of exit episode j relative to the continuation of the spell). The elements of β represent the effect on the odds ratio of a change in the variables contained in X_t.

Before discussing the alternative exit episodes (i.e., j in Equation (3)), it is important to note that the current sample has a mix of exits, some of which are crisis driven, while others occurring in an orderly fashion. However, the factors triggering a disorderly exit are expected to be different from the causes behind exits that occur in an orderly fashion. For instance, while a crisis-driven exit to a more flexible regime could be associated with a decline in economic health, this correspondence need not hold for exits to more flexible regimes that occur in an orderly fashion. In fact, orderly exits could occur from positions of macroeconomic strength (e.g., in Israel and Poland, the gradual moves towards increased exchange rate flexibility when faced with capital inflows during the 1990s were also accompanied by a steady buildup of official reserves). Thus, a distinction should be made between crises-driven exits and orderly exits in estimating the determinants of exits from pegged regimes. The following criterion for an "exchange market pressure" episode is used to make this distinction:

$$(4) \qquad \varepsilon_t \geq \bar{\varepsilon} + 2\sigma ,$$

where, ε_t is the quarterly rate of depreciation of the nominal exchange rate (expressed in units of the national currency per U.S. dollar), $\bar{\varepsilon}$ is the average rate of depreciation from the beginning of the first pegged spell until the end of its last pegged spell, and σ is the standard deviation of the depreciation rate during the same period. This criterion picks up "jump changes" in the nominal exchange rate movements when the rate of depreciation of the nominal exchange rate is greater than the average depreciation by at least two standard deviations of depreciation during the same period.[17] Using this criterion, the dependent variable, D_{it} (in country i at time t) now can take one of the following six values:

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[17] In order to rule out situations when large depreciations occur in a hyperinflationary environment (and do not occur because of downward pressure on the exchange rate), an additional condition is imposed that the annual rate of inflation should be less than 90 percent. The robustness of the empirical results is also checked by using an alternative specification to identify crisis (see Appendix II).

$D_{it} = 0$ if there is no change in the pegged regime and the country faces no exchange market pressure (this episode is termed as "tranquility").

$D_{it} = 1$ if the exchange rate is adjusted within the prevailing exchange rate regime in an orderly fashion (i.e., not owing to exchange market pressure).

$D_{it} = 2$ if there is a shift to a more flexible regime relative to the prevailing regime, and the exit occurs in an orderly fashion.

$D_{it} = 3$ if there is a shift to a less flexible regime relative to the prevailing regime, and the exit occurs in an orderly fashion.

$D_{it} = 4$ if there is a shift to other regimes, and the exit occurs in an orderly fashion

$D_{it} = 5$ if there is exchange market pressure as defined by the above criterion (whereby the exchange rate regime could be successfully defended, or involve a devaluation or shift to an alternative exchange rate regime).

The sample of exits is now disaggregated into 41 orderly exits to more flexible regimes, 14 orderly exits to less flexible regimes, 15 orderly shifts to other regimes, 28 orderly adjustments within the same regime, and 30 episodes with "exchange market pressure." This distinction permits an analysis of whether factors underlying crisis episodes differ from orderly exits, and also permits an examination of any systematic relationship between changes in economic and financial indicators and the nature of orderly exits from pegged regimes.[18] The explanatory variables used in the regression analysis include measures of foreign currency liquidity, external competitiveness, external performance, banking system vulnerability, fiscal vulnerability, and trade openness, as well as duration within the pegged spell, and two dummy variables signifying the nature of the economy and the existence of an IMF program. These variables and the expected sign of the associated coefficients are discussed in detail in Box 1.[19]

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[18] To economize on the loss in degrees of freedom in the regression model and to assess the argument that all "crisis" episodes should be driven by a deterioration of economic conditions, episodes of exchange market pressure are not disaggregated further in terms of the nature of exit from the pegged regime. However, see Appendix II for a robustness analysis, which disaggregates exchange market pressure episodes into "failed attacks," when the exchange rate regime is successfully defended, and other disorderly exits.

[19] Appendix III describes these explanatory variables in more detail.

Box 1. Explanatory Variables used in the Regression

(i) **Foreign currency liquidity**, measured by the level of official international reserves as a percentage of imports. The adoption of a less flexible exchange rate regime could require higher reserves (or no declines in the existing level of reserves) to improve the credibility of the peg. An episode of exchange market pressure is expected to be associated with a decline in reserves. For other types of exits, no specific association is expected between the nature of the exit and the level of reserves.

(ii) **A change in external competitiveness** proxied by the deviation of the real effective exchange rate (REER) from its trend. An appreciation of the REER under a pegged regime could imply a deterioration of external competitiveness, thus inducing a shift to a more flexible regime (or an adjustment within the same regime) or a crisis.

(iii) **Export performance** measured by the annual growth in export revenue (measured in dollars). [1] Orderly exits would be associated with an improvement or no change in export performance, while crisis episodes with a decline in export performance.

(iv) **Net open foreign exchange positions of banks**, proxied by foreign liabilities of commercial banks (expressed as a share of their foreign assets). An increase in this variable implies greater vulnerability to exchange rate risk that could induce a shift to a more flexible regime (in an orderly or disorderly manner). Conversely, a shift to a less flexible regime is expected to be accompanied with a decline in bank vulnerability (to increase the credibility of the pegged regime). The ratio of nonperforming loans to total loans would be a good proxy for banking system vulnerability, but could not be included owing to the lack of this data at quarterly frequency.

(v) **Fiscal vulnerability** measured by the annual growth of government borrowing from the banking system. An increase in this variable is expected to undermine the sustainability of a pegged regime, thus inducing either adjustments within the same regime or shifts to more flexible regimes (either in an orderly or disorderly manner), and decreasing the probability of shifting to a less flexible regime. Fiscal deficit would be a better proxy for fiscal vulnerability. However, such data on a quarterly frequency were not available for all the sample countries.

(vi) **Spell duration** to analyze whether the length of the pegged spell could explain the nature of exit. The statistical analysis in the previous section indicated that exits to less flexible regimes are associated with relatively long spell duration (compared with other exits). An increase in time spent within a pegged spell could reflect that the exchange rate anchor is "working well"—either owing to perceived appropriateness of the overall policy mix or to other factors, such as the existence of tight exchange controls that safeguard the exchange rate from volatile cross-border capital flows—thus decreasing (increasing) the probability of shifting to a more (less) flexible regime.

(vii) **Trade openness**, expressed as the sum of exports and imports as a percentage of GDP, to measure the degree of trade integration with the rest of the world. When trade openness increases the costs of a pegged regime (e.g., terms of trade shocks), this could increase (decrease) the probability of shifting to a more (less) flexible regime. However, when openness increases the costs of dissolving a pegged regime (e.g., increase in domestic inflation induced by devaluation or a shift to a more flexible regime), this could decrease (increase) the probability of exiting to a more (less) flexible regime.

(viii) **Dummy variables to describe the nature of the economy**—for example, emerging market countries, industrial countries and non-emerging developing countries check on whether the nature of exit depends on these structural characteristics.

(ix) **A dummy variable for an IMF program,** to see whether the shift to an alternative type of exchange rate regime is related to "IMF advice" under an economic program (see Collins, 1996 for the use of a similar variable).

(x) **Alternative proxies for expansionary monetary policies** (e.g., credit to the private sector or total domestic credit in percentage of GDP, growth of base money in percentage of GDP). These indicators did not behave in any systematic manner in the regression analysis and the results are not reported here.

[1] Owing to the absence of data on export price index for all countries in the sample, export growth could not be computed in real terms. Although export growth is closely related to REER (e.g., an appreciation of the REER may cause a decline in export growth), trends in export behavior are also influenced by various other economic conditions unrelated to the REER. These might include export quotas, special bilateral or multilateral agreements, tariff preferences, and recession in the main trading partner. Thus, these two variables could still be used together in the same regression.

Estimation results

Table 2 reports the estimation results. To avoid an overlapping of episodes, the data are refined to ensure that the five exit modes are at least a year apart.[20] Each coefficient (i.e., elements in vector β) represents the impact of a change in a given explanatory variable on the logarithm of the odds ratio (see Equation (3)). The parentheses contain probability values (p-values)—the statistical significance of an explanatory variable increases with lower p-values. Results that are statistically significant at least at the 15 percent level are discussed below.

The probability of a crisis increases with declines in export growth and official foreign reserves, and with an appreciation of the REER relative to its trend, and is higher for emerging market economies. The first three variables representing the degree of "economic health" confirm that a deterioration of economic health increases the vulnerability to exchange market pressure. Emerging market economies could be characterized by volatile cross-border capital flows, which could challenge the sustainability of the pegged regime and precipitate crisis.[21] The probability of a crisis declines with the existence of an IMF program. Crises are also preceded by a relatively long duration within the pegged spell—implying that existing inconsistencies between the pegged regime and other economic policies could be exacerbated with increase in spell duration. Interestingly, however, increases in the government's borrowing from the banking system, foreign liabilities of banks, or trade openness appear to have no significant impact on the probability of crises.

The probability of an orderly shift to a more flexible exchange rate regime is higher for emerging market and nonemerging market developing countries, and rises with an increase in trade openness and government borrowing from the banking system. An increase in trade openness may increase exposure to terms of trade shocks, which could be better absorbed by adopting a more flexible exchange rate regime. At the same time, a rise in government borrowing could challenge the maintenance of a pegged regime, inducing a shift to a more flexible exchange rate regime.

The probability of an exit to a less flexible exchange rate regime is lower for emerging market and other developing economies, and rises with an increase in reserves and spell

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[20] Also, there is loss of observations owing to missing data on some explanatory variables, which reduces the number of exits in the regression to 99 (24 episodes with exchange market pressure, 32 orderly shifts to more flexible regimes, 12 orderly shifts to less flexible regimes, 14 shifts to other regimes, and 17 orderly adjustments within the same regime).

[21] See Horiguchi (2000) for a similar argument. While gross private capital flows would be a better proxy for capital account openness, this variable could not be used owing to the absence of the data (at quarterly frequency) for many of the sample countries.

duration, and a decline in foreign liabilities of banks. As discussed above, an increase in time spent within the peg could indicate that the exchange rate anchor is serving well, supporting

Table 2. Multinomial Logit Regression 1985:1–2002:2[1]

Explanatory Variables	D = 1 Orderly adjustment within the same regime	D = 2 Orderly shift to a more flexible regime	D = 3 Orderly shift to a less flexible regime	D=4 Orderly shift to other regime	D =5 Exchange market pressure episode
Export revenue growth	0.016	-0.002	-0.001	0.010	-0.024*
	(0.29)	(0.90)	(0.96)	(0.45)	(0.14)
Real effective exchange rate	0.042	0.009	0.277**	-0.001	0.066**
(Deviation from linear trend)	(0.35)	(0.80)	(0.01)	(0.96)	(0.08)
Duration within the pegged spell	-0.196**	-0.031	0.250**	0.027	0.048**
	(0.01)	(0.23)	(0.00)	(0.48)	(0.03)
International liquidity	-0.002	0.001	0.006**	-0.001	-0.010**
(NIR as a percent of imports)	(0.55)	(0.76)	(0.03)	(0.60)	(0.00)
Foreign liabilities of banks (as a share	-0.006*	0.0002	-0.024**	-0.007*	0.0002
of foreign assets)	(0.14)	(0.77)	(0.01)	(0.12)	(0.86)
Growth of government borrowing	-0.001	0.001**	-0.001	0.0004	-0.002
from the banking system	(0.67)	(0.02)	(0.85)	(0.57)	(0.57)
Trade openness	-0.009	0.013**	0.002	0.004	-0.007
	(0.45)	(0.06)	(0.84)	(0.76)	(0.42)
Emerging market country (dummy)	-0.966	1.560	-3.285	1.856	0.914
Other developing country (dummy)	-0.161	0.665	-3.500	2.269	-0.449
IMF program (dummy)	-0.031	-0.79	-2.51	-0.249	-0.881
Memorandum items:					
Number of Observations			906		
Log Likelihood			-401.71		
(Pseudo R^2)			(0.12)		
Likelihood Ratio Test, χ^2 (50)			112.33, (0.00)**		

Hypothesis—Coefficients same between	χ^2 Statistic (p-value)	Reject Hypothesis?
Tranquility and exchange market pressure episode	19.9 (0.03)	YES
Tranquility and orderly exit to more flexible regime	21.5 (0.02)	YES
Tranquility and orderly exit to less flexible regime	15.6 (0.11)	YES
Tranquility and orderly exit to other regime	8.6 (0.57)	NO
Tranquility and orderly adjustment within the same regime	10.8 (0.38)	NO

[1] Crisis is defined as: $\varepsilon_t \geq \bar{\varepsilon} + 2\sigma$, where ε_t is the rate of depreciation of the exchange rate over the previous quarter, $\bar{\varepsilon}$ is the average rate of depreciation for the sample and σ is the standard deviation of the rate of depreciation from the mean over the same period. Coefficients represent β in equation 1 and the t statistics are in the parentheses (except for the dummy variables). Coefficients that are significant at the 10 and 15 percent levels are marked by the signs "**," and "*," respectively. The chi-squared statistic for the Wald test checking whether the joint contribution of all coefficients is zero is rejected at 1 percent level.

the adoption of a more rigid exchange rate regime. Similarly, a decline in banks' vulnerability to exchange rate risk and an increase in foreign reserves support a shift to a more rigid exchange rate regime. Surprisingly, these exits are also associated with an appreciation of the REER (relative to trend).[22] The shift to a less flexible regime is negatively related to the existence of an IMF program.

The probability of an orderly adjustment within the same regime is lower for emerging market and other developing economies, increases with decline in foreign liabilities of banks, and decreases in spell duration.

These results indicate that while crisis episodes are generally associated with deterioration in economic indicators (e.g., a decline in official international reserves, appreciation of REER, a decline in export growth), orderly exits could be associated with an improvement of economic health. All orderly exit episodes are negatively related to the existence of an IMF program, which may provide some evidence against the claimed influence of the IMF on the observed trend toward more flexible exchange rate regimes.[23]

The bottom panel of Table 2 presents tests to analyze whether the five exit modes—orderly adjustments within the same regime, orderly shifts to a more or a less flexible regime, orderly shifts to other regimes, and market pressure episodes—are distinguishable from periods of tranquility. The chi-squared test statistics indicate that shifts to more flexible regimes and disorderly exits are significantly different from periods of tranquility (at the 10 percent level of significance). However, orderly shifts to other regimes or orderly adjustments within the same regime are not distinguishable from periods of tranquility.

Robustness Checks

To check the robustness of the above results, the regression analysis is modified in the following ways (see Appendix II for details): (i) by using an alternative criterion to identify disorderly exits, (ii) by allowing crisis episodes to be disaggregated to episodes that were successfully defended, that is, failed attacks, and disorderly exits of alternative modes, (iii) by excluding all exits involving the adoption of the euro (assuming that these exits were more of a political nature rather than being influenced by changes in economic conditions only), and (iv) by excluding all industrial countries from the sample. These modifications did not change the main conclusions of the paper. Finally, two alternative prediction tools used to

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[22] An appreciation of the REER could be associated with improvement in productivity (as in Balassa-Samuelson effects), which could then support an orderly shift to a less flexible exchange rate regime.

[23] For instance, based on a sample of Latin American and Caribbean countries during 1978–1992, Collins (1996) finds that countries involved in IMF programs were more likely to choose flexible regimes.

assess the goodness of fit of the regression model indicate a reasonable prediction performance of the model. Using the first criterion, about 67 percent of the disorderly exits are predicted correctly, as are 53 percent of the orderly exits to more flexible regimes, and 92 percent of the orderly exits to less flexible regimes; using the second criterion, these shares represent 46 percent, 44 percent and 67 percent, respectively.

IV. Conclusions

This paper uses a new database on de facto exchange rate regimes for a diverse sample of 34 countries to address some key issues related to exchange rate regime dynamics. First, based on statistical analyses, it establishes duration properties of alternative kinds of pegged regimes, and finds that exits to less flexible regimes are preceded by longer spell durations relative to other exits. Second, using a multinomial logit model, it estimates the factors underlying a variety of different types of exits from pegged exchange rate spells, including orderly adjustments within the prevailing regime, orderly shifts to more flexible regimes, orderly shifts to less flexible regimes, orderly shifts to other regimes, and exchange market pressure episodes.

The estimation results provide the following main conclusions, which have important policy implications. First, episodes with exchange market pressures are generally preceded by a deterioration of economic conditions. Second, the relationship between economic indicators and the probability of orderly exits depends on the nature of exit. In particular, orderly exits to less flexible regimes are associated with a buildup of international reserves and decline in foreign liabilities of the banking system, presumably to credibly defend the shift to the more rigid pegged regime. On the other hand, orderly exits to more flexible regimes are associated with an increase in fiscal vulnerability and trade openness, which could make a pegged regime more difficult to sustain. Third, emerging markets appear to be more prone to both crises and orderly shifts to more flexible regimes. These economies could be experiencing volatile cross-border capital flows (relative to other economies), posing challenges for the maintenance of a pegged regime. Fourth, the existence of an IMF program does not appear to play a role in leading to crises or orderly shifts to greater or lesser exchange rate flexibility. These results are robust to alternative sensitivity analyses.

Another result worth noting is that the duration within the pegged spell is a significant determinant of the nature of the exit episode. In particular, the probability of exiting to a less flexible exchange rate regime increases with spell duration (while the probability of adjustments within the same regime declines with duration). Long duration within a peg regime could indicate that the exchange rate anchor is "serving well" for the economy, thereby supporting the shift to a less flexible regime. However, the probability of a crisis also increases with the duration within a pegged spell indicating that existing inconsistencies between the exchange rates and other macroeconomic policies could increase with increase in time spent in a pegged spell.

A natural extension of this analysis would be to apply duration models and investigate the nature of time dependence of peg regimes. For instance, it would be interesting to analyze the exit rate (the rate at which spells would be completed over time, given that they have lasted for a certain period of time) for alternative peg regimes. Some other interesting questions could also be explored, including whether exit rates depend on the nature of the exit from the peg regime and whether they increase (or decrease) monotonically or exhibit nonmonotonic behavior. We intend to address these questions as a future extension to this analysis.

NATURE OF EXITS FROM PEGGED EXCHANGE RATE REGIMES

Nature of Prevailing Exchange rate Regime	Country (Number of Exit Episodes)	Period of Exit	Duration of the Pegged Regime	Nature of Exit
Currency board arrangement 1 exit episode	Argentina (1)	2002:1	43 quarters	More flexible regime (independent float)*, +
Fixed peg to a single currency 15 exit episodes	Egypt (3)	1990:3	3 quarters	Adjustment (devaluation) *, +
		1991:1	1 quarter	More flexible regime (horizontal band) *, +
		1999:4	10 quarters	More flexible regime (managed float)
	El Salvador (2)	1990:2	17 quarters	More flexible regime (managed float) *, +
		2001:1	32 quarters	Less flexible regime (dollarization)
	India (2)	1992:4	4 quarters	Adjustment (devaluation)
		1995:3	9 quarters	More flexible regime (managed float)
	Israel (1)	1986:3	4 quarters	Other regime (fixed peg to a basket)
	Mexico (1)	1989:1	3 quarters	Other regime (forward-looking crawling peg
	Philippines (2)	1991:2	1 quarter	More flexible regime (managed float)
		1997:3	6 quarters	More flexible regime (independent float) *, +
	Poland (1)	1991:2	4 quarters	Other regime (fixed peg to a basket)
	Sri Lanka (1)	1990:3	4 quarters	Other regime (backward-looking crawling peg)
	Venezuela (2)	1995:4	5 quarters	Adjustment (devaluation) *, +
		1996:2	1quarter	More flexible regime (managed float) +
Fixed peg to a basket of currencies 10 exit episodes	Czech Republic (1)	1996:1	11 quarters	More flexible regime (horizontal band)
	Hungary (4)	1991:1	3 quarters	Adjustment (devaluation) *, +
		1991:4	2 quarters	Adjustment (devaluation) +
		1992:4	1 quarter	Adjustment (devaluation) +
		1994:1	1 quarter	Adjustment (devaluation) +
	Israel (2)	1987:1	1 quarter	Adjustment (devaluation)
		1988:4	6 quarters	More flexible regime (devaluation and shift to a horizontal band)
	Jordan (1)	1995:4	25 quarters	Other regime (fixed peg to a single currency)
	Poland (1)	1991:4	1 quarter	Other regime (forward-looking crawling peg)
	Thailand (1)	1997: 3	50 quarters	More flexible regime (managed float) *, +
Horizontal band 49 exit episodes	Belgium (2)	1993:3	28 quarters	More flexible regime (widening of band) +
		1999:1	21 quarters	Less flexible regime (currency union)
	Czech Republic (1)	1997:2	4 quarters	More flexible regime (managed float) *, +
	Ecuador (1)	1993:3	2 quarters	Other regime (crawling band with undisclosed bandwidth) +
	Egypt (2)	1997:1	23 quarters	Less flexible regime (fixed peg to a single currency
		2001:2	1 quarter	More flexible regime (devaluation of central parity and widening of band)
	Finland (5)	1988:4	9 quarters	More flexible regime (widening of band)

Nature of Prevailing Exchange rate Regime	Country (Number of Exit Episodes)	Period of Exit	Duration of the Pegged Regime	Nature of Exit
Horizontal band (continued)		1991:4	10 quarters	Adjustment (devaluation of central parity) +
		1992:3	2 quarters	More flexible regime (independent float) +
		1998:1	4 quarters	Adjustment (devaluation of central parity)
		1999:1	3 quarters	Less flexible regime (currency union)
	France (3)	1987:1	2 quarters	Adjustment (devaluation of central parity).
		1993:3	25 quarters	More flexible regime (widening of band)
		1999:1	21 quarters	Less flexible regime (currency union)
	Germany (1)	1999:1	21 quarters	Less flexible regime (currency union)
	Greece (1)	2001:1	11 quarters	Less flexible regime (currency union)
	Iceland (5)	1992:4	15 quarters.	Adjustment (devaluation). *, +
		1993:2	1 quarter	Adjustment (devaluation of central parity).
		1995:3	8 quarters	More flexible regime (widening of bandwidth)
		2000:1	17 quarters	More flexible regime (widening of bandwidth) +
		2001:1	3 quarters	Independent float (more flexible regime) +
	Ireland (4)	1987:1	1 quarter	Adjustment (devaluation of central parity).
		1993:1	23 quarters	Adjustment (devaluation of central parity) +
		1993:3	1 quarter	More flexible regime (widening of band) +
		1999:1	21 quarters	Less flexible regime (currency union)
	Israel (4)	1990:1	2 quarters	More flexible regime (widening of bandwidth).
		1990:3	1 quarter	Adjustment (devaluation of central parity).
		1991:1	1 quarter	Adjustment (devaluation of central parity). *, +
		1991:4	2 quarters	More flexible regime (crawling band) +
	Italy (5)	1986:2	3 quarters	Adjustment (devaluation of central parity).
		1987:1	2 quarters	Adjustment (devaluation of central parity).
		1990:1	11 quarters	Less flexible regime (narrowing of bandwidth)
		1992:3	9 quarters	More flexible regime (independent float) +
		1999:1	8 quarters	Less flexible regime (currency union)
	Norway (1)	1992:4	25 quarters	More flexible regime (managed float)
	Portugal (3)	1992:4	1 quarter	Adjustment (devaluation of central parity).
		1993:2	1 quarter	Adjustment (devaluation of central parity).
		1999:1	21 quarters	Less flexible regime (currency union)
	Russia (1)	1994:1	2 quarters	More flexible regime (managed float)
	Spain (4)	1992:3	12 quarters	Adjustment (devaluation of central parity). +
		1993:2	1 quarter	Adjustment (devaluation of central parity). *, +
		1995:1	5 quarters	Adjustment (devaluation of central parity).
		1999:1	15 quarters	Less flexible regime (currency union)
	Slovak Republic (4)	1996:1	11 quarters	More flexible regime (widening of bandwidth). +
		1996:3	1 quarter	More flexible regime (widening of bandwidth).
		1997:1	1 quarter	More flexible regime (widening of bandwidth).
		1998:4	6 quarters	More flexible regime (managed float)

Nature of Prevailing Exchange rate Regime	Country (Number of Exit Episodes)	Period of Exit	Duration of the Pegged Regime	Nature of Exit
Horizontal band (continued)	Sri Lanka (1)	2001:1	2 quarters	More flexible regime (managed float)
	United Kingdom (1)	1992:3	7 quarters	More flexible regime (independent float) +
Crawling peg 18 exit episodes	Brazil (4)	1990:1	3 quarters	More flexible regime (managed float)
		1994:3	12 quarters	More flexible regime (managed float)
		1998:2	12 quarters	Other regime (from backward-looking to forward-looking crawling peg) +
		1999:1	2 quarters	More flexible regime (independent float) *, +
	Ecuador (2)	1991:3	2 quarters	Adjustment (devaluation.
		1992:3	2 quarters	Adjustment (devaluation). *, +
	Greece (1)	1998:1	34 quarters	More flexible regime (horizontal band).
	Mexico (1)	1991:4	10 quarters	Other regime (although the shift is to a crawling band, the authorities tried to maintain the exchange rate close to the appreciated limit of the band, thereby not fully using the flexibility offered by the band)
	Peru (1)	1990:3	4 quarters	More flexible regime (managed float) +
	Poland (2)	1993:3	5 quarters	Adjustment (devaluation).
		1995:2	6 quarters	More flexible regime (crawling band)
	Portugal (1)	1990:4	17 quarters	Other regime (crawling band with undisclosed width, therefore not considered to be more flexible)
	Russia (1)	1998:3	12 quarters	More flexible regime (managed float) *, +
	Sri Lanka (1)	1995:1	17 quarters	More flexible regime (crawling band)
	Turkey (3)	1995:3	5 quarters	Other regime (from forward-looking to backward-looking crawling peg)
		1998:2	10 quarters	Other regime (from backward-looking to forward-looking crawling peg)
		2001:1	10 quarters	More flexible regime (independent float) *, +
	Venezuela (1)	1994:2	4 quarters	More flexible regime (independent float) *, +

Nature of Prevailing Exchange rate Regime	Country (Number of Exit Episodes)	Period of Exit	Duration of the Pegged Regime	Nature of Exit
Crawling band 32 exit episodes	Chile (7)	1988:1	10 quarters	More flexible regime (widening of bandwidth).
		1989:2	4 quarters	More flexible regime (widening of bandwidth).
		1992:1	10 quarters	More flexible regime (widening of bandwidth).
		1992:3	1 quarters	Other regime (the anchor was shifted from the U.S. dollar to a basket of currencies)
		1997:1	17 quarters	More flexible regime (widening of bandwidth).
		1998:2	4 quarters	Less flexible regime (narrowing of bandwidth).
		1999:3	2 quarters	More flexible regime (widening of bandwidth).
	Ecuador (6)	1994:4	4 quarters	Other regime (from backward-looking to forward-looking crawling band)
		1995:4	2 quarters	More flexible regime (widening of bandwidth).
		1997:1	4 quarters	Adjustment (devaluation)
		1998:1	2 quarters	Adjustment (devaluation)
		1998:3	1 quarter	Adjustment (devaluation)
		1999:1	1 quarter	More flexible regime (independent float) *, +
	Hungary (2)	2000:1	19 quarters	Other regime (the anchor was shifted from a currency basket to the euro).
		2001:2	4 quarters	More flexible regime (widening of bandwidth).
	Indonesia (1)	1997:3	8 quarters	More flexible regime (independent float) *, +
	Israel (4)	1992:4	3 quarters	Devaluation of the central parity (adjustment)*, +
		1993:3	2 quarters	Adjustment (devaluation of the central parity)
		1995:2	6 quarters	More flexible regime (widening of bandwidth).
		1997:2	7 quarters	More flexible regime (widening of bandwidth).
	Mexico (1)	1994:4	11 quarters	More flexible regime (independent float) *, +
	Poland (4)	1995:4	1 quarters	Adjustment (revaluation of the central parity)
		1998:1	8 quarters	More flexible regime (widening of bandwidth).
		1998:4	2 quarters	More flexible regime (widening of bandwidth).
		2000:2	4 quarters	More flexible regime (independent float)
	Portugal (1)	1992:2	5 quarters	Less flexible regime (horizontal band)
	Sri Lanka (1)	2000:2	20 quarters	Other regime (horizontal band with wider bandwidth)
	Venezuela (5)	1997:1	2 quarters	Adjustment (revaluation of the central parity) +
		1997:3	1 quarter	Adjustment (revaluation of the central parity)
		1998:1	1 quarter	Adjustment (revaluation of the central parity)
		2000:4	10 quarters	Adjustment (revaluation of the central parity)
		2002:1	4 quarters	More flexible regime (independent float)

Exits signed "*" or "+" were associated with exchange market pressure defined by the criteria in the main analysis and the robustness analysis, respectively.

ALTERNATIVE ROBUSTNESS TESTS

Alternative Criterion for Defining Crisis

The exchange market pressure index is computed as a weighted average on the monthly depreciation of the nominal bilateral dollar exchange rate and changes in short-term interest rates, with the weights equal to the inverse of the sample standard deviations of each component of the index.[24] The data are refined further to ensure that exit episodes are at least two years apart, and the regression model is estimated using this criterion. The results differ from the original results in the following manner: (i) orderly adjustments within the same exchange rate regime are also associated with an increase in export revenue growth, (ii) orderly shifts to less flexible regimes are no longer associated with an appreciation of the REER relative to trend, (iii) orderly exits to more flexible regimes are no longer associated with increase in trade openness, (iv) orderly exits to other regimes are also associated with increase in spell duration while crisis is not significantly associated with spell duration.

Distinguishing the Nature of Exits for Crises Episodes

Crises episodes are now disaggregated in the same manner as orderly exits. Since crises episodes in the sample were either successfully defended or led to adjustments within the same regime or exits to more flexible regimes only, the dependent variable is now allowed to have eight values according to the following criteria: (i) no change in the regime and no exchange market pressure, (ii) an orderly adjustment within the same regime, (iii) an orderly shift to a more flexible regime, (iii) an orderly shift to a less flexible regime, (iv) an orderly shift to other regimes, (v) a failed attack, i.e., exchange market pressure is withstood without any change in the regime, (vi) a disorderly exit resulting in an adjustment within the same regime, and (vii) a disorderly exit to a more flexible regime. The general results continue to hold with some interesting differences between disorderly exits to more flexible regimes and disorderly exits involving adjustments within the same regime—declines in export revenue and increase in spell duration increase the probability of a disorderly exit to a more flexible regime more significantly than that of a disorderly adjustment within the same regime, while increase in foreign liabilities of the banking system increases the probability of a disorderly exit involving adjustments within the same regime. Both types of disorderly exits are positively associated with emerging market economies and negatively associated with existence of an IMF program.

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[24] This index draws from Bubula and Ötker-Robe (2002). The data on short-term interest rates were obtained from IFS. Money market (MM) rates were used whenever available. Treasury bill rates were used when MM rates were unavailable. Bank lending rates were used when both MM and treasury bill rates were unavailable. Bank deposit rates were used when MM, treasury bill, or bank lending rates were unavailable. Finally, discount rates were used when all other interest rates were unavailable.

Excluding "Politically Influenced" Exits

All exits involving the adoption of the euro are excluded. Arguably, the decision to adopt the euro was in part political and motivated by different factors compared with the other exit cases in the sample. The number of exits to less flexible regimes is now reduced to 5, reducing the total number of exits to 92. However, the original results continue to hold (Table 3).

Table 3. Multinomial Logit Regression, 1985:1–2002:2
(Exits characterized by the adoption of euro excluded)

Explanatory Variables	D = 1 Orderly adjustment within the same regime	D = 2 Orderly shift to a more flexible regime	D = 3 Orderly shift to a less flexible regime	D=4 Orderly shift to other regime	D =5 Exchange market pressure episode
Export revenue growth	0.011	-0.003	-0.003	0.009	-0.030**
	(0.46)	(0.78)	(0.90)	(0.51)	(0.07)
Real effective exchange rate (deviation from	0.040	0.006	0.360**	-0.002	0.065**
linear trend)	(0.37)	(0.85)	(0.02)	(0.97)	(0.09)
Duration within the pegged regime	-0.166**	-0.023	0.265**	0.033	0.071**
	(0.04)	(0.38)	(0.02)	(0.39)	(0.00)
International liquidity	-0.001	0.001	0.007**	-0.002	-0.012**
(NIR as a percent of imports)	(0.58)	(0.78)	(0.03)	(0.56)	(0.00)
Foreign liabilities of banks (as a share of	-0.008**	-0.0002	-0.030**	-0.008*	0.001
foreign assets)	(0.07)	(0.82)	(0.03)	(0.09)	(0.55)
Growth of government borrowing from the	-0.001	0.001**	-0.001	0.0004	-0.001
banking system	(0.72)	(0.01)	(0.81)	(0.53)	(0.55)
Trade openness	-0.006	0.016**	0.030	0.006	-0.001
	(0.62)	(0.02)	(0.61)	(0.64)	(0.87)
Emerging market country (dummy)	-1.555	1.010	-3.708	1.068	0.924
Nonemerging market developing country (dummy)	-0.797	0.045	-3.918	2.425	-1.516
IMF program (dummy)	-0.028	-0.78	-2.02	-0.251	-0.869
Memorandum items:					
Number of observations			787		
Log likelihood			-366.92		
(Pseudo R^2)			(0.12)		
Likelihood ratio test, $\chi^2(50)$			99.05, (0.00)**		

Excluding Industrial Countries

The results continue to hold when all industrial countries are excluded from the sample, and the multinomial regression is reestimated

Predictive Performance

Table 4 presents the prediction probabilities of the exit episodes to assess the goodness of fit of the regression model.[25] A useful prediction rule for a balanced multinomial regression model is "a particular event is predicted to occur if its predicted probability is the maximum of the predicted probabilities for all possible events." However, the current model is unbalanced with a disproportionately large number of observations in tranquility compared to exits implying that the above prediction rule would almost always predict D = 0 relative to the exits.[26] To avoid this problem, the prediction rule is modified in the following two ways:

Criterion 1: A particular exit episode (j) is predicted to occur if the prediction probability for that exit, P_j, is at least as high as the share of observations for that exit episode in the sample.[27]

Criterion 2: A particular exit episode (j) is predicted to occur if (i) its prediction probability, P_j, is at least as high as its share of observations in the sample *and* (ii) P_j is higher than the predicted probabilities for other exit episodes.

Table 4. Prediction Performance

	D = 1 Adjustment within the same regime	D = 2 Orderly shift to a more flexible regime	D = 3 Orderly shift to a less flexible regime	D=4 Orderly shift to other regime	D =5 Disorderly exit
Prediction Rule 1: Predict exit episode (j = 0,1,...,5) if predicted probability for it is greater than the share of exit episode in the sample					
Number of correct predictions	12	17	11	1	16
Total number of observations	17	31	11	14	24
Percentage of correct predictions	70.6	53.1	91.7	7.1	66.7
Prediction Rule 2: Predict exit episode (j = 0,1,...,5) if predicted probability for it is greater than the share of exit episode in the sample, and for all exit events, the predicted probability for the exit episode is greater than the predicted probabilities for other exit episodes					
Number of correct predictions	8	14	8	1	11
Total number of observations	17	31	11	14	24
Percentage of correct predictions	47.1	43.8	66.7	7.1	45.8

[25] The model is predictive in nature since all deterministic explanatory variables are expressed in terms of their lagged values.

[26] See Greene (1997).

[27] See Esquivel and Larrain (1998) for a similar application.

The prediction performance for an exit episode is measured by the share of correct predictions in the total number of observations for which the exit episode actually occurred. The overall prediction performance (using the two criteria defined above) is reasonable—59 percent of the exits are predicted correctly using the first criterion, and 43 percent are predicted correctly using the second criterion. However, when disaggregated by nature of exit, the predictive performance is not uniform. Using the first criterion, 71 percent of exits involving adjustments within the same regime are predicted correctly, as are 53 percent of orderly shifts to more flexible regimes, 92 percent of orderly shifts to less flexible regimes, 7 percent of orderly shifts to other regimes, and 67 percent of disorderly exits. Using the second criterion, the correctly predicted percentages are 47, 44, 67, 7, and 46, respectively.

DATA

The data on explanatory variables (unless specified otherwise) were obtained from the IFS database of the IMF. For deterministic variables, lagged values (average of previous two quarters) are used in the estimation model.

Real effective exchange rate appreciation (REER) is measured by the deviation of the REER from its trend.

Export growth is measured by the annual growth in the (dollar) value of exports (line 70D).

International liquidity is measured by the excess of official reserves of the central bank over its liabilities to the IMF (i.e., line 1LD- line 2TL). The end of period dollar SDR exchange rate (line AA) is used to convert IMF liabilities in SDRs to that in U.S. dollars. This liquidity measure is expressed as a percentage of dollar imports (line 71D).

Domestic banks' foreign liability is measured by the share of banks' foreign liabilities in foreign assets (lines 21 and 26C, respectively).

Government vulnerability is measured by the growth of government borrowing from the banking system (line 12A + line 22A).

Trade openness or **trade integration** is measured by the sum of exports and imports expressed as a percentage of GDP (line 99B). When GDP data were not available at a quarterly frequency, annual GDP was regressed on a time trend and square of the time trend and the estimated coefficients were used to construct quarterly GDP (e.g., for Chile, Greece, Egypt, El Salvador, Iceland, Jordan, and Sri Lanka, the whole quarterly series was constructed. For Thailand, the quarterly GDP series prior to 1993 and for Russia quarterly GDP series for 1993 were constructed. When data for industrial production index (IPI, line 66) were available at quarterly frequency, its annual growth rate was used to construct quarterly GDP (e.g., for India prior to 1996). Mexico's quarterly GDP was obtained from the OECD database. GDP series for France, Germany, Spain, and the United Kingdom were obtained from IMF's regional desk data.

Emerging market countries comprise Argentina, Brazil, Chile, the Czech Republic, Egypt, Hungary, India, Indonesia, Israel, Mexico, Peru, the Philippines, Poland, Russia, Thailand, Turkey, and Venezuela (source: *The Economist*).

Industrial countries comprise Belgium, Finland, France, Germany, Greece, Italy, Iceland, Ireland, Norway, Portugal, Spain, and the United Kingdom.

Nonemerging market developing countries comprise Ecuador, El Salvador, Jordan, the Slovak Republic, and Sri Lanka.

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