Capital Controls and Exchange Rate Instability in Developing Economies

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Abstract

A large literature on the appropriate sequencing of financial liberalization suggests that removing capital controls prematurely may contribute to currency instability. This paper investigates whether legal restrictions on international capital flows are associated with greater currency stability. We employ a comprehensive panel data set of 69 developing economies over the 1975–1997 period, identifying 160 currency crises. We control for macroeconomic, political, and institutional characteristics that influence the probability of a currency crisis, employ alternative measures of restrictions on international payments, and account for possible joint causality between the likelihood of a currency attack and the imposition of capital controls. We find evidence that restrictions on capital flows *do not* effectively insulate economies from currency problems; rather, countries with few capital controls and liberalized regimes appear to be less prone to speculative attacks.

Keywords: Currency Crises, Balance of Payments Crises, Capital Controls

JEL: F34, F15, F2, F31, G15, G18

1. Introduction

In the aftermath of the East Asian, Russian, and Brazilian currency crises of the 1990s, many economists and policymakers have focused on large and volatile capital flows as an underlying source of instability to the international financial system. A growing conventional wisdom (e.g. Radelet and Sachs, 1998; Stiglitz, 2000) holds that liberalization of international capital flows, especially when combined with fixed exchange rates, is either an underlying cause or at least a contributing factor behind the rash of currency crises experienced in recent years. A common policy prescription under these circumstances is to impose restrictions on capital flows and other international payments with the hope of insulating economies from speculative attacks and thereby creating greater currency stability.

An older literature on the optimal sequencing of economic reform also suggests the importance of capital controls during the process of development. In this view, liberalization of the capital account should not be undertaken until the end of the process; freeing up capital flows prematurely before domestic and trade liberalization could lead to economic instability (McKinnon, 1973, 1991; Edwards, 1984).

While there is an extensive empirical literature measuring the effects of capital controls on particular economic variables—e.g. capital flows, interest differentials, inflation, and output—surprisingly little systemic work has been undertaken regarding their impact on exchange rate stability in developing countries.[1] Several papers have investigated the experiences of capital controls for a few selected countries (e.g. Edison and Reinhart, 2001; Edwards, 1999; Gregorio, Edwards, and Valdes, 2000), while Edwards (1989) has investigated the role of capital account restrictions for twenty-four developing countries in the period prior to devaluation crises. However, we are aware of no systematic studies that investigate the link between capital flow restrictions and exchange rate stability for a broad set of developing economies; our sample consists of 69 developing countries over a 23-year period.[2]

The objective of this study is to systematically investigate whether capital account restrictions help to insulate developing countries from speculative attack on their currencies. We investigate the occurrence of currency crises, the maintenance of capital market restrictions, and

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[1] Dooley (1996) provides a recent survey of the relevant literature.

[2] Eichengreen, Rose, and Wyplosz (1995) find evidence that capital controls may limit the vulnerability of industrial countries to speculative attacks.

the link between the two, over time and across countries. More formally, we employ an empirical model of the determinants of currency crises as a benchmark from which to investigate the marginal effects of capital account restrictions. In particular, we investigate the extent to which capital controls effectively insulate countries—i.e., lower the probability—from a currency attack.

A key challenge of our inquiry is to identify key factors that both lead countries to impose capital controls and contribute to currency attacks, since there is a risk that excluding certain country or economic characteristics from the empirical model might lead to incorrect inferences. To this end, we control for a host of economic, political, and institutional factors usually associated with currency instability and capital controls. We also develop an empirical model of the factors explaining governments' decisions to maintain capital controls, jointly explaining this decision with the onset of a currency attack.

Section 2 reviews the literature linking capital account restrictions and currency stability. Section 3 describes the empirical methodology and data. Section 4 presents an overview of the data and shows the frequencies of currency crises, both unconditional and conditional on the presence of capital controls. Section 5 presents the results from testing the effect of capital market restrictions on the likelihood of currency crises using a probit model. A series of robustness and sensitivity tests are undertaken, including utilizing alternative measures of payments restrictions. Section 6 motivates and presents estimates of the bivariate probit model where currency crises and capital restrictions are jointly determined. Section 7 concludes the study.

2. Capital Controls, Sequence of Financial Liberalization and Instability

The idea of restricting capital mobility as a means of reducing macroeconomic instability has a long history. Indeed, stringent restrictions and limitations on capital flows were the norm during the Bretton Woods era, and over much of the immediate post-war period they were officially sanctioned by most governments in the large industrial countries and by the International Monetary Fund. With the turbulence in exchange markets following the introduction of generalized floating, Tobin (1978) argued that a global tax on foreign exchange transactions would reduce destabilizing speculation in international financial markets. After the European currency crisis of 1992-93, Eichengreen and Wyplosz (1993) proposed Tobin taxes to

discourage short-term speculators from betting against major currencies. In the aftermath of the Asia currency crisis of 1997-98, Krugman (1998) proposed limiting capital flows for developing countries that were unsuitable for either currency unions or free floating exchange rate regimes. In a similar vein, Stiglitz (2000) and Eichengreen (1999) have argued that developing countries should manage and limit capital flows under certain market conditions.

A large literature on the appropriate sequencing of financial liberalization also suggests that early lifting of controls on the capital account may destabilize the economy. McKinnon (1973, 1993), for example, maintains that decontrol of the capital account should come at the end of the reform sequence, following domestic financial liberalization, bank reform, and trade liberalization. In particular, McKinnon argues that a rapid inflow of (official or private) capital will cause real appreciation of the exchange rate, making it difficult for domestic tradeables producers "to adjust to the removal of protection" (1993, p. 117). Thus, "[a] big injection of capital at the time the liberalization occurs finances an unusual increase in imports while decreasing exports and throws out the wrong long-run price signals in private markets" (*ibid*., see also Edwards 1984, pp. 3–4).

On the other hand, capital controls may also have a destabilizing effect. Restrictions on the international capital account may in fact lead to a net capital outflow and precipitate increased financial instability. Dooley and Isard (1980) point out that controls preventing investors from withdrawing capital from a country act like a form of investment irreversibility: by making it more difficult to get capital out in the future, controls may make investors less willing to invest in a country. Following this reasoning, Bartolini and Drazen (1997a, b) show that imposing capital controls can send a signal of inconsistent and poorly designed future government policies.

Capital controls may also be ineffective and distortionary. Edwards (1999), for example, argues that legal capital restrictions frequently prove ineffective, and are easily sidestepped by domestic and foreign residents and firms. He documents how capital controls may lead to economic distortions and government corruption that in turn contribute to economic instability.

Several empirical papers have investigated the experiences with capital controls of selected developing countries. Edison and Reinhart (2001) focus on the recent experiences of Malaysia and Thailand, while Edwards (1999) and Gregorio, et al. (2000) examine Chile. In general, these studies have found little effect of capital controls in averting currency crises, at least not without other supporting economic policies. Using various econometric tests and a

detailed case study of Chilean controls imposed in the 1980s, for example, Edwards (1999) finds that "…the relative absence of contagion effect on Chile [during the currency crises of the 1990s] is due to its sturdy banking regulation and not to its capital controls policy" (p. 22). This finding is supported by Edwards' (1989) analysis of the role of capital controls in thirty-nine devaluation episodes for twenty-four developing countries over the period 1961-82. He finds that countries typically intensified their control programs in the year before devaluation, and concludes that "[a]t most one can argue that these heightened impediments to trade managed to slow down the unavoidable balance of payments crisis" (pp. 189–90).

Other studies provide a more mixed view of the effects of capital controls on the factors contributing to currency pressures in developing countries. On the one hand, Bartolini and Drazen (1997a), who survey a number of episodes of capital account liberalization, find that the easing of restrictions on capital outflows often represented early ingredients of a broad set of reforms (including the lifting of various elements of financial repression) and frequently led to large capital inflows. On the other hand, Grilli and Milesi-Ferretti (1995), investigating the effects of restrictions on capital flows in a panel of industrial and developing economies, find that capital controls have a significant negative effect on foreign borrowing, interpreting their use as a means of enforcing financial repression of the economy. They also find that capital controls are associated with lower domestic interest rates, consistent with the view that they limit international arbitrage in asset markets. However, they do not investigate the link between capital restrictions and the likelihood of currency crises.

We are aware of no empirical studies that systematically investigate the link between capital controls (and exchange restrictions generally) on currency stability for a broad sample of developing economies. Our study fills this void. Another contribution of our work is to enhance understanding of the empirical factors explaining both currency crises and capital account restrictions, and causal linkages between the two phenomena.

3. Data and Methodology

3.1 Defining Currency Crises

Our indicator of currency crises is constructed from "large" changes in an index of currency pressure, defined as a weighted average of monthly real exchange rate changes and

monthly (percent) reserve losses.[3] Following convention (e.g. Kaminsky and Reinhart, 1999) the weights are inversely related to the variance of changes of each component over the sample for each country. Our measure presumes that any nominal currency changes associated with exchange rate pressure should affect the purchasing power of the domestic currency, i.e. result in a change in the real exchange rate (at least in the short run). This condition excludes some large depreciations that occur during high inflation episodes, but it avoids screening out sizable depreciation events in more moderate inflation periods for countries that have occasionally experienced periods of hyperinflation and extreme devaluation.[4] Large changes in exchange rate pressure are defined as changes in our pressure index that exceed the mean plus 2 times the country-specific standard deviation, provided that it also exceeds 5 percent.[5] The first condition insures that any large (real) depreciation is counted as a currency crisis, while the second condition attempts to screen out changes that are insufficiently large in an economic sense relative to the country-specific monthly change of the exchange rate.

3.2 Measuring Restrictions on International Payments

Our main focus is on the effects of restrictions on international capital flows. The underlying source for our measures of external restrictions is the *Annual Report on Exchange Arrangements and Exchange Restrictions* (*EAER*). A country is classified as either "restricted" (value of unity) or "liberalized" (value of zero) depending on the existence of controls on the capital account at year-end. Specifically, for the 1975-94 period the *EAER* coded countries (published in the reports through 1995) for the existence (or not) of "restrictions on payments for capital transactions." From 1996, the *EAER* (starting with the 1997 Annual Report) reported 10

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[3] Our currency pressure measure of crises does not include episodes of defense involving sharp rises in interest rates. Data for market-determined interest rates are not available for much of the sample period in many of the developing countries in our dataset.

[4] This approach differs from that of Kaminsky and Reinhart (1999), for example, who deal with episodes of hyperinflation by separating the nominal exchange rate depreciation observations for each country according to whether or not inflation in the previous 6 months was greater than 150 percent, and they calculate for each sub-sample separate standard deviation and mean estimates with which to define exchange rate crisis episodes.

[5] Other studies defining the threshold of large changes in terms of country-specific moments include Kaminsky and Reinhart (1999); Kaminsky, Lizondo, and Reinhart (1998); and Esquivel and Larrain (1998). Kaminsky and Reinhart (1999) use a three standard deviation cut-off. While the choice of cut-off point is somewhat arbitrary, Frankel and Rose (1996) suggest that the results are not very sensitive to the precise cut-off chosen in selecting crisis episodes.

separate categories for controls on capital transactions (11 categories in the 1998 Annual Report). We defined the capital account to be restricted for the 1996-97 observations (i.e. not liberalized) if controls were in place in 5 or more of the *EAER* sub-categories of capital account restrictions *and* "financial credit" was one of the categories restricted.[6]

In our sensitivity tests, we also consider three alternative measures of restrictions on international payments and one measure of restrictions on domestic financial institutions. Specifically, we consider: (i) a dichotomous a measure of the requirement to surrender or repatriate export proceeds;[7] (ii) a dichotomous measure of restrictions placed on the current account of the balance of payments; (iii) an overall balance of payments controls measure, defined as a simple average of dichotomous indices of capital account restrictions, requirements to surrender or repatriate export receipts, and the presence of an official system of multiple exchange rates;[8] and (iv) a measure of domestic financial controls , defined as official restrictions on bank deposit interest rates.[9]

3.3 Determinants of Currency Crises

An important part of our work is to identify appropriate control variables in our multivariate probit models. We want to ensure that empirical links between external controls and currency crises are not spurious, attributable to variables omitted from the probit regressions. The theoretical and empirical literature has identified a vast array of variables potentially associated with currency crises (see, e.g. Frankel and Rose, 1996; Kaminsky, Lizondo, and Reinhart, 1998; Kaminsky and Reinhart, 1999). The choice of explanatory variables in our

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[6] The 11 classifications under capital restrictions reported in the 1998 *EAER* were controls on: (1) capital market securities, (2) money market instruments, (3) collective investment securities, (4) derivatives and other instruments, (5) commercial credits, (6) financial credits, (7) guarantees, sureties, and financial backup facilities, (8) direct investment, (9) liquidation of direct investment, (10) real estate transactions, and (11) personal capital movements.

[7] Note that, for the 1975-94 period *EAER* coded countries (published in the reports through 1995) for the existence (or not) of "surrender or repatriation requirement for export proceeds." For 1995 on, the *EAER* began (with the 1996 Annual Report) to disaggregate controls on export proceeds as follows: "repatriation requirements for export proceeds" and "surrender requirements for export proceeds." We use the union of these measures for the 1996-97 observations.

[8] This measure of balance of payments controls has been employed by Bartolini and Drazen (1997b).

[9] Data on deposit interest rate restrictions is from Demirgüç-Kunt and Detragiache (1998) and was augmented to cover additional countries with information from Williamson and Mahar (1998), Honohan (2000), Galbis (1993), and other IMF studies.

benchmark model for the analysis was determined by the questions we posed earlier, the availability of data, and previous results found in the literature. We postulate a "canonical" model of currency crises in order to form a basic starting point to investigate the effects of capital controls. The main source of the macro data is the International Monetary Fund's *International Financial Statistics* (CD-ROM).

Our basic canonical model consists of five macroeconomic control variables that are lagged to limit simultaneity problems. (Data employed in extensions of the benchmark model are discussed in Section 5.2.) These variables are the log ratio of broad money to foreign reserves (lines 34 plus 35 divided by 1ld times ae), domestic credit growth (line 32), the current account to GDP ratio (line 78ald times xrrf divided by 99b) real GDP growth (line 99b.r or 99b.p), and real exchange rate overvaluation.[10]

We expect the growth rate of M2/foreign reserves to be relatively high prior to a currency crisis. A rise in the M2/foreign reserves ratio implies a decline in the foreign currency backing of the short-term domestic currency liabilities of the banking system. This would make it difficult to stabilize the currency if sentiment shifts against it. Similar reasoning suggests that a larger current account surplus-to-GDP ratio would be expected to lessen the likelihood of a currency crisis, while rapid credit growth would be anticipated to precede a currency crisis. We also expect relatively large exchange rate overvaluation and declining real output growth to be associated with increased likelihood of a currency crisis. Substantially overvalued exchange rates may lead to the expectation that a large adjustment may occur, and declining real GDP growth may signal worsening economic conditions and undermine investor confidence in home-country investment opportunities.

3.4 Data Sample and Measurement Concerns

Our data sample is determined by the theoretical determinants of currency market volatility and by the availability of data. We do not confine our analysis to countries experiencing currency crises. That is, we include developing countries that both did and did not

[10] Real exchange rate overvaluation is defined as deviations from a fitted trend in the real trade weighted exchange rate. The real trade-weighted exchange rate is the trade-weighted sum of the bilateral real exchange rates (defined in terms of CPI indices) against the U.S. dollar, the German mark, and the Japanese yen. The trade-weights are based on the average bilateral trade with the United States, the European Union, and Japan in 1980 and 1990.

experience a severe currency crisis/speculative attack during the 1975-97 sample period. Using such a broad control group allows us to make inferences about the conditions and characteristics distinguishing countries encountering crises and others managing to avoid crises.

The minimum data requirements to be included in our study are that GDP are available for a minimum of 10 consecutive years over the period 1975-97. This requirement results in a sample of 69 developing countries.[11] We use annual crisis observations in our analysis. While we employ monthly data for our (real) exchange rate pressure index to identify currency crises and date each by the year in which it occurs, using annual data enables inclusion of a relatively large number of countries.

For each country-year in our sample, we construct binary measures of currency crises, as defined above (1 = crisis, 0 = no crisis). A currency crisis is deemed to have occurred for a given year if the change in currency pressure for any month of that year satisfies our criteria (i.e. two standard deviations above the mean as well as greater than five percent in magnitude). To reduce the chances of capturing the continuation of the same currency crisis episode, we impose windows on our data. In particular, after identifying each "large" monthly change in currency pressure, we treat any large changes in the following 24-month window as a part of the same currency episode and skip the years of that change before continuing the identification of new crises. With this methodology, we identify 160 currency crises over the 1975-97 period. Appendix A lists the countries included in the sample and corresponding currency crisis dates, if any.

Appendix B reports the periods for which international payments controls (either in the form of capital account, export receipt, or current account restrictions) and domestic finance restrictions were *not* in place, i.e. periods of liberalization, for the countries in the sample. It is interesting to note that the measures differ somewhat in indicating the presence of controls for individual countries, but usually at least one measure picks up commonly recognized episodes of liberalization.

For example, the IMF measure of capital controls does not catch the liberalization episodes of Argentina and Brazil in the late 1970s. However, the other measures, such as the presence of current account restrictions and the measure of domestic financial repression, do capture these experiences. Argentina liberalized its current account during 1977-81 and from

[11] The developing country sample excludes major oil-exporting countries.

1993 on (along with the capital account) and domestic interest rates were liberalized over 1977-82 (but later restricted again until 1987). The measure of domestic interest rate controls indicates Brazil financially liberalized during 1976-78, reverted to restrictions in 1979, and liberalized again after 1988.

Thus, no one measure may adequately capture all of the nuances in the extent to which controls are present for any given country or point in time. Taken overall, however, we feel that the set of measures we employ do an adequate job in capturing the financial control regime in place during the occurrence of currency crises for a broad panel of countries.

We conclude this section by acknowledging that the measures of capital controls, current account restrictions, and other restrictions on balance of payments flows published by the IMF are somewhat crude. By providing only a dichotomous indication of the existence of controls, they are limited in their ability to measure the extent to which restrictions are applied and enforced. However, they are the only source of data available that can be collected with some consistency across a broad group of developing countries and over a reasonably long period of time. This is a constraint faced by any panel study in this literature. Concerns about measurement should be allayed by our use of a range of restriction indicators.

4. Descriptive Statistics and Conditional Frequencies

4.1 Descriptive Statistics on Currency Crises and Capital Controls

Table 1 shows the occurrence of currency crises and capital controls over the 1975-97 period, and by 5-year intervals (except for the 1995-97 sub-sample). The table reports the unconditional frequency of currency crises and presence of capital controls (number of "crisis" or "controls in place" observations, divided by the total number of observations).

The 69 developing countries in our dataset experienced 160 currency crises over the 1975-97 period, implying a frequency of 11.7 percent of the available country-year observations. Crises were least frequent during the 1975-79 period (9.9 percent average frequency) and most frequent during the 1985-89 period (14.3 percent frequency). In our sample, the recent spate of

currency crises around the world is not an uncommon event, and does not indicate a rise in the frequency of currency crises over time.[12]

Table 1 also reports the frequency of restrictions on capital flows during the period. Most of the time capital controls were in place in developing economies (83.4 percent of the observations). Although this frequency was always high during the sample period, it rose noticeably from 1975 through 1989 and then declined in the 1990s. The high point was an average frequency of 89.0 percent during 1985-89, and the low point was 76.4 percent during 1995-97.

4.2 Currency Crises: Frequencies Conditional on Capital Controls

Table 2 shows the frequency of currency crises conditional upon a country's having restricted capital flows. This table sheds light directly upon the main question of interest: whether restrictions on capital flows affect the probability of a currency crisis. To take account of the possibility that controls are implemented in response to a crisis, we report results conditional on the presence of controls at the end of the year *prior* to a crisis as well as at the end of the year in which a crisis occurs. c^2 statistics for tests of the null hypothesis of independence between the frequency of crises and the presence of controls are also presented.

The most striking result from Table 2 is that the country-year observations associated with more restrictions on capital flows have substantially higher frequencies of currency crises than those observations where no controls were in place. Specifically countries with restricted capital flows had crises contemporaneously 12.7 percent of the time, compared to 6.8 percent for those not having restrictions. The c^2 statistics reject the null of independence and indicate that this difference is significant (at better than 5 percent). The difference in currency crisis frequency according to whether the capital account restrictions were in place or not in the preceding year is smaller (12.5 percent versus 8.0 percent), but is still significant at the 10 percent level. This is suggestive *prima facie* evidence that controls may not be effective and, indeed, may increase the likelihood of a currency crisis (e.g. Bartolini and Drazen, 1997a). It suggests that the presence of capital controls does not reduce a country's exposure to currency instability.

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[12] Currency crises were most frequent in Africa (16.2 percent frequency), and least frequent in Asia (9.6 percent). Despite recent high profile currency crises in Thailand, Malaysia, Indonesia, and Korea, the developing economies in Asia have been less frequently affected by currency instability.

5. Estimation Results

Our use of probit models allows us to go beyond the conditional frequencies reported in the previous section and to focus on the contribution of payment restrictions to currency crises, while controlling for other macroeconomic and institutional factors that vary across time and country. We estimate the probability of currency crises using a multivariate probit model for our data set of developing countries over the 1975-97 period. We observe that either a country at a particular time (observation t) is experiencing the onset of a crisis (i.e. the binary dependent variable, say y_t, takes on a value of unity), or it is not ($y_t = 0$). The probability that a crisis will occur, Pr($y_t = 1$), is hypothesized to be a function of a vector of characteristics associated with observation t, x_t , and the parameter vector ß. The likelihood function of the probit model is constructed across the n observations (the number of countries times the number of observations for each country) and the log of the function

$$\ln L = \sum_{t=1}^{n} \left[y_t \ln F(b' x_t) + (1 - y_t) \ln(1 - F(b' x_t)) \right]$$

is then maximized with respect to the unknown parameters using non-linear maximum likelihood. The function $F(.)$ is the standardized normal distribution.

In these equations we employ a 24-month window following the onset of a crisis (i.e. episode of exchange rate pressure), as discussed in Section 3.4, and we eliminate from the dataset these observations. Following Eichengreen and Rose (1998), we use a weighted-probit regression where the weight is GDP (in dollars) per capita. Countries with higher GDP per capita generally have more reliable data, and the observations are correspondingly given greater weight in the analysis. An implication of this specification is that more importance is attached to relatively high income developing economies.

In each table we report the effect of a one-unit change in each regressor on the probability of a crisis (expressed in percentage points so that .01=1%), evaluated at the mean of the data. We include the associated z-statistics in parentheses; these test the null of no effect. Note that the sample size of the probit analysis varies depending on the set of variables considered.

We also report various diagnostic measures. The in-sample probability forecasts are also evaluated with "pseudo" R^2 statistics. For dependent binary variables, it is natural to ask what fraction of the observations are "correctly called," where, for example, a crisis episode is correctly called when the estimated probability of crisis is above a given cut-off level and a crisis in fact occurs. Greene (2000) points out the chosen cut-off point should reasonably differ

depending on the unconditional probability of the event and problem at hand. For our "goodness-of-fit" statistics we consider two different probability cut-offs: 25 percent and 10 percent. These cut-offs bracket the unconditional crisis frequency of roughly 12 percent (see Table 1).

5.1 Benchmark Model Estimates

Table 3 reports the results from the benchmark probit equations without and with (lagged) macroeconomic factors to explain the likelihood of the *onset* of a currency crisis in any given year, controlling for the presence of capital account restrictions. The inclusion of the macroeconomic variables reduces the sample range from 1174 to 921 observations. Columns (1) and (2) report results of including contemporaneous capital controls; columns (3) and (4) report the corresponding results for capital controls in place during the *preceding* year. Our main interest is in the latter.

The benchmark equations (with the macroeconomic variables) explain a substantial faction of the currency crises in our sample. Focusing on column (4), the pseudo R-squared is 35 percent and the percentage of observations correctly predicted is 82 (56) percent when the probability threshold is 25 percent (10 percent). All of the macroeconomic controls have the expected signs and, except for lagged credit growth, are significant at the 1 percent level. A high M2/reserves ratio, current account deficits, overvalued real exchange rates, and sluggish GDP growth are significant leading indicators of the onset of a currency crisis.

Consistent with the conditional frequencies (Table 2), these results indicate a statistically significant and economically meaningful *negative* link between liberalization and the likelihood of a currency crisis. This result holds when either the contemporaneous or lagged value of capital account restrictions is included. After controlling for macroeconomic factors, the likelihood of a currency crisis in developing economies appears to increase by 5.2 percent (8.4 percent) when capital controls were in place during the previous (current) year. When macroeconomic controls are not included, the estimates are substantially higher.

5.2 Sensitivity Analysis: Additional Macroeconomic and Political Determinants

Table 4a shows the sensitivity of the benchmark model estimates to the inclusion of additional macroeconomic and political variables in the regressions. The objective is to control for a variety of economic and political factors that might help distinguish those countries that

tend to be more prone to currency crises from those experiencing greater stability. Our main concern here is that excluding one or several explanatory variables that are highly correlated with both currency crises and the decision to maintain capital controls could bias the estimates in the benchmark model. (Issues of joint determination are considered in Section 6.)

The "twin crisis" phenomenon suggests that a domestic banking crisis could make a speculative attack on the currency more likely (Kaminsky and Reinhart, 1999; Glick and Hutchison, 2001). Our banking crisis measure (contemporaneous and lagged) is constructed as a binary variable, with unity indicating the onset of a banking crisis, i.e. first year of a period of bank distress and zero otherwise.[13] Column (1) includes contemporaneous and lagged bank crises as additional explanatory variables in the benchmark regression. Contemporaneous bank crises are significant at the 10 percent level and are associated with a higher likelihood (about 6 percent) of the onset of a currency crisis. The point estimate on lagged capital controls is 5.25 (significant at the 1 percent level).

The international factors that we consider in our sensitivity tests are the level of U.S. real long-term interest rates (line 61..zf minus the percent change in 99b.r over 99b) and the possibility of regional contagion in currency crises. The measure of contagion takes on a value of unity if a currency crisis has occurred in some other country in the region. Eichengreen and Rose (1998) and others have found that high foreign ("Northern") interest rates increase the likelihood of debt repayment and increase pressure on currencies in developing countries. Glick and Rose (1999) and others find that contagion, primarily based on regional trade linkages, is an important element in the transmission of currency crises internationally.

Column (2) of Table 4a reports the results from including international factors in the benchmark regression. Neither contagion nor high U.S. real interest rates play a significant systematic role in helping to predict the onset of currency crises in our sample of developing countries. The point estimate on lagged capital controls is robust—above 5 in magnitude and significant at the 1 percent level.

We also consider two political variables in our sensitivity tests—the frequency of change in government and the degree of political freedom. These factors also could help to distinguish historically unstable countries and economies—those presumably with greater currency

[13] We report results using only Caprio and Klingebiel's (1999) "major" or "systemic" bank crisis; the results are similar with their more inclusive measure of crises.

instability and more frequent imposition of capital controls—from more stable situations. We attempt to control for political instability and political conditions by measuring the total number of democratic and undemocratic (e.g. coups) changes in government over the period 1970-97, as determined from Zarate's Political Collections website (www.terra.es/personal2/monolith), supplemented by information from the Encarta Encyclopedia website (www.encarta.msn.com). The political freedom measure is taken from the Freedom House website (www.freedomhoouse.org, coded on a scale from 1–3, with 3 indicating the highest degree of political freedom).

Column (3) includes these two political variables in the benchmark model with the macroeconomic variables. The number of changes in government is significantly positive, indicating that greater political instability raises the likelihood of the onset of a currency crisis. Political freedom, however, is not statistically significant at conventional levels. The point estimate on lagged capital controls is again around 5 and statistically significant at the 1 percent level.

5.3 Sensitivity Analysis: Alternative Measures of Restrictions on Transactions

The capital account controls measure is a rather rudimentary measure of balance of payments restrictions and, by providing only a dichotomous indication of the existence of controls, does not allow one to measure variations in the extent to which controls are applied and enforced. As discussed in section 3, we assess the robustness of the benchmark estimates by using four alternative measures of balance of payments and financial restrictions.

The results from these sensitivity tests are reported in Table 4b. In each case, the coefficient on the exchange "control" variable is positive and statistically significant (at either the 1 percent or 5 percent level). The explanatory power of the equations and the estimated coefficients of the other explanatory variables in Table 4b are also very similar to the other estimated equations.[16] Thus, all of our measures of financial restrictions gives the same result—countries with restrictions, however measured, are more prone to currency attacks. At a

[16] In addition, a fifth measure was constructed: the first principle component of the indices of capital account controls, export receipt controls, and multiple exchange rates. The results are almost identical to the other results in Table 4b. They are not reported for brevity but are available from the authors upon request.

minimum, one may conclude that there is no evidence that restrictions on capital flows, balance of payments, or domestic financial markets effectively insulate countries from currency instability.

6. Joint Determination of Currency Crises and a Regime of Capital Controls

We wish to further explore the causal linkages between currency crises and the decisions of governments to maintain a system of capital controls. To this end, we estimate a recursive bivariate probit equation jointly explaining these two phenomena (see Greene, 2000, Chapter 19). The first equation explaining the onset of currency crises is our benchmark specification. The second equation is our attempt to capture the economic and political factors that make countries more likely to maintain a system of restrictions on international capital flows. The system is recursive in that capital controls (either contemporaneous or lagged) are treated as a determinant of currency crises, but not vice versa.[17]

Several studies have investigated the factors that explain why governments maintain a system of capital controls. Grilli and Milesi-Ferretti (1995), Bartolini and Drazen, (1997a, b); and Alesina, Grilli, and Milesi-Ferretti (1994), for example, present empirical results on a number of possible determinants of capital controls Among other factors, they find countries with a higher level of government expenditure, relatively closed to international trade, and with large current account deficits are more likely to restrict capital flows. Grilli and Milesi-Ferretti (1995) also report evidence that political instability is associated with fewer capital account restrictions in developing economies. Bartolini and Drazen (1997b) link a high degree of restrictions on international payments in developing economies with high world real interest rates—measured as the weighted real interest rate in the G-7 industrial countries—in a yearly time-series regression. They view the causality as running from world interest rates to capital restrictions: restrictions are removed when the cost of doing so is low, i.e. only a small outflow of capital is expected when world interest are low. Edwards (1989), investigating the experiences of twenty countries over the 1961-82 period, finds that capital controls are frequently intensified in the year prior to the onset of a currency crisis. This suggests that a common set of factors may

[17] The recursive structure is necessary to satisfy the logical consistency condition for models of simultaneous binary variables (see Maddala, 1983, Chapter 5, model 6).

contribute both to the onset of a currency crisis and lead governments to impose or maintain capital account restrictions.

Following these studies, we consider a number of potential structural, political, and economic determinants of capital controls. In particular, we consider two macroeconomic variables, two economic structure variables, and two political variables. The macroeconomic variables are the current account (as a percent of GDP) and the level of "Northern" real interest rates (proxied by the level of the U.S. real long-term interest rate). We expect that large current account surpluses place less pressure on countries to maintain a system of controls on international payments. High Northern interest rates, by contrast, make capital liberalization—and integration with world capital markets—more costly in terms of the service of domestic government debt (Bartolini and Drazen, 1997a). The maintenance of capital controls in this circumstance would be expected.

The economic structure factors considered are the relative size of government spending and openness to world trade. Countries with high levels of government spending may both be more prone to currency instability and more likely to impose some form of exchange controls. High government spending indicates that governments have large funding requirements, and have a greater incentive to resort for seignorage finance and capital controls as a source of revenue. By contrast, relatively open economies in terms of international trade (measured by the sum of exports and imports as a percentage of GDP) are also more likely to be open to international capital flows, and less prone to impose controls. International openness is also found by Romer (1993) to be associated with lower inflation rates, that in turn may lead to greater economic stability and less pressure for capital controls. Finally, the two political explanatory variables included in our model are the total changes in government and the measure of political freedom.

We first estimate the parameters of the bivariate probit model using maximum likelihood, with the correlation between disturbances (ρ) in the two equations allowed to vary freely. ρ measures (roughly) the correlation between currency crises and capital controls after accounting for the effects of the included determinants. The low estimated value of ρ suggests that any omitted effects may well be uncorrelated across the two equations of our bivariate model.[18] That

[18] The estimated value of ρ is .16 in the case capital controls affect currency crises contemporaneously and .22 when they enter lagged.

is, after the direct effect of capital controls on currency crisis is taken account of, the correlation of any omitted determinants of crises and controls is low.

To formally test the significance of ρ, we estimate the model with ρ fixed at zero. We then used the two sets of results to test for the significance of our ρ estimate against the null that ρ equals zero using a likelihood ratio test, a Wald test, and Lagrange multiplier test.[19] On the basis of these tests, we rejected the alternative that ρ is not equal to zero, and report only results with ρ constrained to equal zero.

Columns 1a and 1b of Table 5 report the bivariate probit equations where the capital control variable enters the two equations contemporaneously. Columns 2a and 2b report the bivariate probit equations where the capital control variable enters the two equations lagged one year. The results for the currency crisis equations (columns 1a and 2a) are quite similar to the standard probit results, both in terms of the overall explanatory power of the equations and the point estimates of the coefficients. The point estimates on the capital control variable in the bivariate probit equations are very close to the earlier estimates. Lagged capital controls are again associated with about a 5 percent rise in the likelihood of a currency crisis.

As expected, current account surpluses and more open economies are associated with a lower likelihood of capital controls. Countries with relative large government sectors are more likely to have capital controls. These findings are consistent with Grilli and Milesi-Ferretti (1995). Unlike other studies, however, we find that more political instability (changes in government) is associated with a lower likelihood of capital controls in developing countries. Northern interest rates and political freedom, however, are not statistically significant explanatory factors.

7. Concluding Remarks

We find that restrictions on capital controls are associated with higher probability of an exchange rate crisis. This result is clearly evident in the calculation of conditional frequencies and in the context of probit models estimating the likelihood of the onset of a currency crisis

[19] The likelihood ratio statistic, distributed as χ^2 with one degree of freedom under the null, equaled .23, well below the five percent critical value of 3.84. The Wald statistic was .14, also well below the critical value of 3.84. The Lagrange multiplier statistic was .45, which was consistent.

where account is taken of a host of macroeconomic and institutional factors. We find no evidence that countries with no or few restrictions on the capital account are more prone to speculative attacks.

We are aware of concerns about the quality of data on capital controls used in our analysis. Measures of capital controls, current account restrictions, and other restrictions on the balance of payments published by the IMF are rough proxies for controls and do not pick up many nuances in the extent of controls over time and across countries. However, they are the only source of data available that can be collected with some consistency across a broad group of developing countries and over a reasonably long period of time—a constraint faced by every study in this literature. Moreover, this constraint may not be too problematic, since a close inspection of our alternative measures of financial restrictions indicates that almost all commonly recognized episodes are identified by at least one of the measures. Furthermore, the results are not sensitive to the particular measure of financial restrictions used.

This evidence is supportive, of course, of previous work questioning the effectiveness of capital controls in insulating countries from speculative attacks on inconsistent policy regimes.[20] It also indicates that, in the context of the sequencing literature on economic reform, an environment where the capital account is liberalized does not appear to be more vulnerable to exchange rate instability. Surprisingly, the opposite appears to be the case. Countries without capital controls appear to have greater exchange rate stability and fewer speculative attacks. This result holds even when taking account of macroeconomic factors—inconsistent policy regimes—that lead to speculative attacks, as well as country-specific political and institutional factors that induce countries in the first place to maintain a system of capital controls.

[20] Dooley (1996), summarizing the literature, concludes: "Capital controls or dual exchange rate systems have been effective in generating yield differentials, covered for exchange rate risk, for short periods of time, but they have little power to stop speculative attacks on regimes that were seen by the market as inconsistent" (p. 677).

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Table 1. Currency Crises and Capital Controls, Unconditional Frequency (in percent)

	1975-1997	1975-1979	1980-1984	1985-1989	1990-1994	1995-1997
Currency crises[a]	11.7	9.9	12	14.3	11.8	9.7
(Number of crises)	(160)	(26)	(34)	(43)	(38)	(19)
Capital controls[b]	83.8	79.4	84.2	89.0	86.6	76.2

[a] Number of crises divided by total country-years with available data. Number of crises in parentheses.
[b] Number of country-years with capital controls in place at end of year divided by total country-years with available data

Table 2. Currency Crises, Frequency Conditional on Capital Controls (in percent)

	Controls in place [a]	No Controls in place [b]	P^2 [c]
Controls in current year	12.7	6.8	6.11**
Controls in previous year	12.5	8.0	3.50*

[a] Number of currency crises for which capital controls in place at end of current or previous year, divided by total number of country-years with controls in place.

[b] Number of currency crises for which capital controls *not* in place at end of current or previous year, divided by total number of country-years with controls *not* in place.

[c] Null hypothesis of independence between frequency of currency crises and controls is distributed as $P^2(1)$. ** and * indicate rejection of null at 5 and 10 percent significance levels, respectively.

Table 3. Probit Results for Currency Crises: Benchmark

Explanatory Variable	(1)	(2)	(3)	(4)
Capital account controls t	11.49**	8.38**		
	(5.32)	(3.70)		
Capital account controls t-1			8.62***	5.24***
			(4.02)	(2.31)
Log(M2/Reserves) t-1		1.85**		2.21***
		(2.11)		(2.44)
Credit growth t-1		0.02		0.03
		(1.29)		(1.37)
Current account/GDP t-1		-0.34***		-0.37***
		(2.58)		(2.69)
Real overvaluation t-1		0.11***		0.11***
		(3.21)		(3.25)
Real GDP growth t-1		-0.39**		-0.43***
		(2.28)		(2.38)
Summary statistics				
No. of Crises	157	120	157	120
No. of Observations	1174	921	1173	921
Log likelihood	-370.8	-268.9	-376.9	-273.2
Pseudo-R2	0.33	0.36	0.31	0.35
Goodness-of-fit (25% cutoff) [a]				
% of obs. correctly called	87	82	87	82
% of crises correctly called	0	18	0	15
% of non-crises correctly called	100	92	100	92
Goodness-of-fit (10% cutoff) [a]				
% of obs. correctly called	28	52	27	56
% of crises correctly called	90	80	89	80
% of non-crises correctly called	18	48	18	52

Note: The table reports the change in the probability of a crisis in response to a 1 unit change in the variable evaluated at the mean of all variables (x 100, to convert into percentages) with associated z-statistic (for hypothesis of no effect) in parentheses below. Results significant at 1, 5, and 10 percent levels are indicated by ***, **, and *, respectively. Constant included, but not reported. Observations are weighted by real GDP per capita (in dollars).

[a] Goodness-of-fit statistics defined respectively as (A + D) / (A + B + C + D), A / (A + C), and D / (B + D), where A(C) denote number of crises with predictions of crises above (below) probability cutoff and B (D) denote number of corresponding non-crises with predictions of crises above (below) the cutoff.

Table 4a. Sensitivity Analysis: Additional Macroeconomic and Political Determinants

Explanatory Variable	(1)	(2)	(3)
Capital acct. controls t-1	5.25***	5.42***	5.01**
	(2.33)	(2.39)	(2.23)
Log(M2/Reserves) t-1	2.52***	2.07***	2.34***
	(2.81)	(2.32)	(2.55)
Credit growth t-1	0.02	0.02	0.02
	(0.96)	(1.30)	(1.25)
Current account/GDP t-1	-0.27**	-0.33***	-0.37***
	(1.96)	(2.44)	(2.72)
Real overvaluation t-1	0.09***	0.09***	0.11***
	(2.55)	(2.58)	(3.16)
Real GDP growth t-1	-0.43***	-0.39**	-0.41**
	(2.43)	(2.16)	(2.30)
Contagion t		2.73	
		(1.18)	
U.S. real interest rate t-1		0.62	
		(1.45)	
Change of government t			3.83*
			(1.73)
Freedom t-1			-1.55
			(1.16)
Bank crisis t	5.75*		
	(1.65)		
Bank crisis t-1 or t-2	4.68		
	(1.48)		
Summary statistics			
No. of Crises	119	120	120
No. of Observations	912	921	921
Log likelihood	-265.3	-271.3	-271.1
Pseudo-R2	0.36	0.36	0.36
Goodness-of-fit (25% cutoff) [a]			
% of obs. correctly called	82	81	83
% of crises correctly called	15	17	15
% of non-crises correctly called	93	91	93
Goodness-of-fit (10% cutoff) [a]			
% of obs. correctly called	56	55	57
% of crises correctly called	75	79	73
% of non-crises correctly called	53	52	55

Note: See Table 3.

Table 4b. Sensitivity Analysis: Alternative Measure of Financial Restrictions

Explanatory Variable	Export Receipt Restrictions (1)	Current Account Restrictions (2)	Balance of Payments Controls (3)	Domestic Financial Controls (4)
Controls t-1	5.80**	4.63***	8.77***	5.81***
	(2.25)	(2.52)	(2.88)	(2.76)
Log(M2/Reserves) t-1	2.55***	2.79***	2.34***	3.19***
	(2.86)	(3.19)	(2.64)	(3.38)
Credit growth t-1	0.02	0.02	0.01	0.01
	(0.92)	(1.06)	(0.56)	(0.73)
Current account/GDP t-1	-0.27**	-0.29**	-0.27*	-0.26
	(1.97)	(2.10)	(1.95)	(1.49)
Real overvaluation t-1	0.09***	0.08***	0.09***	0.06
	(2.55)	(2.36)	(2.50)	(1.65)
Real GDP growth t-1	-0.41***	-0.36**	-0.39**	-0.45***
	(2.33)	(2.01)	(2.20)	(2.33)
Bank Crisis t	5.62	6.01*	5.98*	8.80***
	(1.63)	(1.71)	(1.75)	(2.39)
Bank Crisis t-1 or t-2	4.84	5.19	4.78	6.84**
	(1.52)	(1.62)	(1.54)	(2.01)
Summary statistics				
No. of Crises	119	119	119	112
No. of Observations	914	914	912	808
Log likelihood	-265.6	-265.0	-263.9	-246.7
Pseudo-R2	0.36	0.36	0.36	0.36
Goodness-of-fit (25% cutoff) [a]				
% of obs. correctly called	83	82	82	80
% of crises correctly called	17	15	13	21
% of non-crises correctly called	93	92	92	90
Goodness-of-fit (10% cutoff) [a]				
% of obs. correctly called	57	54	57	53
% of crises correctly called	72	70	71	78
% of non-crises correctly called	55	51	55	49

Note: See Table 3. Alternative control measures: export receipt controls defined by presence of surrender or repatriation requirements for export receipts; current account controls; balance of payments controls defined as average (i.e. 0, .33, .67, or 1) of presence of capital account controls, export receipt controls, and multiple exchange rates; and domestic financial controls defined by presence of domestic interest rate restrictions.

Table 5. Bivariate Probit Results for Currency Crises and Capital Controls

Explanatory Variable	Currency Crises (1a)	Capital Controls t (1b)	Currency Crises (2a)	Capital Controls t-1 (2b)
Capital acct. controls t	-8.34*** (3.59)			
Capital acct. controls t-1			-5.20** (2.14)	
Log(M2/Reserves) t-1	1.94** (2.11)		2.30*** (2.43)	
Credit growth t-1	0.02 (1.31)		0.02 (1.40)	
Current account/GDP t-1	-0.34*** (2.55)	-1.05*** (3.53)	-0.37*** (2.64)	-1.26*** (4.16)
Real overvaluation t-1	0.11*** (3.41)		0.11*** (3.48)	
Real GDP growth t-1	-0.40** (2.25)		-0.43*** (2.37)	
Govt. Spdg/GDP t-1		1.21*** (2.83)		0.80* (1.79)
Openness t		-0.29*** (6.48)		-0.27*** (6.96)
U.S. real interest rate t-1		-0.40 (0.51)		-1.14 (1.50)
Total changes of government		-2.24*** (2.55)		-2.48*** (2.93)
Freedom t-1		-2.11 (0.73)		-4.70 (1.64)
Summary statistics				
No. of crises/presence of controls	117	721	117	724
No. of observations	892		892	
Log likelihood	-708.1		-708.0	
McFadden-R2	0.35		0.35	
Goodness-of-fit (25% cutoff) [a]				
% of obs. correctly called	82		82	
% of crises correctly called	19		16	
% of non-crises correctly called	92		92	
Goodness-of-fit (10% cutoff) [a]				
% of obs. correctly called	47		52	
% of crises correctly called	85		84	
% of non-crises correctly called	42		47	

Note: See Table 3. Results from estimate of bivariate (recursive) probit model for currency crises and (current or lagged) capital controls with cross-equation correlation between disturbances restricted to 0.

Appendix A. Currency Crisis Episodes

Argentina	1975, 1982, 1989
Bangladesh	1975
Belize	
Bolivia	1981, 1983, 1988, 1991
Botswana	1984, 1996
Brazil	1982, 1987, 1990, 1995
Burundi	1976, 1983,1986, 1989, 1997
Cameroon	1982, 1984, 1994
Chile	1985
China, P.R.: Hong Kong	
Columbia	1985
Costa Rica	1981
Cyprus	
Dominican Republic	1985, 1987, 1990
Ecuador	1982, 1985, 1988
Egypt	1979, 1989
El Salvador	1986, 1990
Equatorial Guinea	1991, 1994
Ethiopia	1992
Fiji	1986
Ghana	1978, 1983, 1986
Grenada	1978
Guatemala	1986, 1989
Guinea-Bissau	1991, 1996
Guyana	1987, 1989
Haiti	1977, 1991
Honduras	1990
Hungary	1989, 1994
India	1976, 1991, 1995
Indonesia	1978, 1983, 1986, 1997
Jamaica	1978, 1983, 1990
Jordan	1983, 1987, 1989, 1992
Kenya	1975, 1981, 1985, 1993, 1995, 1997
Korea	1980, 1997
Lao People's D. R.	1995
Madagascar	1984, 1986, 1991, 1994
Malawi	1982, 1985, 1992, 1994
Malaysia	1986, 1997

Mali	1993
Malta	1992, 1997
Mauritius	1979
Mexico	1976, 1982, 1985, 1994
Morocco	1983, 1990
Mozambique	1993, 1995
Myanmar	1975, 1977
Nepal	1975, 1981, 1984, 1991, 1995
Nicaragua	1993
Nigeria	1986, 1989, 1992
Pakistan	
Panama	
Paraguay	1984, 1986, 1988, 1992
Peru	1976, 1979, 1987
Philippines	1983, 1986, 1997
Romania	1990
Sierra Leone	1988, 1990, 1997
Singapore	1975
South Africa	1975, 1978, 1984, 1996
Sri Lanka	1977
Swaziland	1975, 1979, 1982, 1984
Syrian Arab Republic	1977, 1982, 1988
Thailand	1981, 1984, 1997
Trinidad & Tobago	1985, 1988, 1993
Tunisia	1993
Turkey	1978, 1994
Uganda	1981, 1987, 1989
Uruguay	1982
Venezuela	1984, 1986, 1989, 1994
Zambia	1985, 1994
Zimbabwe	1982, 1991, 1994, 1997

[a] Currency crises defined by criteria described in text, with 24-month exclusion windows imposed.

Appendix B. Balance of Payments and Domestic Financial Liberalization Dates

	Capital Account Liberalization	Current Account Liberalization	Export Receipts Liberalization	Domestic Financial Liberalization
Argentina	1993–	1977-81, 1993–	1993–	1977-82, 1987–
Bangladesh		1994-95		1989–
Belize	1981-85	1984-95		
Bolivia	1975-80, 1986-95	1975-80, 1986-95	1997–	1985–
Botswana		1975-79, 1995, 1997	1987-92	
Brazil				1976-78, 1989–
Burundi				1989–
Cameroon		1975-86, 1993-95		1990–
Chile		1976-81, 1995		1974-81, 1985–
China, P.R.: Hong Kong	1975–	1975–	1975–	1975
Columbia				1980–
Costa Rica	1980-81, 1995–	1975-80, 1994–		1986–
Cyprus		1993-95		NA
Dominican Republic		1995		
Ecuador	1975-85, 1988-92, 1995	1975-81, 1993–		1986-87, 1992–
Egypt		1996–	1994–	1991–
El Salvador	1996–	1993–	1996–	1991–
Equatorial Guinea		1994-95		NA
Ethiopia				
Fiji		1975-87, 1992-95		1985–
Ghana		1993-95		1987–
Grenada		1993-95	1975-78	NA
Guatemala	1975-79, 1989–	1975-79, 1989–	1975-79	1989–
Guinea-Bissau				NA
Guyana		1993–	1996–	1991–
Haiti		1975–	1975-80, 96–	1995–
Honduras	1975-79, 1993-95	1975-80, 1993–	1975-77	1990–
Hungary		1996–		1987–
India				1991–
Indonesia	1975-95	1975-76, 1978–	1982–	1983–
Jamaica	1996–	1996–	1992–	1991–
Jordan		1979-86, 1997–	1995–	1988–
Kenya	1996–	1996–	1996–	1991–
Korea		1978-81, 1988-95		1984-88, 1991–
Lao People's D. R.		1996–		
Madagascar		1997–		1985–
Malawi		1995		1988–

	Capital Account Liberalization	Current Account Liberalization	Export Receipts Liberalization	Domestic Financial Liberalization
Malaysia	1975-95	1975–	1982-92	1978–
Mali		1975-95		
Malta		1994-95		NA
Mauritius	1996–	1993–	1997–	1981–
Mexico	1975-81	1975-81, 1987–	1975-81, 1993–	1977-81, 1989–
Morocco		1993-95		1991–
Mozambique				
Myanmar				NA
Nepal		1995		1986–
Nicaragua	1975-77, 1996–	1975-77, 1993–	1975-77, 1996–	NA
Nigeria		1986-88		1990-93
Pakistan				1991–
Panama	1975–	1975–	1975–	NA
Paraguay	1982-83, 1996–	1978-81, 1992-95	1997–	1991–
Peru	1978-83, 1993–	1978-83, 1992-95, 1997–	1992–	1980-84, 1990–
Philippines		1985, 1995	1992–	1981–
Romania			1992	1991–
Sierra Leone		1986-91, 1995	1995–	1987–
Singapore	1978–	1975-96	1978–	1974–
South Africa		1975-77, 1993-95		1980
Sri Lanka		1978-79, 1992-95	1992–	1980–
Swaziland		1975-95		NA
Syrian Arab Republic				
Thailand		1975–		1989–
Trinidad & Tobago	1994–	1975-81, 1992	1993–	1994–
Tunisia		1992-95		1987–
Turkey	1997–	1989-95		1980-82, 1988
Uganda	1997–	1994–	1995–	1991–
Uruguay	1978-92, 1996–	1976–	1981, 1996–	1976–
Venezuela	1975-83, 1996–	1975-82, 1988-92, 1996–	1976-82, 1997–	1981-84, 1991-93, 1996–
Zambia	1996–	1996–	1996–	1992–
Zimbabwe			1995	1992–

Note: "–" indicates liberalization continues until the end of the sample in 1997; blank cell indicates liberalization never implemented; NA indicates no data available.