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Current Account Reversals and Currency Crises: Empirical Regularities

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Abstract

This paper studies large reductions in current account deficits and exchange rate depreciations in low- and middle-income countries. It examines which factors help predict the occurrence of a reversal or a currency crisis, and how these events affect macroeconomic performance. Both domestic factors, such as the low reserves, and external factors, such as unfavorable terms of trade, are found to trigger reversals and currency crises. The two types of events are, however, distinct; an exchange rate crash is associated with a fall in output growth and a recovery thereafter, while for reversals there is no systematic evidence of a growth slowdown.

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SUMMARY

Are external crises characterized by large nominal devaluations invariably followed by sharp reductions in current account deficits? Or do reductions in external imbalances occur even without a sharp exchange rate devaluation? And what is the impact of crises and reversals in current account imbalances on economic performance? Our paper addresses these questions by characterizing real and nominal aspects of sharp external adjustments in low- and middle-income countries. It presents stylized facts associated with sharp reductions in current account deficits (reversals) and with large nominal devaluations (currency crises), and studies empirically what factors help predict crises and reversals and what factors explain macroeconomic performance following such events.

Econometric analysis of leading indicators of reversals in current account imbalances shows that these are more likely to occur in countries with persistent deficits, low reserves, and unfavorable terms of trade, and are less likely to occur in countries that receive high official transfers and whose debt is largely concessional. Growth after reversals tends to be faster in more open economies and in countries whose real exchange rate was less appreciated prior to the reversal.

Currency crises are more likely to occur when reserves are low, the real exchange rate is appreciated, and external conditions are unfavorable--high interest rates and low growth in industrial countries. Growth tends to decline the year of the crisis, and to recover thereafter.

A comparison of currency crises and current account reversals shows that these are distinct events. Less than one-third of all current account reversals are preceded by a currency crisis, suggesting that the conventional wisdom that large nominal depreciations precede a turnaround in the current account is not accurate. This points to the need of looking more closely at current account reversals, distinguishing between those that reflect an external crisis and those that do not.

I. INTRODUCTION

Three waves of external crises have swept international capital markets during the 1990s: the EMS crisis in 1992–93, the collapse of the Mexican peso with its induced "tequila effects" and, most recently, the financial crisis in East Asia. In Italy and Mexico, the currency crisis was followed by a sharp reversal in the current account; Italy went from a deficit of 2.4 percent in 1992 to an average surplus of 2 percent in 1993–97, and Mexico from a deficit of 7 percent in 1994 to virtual balance in 1995–96; a similar outcome is expected to occur in East Asia. Are external crises characterized by large nominal devaluations invariably followed by sharp reductions in current account deficits? And what is the impact of crises and reversals in current account imbalances on economic performance? Our paper addresses these questions by characterizing real and nominal aspects of sharp external adjustments in low- and middle-income countries. It presents stylized facts associated with sharp reductions in current account deficits (reversals) and with large nominal devaluations (currency crises), studies empirically what factors help predict crises and reversals and what factors explain macroeconomic performance after such events occur.

Recent episodes of external instability have stimulated new theoretical and empirical research on crises, in an attempt to provide a conceptual framework that helps understand these traumatic events and, possibly, to improve policy design so as to minimize the likelihood of their occurrence. In principle, a reversal in capital flows can cause a currency crisis and force a reduction in current account deficits, because of the drying up of sources of external financing. However, a reversal can also occur in response to a change in macroeconomic policy designed to forestall the possibility of future speculative attacks or capital flow reversals, or as a consequence of a favorable terms-of-trade shock. Speculative attacks leading to currency crises can follow a collapse in domestic assets markets, as seems to be the case in recent events in Asia, accumulation of short-term debt denominated in foreign currency, a persistent real appreciation and deterioration of the current account, as was the case of Mexico, or a political choice to abandon a rigid exchange rate system, as in the case of the United Kingdom in 1992.

How well does theory match the variety of these different experiences? So-called first-generation models of currency crises (e.g., Krugman (1979) and Flood and Garber (1984)) are built on an inevitable collapse of a fixed exchange rate system, in which the central bank mechanically expands domestic credit, for example by monetizing a persistent fiscal deficit. After a period of gradual reserve losses, a perfectly foreseen speculative attack wipes out the remaining reserves of the Central Bank and forces the abandonment of the fixed exchange rate. The second generation currency crisis models (e.g. Obstfeld (1994)) endogenize government policy. Would-be speculators forecast the government choice as to whether or not to defend the peg, based on trading off short-term flexibility and long-term credibility. The peg is abandoned either as a result of deteriorating fundamentals, as in the

first generation models, or as a result of a speculative attack driven by self-fulfilling expectations. [2]

The latest waves of currency crises referred to above have brought explanations of crises based on multiple equilibria and/or on contagion effects to the forefront (on the former see, for example, Eichengreen, Rose and Wyplosz (1995), and Jeanne and Masson (1997) among others; on the latter, Eichengreen et al. (1996), Calvo and Mendoza (1997), Jeanne (1997) and Masson (1998)).[3] Empirical tests of crisis models use various indicators of fundamentals, such as reserves to money ratio, fiscal balance, and the rate of domestic credit creation. The issue is whether (some) fundamentals are steadily deteriorating in the period leading up to a speculative attack or not. However, it is difficult to infer from the data whether the collapse of the peg is a result of deteriorating fundamentals or self-fulfilling prophecies (see, for example, Eichengreen et al. (1995) and Krugman (1996)). A growing body of research is devoted to studying the mechanics of crises in developing countries. Edwards (1989) studied the link between devaluation, the current account and output behavior. Kaminsky and Reinhart (1996), Kaminsky, Lizondo and Reinhart (1998) and Demirgüç-Kunt and Detragiache (1997) focus on leading indicators of balance-of-payments and banking crises; Sachs, Tornell and Velasco (1996b) explore the spillover effects of the Mexican crisis on other emerging markets; closest to our work, Frankel and Rose (1996) undertake a large cross-country study of currency crashes in low-and middle-income countries.

The focus on the current account goes back to work by Sachs (1981, 1982) and follows up on our own research on current account sustainability (Milesi-Ferretti and Razin, 1996a, b) and on current account reversals (Milesi-Ferretti and Razin (1998)). Recent empirical research in the area include work by Cashin and McDermott (1996) that develop an econometric methodology to evaluate the sustainability of current account deficits and apply it to Australia, Debelle and Faruqee (1996) who undertake a cross-country study of determinants of the current account, Kraay and Ventura (1997), who argue that debtor and creditor countries respond asymmetrically to income shocks, and Lane and Perotti (1997) who investigate the impact of fiscal policy on the trade balance in OECD countries.

A number of authors have instead focused on capital account developments, and in particular on capital flows to emerging markets (see, for example, Calvo, Leiderman and

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[2] The fact that the attack is self-fulfilling does not, of course, mean that fundamentals do not matter; indeed, in these models there is a range of "good" fundamentals that rule out speculative attacks.

[3] Contagion effects, broadly defined, can (but need not) have "fundamental" origins; for example, a large depreciation in a country can imply a loss of competitiveness and a decline in external demand for a neighboring country. Eichengreen et al. (1996) try empirically to distinguish between different types of contagion.

Reinhart (1993), Corbo and Hernández (1996), Fernández-Arias (1996), Fernández-Arias and Montiel (1996)). These studies have underlined the importance of both "push" and "pull" factors in explaining capital flows.

In this paper we put together these related strands of literature, and undertake a study of indicators and consequences of current account reversals and currency crises in a large sample of low- and middle-income countries over the period 1970–96. We try to answer four questions: first, what triggers large and persistent reductions in current account deficits? Second, what triggers sharp exchange rate depreciations (currency crises)? Third, what are the consequences of these events for output and consumption? Fourth, is there a link between current account reversals and currency crises? Although our study does not focus directly on reversals in capital flows, it uses data on size and composition of external liabilities in its characterization of external crises, and it includes "push" factors, such as interest rates and economic growth in industrial countries, among the determinants of current account reversals and currency depreciation. Our findings concerning indicators of reversals and crises are in line with what suggested by theoretical models, with both domestic factors (such as the level of reserves) and external factors (such as the terms of trade and world interest rates) playing a role in triggering reversals and crises. We also find that output performance before and after a currency crisis exhibits much more "continuity" than before and after a current account reversal, and that the majority of reversals are not preceded or accompanied by a currency crisis.

II. THEORETICAL DETERMINANTS OF REVERSALS AND CURRENCY CRISES

Intertemporal models of current-account determination provide a variety of channels through which temporary shocks can induce improvements in the current account balance (see, for example, Obstfeld and Rogoff (1996)). The improvement could occur, for example, as a result of a positive income shock that is unexpected and temporary, such as an improvement in the terms of trade, or as the effects of a negative income shock die out.[4] A similar outcome can occur in response to a bad (temporary) productivity shock or when the effects of a positive productivity shock die out. In developing countries, liquidity constraints can provide a powerful additional mechanism to explain fluctuations in the current account. In this context, a reversal may be needed to ensure that a country faced with a reduction in the availability of external financing remains solvent. Changes in the availability of external financing can in turn be driven by events exogenous to the country (such as an increase in

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[4] Kraay and Ventura (1997) argue that a debtor country may actually reduce its current account deficit in response to a **negative** transitory income shock, as the reduction in wealth leads to a reduction in the share of wealth allocated to foreign assets (which is negative in a debtor country). Tornell and Lane (1998) show that in the presence of a "common pool" problem, a positive terms-of-trade shock can induce a more-than-proportional increase in spending and a worsening of the current account.

interest rates in industrial countries) or in response to a negative shock affecting the country that leads foreign investors to change their evaluation of the country's future prospects.

A simple sufficient condition for solvency is that the ratio of external liabilities to GDP is stabilized; hence we quantify the size of the reversal in the trade balance that is needed for this purpose. Let *tb* be the trade balance before the reversal, and let *tb** be the level of the trade balance needed to stabilize the ratio of external debt to GDP. We can then write

$$REV = tb^* - tb = (r^* - \gamma^* - \epsilon^*)d - tb$$
$$= [(r^* - r) - \gamma^* - \epsilon^*]d - (s - i)$$

where r (r^*) is the pre-(post-)reversal level of the real interest rate on external debt, γ^* is the post-reversal rate of growth of the economy, ϵ^* is the post-reversal rate of real appreciation, d is the ratio of external liabilities to GDP and s and I are the shares of national savings and domestic investment to GDP. As long as the real interest rate (adjusted by the rate of real appreciation/depreciation) exceeds the economy's growth rate, stabilization of the ratio of external liabilities to GDP requires a trade surplus. The size of the reversal is larger, the larger the initial trade imbalance. For a given initial trade imbalance, the size of the necessary reversal from deficit to surplus is increasing in the level of external debt and in the rate of interest, and decreasing in the rate of growth. The second way to express the equality relates the size of the necessary reversal to the relation between interest rates before and after the event. On the one side, a reversal can be thought as lowering the risk premium on external debt, thereby reducing the actual size of the necessary turnaround in the trade balance. On the other side, the need for a turnaround may arise because of an increase in world interest rates, in which case the interest differential would raise the size of the necessary reversal. Clearly, any shock that affects r^* or γ^* alters the intertemporal budget constraint faced by the country and may therefore require a reversal in the trade balance. This reversal may be generated, for example, by a combination of exchange rate depreciation and a fiscal policy tightening (see Milesi-Ferretti and Razin (1996a) for some country examples).

In a world economy with problems such as asymmetric information, moral hazard, adverse selection among borrowers, and the absence of international bankruptcy arrangements, even solvent borrowers may face severe liquidity constraints due to a sudden reversal in capital flows. These problems are particularly relevant to developing countries' economies characterized by shallow financial markets, high vulnerability to terms of trade shocks and political uncertainty. Indicators of a country's vulnerability to sharp capital flow reversals, such as, for example, the composition of external liabilities, can therefore provide information regarding the likelihood of a sharp turnaround in the current account balance.

The simplest theoretical framework in which to describe currency crises is provided by Krugman (1979) and Flood and Garber (1984). In this framework, the source of the crisis is an inconsistency between the exchange rate peg and the rate of domestic credit expansion,

that leads to a gradual depletion of foreign exchange reserves, culminating in a speculative attack in which the remaining reserves are wiped out instantly. The attack takes place once the "shadow exchange rate" e^s, defined as the implicit floating exchange rate that would prevail once reserves are exhausted, equals the pegged rate e. In the simple monetary model upon which this analysis is based, a measure of the vulnerability to speculative attacks is usefully given by

$$\frac{e^s}{e} = \frac{1 - \mu \frac{eR}{M2}}{1 - \eta \pi}$$

where μ is the base money multiplier, *M2* is broad money, *R* is the level of foreign exchange reserves, η is the interest semi-elasticity of the demand for money and π the rate of credit expansion. In this context, Calvo (1997) emphasizes the importance of the ratio *eR/M2* and of the ratio of reserves to short-term debt as a measure of the adequacy of international reserves. This class of models does not yield clear predictions with regard to the link between exchange rate crises and the behavior of the trade balance. However, if the model is amended to allow for capital controls (as in Wyplosz (1986)) reserve depletion can take place through the current account as well, with trade deficits eventually leading to an exhaustion of reserves and a collapse of the peg.

Insofar as current-account reversals occur in periods of economic distress, with liquidity constraints due to a reversal in capital flows, we would expect a link between reversals and large currency depreciations. However, this may not be the case when reversals are induced by other factors, such as favorable terms-of-trade developments. The empirical work of the next Sections characterizes empirical regularities associated with both current account reversals and currency crashes, attempts to shed light on what indicators provide a signal of the likelihood of these events occurring and looks at whether reversals and currency crises are related.

III. THE DATA

Our data set consists of 105 low- and middle-income countries (48 African countries, 26 Asian countries, 26 countries from Latin America and the Caribbean and 5 European countries). A complete list of countries is in Appendix 1. In the empirical analysis we also make use of a reduced sample, comprising 39 middle-income countries with population above 1 million.[5] These countries are indicated with an asterisk in Appendix 1. The main source of data is the World Bank (World Tables and Global Development Finance);

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[5]These countries had income per capita (Summers and Heston definition) above $1,500 and population above 1 million in 1985, as well as an average current account deficit during the sample period below 10 % of GDP.

Appendix 2 describes data sources and definitions. In addition to standard macroeconomic and external variables, the data set includes a number of financial sector variables and of variables reflecting the composition of external liabilities, whose role in determining the likelihood of external crises has been emphasized in recent literature (see, for example, Calvo (1997)).

The data belongs to different categories:

Macroeconomic variables such as economic growth, real consumption growth, the rate of investment, the fiscal balance, the level of GDP per capita;

Financial variables such as the ratio of M2 to GDP, the credit growth rate and the ratio of private credit to GDP;

External variables such as the current account balance (exclusive and inclusive of official transfers), the real effective exchange rate, the degree of real exchange rate overvaluation,[6] the degree of openness to trade, the level of external official transfers as a fraction of GDP;

Debt variables such as the ratio of external debt to output, the interest burden of debt as a fraction of GNP, the share of concessional debt, short-term debt, public debt and multilateral debt in total debt and the ratio of FDI flows to debt outstanding.

Foreign variables such as the real interest rate in the United States (as a proxy for world interest rates), the rate of growth in OECD countries, and the terms of trade.[7]

Dummy variables such as regional dummies, a dummy for the exchange rate regime that takes the value 1 if the country's exchange rate is pegged and zero otherwise, and a dummy takes the value 1 if the country has an IMF program in place for at least six months during the year.[8]

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[6] For the CPI-based real effective exchange rate (period average =100), an increase represents a real **appreciation**. The degree of real overvaluation, calculated using a bilateral rate vis-à-vis the U.S. dollar, is for every country the percentage deviation from the country's sample average, as in Frankel and Rose (1996). Goldfajn and Valdés (1996) study the dynamics of real exchange rate appreciations and the probability of their "unwinding".

[7] For the terms of trade index, we take for each country the average value over the sample to equal 100. An increase in the index represents an improvement in the terms of trade.

[8] The source for these variables is Cottarelli and Giannini (1997).

IV. INDICATORS OF CURRENT ACCOUNT REVERSALS

In the definition of reversal events we want to capture large and persistent improvements in the current account balance, that go beyond short-run current account fluctuations as a result of consumption smoothing. The underlying idea is that "large" events provide more information on determinants of reductions in current-account deficits than short-run fluctuations. These events have to satisfy three requirements:

1. an average reduction in the current account deficit of at least 3 (5) percentage points of GDP over a period of three years with respect to the three years before the event;

2. the maximum deficit after the reversal must be no larger than the minimum deficit in the three years preceding the reversal;

3. the average current account deficit must be reduced by at least one third.

The first and second requirements should ensure that we capture only reductions of sustained current account deficits, rather than sharp but temporary reversals. The third requirement is necessary so as to avoid counting as a reversal a reduction in the current account deficit from, say, 15 to 12 percent.

Since we define events based on three-year averages, the actual sample period during which we can measure reversal events is 1973 to 1994. According to our definition, reversals can occur in consecutive years; in this case, however, they are not independent events. In the empirical analysis that follows we therefore exclude reversals occurring within two years of a previous one. Table 1 summarizes the number of events according to different definitions.

The first notable feature is that reversal events are by no means rare. For example, for a 3 percent average reduction in the current account deficit (excluding official current transfers), we find 152 episodes in 69 countries; for a 5 percent reduction 117 episodes in 59 countries. If we exclude reversals occurring within two years of a previous one, the total is 100 episodes (77 for a 5 percent reduction). The geographical distribution of reversals is relatively uniform across continents, once we adjust for the number of countries in the sample. An analysis of the time distribution shows, not surprisingly, that a significant share of total reversals occurs in the period immediately following the debt crisis, as well as in the late eighties. The number of reversals during the 1970s is instead fairly low.[9] The size of the reversals is also noteworthy. For 3 percent events (excluding transfers), the median reversal (which is smaller than the average) is 7.4 percentage points of GDP, from a deficit of 10.3 percent to a deficit of 2.9 percent. Malaysia, for example, had an average current-account deficit of over 11 percent in 1981–83, but only of 2.5 percent in 1984–86.

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[9] Note that several oil-producing countries in the Middle-East (such as Iraq, Saudi Arabia, Kuwait, UAE, Bahrein) are excluded from the sample.

Table 1. Current Account Reversals

A. Geographical Distribution

Size of reversal ↓	Total	Africa (48 countries)	Asia (26 countries)	Europe (5 countries)	L.Am.& Car. (26 countries)
3% (no transfers)	152	67	48	4	33
3%,window (no transfers)	100	43	29	3	25
5% (no transfers)	117	55	38	2	22
5%, window (no transfers)	77	35	22	1	19
3 %	167	76	48	4	39
3% , window	107	47	30	3	27

B. Time Distribution

Size of Reversal ↓	Before 1978	1978–81	1982–1985	1986–1989	1990–1994
3% (no transfers)	7	17	66	41	21
3%,window (no transfers)	7	14	41	23	15
5% (no transfers)	4	13	54	35	12
5%, window (no transfers)	4	10	34	21	8
3 %	7	20	67	49	24
3% , window	7	17	39	29	15

Notes:
3 (5)%: reduction in the current account deficit by at least 3(5)% over three years with respect to the preceding 3 years. No transfers definition excludes official transfers from the current account.
Window: excludes crises occurring within 3 years of another crisis.

These numbers confirm that reversal episodes are associated with major changes in a country's external position. What are their implications for the path of other macroeconomic and financial variables? In order to address this question, we follow a methodology developed in Eichengreen et al. (1995). The basic idea of this event-study methodology is to distinguish between periods of "turbulence"—here, those within three years of a reversal event—and the remaining, "tranquil" periods. Graphs allow a comparison of variables during "turbulent" periods with their (average) value during tranquil periods.

Figures 1 and 2 depict the behavior of a set of variables during periods of turbulence (around the time of reversals) for the whole sample and for the reduced sample comprising 39 middle-income countries, respectively. Each panel shows deviations of these variables from their mean during periods of tranquility, except for the first panel, which plots the **median** rate of depreciation in turbulent periods, as a deviation from the sample median in tranquil periods. The plotted values for the remaining panels refer to reversal events, and are the means (plus or minus two standard deviations) of the variable during each year of the reversal episode (from t-3 to t+3) as a deviation from the sample mean of the variable during tranquil periods.[10] Hence a positive value for a variable indicates that it tends to be higher in "turbulent" than in "tranquil" periods.[11]

The Figures show that the real exchange rate starts out more appreciated than average before reversal periods, and then depreciates throughout the period. The panel depicting the behavior of the nominal exchange rate shows indeed an acceleration in the median rate of currency depreciation which occurs a couple of years before reversals. Reversals tend also to be preceded by unfavorable terms of trade, low foreign exchange reserves, a high interest burden of external debt, low consumption growth and a high but declining fiscal deficit. After a reversal occurs, reserves tend to rise, the fiscal balance continues to improve and the real exchange rate to depreciate. Note also that no clear pattern for output growth characterizes the period preceding or following a reversal. This finding runs counter to the conventional wisdom that sharp reductions in current account deficits reflect an external crisis and that they are achieved by domestic output compression so as to reduce import demand. Indeed, it is a reflection of the fact that reversal events can have different characteristics; some are associated with balance-of-payments crises, but others are spurred by different factors, such as favorable external shocks or an improvement in macroeconomic policy conduct.

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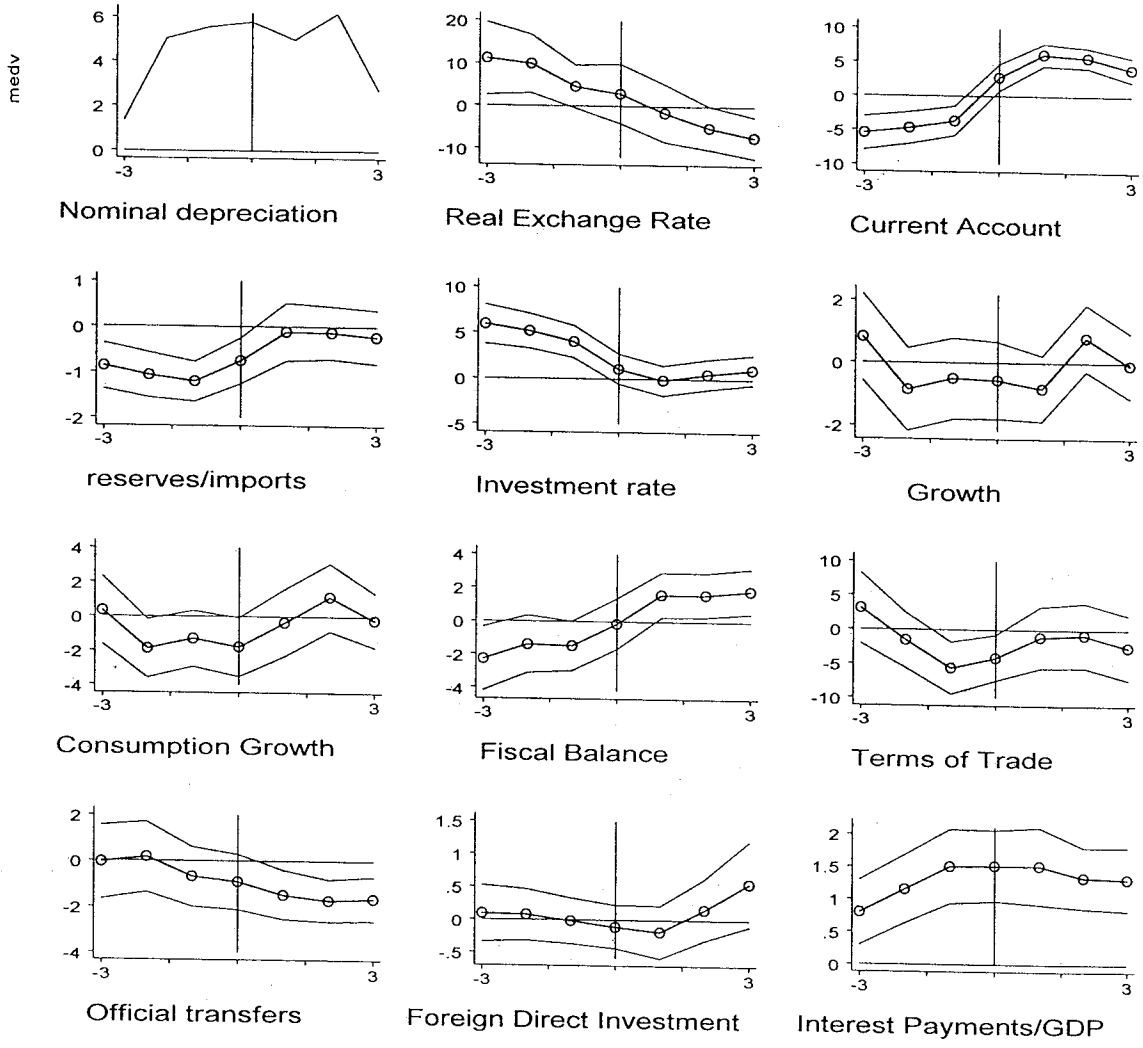
[10] Frankel and Rose (1996) do not subtract the mean of the tranquil period, so as to provide information about the average **level** of a variable. We chose to de-mean variables so as to sharpen the graphical presentation.

[11] One potential problem with this methodology is that the time distribution of reversal episodes is concentrated in the 1980s, and therefore the characteristics of reversal events we identify are in part influenced by the characteristics of the 1980s with respect to the 1970s and the 1990s. However, the graphs restricted to the 1980s show the same overall pattern as Figure 1.

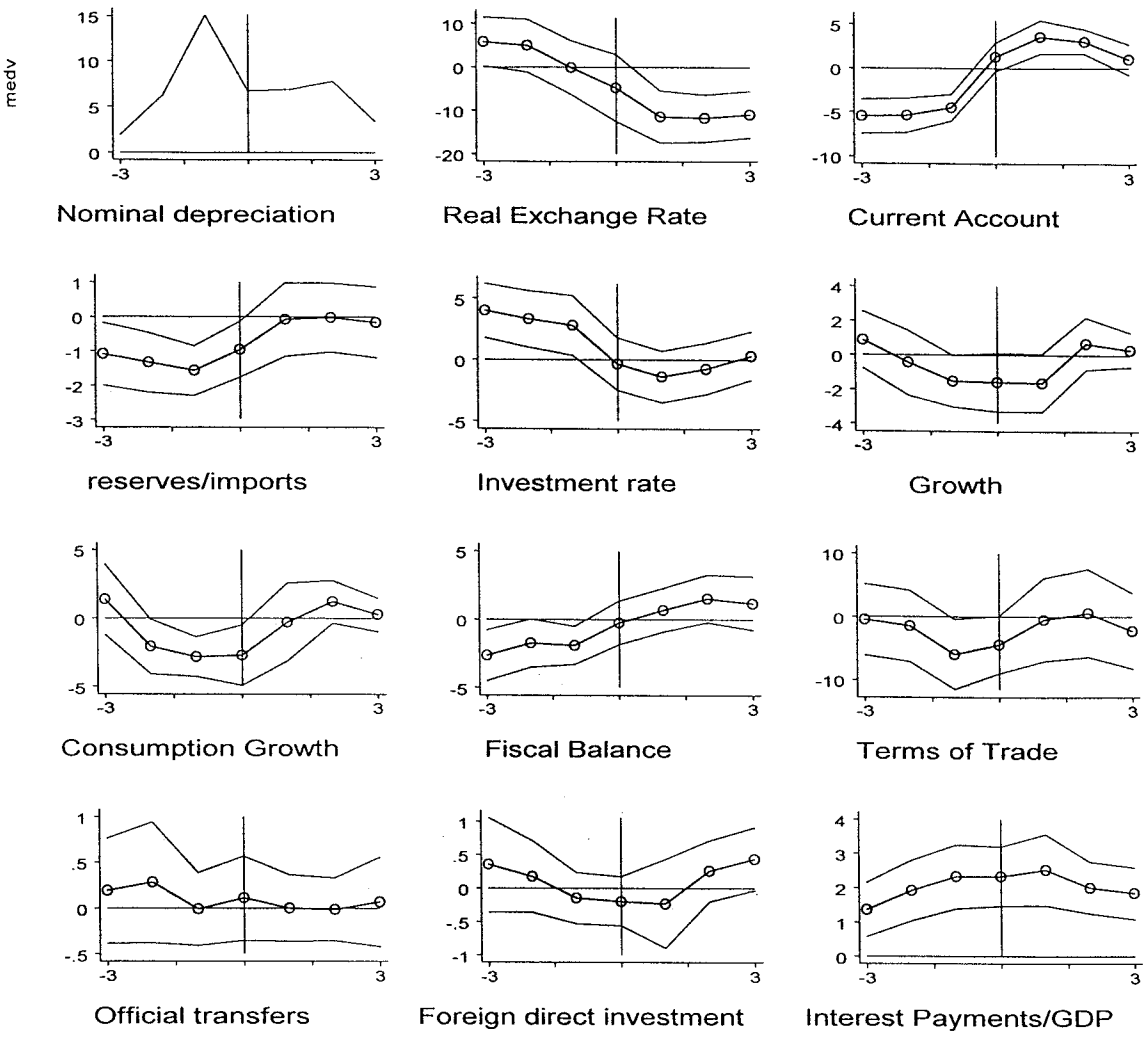
Figure 1. Current Account Reversals



Notes:

Data for 100 reversals from 105 countries, 1970-96. For each variable, the plots represent deviations from its average during periods of tranquility (mean plus 2 standard deviation band for panels 2-12; median for panel 1); scales and data vary by panel. A reversal is defined as an average improvement in the current account balance (net of official transfers) of at least 3 percent over a period of 3 years with respect to the previous 3 years. "Tranquil" periods are those that are not within three years of a current-account reversal.

Figure 2. Current Account Reversals



Notes:

Data for 47 reversals from 39 countries, 1970-96. For each variable, the plots represent deviations from its average during periods of tranquility (mean plus 2 standard deviation band for panels 2-12; median for panel 1); scales and data vary by panel. A reversal is defined as an average improvement in the current account balance (net of official transfers) of at least 3 percent over a period of 3 years with respect to the previous 3 years. "Tranquil" periods are those that are not within three years of a current-account reversal

We then use multivariate probit analysis to examine whether a set of explanatory variables help predict whether a country is going to experience a reversal in current account imbalances. More specifically, we estimate the probability of a reversal occurring at time *t* (meaning a 3 percent average decline of the current account deficit between *t* and *t* +2 with respect to the period between *t-1* and *t - 3*) as a function of variables at *t* - 1 and of contemporaneous exogenous variables (terms of trade, industrial countries' growth, world interest rates). The choice of the set of explanatory variables is motivated by existing research on currency and banking crises, as well as by our previous work comparing episodes of persistent current account deficits, that identified a number of potential indicators of sustainability. Among the explanatory variables we include the current account deficit (CA), economic growth (GROW), the rate of investment (INV), the level of GDP per capita (GDP), the real effective exchange rate (RER), openness to trade (OPEN), foreign exchange reserves as a fraction of imports (RES), the level of external official transfers as a fraction of GDP (OT), the ratio of external debt to GDP (DEBTY), the share of concessional debt in total debt (CONRAT), the share of public debt in total debt (PUBRAT), the ratio of credit to GDP (CRED) (a proxy for financial development). Other variables, such as the ratio of FDI flows to GDP (FDI) and the share of short-term debt in total debt (SHORT) were excluded from the probit because they turned out to be economically and statistically insignificant. We excluded the fiscal deficit because of problems with data availability—it did not enter significantly in the probit analysis, and it reduced sample size considerably. Note that the definition of the event is based on changes in the current account balance, and we therefore believe it is important to control for the level of the current account balance to the reversal.

Among the "exogenous" variables we include the lagged and contemporaneous real interest rate in the United States (RINT—as a proxy for world interest rates), the lagged and contemporaneous rate of growth in OECD countries (GROECD), the lagged level of the terms of trade (TT) and the change in the terms of trade in the reversal period ($\Delta TT(t+1)$). We also use the dummy for the exchange rate regime (PEG) and the one for an IMF program (IMF).[12] For some of the lagged explanatory variables, namely the current account, the rate of growth and the investment share we use a three-year average (over the period *t*-1 to *t*-3) rather than their level at *t*-1, to ensure consistency with the way we measure reversals.

It is clearly incorrect to interpret this probit analysis in a "structural" way, given that many of the explanatory variables are endogenous. Nevertheless, the analysis can provide a useful multivariate statistical characterization of reversal events as well as identify potential "leading indicators" of reversal events. Probit results are presented in Table 2.

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[12] Santaella (1996) and Knight and Santaella (1997) study the determinants of IMF programs and characterize the stylized facts that precede them.

Table 2. Indicators of Reversals

	(1) With Adj.Events Full Sample	(2) No Adjac. Events Full Sample	(3) No Adjac. Events Avg CA>-10%	(4) No Adjac. Events Mid. Income Co.
Avg CA	- 0.60**	- 0.44**	- 0.63**	-0.62**
	(0.11)	(0.10)	(0.20)	(0.21)
Avg GROW	-0.05	-5.7E-3	0.070	-0.10
	(0.13)	(0.10)	(0.11)	(0.15)
Avg INV	0.145*	0.075	0.12**	0.19**
	(0.082)	(0.063)	(0.068)	(0.095)
GDP	1.2E-3**	7.8E-4**	6.5E-4**	1.2E-3**
	(4.6E-4)	(4.1E-4)	(3.6E-4)	(5.3E-4)
OPEN	-0.028	-0.013	-0.013	-0.017
	(0.019)	(0.014)	(0.015)	(0.020)
RES	-0.81**	-0.60**	-0.45**	-0.50**
	(0.24)	(0.21)	(0.17)	(0.22)
RER	0.007	7.4E-3	0.016**	7.0E-3
	(0.012)	(.0.012)	(0.009)	(0.016)
OT	-0.64**	-0.49**	-0.44*	
	(0.20)	(0.17)	(0.29)	
DEBT	-0.019**	-0.024**	0.012	0.029*
	(0.009)	(0.009)	(0.009)	(0.017)
PUBRAT	0.050	0.036	0.045**	
	(0.035)	(0.025)	(0.022)	
CONRAT	-0.091**	-0.076**	-0.074**	
	(0.032)	(0.026)	(0.030)	
CREDIT	0.018	0.029	0.024	0.061**
	(0.029)	(0.023)	(0.021)	(0.031)
TT	-0.074**	-0.054**	-0.044**	-0.042**
	(0.026)	(0.021)	(0.020)	(0.025)
ΔTT(t+1)	4.4E-3	1.8E-3		
	(2.8E-3)	(0.019)		
RINT	0.83**	2.72*	0.12	0.24
	(0.32)	(1.60)	(0.16)	(0.22)
GROECD	-0.37	-0.20	-0.18	-0.49*
	(0.33)	(0.24)	(0.22)	(0.37)
GROECD(t+1)	1.28**	0.58**		
	(0.41)	(0.28)		
PEG	-2.22*	-1.77*	-1.62**	-2.03**
	(1.32)	(1.13)	(1.02)	(1.36)
IMF	1.52	1.38*	0.37	-0.12
	(1.09)	(0.91)	(0.72)	(1.14)
Pseudo R^2	0.22	0.26	0.36	0.36
Observations	1301	1044	762	489

Notes:
Dependent variable takes the value 1 if a reversal of at least 3% takes place at time *t+1*, and zero otherwise. Estimation by probit. The table reports probit slope derivatives (and associated z-statistics in brackets), times 100. Standard errors are corrected using the Huber/White sandwich estimator of variance. **(*) indicate statistical significance at the 95% (90%) confidence level. The variables CA, GROW and INV are averages over the three years preceding the event. The variables OPEN, CONRAT, PUBRAT, OT, RER, TT, GDP, RINT, GROECD are levels. The first three probits include continent dummies (coefficients not reported). Omitted variables in models (3) and (4) were excluded based on a joint F-test.

Table 2. Goodness of Fit (concluded)

Model (1)

		Predicted 0	1	Total
Actual	0	1186	7	1193
	1	101	7	108
	Total	1287	14	1301

Model (2)

		Predicted 0	1	Total
Actual	0	972	4	976
	1	60	8	68
	Total	1032	12	1044

Model (3)

		Predicted 0	1	Total
Actual	0	695	6	701
	1	44	17	61
	Total	739	23	762

Model (4)

		Predicted 0	1	Total
Actual	0	444	4	448
	1	28	13	41
	Total	472	17	489

Overall, the empirical analysis identifies a number of robust predictors of reversals in current account imbalances, regardless of the sample definition:

Current account deficit: not surprisingly, reversals are more likely in countries with large current account deficits. This result is consistent with solvency and willingness to lend considerations.

Foreign exchange reserves: countries with lower reserves (expressed in months of imports) are more likely to experience a reversal. Clearly, low reserves make it difficult to sustain large external deficits and may reduce the willingness to lend of foreign investors. The ratio of reserves to M2, indicated by Calvo (1997) and others as a key predictor of balance-of-payments crises, also appears to signal reversals ahead of time in our sample.

GDP per capita. Countries with higher GDP per capita are more likely to experience reversals. The coefficient on this variable captures the difficulty of extremely poor countries in reversing external imbalances. The positive coefficient is also consistent with the theory of stages in the balance of payments: as a country gets richer, a reduction in deficits (or a shift to surpluses) is more likely.

Terms of trade. Reversals seem more likely in countries with worsened terms of trade. One interpretation of this finding is that countries that have suffered terms-of-trade deterioration are more likely to experience a reversal of capital flows, and may therefore be forced to adjust. The evidence is also in line with what suggested by Kraay and Ventura (1997), since the countries in our sample are almost entirely net debtors, and by Tornell and Lane (1998).

We also find some evidence that reversals are more likely in countries with high *investment*: insofar as high investment contributes to export capacity, it can lead to a narrowing of external imbalances. Reversals also appear less likely in countries that peg their exchange rates. If a peg precludes an adjustment in the nominal (and real) exchange rate, it can hamper the reduction of external imbalances.

When we consider the full sample, that includes a large number of very poor countries, we find the following additional indicators:

Concessional debt. The higher the share of concessional debt in total debt, the less likely is a current account reversal. Concessional debt flows are less likely to be reversed, and they are likely to be higher in those countries that have more difficulties reducing their external imbalances and servicing their external obligations. The statistical significance of the share of concessional debt vanishes once we exclude the poorest countries from our sample, and therefore the variable was excluded form the last probit model (Table 2, column 4).

Official international transfers. A current account reversal is less likely when official transfers are high. Clearly, higher official transfers reduce the need to adjust the current account (we are measuring the current account net of such transfers).

OECD growth. Reversals in developing countries are more likely to occur in years when the growth rate in industrial countries is high. High growth increases the demand for exports from developing countries, helping to narrow current account deficits.

U.S. interest rates. Reversals are more likely after a period of high real interest rates in industrial countries. High real interest rates increase the cost of borrowing for developing countries and reduce the incentive for capital to flow to developing countries.

It is interesting to note that the coefficient on the level of external debt has the wrong sign in the first two probit models. This reflects the fact that several poor countries are highly indebted but have persistently high current account deficits, without reversals. Indeed, when these countries are eliminated from the sample the coefficient on external debt changes sign (see columns (3) and (4)). Reversals do not appear to be systematically correlated with GDP growth before the event; we also do not find significant links between the real exchange rate (or its rate of change) before the event and current account reversals (see, however, Section 5). [13] Of course, it should be kept in mind that this finding is conditional on a given current account balance (see also Figures 1 and 2).

The second part of Table 2 shows the goodness of fit of the probit model, under the assumption that a crisis is correctly predicted if the estimated probability is above 0.5. Note that the fit improves considerably when we eliminate very poor countries. This is not surprising—indeed, one can think that the determinants of swings in the current account can differ substantially between countries that rely exclusively on official transfers, mostly on concessional terms, and those that have more access to international capital markets.

The results presented so far have to be interpreted taking into account the fact that the empirical analysis aggregates reversal events that have quite different features; it includes both full-fledged balance-of-payments crises, as, say, Mexico 1982, and improvements in the current account spurred by favorable terms-of-trade developments or a timely correction in macroeconomic policy. A better understanding of the dynamics of current account reversals and of the role of economic policy will require a classification of these events based on their salient features (terms of trade shocks, swings in capital flows etc.). This would provide an opportunity for a closer match between intertemporal models of current account determination and developing countries' data.

V. CURRENT ACCOUNT REVERSALS AND OUTPUT PERFORMANCE

This section examines the behavior of output growth in countries that experienced sharp reductions in current account imbalances. We focus on two issues: first, whether reversals are costly in terms of output, and, second, what factors determine a country's rate of

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[13] Results using the degree of overvaluation (OVERVAL) instead of RER, are analogous.

growth during a reversal period. Output costs clearly arise when reversals are associated with macroeconomic crises; more generally, they can be due to macroeconomic adjustment and a reallocation of resources across sectors.

For the purpose of this "before-after" analysis we selected the 3 percent event definition and we eliminated adjacent events.[14] This leads to identify 100 reversal episodes for the definition excluding official transfers. The first interesting finding is that the median change in output growth between the period after and before the event is around zero, suggesting that reversals in current account deficits are not necessarily associated with domestic output compression. However, output performance is very heterogeneous. For example, Uruguay's average growth was - 7 percent in the period 1982–84, compared to 4 percent in the period 1979–81; Malaysia went instead went from growth of 2.4 percent in 1984–86 to growth of close to 8 percent over the following three years.

Our dependent variable in the regression analysis is the average rate of output growth during the three years of the reversal period, as deviation from OECD average during the same period. We take the deviation of growth from the OECD average because reversal events occur in different years, and we want to provide some (rough) correction of each country's performance for the overall behavior of the world economy during that period. Our explanatory variables include average growth (also as a deviation from the OECD average), average investment, the average current account balance, GDP per capita (a "conditional convergence" term), the ratio of external debt to GDP (DEBTY), the overvaluation of the real exchange rate, official transfers and U.S. real interest rates. They are all dated prior to the reversal.[15] Results are presented in Table 3.

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[14] In Milesi-Ferretti and Razin (1998) we grouped events occurring in adjacent years for the same country, counting them as a single, longer-lasting reversal.

[15] All averages are calculated over the 3-year period preceding the reversal. The percentage change in the terms of trade between the two periods was statistically insignificant and was excluded from the regression so as to increase sample size.

Table 3. Consequences of Reversals

Dependent Variable is Output Growth During Reversal Period
(As deviation from OECD average)

	Full Sample	Full Sample Regional Dummies	Avg CA>-10% Regional Dummies	Mid-inc. Countries Regional Dummies
Lagged Dep Var.	0.10 (0.11)	0.10 (0.11)	0.10 (0.10)	0.32** (0.12)
CA	-0.10 (0.08)	-0.14* (0.07)	-0.13 (0.08)	-0.07 (0.09)
OVERVA	- 0.076** (0.017)	- 0.078** (0.016)	- 0.069** (0.018)	-0.070** (0.023)
OPEN	0.030** (0.011)	0.021* (0.011)	0.026** (0.013)	0.031* (0.016)
DEBTY	- 0.018** (0.07)	- 0.016** (0.079)	-0.018 (0.011)	-0.025** (0.009)
RINT	-0.23 (0.17)	-0.29* (0.16)	-0.20 (0.17)	-0.42 (0.18)
OT	-0.29** (0.11)	-0.31** (0.10)	-0.55 (0.35)	
GDP	-3.1E-4 (2.4E-4)	-1.4E-4 (2.6E-4)	-3.0E-4 -2.9E-4	-1.6E-4 (-2.8E-4)
INV	0.058 (0.044)	0.067 (0.048)	-0.067 (0.044)	-0.037 (0.067)
R^2	0.35	0.40	0.44	0.58
No. Obs.	84	84	66	44

Notes:
Estimation by OLS with White's correction for heteroskedasticity; standard errors in brackets. **(*) indicate statistical significance at the 95% (90%) confidence level. The dependent variable is a three-year average, expressed as deviation from the OECD average during the same period. The explanatory variables CA and INV are averages over the three years preceding the event; the variables OPEN, GDP, RER, TT, OT and DEBTY are levels the year before the event.

The Table shows that countries more open to trade and with a less appreciated level of the exchange rate before the event are likely to grow faster after the event. The size of the point estimates indicates that the effects of these variables are also economically significant: for example, a country that has an overvaluation of 10 percent before the reversal is likely to grow 0.7 percent slower for the following three years. We also find some evidence that countries with high external debt and those that receive high official transfers tend to grow more slowly. The latter finding could of course simply reflect the fact that poor countries that grow slowly tend to receive large transfers. Indeed, when we exclude countries with low per capita income, the coefficient on official transfers changes sign and becomes statistically insignificant (regression not reported). Note also that the correlation of growth before and after the event is low and statistically insignificant, with the exception of the regression for the group of middle-income countries.

Overall, the empirical analysis seems to provide a reasonable characterization of short/medium-run output performance during periods of substantial reduction in external imbalances. A noteworthy finding is that reversal events seem to entail substantial changes in macroeconomic performance between the period before and the period after the crisis, but are not systematically associated with a growth slowdown.

VI. PREDICTORS OF CURRENCY CRASHES

In this Section we extend and refine work by Frankel and Rose (1996), by considering a longer sample and alternative definitions of currency crises. We use 4 definitions of currency crises; the first one (CRISIS1), used by Frankel and Rose (1996), requires an exchange rate depreciation vis-à-vis the dollar of 25 percent, which is at least 10 percent higher than the depreciation the previous year. The main problem with this definition is that it considers as a crisis an episode in which the rate of depreciation increases from, say, 50 to 61 percent. To avoid capturing the large exchange rate fluctuations associated with high-inflation episodes, the second definition (CRISIS2) requires, in addition to a 25 percent depreciation, at least a doubling in the rate of depreciation with respect to the previous year **and** a rate of depreciation the previous year below 40 percent. The third and fourth definitions (CRISIS3 and CRISIS4) focus on those episodes in which the exchange rate was relatively stable the previous year, and that therefore may be closer to the concept of currency crisis implicit in theoretical models. CRISIS3 requires a 15 percent minimum rate of depreciation, a minimum 10 percent increase in the rate of depreciation with respect to the previous year and a rate of depreciation the previous year of below 10 percent. Finally, CRISIS4 is analogous to CRISIS3 with the additional requirement that the exchange rate be pegged the year before the crisis.

We do not consider as a crisis any event that occurs within three years of another crisis; we therefore construct a "window" around each crisis event which is distinguished from periods of "tranquility". This reduces the total amount of crises; Table 4 summarizes the currency crisis episodes according to the different definitions.

Table 4. Currency Crashes

A. Geographical Distribution

Type of crisis ↓	Total	Africa (48 countries)	Asia (26 countries)	Europe (5 countries)	Lat. Am.& Caribbean (26 countries)
CRISIS2 no window	168 (142*)	85 (59*)	30	6	47
CRISIS 1 window	172 (146*)	81 (55*)	30	7	54
CRISIS2 window	142 (116*)	73 (47*)	27	4	38
CRISIS3 window	162 (136*)	84 (58*)	33	7	38
CRISIS4 window	119	67 (41*)	17	7	28

B. Time Distribution

Type of crisis ↓	Before 1978	1978–81	1982–1985	1986–1989	1990–94	1995–96
CRISIS2 no window	15	33 (20*)	33	29	52 (39*)	6
CRISIS 1 window	16	32 (19*)	37	26	53 (40*)	8
CRISIS2 window	14	30 (17*)	28	20	45 (32*)	5
CRISIS3 window	29	36 (23*)	30	18	41 (28*)	8
CRISIS4 window	21	30(17*)	19	14	30(17*)	5

Notes:
CRISIS1: depreciation of 25%, at least 10% higher than the previous year.
CRISIS2: depreciation of 25%, at least double the previous year, with the latter below 40%.
CRISIS3: depreciation of 15%, at least 10% higher than the previous year, with the latter below 10%.
CRISIS4: same as CRISIS3 plus pegged exchange rate the year before the crisis.
Window: excludes crises occurring within 3 years of another crisis.
* Counting the depreciation of the CFA franc as a single crash.

There is clearly a large degree of overlap between these definitions of crises. Practically all episodes in CRISIS2 (138 of them) are also episodes of CRISIS1.[16] The overlap between CRISIS3 and CRISIS1 (or CRISIS2) is smaller (109 cases) but still significant. Note also that the number of "crashes" depends crucially on whether one counts countries that experienced a crash or currencies that crashed. The 6 members of the Central African Economic and Monetary Union (Cameroon, Central African Republic, Chad, Congo, Equatorial Guinea and Gabon), the 7 members of the West African Economic and Monetary Union (Benin, Burkina Faso, Côte d'Ivoire, Mali, Niger, Senegal and Togo) plus the republic of the Comoros share the same currency (the CFA franc) which was set as a fixed rate vis-à-vis the French franc until 1994, and then devalued by 50 percent.[17] Our definition of crisis therefore captures 14 country episodes that year, and also in 1981 (because of the depreciation of the French franc vis-à-vis the dollar).

The geographical distribution of currency crashes show that African and Latin American countries tend to experience more crashes than Asian countries (adjusting by the number of countries in the sample). Recall, however, that the recent Asian currency crashes are not in the sample. The time distribution of currency crashes is more uniform than the distribution of reversals, with the highest number of crashes in the early eighties (the period of the debt crisis) and, more surprisingly, in the early nineties. The increase in capital mobility during the latter period may be one possible explanation of this pattern.

Table 5 summarizes changes in the exchange-rate regime in countries that undergo currency crashes. In the whole sample, the exchange rate is pegged 69 percent of the time. The data shows that a number of countries abandon the exchange rate peg the year of the crisis, and a few more the following year.

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[16]The effects of 'windowing" account for the CRISIS2 episodes that are not also CRISIS1.

[17]Technically, the Islamic Federal Republic of Comoros uses a different currency, the CV, which is tied to the French franc in an analogous fashion to the CFA.

Table 5. Currency Crashes and Exchange Rate Regime

Type of Crisis ↓	Total*	Peg Year Before Crisis	Peg Year of the Crisis	Peg Year After Crisis
CRISIS 1 window	164	99	87	79
CRISIS2 window	136	97	83	76
CRISIS3 window	146	114	98	89
CRISIS4 window	115	115	95	87

Note:
* Total number of crises for which data on exchange rate regime before and after crisis is available.

As in the case of current account reversals, we present in Figures 3 and 4 some evidence on the behavior of key variables around the time of the crisis for the whole sample and for the sample of middle-income countries, respectively (the graphs refer to CRISIS2—the graphs for the other crises are similar, and available upon request). The first 2 panels of Figures 3 and 4 depict the behavior of the **median** rate of depreciation and of CPI inflation around the time of a currency crash, as deviations from the sample median during periods of tranquility. The other panels depict deviations from means and standard error bands (as in Figures 1 and 2). For the whole sample, the median rate of depreciation prior to crises is below 2 percent, close to the sample median; the median depreciation the year of the crisis is 53 percent, and, after the crisis, it falls to 17 percent. A similar pattern emerges for the rate of inflation, although the increase during the year of the crisis is much smaller than the increase in the rate of depreciation. This is reflected in the behavior of the real exchange rate (or the degree of overvaluation): these increase prior to the crisis and fall the year of the crisis, and do not seem to recover within the three-year window. Another notable feature of crisis years (and of the year preceding a crisis) is a decline in the rate of output growth and especially in consumption growth, with a rebound taking place after the crisis. The median consumption growth rate over the three years preceding a crisis is 3.3 percent; the year of the crisis, 0.2 percent and the following three years 2.2 percent. For output growth, we get 2.6 percent, 1.4 percent and 3.1 percent, respectively. Not surprisingly, foreign exchange reserves around crisis periods tend to be lower than during tranquil periods, and the terms of trade less favorable. There is some evidence that current account deficits are larger before crises than in tranquil periods; however, the Figures show an improvement in the current account position after the devaluation only for middle-income countries.

We turn now to multivariate probit analysis. We estimate the probability of a currency crisis at time $t+1$ as a function of a set of explanatory variables at time t and of "external" factors at time t and $t+1$. The set of explanatory variables is similar to the one we have used for reversals; here we also report results using the ratio of reserves to M2 (RESM2) as an alternative to reserves measured in months of imports (RES). Results are presented in Table 6. The first four columns report probit analysis using the full sample and the 4 different definitions of crises, while the last 2 columns report the results for the sample of 39 middle-income countries. Overall, these results suggest some robust leading indicators of currency crashes, regardless of the precise definition of the crash:

Foreign exchange reserves. Crashes are more likely in countries with low foreign exchange reserves, measured as a fraction of imports or as a fraction of M2.[18] This finding is clearly in line with theoretical models of currency crises.

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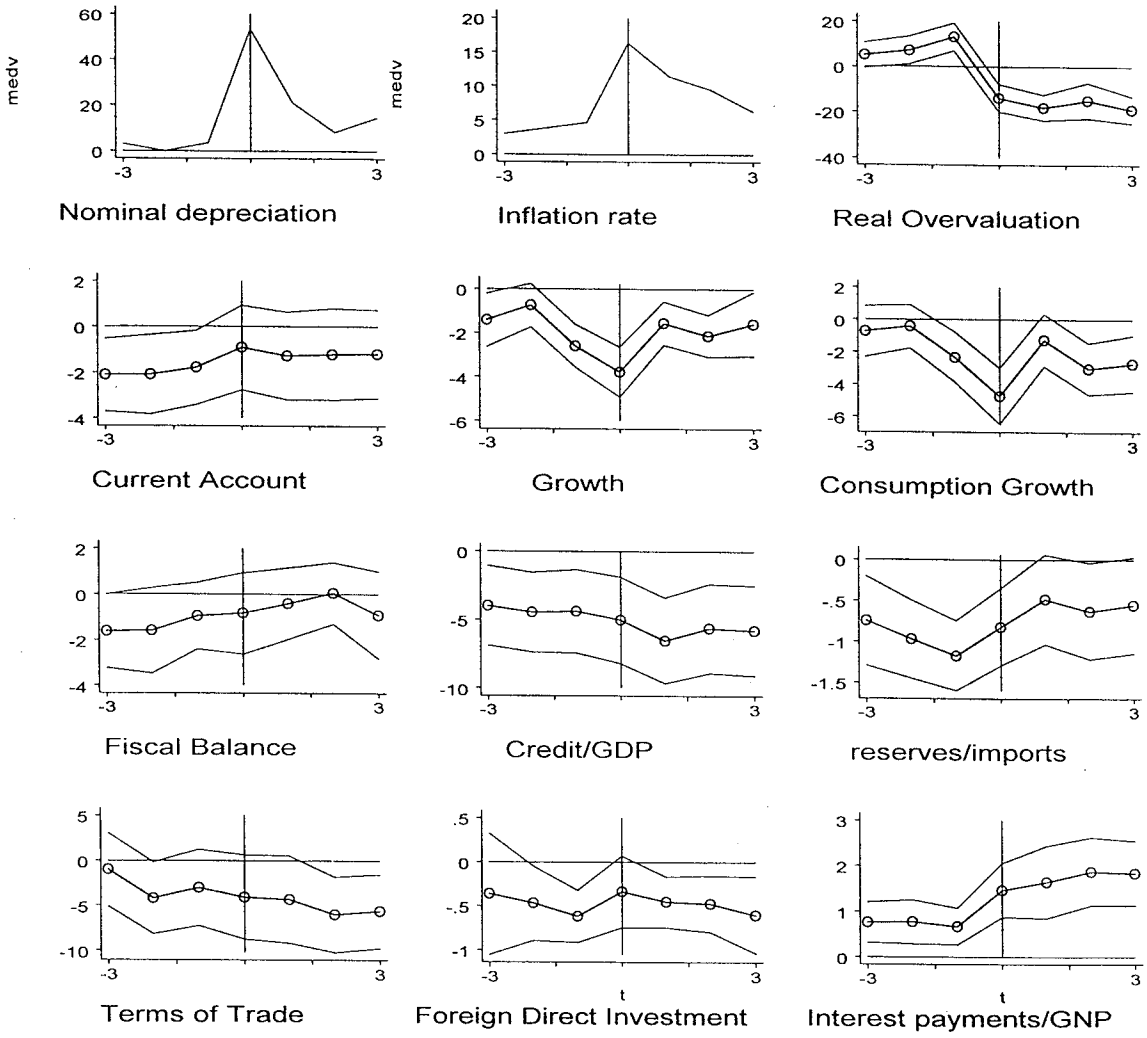
[18] The regressions using RESM2 instead of RES are not reported, but available from the authors. Klein and Marion (1997) report similar results using the ratio of reserves to M1 for a sample of Latin American countries.

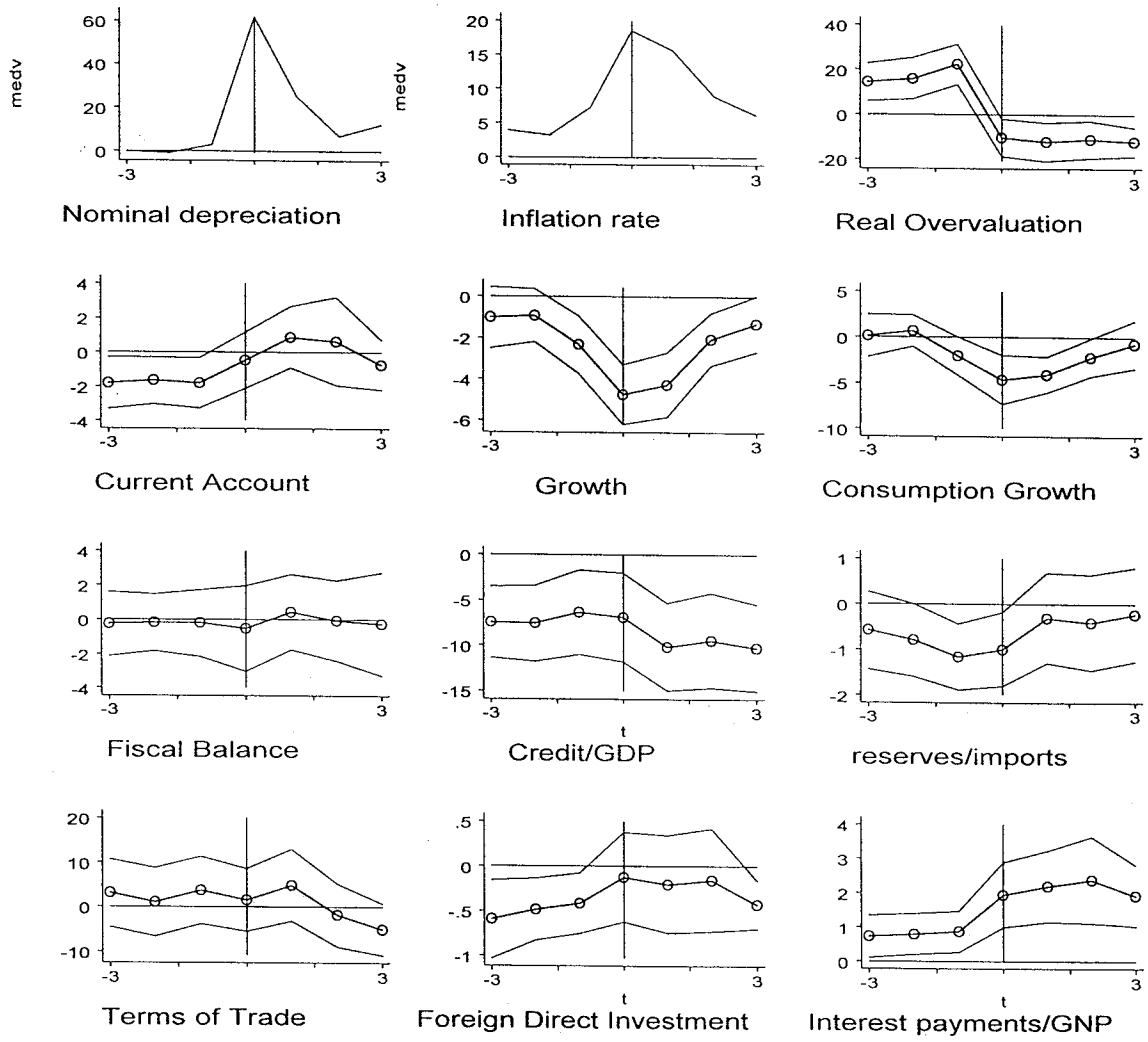
Figure 3. Currency Crashes



Notes:

Data for 142 crashes from 105 countries, 1970–96. For each variable, the plots represent deviations from its average during periods of tranquility (mean plus 2 standard deviation band for panels 3–12; median for panels 1 and 2); scales and data vary by panel. A crash is defined as a nominal exchange-rate depreciation vis-à-vis the US dollar of at least 25 percent, which is at least double the previous year's depreciation, with the latter below 40 percent. "Tranquil" periods are those that are not within three years of an exchange rate crash.

Figure 4. Currency Crashes



Notes:

Data for 51 crashes from 39 countries, 1970–96. For each variable, the plots represent deviations from its average during periods of tranquility (mean plus 2 standard deviation band for panels 3–12; median for panels 1 and 2); scales and data vary by panel. A crash is defined as a nominal exchange-rate depreciation vis-à-vis the US dollar of at least 25 percent, which is at least double the previous year's depreciation, with the latter below 40 percent. "Tranquil" periods are those that are not within three years of an exchange rate crash.

Table 6. Indicators of Currency Crashes

	(1) CRISIS1 Full sample	(2) CRISIS2 Full sample	(3) CRISIS3 Full sample	(4) CRISIS4 Full sample	(5) CRISIS2 Mid. Inc.	(6) CRISIS3 Mid. Inc.
CA	-0.25	-0.036	-0.11	-0.07	-0.36*	-0.39**
	(0.19)	(0.16)	(0.17)	(0.09)	(0.21)	(0.19)
GROW	0.11	0.18	0.53**	0.22*	0.27	-0.02
	(0.23)	(0.20)	(0.22)	(0.12)	(0.23)	(0.17)
INV	-0.15	-0.14	-0.21	-0.13	-0.12	-0.08
	(0.15)	(0.14)	(0.15)	(0.08)	(0.15)	(0.10)
GDP	-1.9E-4	-9.9E-4	-1.6E-3*	-2.5E-4	2.1E-4	2.4E-4
	(8.5E-4)	(6.3E-4)	(8.4E-4)	(4.5E-4)	(7.4E-4)	(5.7E-4)
OPEN	-0.15**	-0.054*	0.038	0.028*	0.05	0.11**
	(0.04)	(0.029)	(0.029)	(0.015)	(0.04)	(0.04)
RES	-1.37**	-1.23**			-0.75**	
	(0.35)	(0.32)			(0.30)	
RESM2			-15.3**	-7.27**		-15.5**
			(-3.64)	(2.26)		(4.17)
OVERVAL	0.13**	0.15**	0.24**	0.17**	0.24**	0.17**
	(0.04)	(0.04)	(0.04)	(0.03)	(0.06)	(0.06)
DEBTY	-0.001	0.007	0.014	0.009	0.037*	0.01
	(0.01)	(0.009)	(0.011)	(0.006)	(0.024)	(0.02)
VARRAT	-0.01	-0.16**				
	(0.07)	(0.06)				
CONRAT	-0.17**	-0.16**	-0.042	0.009		
	(0.06)	(0.05)	(0.039)	(0.02)		
FDI	-0.43	-0.31	-0.012	0.23	-0.84	-0.56
	(0.56)	(0.41)	(0.50)	(0.30)	(0.61)	(0.54)
CRED	0.07	-0.02	0.073	0.017	-0.03	-0.06*
	(0.06)	(0.05)	(0.051)	(0.03)	(0.04)	(0.035)
TT	-0.11**	-0.10**	-0.061	-0.060**	-0.064*	-0.057**
	(0.04)	(0.04)	(0.038)	(0.023)	(0.037)	(0.030)
ΔTT(t+1)	-0.10*	-0.08	-0.099*	-0.066**		
	(0.06)	(0.05)	(0.053)	(0.031)		
RINT	0.34	-0.20	-0.014	-0.31	1.15**	0.45*
	(0.55)	(0.48)	(0.50)	(0.29)	(0.37)	(0.27)
RINT(t+1)	1.24**	1.08**	1.36**	0.62**		
	(0.51)	(0.44)	(0.46)	(0.28)		
GROECD	-1.74**	-1.34**	-1.61**	-0.49**	-0.49	-0.84**
	(0.54)	(0.48)	(0.50)	(0.28)	(0.48)	(0.42)
GROECD(t+1)	-0.20	-0.24	-0.53	0.13	1.32**	0.37
	(0.66)	(0.57)	(0.62)	(0.35)	(0.58)	(0.43)
PEG	-7.57**	-2.61	1.34		-0.60	2.26*
	(2.51)	(1.78)	(1.59)		(1.43)	(1.38)
IMF	-2.84**	-2.58*	0.63	0.58	-2.32	1.01
	(1.45)	(1.30)	(1.64)	(0.99)	(-1.38)	(1.44)
Pseudo R^2	0.29	0.24	0.27	0.29	0.36	0.36
Observations	838	897	878	985	474	472

Notes: Estimation by probit. The table reports probit slope derivatives (and associated z-statistics in brackets) multiplied by 100. Dependent variable takes the value 1 if a currency crash occurs at time $t+1$, and zero otherwise. **(*) indicate statistical significance at the 95% (90%) confidence level. The variables CA, GROW and INV are averages over the three years preceding the event. Variables are dated at time t unless otherwise marked. Regressions include continent dummies (coefficients not reported). Omitted variables in models (5) and (6) were excluded based on a joint F-test.

Table 6. Goodness of Fit (concluded)

Model (1)

Actual \ Predicted	0	1	Total
0	725	9	734
1	71	33	104
Total	796	42	838

Model (2)

Actual \ Predicted	0	1	Total
0	808	5	813
1	70	14	84
Total	878	19	897

Model (3)

Actual \ Predicted	0	1	Total
0	779	7	786
1	69	23	92
Total	848	30	878

Model (4)

Actual \ Predicted	0	1	Total
0	913	4	917
1	56	12	68
Total	969	16	985

Model (5)

Actual \ Predicted	0	1	Total
0	430	3	433
1	26	15	41
Total	456	18	474

Model (6)

Actual \ Predicted	0	1	Total
0	422	4	426
1	30	16	46
Total	452	20	472

Real exchange rate overvaluation. Crashes are more likely in countries in which the real exchange rate is appreciated relative to its historical average. This finding suggest that even the crude measure of exchange rate misalignments adopted here provides some useful information on the likelihood of exchange rate collapse.[19]

U.S. interest rates. Crashes are more likely when real interest rates in the U.S. are (or have been) high. Higher interest rates in industrial countries make investment in developing countries less attractive and are more likely to cause reversals in capital flows.

Growth in industrial countries. Crashes are more likely if growth in industrial countries has been sluggish. A possible channel is through lower demand for developing countries' exports, a decline in foreign exchange reserves and a more likely collapse of the currency.

Terms of trade. a crisis is less likely when the terms of trade are favorable. This is another intuitive finding: better terms of trade should improve a country's creditworthiness (and its cash flow) and make it less vulnerable to speculative attacks.

When we use the whole sample, a number of other factors are good leading predictors of crises according to CRISIS1 and CRISIS2, but not CRISIS3 and CRISIS4:

Share of concessional debt. Crashes to be less likely in countries that receive a large share of debt at concessional terms. This finding may be explained by the fact that these flows are less likely to be reversed.

Openness. More open economies are less likely to suffer an exchange rate crash. This evidence suggests that when we include crises associated with high inflation episodes the benefits of trade openness outweigh the higher vulnerability to external shocks. This is not the case, however, when we focus on crashes that were preceded by relatively stable exchange rates (see columns 3, 4 and 6).[20]

IMF dummy. Countries with an IMF program in place are less likely to suffer a crash the following year. In addition to a possible 'credibility effect', this finding could reflect the fact that programs are approved or remain in place in countries willing to strengthen their fundamentals.

For the sample of middle-income countries we also find that a crash is more likely when the *current account deficit* is large. For the full sample, which includes several low-

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[19] A potential problem with this finding is that the definition of the benchmark as the sample average implies a tendency for mean reversion.

[20] Klein and Marion (1997) find that openness significantly reduces the likelihood of a devaluation in a sample of Latin American countries pegging their exchange rate.

income countries with very large current account deficits throughout the period, the current account has the expected sign, but is statistically insignificant. The finding that countries with a pegged exchange rate are less likely to suffer a crash of type 1 may simply reflect the fact that the rate of depreciation tends to be lower in countries with a pegged exchange rate than in countries with a floating exchange rate (the median rate of depreciation in the sample for countries that peg is zero, while it is 12 percent for countries with a floating exchange rate). Indeed, when we limit the definition of crisis to countries with a low initial rate of depreciation (CRISIS3 and 4) the coefficient on the peg variable changes sign.

The second part of Table 6 reports the goodness of fit of the model. Again, the assumption is that a crisis is correctly predicted if the estimated probability is above 0.5. As in the case of reversals, goodness of fit improves when the sample is restricted to middle-income countries. Note also the difference in the classification accuracy for the full sample between CRISIS1 and CRISIS2: this is due to the fact that the model predicts easily accelerations in the rate of depreciation associated with episodes of high inflation.

These results are broadly in line with those reported by Frankel and Rose (1996). They highlight the importance of both domestic factors, such as the degree of overvaluation and the level of reserves, and external factors, such as growth and interest rates in industrial countries and the terms of trade, in explaining the occurrence of currency crashes.

VII. CURRENCY CRISES AND OUTPUT PERFORMANCE

In this Section we characterize output performance after a currency crisis. The objective is twofold: first, to identify some stylized facts regarding the behavior of macroeconomic variables before and after the crisis, and second, to investigate what factors can help us explain output growth after the crisis.

A stylized fact that emerged from the analysis of the previous section is that output and consumption growth the year of the crisis are lower than the average during the three preceding years and during the three following years. This finding suggests that we are indeed picking up events that have disruptive effects on macroeconomic activity, at least in the short run. One telling example is Korea, who experienced a currency crisis (according to the first 3 definitions) in 1980. Its average growth in the three years preceding the crisis was above 10 percent; in 1980 output fell by close to 3 percent, and in the three successive years growth was back at 8 percent. In the regression analysis we explore the determinants of output performance in the three years following a currency crash. Our dependent variable is the average growth rate in the three years following the crash, as a deviation from OECD average during the same period. Our independent variables include: the average growth rate in the three years preceding the crisis, the growth rate the year of the crisis (both expressed as deviation from the OECD average during those periods), the average investment rate and current account balance the three years prior to the crisis, the change in the terms of trade between the two periods, as well as the debt-to-GDP ratio, the degree of real exchange rate

overvaluation, GDP per capita, the real interest rate in the U.S. and the ratio of external transfers to GDP, all measured the year before the crisis.

Results are presented in Table 7. Overall, the most robust predictor of output performance after a crisis appear to be the average growth rate before the crisis. We also find evidence that countries more open to trade tend to grow faster after a currency crisis. While the latter finding is in line with what reported in Section 5 for the before–after analysis of current account reversals, the former is different, and suggests a stronger degree of "continuity" in output performance in the case of currency crises than in the case of reversals, especially for the sample of middle-income countries. The growth rate the year of the crisis and the current account balance prior to the crisis are not good predictors of subsequent performance, after controlling for other growth determinants. It is interesting to note that the real exchange rate (or the degree of overvaluation), that seem to play an important role both in explaining output performance after reversals and in triggering currency crises, are not good predictors of economic performance after a currency crash. A regression of the growth rate the year of the crisis on the set of lagged dependent variables (not reported) also does not find any economically and statistically significant effect of the degree of overvaluation. Finally, in the sample of middle-income countries the investment rate prior to the crisis is statistically significant, but has the wrong sign.

These findings also suggest that currency crashes and reversals in current account imbalances have indeed different characteristics and have a different impact on macroeconomic performance. The next section explores this issue in more detail.

VIII. CRISES AND REVERSALS: A COMPARISON

Are reversals usually preceded by a currency crisis? The stylized facts presented in Figures 1–4 and especially the time profile of crashes and reversals presented in Tables 1 and 4 suggest that these two types of events have different characteristics. Indeed, Table 8 shows that only around a third of reversals are accompanied by, or preceded by, a currency crisis; the median rate of depreciation in the year of a current account reversal and in the two preceding years is around 7 percent, well below all the thresholds we use for currency crashes.[21] We now investigate this issue in more detail.

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[21] The definition of crisis does not affect significantly the selection of reversal episodes preceded by a crisis. For example, for 3% non-adjacent reversals (excluding transfers) and non-adjacent crises (second line of data in Table 8), 22 of the crises episodes that precede reversals are the same regardless of the crisis definition.

Table 7. Consequences of Currency Crashes

Dependent Variable is Average Output Growth After a Currency Crash (As deviation from OECD growth)

	CRISIS1 Full sample	CRISIS2 Full sample	CRISIS3 Full sample	CRISIS1 Mid Inc.	CRISIS2 Mid. Inc.	CRISIS3 Mid. Inc.
Lagged Dep Var.	0.37** (0.12)	0.33** (0.14)	0.21* (0.12)	0.54** (0.17)	0.59** (0.20)	0.65** (0.21)
Growth crisis year	0.03 (0.07)	0.07 (0.08)	0.13 (0.08)	-0.05 (0.08)	0.07 (0.17)	0.08 (0.12)
CA	0.14 (0.12)	0.16 (0.14)	0.11 (0.09)	0.14 (0.14)	0.32* (0.17)	0.07 (0.15)
RER	- 0.01 (0.02)	0.014 (0.009)	0.006 (0.01)	-0.01 (0.01)	0.008 (0.02)	-0.03 (0.02)
Δ TT	0.063** (0.026)	0.054* (0.030)	0.026 (0.023)	0.055* (0.029)	0.056 (0.033)	-0.005 (0.03)
OPEN	0.058** (0.021)	0.074** (0.023)	0.056** (0.018)	0.03 (0.02)	0.063** (0.031)	0.03 (0.03)
DEBTY	-0.010 (0.011)	- 0.012 (0.012)	- 0.011 (0.009)	-0.006 (0.01)	-0.017 (0.016)	-0.014 (0.014)
RINT	-0.06 (0.17)	-0.12 (0.21)	0.12 (0.15)	-0.04 (0.21)	-0.17 (0.26)	-0.003 (0.22)
OT	- 0.13 (0.17)	-0.17 (0.18)	-0.17* (0.10)			
GDP	-4.0E-5 (5.1E-4)	-3.5E-4 (6.2E-4)	-4.1E-4 (6.5E-4)	6.4E-5 (3.2E-4)	-5.5E-5 (4.3E-4)	1.2E-4 (4.4E-4)
INV	-0.09 (0.10)	-0.07 (0.13)	0.02 (0.09)	-0.23** (0.09)	-0.25* (0.13)	-0.23** (0.11)
R^2	0.35	0.39	0.40	0.47	0.55	0.56
No. Obs.	85	69	80	53	37	42

Notes: Estimation by OLS with White's correction for heteroscedasticity; standard errors in brackets. **(*) indicate statistical significance at the 95% (90%) confidence level. The dependent variable is a three-year average, expressed as deviations from the OECD average during the same period. The explanatory variables CA and INV are averages over the three years preceding the event; the variables OPEN, GDP, RER, OT and DEBTY are levels the year before the event; the variable Δ TT is the percentage change in the average level of the terms of trade between the period after and the period before the event.

Table 8. Currency Crashes and Reversals

A. Number of Reversals Preceded by Currency Crashes*

	Total	CRISIS1 no window	CRISIS2 no window	CRISIS3 no window	CRISIS1 window	CRISIS2 window	CRISIS3 window	CRISIS4 window
3% full sample	152	54	43	51				
3%, window full sample	100				31	26	33	24
3%, window mid-inc. co.	47				18	14	21	14
5% full sample	117	43	36	43				
5%, window full sample	77				25	22	27	20

* Number of reversals accompanied by a currency crash or preceded in at least one of the three previous years by a crash. The current account is defined net of official transfers.

B. Growth Before and After Reversals*

	Total observ.	Growth before revers. (average)	Growth before revers. (median)	Growth after reversal (average)	Growth after reversal (median)
3%	97	3.5	3.2	3.6	3.6
3% + CRISIS1	30	2.7	2.9	3.1	3.1
3% no CRISIS1	67	3.9	3.6	3.8	4.1
3% + CRISIS3	32	3.4	3.1	3.5	2.8
3% no CRISIS3	65	3.6	3.3	4.0	3.6

* Reversals do not include adjacent events and are defined on the basis of the current account net of official transfers. Reversals are divided into those accompanied or preceded (in one of the previous 3 years) by a currency crisis and those that are not. Crisis 1 is a depreciation of 25 percent or more that is at least 10 percent higher than the previous year's depreciation. Crisis 3 is a depreciation of at least 15 percent that is at least 10 percent higher than the previous year, with the previous year's depreciation below 10 percent. Growth before reversal: average (median) growth the three years prior to a reversal. Growth after reversal: average (median) growth rate the year of the reversal and the two successive years.

A first stylized fact is that, as expected, when crises precede or accompany reversals they tend to occur one or two years prior to a reversal. A second stylized fact is that reversals are more likely to be preceded by currency crises in Latin America and the Caribbean than they are in Asia. For example, for the Frankel-Rose definition of crisis, 12 reversals (out of 25) in Latin America were preceded by a crash, but only 5 (out of 29) in Asia.[22] If the definition of crisis is changed so as to exclude countries that had high rates of depreciation before a crash (i.e., we use CRISIS3) the numbers change (9 out of 25 for Latin America, 6 out of 29 for Asia) but not the qualitative finding. For African countries, around 30 percent of reversals are preceded by a crisis. There are some more similarities between the stylized features of reversals and crises for the sample of middle-income countries (see the exchange-rate depreciation panel in Figure 2 and the current account panel in Figure 4). However, as shown in the third row of Table 8a, the fraction of reversals preceded by exchange-rate crashes is still below 50 percent. In order to shed more light on this issue it is probably necessary to provide a "classification" of reversals according to their most relevant features—a task for future research.

The final question we briefly address is whether countries that suffer a currency crisis prior to a reversal tend to perform less well after the reversal. Table 8b provides summary statistics for median and average growth before and after reversals, separating those preceded by crises from those that are not.[23] It shows that average and median growth performance after the reversal is worse for countries that suffered a currency crisis of type 1, but not for a crisis of type 3. The explanation for this finding may lie in the worse growth performance of countries that suffered bouts of high inflation and currency depreciation (that are excluded from crises of type 3).

IX. CONCLUDING REMARKS

This paper has provided a broad-brush characterization of sharp reductions in current account deficits and of currency crises in low- and middle-income countries. Reversals in current account imbalances are more likely to occur in countries that have run persistent deficits, that have low reserves and unfavorable terms of trade, and less likely to occur in countries that receive high official transfers and whose debt is largely on concessional terms. Growth performance after reversals tends to be better in more open economies and in countries whose real exchange rate was less appreciated prior to the reversal. Interestingly, reversals are not systematically associated with a decline in growth; indeed, median growth after a reversal in the current account is the same as before the reversal. Currency crises are more likely to occur when reserves are low, the real exchange rate is appreciated and when

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[22]This is partly a reflection of the fact that more currency crashes happened in Latin America than in Asia (Table 4).

[23]The Table does not include CRISIS2; growth would be intermediate between CRISIS1 and CRISIS3.

external conditions are unfavorable—high interest rates and low growth in industrial countries. Growth tends to decline the year of the crisis, and to recover thereafter. Indeed, growth performance before the crisis is a good predictor of growth performance after the crisis. Economies more open to trade also seem to perform better after a crisis. A comparison of currency crashes and current account reversals shows that these are, in general distinct events. Less than a third of all current-account reversals are preceded by a currency crisis, however defined. This finding suggests that the conventional wisdom that large nominal depreciations precede a turnaround in the current account is not accurate, and points to the need of looking more closely at different types of current account reversals.

Several other questions remain open for future research. For example, the probit analyses of both reversals and currency crises suffer from endogeneity and simultaneity problems that makes it difficult to give any "structural" interpretation to its findings. The issue is how and to what degree these problems can be addressed. Another interesting question is whether swings in the current account are merely a reflection of reversals in capital flows; addressing this question requires the construction of a measure of capital flows, combining current account and reserves data. We also plan to investigate more in detail the behavior of economic policy around the time of reversals and crises, as well as to compare the experience of industrial and developing countries.

LIST OF COUNTRIES

Algeria*	Egypt*	Liberia	Sao Tomé & Princ.
Argentina*	El Salvador*	Madagascar	Senegal
Bangladesh	Equat. Guinea	Malawi	Seychelles
Barbados	Ethiopia	Malaysia*	Sierra Leone
Belize	Fiji	Maldives	Solomon Islands
Benin	Gabon	Mali	Somalia
Bhutan	Gambia	Malta	South Africa*
Bolivia*	Ghana	Mauritania	Sri Lanka*
Botswana*	Grenada	Mauritius*	St. Vincent & Gren.
Brazil*	Guatemala*	Mexico*	Sudan
Burkina Faso	Guinea	Morocco*	Swaziland
Burundi	Guinea Bissau	Myanmar	Syria*
Cameroon	Guyana	Nepal	Tanzania
Cape Verde	Honduras	Nicaragua	Thailand*
Central African Rep.	Haiti	Niger	Togo
Chad	Hungary*	Nigeria	Trinidad &Tobago*
Chile*	India	Oman*	Tunisia*
China	Indonesia*	Pakistan	Turkey*
Colombia*	Iran*	Panama*	Uganda
Comoros	Jamaica*	Papua New Guinea	Uruguay*
Congo	Jordan	Paraguay*	Vanuatu
Costa Rica*	Kenya	Peru*	Venezuela*
Cote d'Ivoire*	Korea*	Philippines*	Western Samoa
Djibouti	Laos	Portugal*	Yemen
Dominican Rep.*	Lebanon	Romania*	Zaire
Ecuador*	Lesotho	Rwanda	Zambia
			Zimbabwe

Note:
* Indicates a middle-income country.

DATA SOURCES AND DEFINITIONS

CA:	Current account balance (excluding official transfers) as a fraction of GDP. Source: World Bank, World Tables.
GDP:	GDP per capita (chain rule). Source: Summers and Heston, Penn Tables 5.6.
FISC:	Fiscal balance (including grants) as a fraction of GDP. Source: World Bank, World Tables.
OT:	Official transfers in US$. Source: World Bank, World Tables.
INV:	Share of investment in GDP. Source: World Bank, World Tables.
GROW:	Growth rate of real GDP (constant 1987 prices). Source: World Bank, World Tables.
TT:	Terms of trade index (period average=100). Source: World Bank, World Tables.
OVERVAL:	Rate of real exchange rate overvaluation vis-à-vis the U.S. dollar, based on relative GDP deflators (percentage deviation from the average level 1970–96).
RER:	CPI-based real effective exchange rate index (period average = 100). Source: International Monetary Fund, Information Notice System.
OPEN:	Average share of exports and imports to GDP. Source: authors' calculations, based on World Bank, World Tables.
RES:	foreign exchange reserves in months of imports. Source: World Bank, Global Development Finance.
RESM2:	Foreign exchange reserves as a fraction of M2. Source; Authors' calculations based on World Bank, World Tables and Global Development Finance.
DEBTX:	Ratio of external debt to exports. Source: World Bank, Global Development Finance.
DEBTY:	Ratio of external debt to GNP. Source: World Bank, Global Development Finance.
INTGNP:	Ratio of interest payments on external debt to GNP. Source: World Bank, Global Development Finance.
CONRAT:	Share of concessional debt in total debt. Source: World Bank, Global Development Finance.
PUBRAT:	Share of public debt in total debt. Source: World Bank, Global Development Finance.
SHORT:	Share of short-term debt in total debt. Source: World Bank, Global Development Finance.
FDI:	Net FDI flows as a fraction of GDP. Source: World Bank, Global Development Finance.
PORTF:	Net portfolio flows as a fraction of GDP. Source: World Bank, Global Development Finance.
RINT:	U.S. prime lending rate, deflated by the U.S. GDP deflator. Source: International Monetary Fund, international Financial Statistics.

GROECD: Real growth rate in OECD countries. Source: International Monetary Fund, International Financial Statistics.

PEG: Dummy variable taking the value of 1 if the exchange rate is fixed or fluctuates within a narrow band, and 0 otherwise. Source: Cottarelli and Giannini (1997) and IMF, Exchange Arrangements and Exchange Restrictions (various issues).

IMF: Dummy variable taking the value of 1 if the country has an IMF program in place for at least 6 months during the year, and zero otherwise. Source: Cottarelli and Giannini (1997).

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