WP/00/67

IMF Working Paper

Currency Crises: In Search of Common Elements

Jahangir Aziz, Francesco Caramazza, and Ranil Salgado

INTERNATIONAL MONETARY FUND

 WP/00/67

IMF Working Paper

African, Asia and Pacific, and Research Departments

Currency Crises: In Search of Common Elements

Prepared by Jahangir Aziz, Francesco Caramazza, and Ranil Salgado[1]

Authorized for distribution by T. Bayoumi, F. Caramazza, and D. Robinson

March 2000

Abstract

The paper seeks to identify common characteristics among a variety of macroeconomic and financial variables for a large sample of currency crises in industrial countries and emerging market economies. It covers crises which culminated in large currency depreciation as well as those in which there was a substantial loss of foreign reserves. The analysis involves comparing the monthly or annual pattern of movement of the various macroeconomic and financial variables around the time of crisis to their behavior during tranquil periods. The robustness of the results is tested by subdividing the sample into different types of currency crises and carrying out a similar analysis for each.

JEL Classification Numbers: F31, F32

Keywords: Currency Crises, Financial Crisis

Author's E-Mail Address: jaziz@imf.org, fcaramazza@imf.org, rsalgado@imf.org

---

[1]This paper builds on the empirical research underlying Chapter IV of the May 1998 *World Economic Outlook* of the International Monetary Fund. The authors would like to thank seminar participants at the 1999 Far Eastern Meeting of the Econometric Society (July 1-3, 1999 in Singapore) for comments and suggestions. The authors thank Gretchen Byrne, Lisa Nugent, and Patricia Medina for excellent research and other assistance.

Contents Page

I. Introduction 4

II. Identifying Crises : Methodology and Data 5

III. The Correlates of Financial Crises 8

IV. The Macroeconomy Before a Crisis 11

A. Methodology 11
B. Antecedents of Crises 13

V. Outcomes of Crises 20

VI. Costs of Crises 23

VII. Conclusions 24

References 26

Appendix
Banking Crises 29

Table
1. Costs of Crises in Lost Output Relative to Trend 31

Figures
1. Incidence of Currency Crises 32
2. Real Effective Exchange Rate 33
3. Export Growth 34
4. Trade Balance 35
5. Terms-of-Trade 36
6. Inflation 37
7. Nominal M1 Growth 38
8. Nominal M2 Growth 39
9. Nominal Domestic Credit Growth 40
10. Real M1 Growth 41
11. Real M2 Growth 42
12. Real Domestic Credit Growth 43
13. Real Interest Rate 44
14. Change in Real Stock Prices 45
15. Change in Stock Prices (Valued in Foreign Currency) 46
16. Change in Foreign Reserves 47
17. M2-to-Reserves Ratio 48

18. Change in M2-to-M1 Ratio 49
19. Output Growth 50
20. World Real Interest Rate 51
21. Change in the Unemployment Rate 52
22. Current Account Balance 53
23. Fiscal Balance 54
24. Short-term Capital Inflows 55

I. INTRODUCTION

The financial crisis that erupted in east Asia in the second half of 1997 was the latest in a series of currency crises that at various times in the post-Bretton Woods period have engulfed emerging market economies and industrialized countries alike. Financial innovations and the increased international integration of financial markets appear to have altered the nature of these crises in recent years; in particular, the spillover effects and the contagious spread of crises seem to have become both more pronounced and far reaching. At a fundamental level, however, many of the same forces have often been at work in different crises. This paper is concerned with these common characteristics. It examines a large number of currency crises in an effort to identify similarities in the behavior of a variety of macroeconomic and financial variables around the times of crises. The sample spans the period 1975-97 for 50 industrial countries and emerging market economies. It coves crises which culminated in large currency depreciation as well as those in which there was a substantial loss of foreign reserves. The analysis involves comparing the monthly or annual pattern of movement of the various macroeconomic and financial variables around the time of crisis to their behavior during tranquil periods. The robustness of the results is tested by subdividing the sample into different types of currency crises and carrying out a similar analysis for each. The paper also examines the behavior of the various variables in the aftermath of a crisis and assesses the costs of crises in terms of lost output.

Following, Frankel and Rose (1996), the paper poses the question: Are currency crises all alike? But it differs from that study in several respects. One difference is that whereas Frankel and Rose focused exclusively on currency crashes characterized by large exchange rate depreciations, this paper instead considers *currency crises* that involve both large depreciations or substantial losses in reserves, or both. Another difference is that the earlier paper, analyzed the experience of developing countries only, using annual data, while, the sample of countries in this study comprises both industrial and emerging market economies. Furthermore, most of the analysis is carried out using monthly data, which allows for a more precise dating of crises and which given the nature of currency crises may be more revealing than annual data. Annual data is used, nonetheless, both to complement the monthly analysis and when variables of particular interest are not available on a monthly frequency.

The methodology used is similar to that of Eichengreen, Rose, and Wyplosz (1995) and Frankel and Rose (1996). Essentially, for each variable of interest a graphical "event study" is conducted to see whether its average pattern of movement both before and after a crisis (the event) is different from its behavior during normal or tranquil periods. The differences in behavior between crisis and tranquil periods are tested for statistical significance. Since the graphical technique does not impose any parametric structure on the data and because the statistical tests require less demanding assumptions about the distribution of the variables, this methodology has the advantage of often being more informative in extracting behavioral patterns over a longer period of time than formal econometric procedures. However, the analysis remains intrinsically univariate. While many studies have supplemented the univariate

analysis with more rigorous multivariate regression analyses, these have not been fully satisfactory for a variety of reasons (discussed in Section IV).

Graphical event studies have drawbacks too, however. For instance, unlike in regression analysis where various sensitivity tests can be employed to check the robustness of results, there are no such standard diagnostics available in graphical analysis. To overcome this problem, in this paper the robustness of the results are checked by examining how the average behavior of different variables changes for different types of currency crises. In particular, the sample of 158 currency crises identified in this paper was divided into various sub-groups: crises in industrial countries, crises in emerging market countries, crises characterized mainly by currency crashes, crises characterized mainly by reserve losses, "severe" crises, "mild" crises, crises associated with serious banking sector problems, crises with fast recoveries, and crises with slow recoveries.[2] For each of these sub-groups, the same variable-by-variable event study was conducted and the behavior of these variables were compared across the various groupings. Behavioral characteristics of variables that displayed largely similar patterns across these groupings were considered to be robust.

To summarize very briefly the main findings, typically prior to a crisis the economy was overheated, with monetary policy significantly expansionary, strong domestic credit growth, an overvalued currency, and in many cases high inflation. The economy was also increasingly financially vulnerable, with rising liabilities of the ranking system not backed by foreign reserves and falling asset prices. Furthermore, some event, such as an increase in a world interest rates or a deterioration in the terms of trade, usually exacerbated the vulnerability of the economy to crisis.

II. Identifying Crises : Methodology and Data

Financial crises may be grouped into three broad categories[3]: *currency crises*, *banking crises*, and *foreign debt crises*. A *currency crisis* may be said to occur when a speculative attack on the exchange value of a currency results in a devaluation (or sharp depreciation) of the currency, or forces the authorities to defend the currency by expending large volumes of international reserves or sharply raising interest rates. A *banking crisis* generally refers to a situation in which actual or potential bank runs or failures induce banks to suspend the internal convertibility of their liabilities or which compels the government to intervene to prevent this

[2]The procedure used in identifying the crises is described in detail in section II. The crisis sub-groups are defined in section IV B.

[3]This definition follows Bordo (1985), Caprio and Klingebiel (1997), and Eichengreen and Rose (1997).

by extending assistance on a large scale.[4] A *foreign debt crisis* is usually described by a situation in which a country cannot service its foreign debt, whether sovereign or private.

This paper focuses on currency crises. In many instances, however, elements of currency, banking, and debt crises may be present simultaneously, as in the recent east Asian crises and in the Mexican 1994–95 crisis. In contrast, the ERM 1992–93 crises were essentially currency crises, even though the Nordic countries that experienced currency crises also had domestic banking crises at around the same time. Furthermore, what may start out as one type of crisis may develop into other kinds as well. Banking crises have often preceded currency crises, especially in developing countries—for instance, as in Turkey and Venezuela in the mid-1990s. Banking problems have preceded debt crises too, as in Argentina and Chile in 1981–82. The converse also has occurred, as in Colombia, Mexico, Peru, and Uruguay, where the withdrawal of external financing in 1982 precipitated banking crises. More recently, what began as currency crises in some east Asian countries metastasized into banking and debt crises, as illustrated most clearly by Indonesia. That one type of crisis precedes another does not necessarily imply causality, however. For instance, when the financial sector is poorly supervised and regulated, banking system fragilities may be fully revealed only after a run on the currency has undermined confidence more generally and precipitated speculative shifts that expose and exacerbate banking and debt problems. This has clearly been a feature of the east Asian crises. Consequently, although banking and debt crises are not analyzed directly in this study, many cases of such crises, such as those of the Latin American debt crisis of the early 1980s and others that involved currency crises, are considered indirectly.

The measurement and dating of currency crises pose various difficulties. In this paper, following procedures adopted in the literature, episodes of significant foreign exchange market pressures are identified and dated using statistical criteria. This approach, while capturing the more serious currency crises, inevitably also picks up episodes where there were significant but less than critical foreign exchange market pressures. This should be borne in mind in interpreting the results and drawing inferences of general applicability.

A currency crisis could be defined simply as a substantial nominal currency devaluation or depreciation.[5] This criterion, however, would exclude instances where a currency came under severe pressure but the authorities successfully defended it by intervening heavily in the

---

[4]Not all financial disturbances are viewed as true financial crises. Financial disturbances which do not impinge on the payments mechanism and do not have potentially damaging consequences for economic activity have been characterized as "pseudo-financial crises"—see Mishkin (1994) and Schwartz (1986).

[5]For example Frankel and Rose (1996) defines a "currency crash" as a nominal depreciation of the currency of at least 25 percent in a year, along with a 10 percent increase from the previous year in the rate of depreciation. The latter condition is included so as to omit from currency crashes the large trend depreciations of high-inflation countries.

foreign exchange market, or by raising interest rates sharply, or by other means. An alternative approach is to construct an index of speculative pressure that takes into account not only exchange rate changes, but also movements in international reserves or interest rates that absorb pressure and thus moderate the exchange rate changes. For example, Eichengreen, Rose, and Wyplosz (1996) use a weighted average of changes in the exchange rate, foreign reserves, and interest rates, relative to Germany, the reference country, to examine currency crises in industrial countries. Crises are then identified as extreme values of the speculative pressure index. Crises identified using such an index would therefore include not only those occasions in which the currency depreciated significantly, but also occasions where actions by the authorities averted a large devaluation or the abandonment of an exchange rate peg.

For this study, currency crises were identified for a group of 50 countries for the period 1975–97. The group included 20 industrial countries and 30 developing countries. The developing country group consisted mainly of countries commonly referred to as emerging market economies.[6] Germany and the United States served as the reference countries for the European and the non-European countries, respectively.

For each country, an index of foreign exchange market pressure was constructed as a weighted average of (detrended) monthly exchange rate changes and reserve changes. The weights were chosen so as to equalize the variance of the two components, thus avoiding the possibility of one of the two components dominating the index. Interest rates were not included in the index owing to the paucity of comparable, market-determined interest rate data for many developing countries over the sample period. Occasions when values of the index exceeded a specified threshold—set to 1½ times the pooled standard deviation of the calculated index plus the pooled mean of the index—were classified as crises. Weights and thresholds were calculated separately for periods of high inflation, which were defined as periods with twelve-month inflation rates greater than 80 percent. For any one country, crises identified within 18 months of a previous crisis were considered as part of the earlier crisis and excluded. Cases in which more than one country was affected by a crisis, either because of a common shock or because of contagion effects, were counted as more than one crisis. For instance, the recent east Asian financial crisis comprised 5 currency crises.[7] These criteria are similar to those used by Eichengreen, Rose, and Wyplosz (1996).

---

[6]The *industrial countries* in the sample were Australia, Austria, Belgium, Canada, Denmark, Finland, France, Greece, Iceland, Ireland, Italy, Japan, Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, and United Kingdom. The *emerging market economies* were Argentina, Bangladesh, Brazil, Chile, China, Colombia, Costa Rica, Ecuador, Egypt, India, Indonesia, Israel, Jamaica, Korea, Malaysia, Mexico, Nigeria, Pakistan, Paraguay, Peru, Philippines, Singapore, South Africa, Sri Lanka, Taiwan Province of China, Thailand, Turkey, Uruguay, Venezuela, and Zimbabwe.

[7]The five crises identified by the index were the crises in Indonesia, Korea, Malaysia, the Philippines, and Thailand.

On the basis of these operational criteria, between January 1975 and November 1997, 158 episodes were identified in which countries experienced substantial exchange market pressures. Other studies have identified a similar number of currency crises, taking into consideration differences in sample size. For example, Kaminsky and Reinhart (1996) identified 71 crises in their sample of 20 countries between 1970 and mid–1995, while Eichengreen, Rose, and Wyplosz (1996) identified 77 crises for a group of 20 industrial countries during 1959–1993, using quarterly data.

Currency crises were found to be relatively more prevalent in the first half of the sample period (1975–1986) than in the second half (1987–1997) (Figure 1). The number of currency crises was particularly high in the mid–1970s (a period of large external shocks to many countries) and in the early to mid–1980s (the Latin American debt crises). Comparing industrial and emerging market countries, it appears that industrial countries had fewer currency crises: the incidence of currency crises in emerging market countries was double that in industrial countries. It also appears that most of the industrial country currency crises occurred in the first half of the sample period, while for the emerging market countries, the frequency of currency crises shows no marked trend.

III. The Correlates of Financial Crises

Having dated the currency crises, the next step is to choose the set of variables whose behavior one can expect *a priori* to systematically differ during episodes of intense exchange market pressures from that in tranquil times. The set of variables chosen is partly determined by the empirical implications of theoretical models of exchange rate and balance of payments crises, the literature on "early warning signals," and previous empirical studies of financial crises.

The early literature on currency crises—usually referred to as the "first-generation models"—developed notably by Krugman (1979) and Flood and Garber (1984)—stressed the role played by economic fundamentals in causing crises. These models typically explained crises as the result of fundamental inconsistencies in domestic policies, such as a persistent money-financed fiscal deficit and a commitment to a pegged exchange rate. Such inconsistencies can for a time be overlooked, as long as the central bank has sufficiently large foreign exchange reserves. But when official reserves fall to a critically low level and are perceived by the market as insufficient, there will be a sudden speculative attack on the currency. These first-generation models, therefore, predicted that a deterioration in the fundamentals would be indicated prior to a crisis by developments such as high or growing fiscal budget deficits, high rates of monetary growth, high inflation, overvalued real exchange rates, large current account and trade deficits, sharp declines in international reserves, and rising domestic interest rates.

The role of domestic macroeconomic imbalances in generating currency crises in first-generation models has been evident in quite a few specific situations. Overly expansionary monetary and fiscal policies have spurred lending booms, excessive debt accumulation, and over-investment in real assets, which have driven up equity and real estate prices to unsustainable levels. The eventual tightening of policies to contain inflation and facilitate the adjustment of external positions, and the inevitable correction of asset prices, have then led to a slowdown in economic activity, debt servicing difficulties, declining collateral values and net worth, and rising levels of nonperforming loans that threaten bank solvency. Macroeconomic factors, especially lending booms, have been found to play an important role in creating financial sector vulnerability in many Latin American countries (Gavin and Hausmann (1996) and Sachs, Tornell, and Velasco (1996)) and in other emerging market economies as well.

A drawback of first-generation models was that they represented policy in an essentially unidimensional and mechanical manner—the government automatically monetized all budget deficits while the central bank accommodated the pressures on the exchange rate by selling reserves without regard to other developments in the economy. Clearly, the range of policy options available even when budget deficits are persistent goes beyond simply monetizing the deficit. When governments have multiple objectives, however, almost all policy options involve some form of trade-off. Second-generation crisis models (Obstfeld (1986) and (1994)) exploit the trade-offs among alternative policies and the tensions in the government's objectives to generate mutually conflicting incentives on the part of the authorities both to abandon an exchange rate peg and to defend it. In addition to this policy uncertainty, if the cost of defending the peg is likely to rise when agents expect the rate to be abandoned, then the exchange market could be subject to self-fulfilling expectations. If investors expect that despite sound fundamentals the government would abandon the peg if a speculative attack were severe enough, then by acting on those beliefs investors may force the government to sacrifice the peg. For example, individual investors may believe a country to have generally sound fundamentals, so that there is no reason for them to withdraw their funds from the country solely on the basis of the fundamentals. However, if a sufficient number of other investors withdraw their funds from the country and thus increase the likelihood that the government would be forced to abandon the peg, then even the investors who were initially confident that the country's fundamentals were sound may also withdraw their investments rather than risk losses from a devaluation. This, in turn, would further increase the likelihood that the peg would be abandoned. In such a case, if some event or shock caused a critical mass of investors to sell a country's currency, an exchange crisis could ensue.

While theoretically it is possible that completely extrinsic events (sunspots) can trigger a crisis—so that the economy is subject to multiple equilibria, some involving crises and others not—it is almost always the case that this possibility holds true only for *certain* ranges of the fundamentals. There are no equilibrium models of currency crises that generate sunspot equilibria for almost *all* possible ranges of the fundamentals, such that sunspot driven crises are not *generic*. Consequently, even in second-generations models, some fundamentals, such as the composition of external debt (Masson (1998) and Cole and Kehoe (1998)) ultimately play the

critical role in generating crises. The role played by such fundamentals, however, is more structural than behavioral, in contrast to first-generation models.

A related but separate explanation of crises focuses on contagion effects, where a crisis in one country triggers crises in others. Contagion effects can be transmitted through trade or financial linkages, or may be a result of similarities in macroeconomic fundamentals. For example, if a group of countries are closely related through trade, then a devaluation in one country can force the others to devalue to maintain price competitiveness. Also, owing to interdependences in creditors' portfolios, illiquidity in one market can force investors to liquidate assets in other markets to cover losses or to meet liquidity needs (Goldfajn and Valdez (1997)). Contagion effects can also be transmitted through commitment costs. For a country, the costs of abandoning a peg fall if neighboring countries (in an economic sense, which in most cases is also in the geographic sense) also abandon their pegs.

The waves of currency crises in the 1990s have generated a lot of interest in contagion effects and there is some evidence (e.g., Eichengreen, Rose, and Wyplosz (1996), Glick and Rose (1999)) that they may be an important cause of crises. Both theoretical and empirical studies of contagion are silent, however, on why a crisis originates in a specific country among a group of vulnerable countries. Thus, even if contagion plays a role in transmitting crises across countries, it is still important to understand the role played by fundamentals in precipitating crises in the first place.[8]

Another set of studies, point to external conditions as the pivotal elements in financial crises, especially in emerging market economies. Most notable have been sudden, large shifts in the terms of trade and in world interest rates that have affected a large number economies simultaneously (sometimes referred to as "monsoonal effects," Masson and Mussa (1995)). An unanticipated drop in export prices, for instance, can impair the capacity of domestic firms to service their debts and result in a deterioration in the quality of banks' loan portfolios. Movements in interest rates in the major industrial countries have become increasingly important to emerging market economies worldwide, reflecting the increasing integration of world capital markets and the globalization of investment. The sensitivity of capital flows to developing countries to changes in world interest rates has been emphasized by amongst others, Calvo, Leiderman, and Reinhart (1993, 1996) and Taylor and Sarno (1997). While sustained declines in world interest rates have induced surges in capital flows to emerging market economies, an abrupt rise in industrial country interest rates can lead to the reversal of those flows. The rise in interest rates not only increases the cost to domestic banks (and firms) of funding themselves offshore, but also worsens adverse selection and moral hazard problems

[8]For an empirical investigation of the role of trade and financial linkages as well as external, domestic, and financial weakness in inducing financial crises, see Caramazza, Ricci, and Salgado (2000).

and the fragility of the financial system.[9] Changes in global financial conditions, therefore, are another possible factor behind banking crises in emerging market economies—see Eichengreen and Rose (1997) for supporting empirical evidence.

This paper does not study contagion effects; it concentrates instead on investigating whether countries' macroeconomic and financial characteristics during periods of crisis differ systematically from those during non-crisis periods. Consequently, the emphasis is mostly on variables of the type suggested by first-generation models and only to a lesser extent on those suggesting second-generation models. Variables employed in the empirical literature on "early warning signals,"[10] such as, measures of financial liberalization, the money multiplier and credit growth; proxies for investor confidence in the domestic currency, the ratio of broad money to international reserves; and the growth in asset prices, are also analyzed.

IV. The Macroeconomy Before a Crisis

A. Methodology

The methodology used in this paper is a modified version of that adopted in other studies of currency crises, such as those of Eichengreen, Rose, and Wyplosz (1995) and Frankel and Rose (1996). The approach employed in those papers was a version of "event study" methodology where for each variable the sample was divided into crisis windows and tranquil periods. A crisis window was defined as some number of periods centered around each crisis date. After all the observations in each of the crisis windows were taken out of the sample for a particular variable, the remaining non-crisis observations were collectively deemed to be the sample of tranquil period observations. Having separated the sample into crisis and tranquil observations, we computed the average across all the separate crisis events for each period in the crisis window. These averages for the crisis window were then plotted against the average for the entire tranquil period. The pattern displayed in the crisis window was taken to be the average behavior of the variable during crises. For the monthly data in this paper, we considered a 49–month period centered around each of the 158 crisis dates to be the crisis window. In the case of annual data, five-year windows centered on the crisis dates were used.

There are both advantages and drawbacks to this methodology. The advantages lie largely in the simplicity of the procedure. Since the graphical technique does not impose any parametric structure on the data it is more informative in extracting patterns of behavior. Moreover, since for this methodology statistical tests require less demanding assumptions about the distributions of the variables, the technique does not run into a problem commonly

---

[9]The links between increases in interest rates and adverse selection and moral hazard problems, and financial crises have been described in Mishkin (1996).

[10]See, for example, Goldstein (1996) and Kaminsky, Reinhart, and Lizondo (1997).

encountered in more formal econometric procedures—namely the invalidity of statistical inferences owing to untenable assumptions regarding the properties of the underlying data.

Among the drawbacks, perhaps the most significant is that the technique is intrinsically univariate. As a result it is often difficult to extract the degree to which a particular pattern displayed by a variable, before and after a crisis, is influenced by the behavior of other variables. Some studies have supplemented the univariate analysis with more rigorous multivariate regression analyses, but these have been unsatisfactory for a variety of reasons. The most appropriate technique to use is a probit or logit-type panel regression model with a sufficient number of lags and leads (for example, in this paper it would have 24 lags and 24 leads for the monthly data) for the set of control variables. Typically, this would involve estimates with too few degrees of freedom even when the number of control variables is kept small, since for most countries the required data is available only from the mid–1970s. Because crises are relatively "rare" events (typically, less than 2 percent of all observations) panel regressions of this sort thus are likely to encounter overfitting problems. In most studies, therefore, either panel restrictions are not respected or a very small number of lags are used. In both cases, the additional information has marginal benefit.

A second drawback of the graphical event-study technique is that typically a large number of diverse countries are included in the sample, making it difficult to draw conclusions from the average behavior of variables. In this paper, this problem is circumvented by standardizing variables with respect to their country-specific means and standard deviations. This filters country-specific characteristics that affect long-run levels and volatility (for example, because of different levels of development or differences in institutional structures—particularly in the financial sector—some countries may have inherently higher growth rates or more volatile paths for monetary variables). It also partly addresses data problems that may occur because of differences in measurement and data collection across countries. To some extent, using country-specific standardized variables is similar to using panel regressions with fixed and random effects.

A third drawback is that even if the countries in the sample are similar (for example, all industrial countries or all developing countries), the crisis situations may not be. For instance, some variables may have behaved differently in more severe crises than in the less severe crises, or in crises where the economic recovery was faster than in crises where the recovery was relatively slower, and crises involving only reserves losses could be inherently different from those with large devaluations. Consequently, while looking for common behavior across many different kinds of crises is informative, it can also be misleading—in that some particular type of crises could be dominating the common pattern. To address this problem, the sample of 158 identified crises was divided into various sub-groups: crises in industrial countries, crises in emerging market countries, crises characterized mainly by currency crashes, crises characterized mainly by reserve losses, "severe" crises, "mild" crises, crises associated with serious banking sector problems, crises with fast recoveries, and crises with slow recoveries. For each of these sub-groups, the same variable-by-variable event study was conducted and the

behavior of these variables was compared across the various groupings to verify whether the behavioral patterns of variables in some crisis categories dominated the overall average behavior. This sub-grouping of crises also provided a check for robustness. If a variable's behavior remained largely similar across the different sub-groups then it can be claimed with some degree of confidence, that such behavior was in fact a common feature of currency crises.

Finally, to test whether the behavior of the various variables differed significantly during periods of crisis from that during tranquil periods, for each variable the two-standard error bands for the difference between the average value of the variable during the crisis period and its tranquil period average were also drawn in the event-study charts. Following standard *t*-tests, if the error band was different from zero, the difference in behavior was claimed to be significant at the 95 percent confidence level. As can be seen in the figures, the standard error bands are wider than in most other studies. The reason may be that while other papers (for example, Frankel and Rose, 1996) show only the error bands for the crisis period and the value of the tranquil period average—the implicit assumption being that the tranquil period observations have no sampling error, this paper assumes that both the crisis and tranquil period observations are subject to sampling errors. Consequently, the appropriate standard errors for the *differences* between crisis and tranquil period averages are the square-root of the sum of the squared standard errors for the crisis and tranquil-period averages. While, this clearly has the effect of widening the error bands, it is the right procedure to follow if inferences regarding the statistical significance of differences between crisis and non-crisis period behavior are to be made.

B. Antecedents of Crises

Figures 2 to 20 portray the behavior of various macroeconomic and financial variables in the run up to currency crises and in their aftermath. Each figure includes 10 panels, with each panel depicting the average behavior of a variable (denoted by a solid line) from 24 months before to 24 months after the crisis date compared to its average level during tranquil or normal times. Since each variable was standardized, units are in terms of country-specific standard deviations—so that each panel shows the difference in the number of standard deviations by which the variable deviated from its country-specific mean during crisis and tranquil periods. Although this way of presenting the data makes it difficult to interpret the differences in absolute or percentage terms, it goes a long way towards addressing the problems associated with pooling a large number of heterogeneous countries, as discussed in the previous section. The dotted lines display the two-times standard error bands of the differences between crisis and tranquil period behavior. If for any period, the error band does not intersect the zero line, then one can infer the difference to be significant at the 95-percent confidence level.

In each figure, the top row, left panel shows the difference in average behavior of a variable during the 49–month crisis window compared to tranquil periods for the overall crisis sample. The other nine panels plot the results for various country and analytical groupings of

the full sample, with a view to checking the robustness of the aggregate results. These groupings include: industrial country crises; developing country crises; crises mainly attributable to a sharp fall in the exchange rate (currency "crashes"); crises mainly attributable to a sizable decline in reserves, ("reserves crises"); currency crises associated with banking crises; relatively "severe" crises; relatively "mild" crises; crises with fast recoveries; and crises with slow recoveries.[11]

Generally, for all crisis groupings (excluding "high-inflation" crises[12]), prior to the outbreak of a crisis the real foreign currency value of the domestic currency was significantly higher than its mean during tranquil periods (Figure 2). At the beginning of the crisis window, around 24 months before a crisis, the *real effective exchange rate* was about 0.4 standard deviations higher than its tranquil period level. Although in some cases the exchange rate declined slightly in the subsequent two years, the overvaluation remained significant during most of the pre-crisis period.

This pattern of real exchange rate overvaluation in the period leading up to a crisis was observed for all of the analytical categories. It ranged from about 0.3 standard deviations above normal around two years prior to emerging market crises and crises with slow recoveries to as much as 0.6 standard deviations for industrial country crises. It should be noted that these results do not imply, however, that the overvaluation was higher in an absolute or percentage

---

[11]Currency "crashes" are crises where the currency component of the exchange market pressure index accounts for 75 percent of the index when the index signals a crisis. Reserves crises are crises where the reserves component of the exchange market pressure index accounts for 75 percent of the index when the index signals a crisis. Currency crises associated with banking crises (also referred to as banking and currency crises) are occurrences where a banking crisis occurs within two years (before or after)—see the Appendix for the definition and description of the incidence of banking crises. Severe crises are identified by increasing the threshold of the exchange market pressure index to three times the pooled standard deviation plus the pooled mean instead of 1.5 times the pooled standard deviation. For the severe crises, the tranquil periods are different from that of the full crisis sample as they are recalculated as periods outside the 49-month severe crisis window. Mild crises are those crises in which the threshold is between 1.5 and 2.0 times the pooled standard deviation plus the pooled mean. For mild crises, the tranquil periods are the same as those for the full sample. Crises with fast recoveries are those crises in which GDP returns to trend within two years after the outbreak of the crisis, while crises with slow recoveries are those in which GDP returns to trend after three years or more. Based on these definitions, there were 45 banking and currency crises, 42 industrial country crises, 116 emerging market crises, 55 currency crashes, 55 reserves crises, 52 severe crises, 84 mild crises, 98 crises with fast recoveries, and 60 crises with slow recoveries.

[12]"High-inflation" crises were defined as crises in which the preceding 12-month inflation rate exceeded 80 percent.

sense in industrial countries, because average exchange rates in crisis and tranquil periods are calculated after removing country-specific means and variance and these are higher for emerging market countries. In fact, in percentage terms, 24 months prior to a crisis real exchange rates in industrial countries were on average only about 10 percent higher than in tranquil times compared to about 25 percent for developing countries.

Although the measured real exchange rate overvaluation was statistically significant at the 95 percent significance level at the beginning of the crisis window for all of the analytical categories, it was not so throughout the pre-crisis period for some of the sub-groups. Specifically, for crises associated with serious banking sector problems as well as for reserves crises—and to a lesser extent for emerging market crises and for crises with fast recoveries—the overvaluation was not statistically significant in the year preceding a crisis. For these categories, the real exchange rate generally depreciated throughout the pre-crisis period. The real exchange rate overvaluation was generally statistically significant at the 90 percent level, however. It is interesting to note that the relative overvaluation of the real exchange rate provided little information on the severity of the crisis or the time it took on average to recover from a crisis, as the pre-crisis behavior of the real exchange rate was broadly similar for severe crises, mild crises, crises with fast recoveries, and crises with slow recoveries.

It is of course not altogether surprising that the real exchange rate tended to be appreciated, relative to its norm, prior to a crisis, since most currency crises involved significant nominal depreciations. What this analysis reveals is that although real exchange rate overvaluation was a dominant feature in the pre-crisis phase of most currency crises, it was by no means present in all. In particular, for crises that involved banking sector problems and in those associated with large reserves losses, the overvaluation was not significant.

Typically, the real exchange rate appreciation in pre-crisis periods was accompanied by a deterioration in *export* performance, especially in the 12 months or so preceding the outbreak of a crisis (Figure 3). However, the difference between crisis and tranquil-period behavior was statistically significant—at the 95 percent confidence level—only in the four months prior to a crisis for the full sample of crises, and was not statistically significant for some crisis groupings, such as industrial country crises and crises with large reserves losses. Similarly, the *trade balance* did not display any significant differences in behavior in the pre-crisis period except for a slight deterioration near the outbreak of a crisis (Figure 4). The *terms-of-trade* generally worsened in the pre-crisis period, but differed significantly from the tranquil period only in the final few months before a crisis (Figure 5). For emerging-market country crises and currency crises associated with serious banking sector problems, however, the terms-of-trade were worsened significantly starting almost a year prior to the crisis. In sum, although poor export performance, which resulted partly from a loss of competitiveness owing to an overvalued exchange rate and deteriorating terms-of trade, appears to have played a role in many crises, it was not a common feature across all crises.

Inflation was significantly higher in pre-crisis periods than in tranquil periods for the entire sample of crises and for several of the analytical categories (Figure 6). Remarkably, for industrial countries the deviation of the rate of inflation from its tranquil period level was greater than for emerging market countries. However, this was the case only for comparisons which abstract from country-specific means and variances. In absolute terms, on average for emerging market countries the inflation rate was 10–15 percent above its tranquil period mean during the two years leading up to a crisis, but for the industrial countries it was only 6–8 percent higher. In other words, the smaller discrepancy between crisis and tranquil-period inflation rates for the emerging market countries compared to that for industrial countries, when measured in standard deviations was because of the higher mean and volatility of inflation in emerging market countries. It should be noted that this difference in behavior of inflation mirrors the difference in real exchange rate overvaluation for these two groups of countries. The build-up of inflation pressures during the period leading up to a crisis was evident, in varying degrees, across most groupings of crises, with the notable exception of severe crises and of currency crises associated with banking crises. In these cases, there were no overt signs of price inflation. In fact for severe crises, the rate of inflation was lower, on average, in pre-crisis periods than in tranquil times.[13]

Signs of overheating also were evident in the *monetary* sector. For the full sample, narrow money and broad money growth were significantly higher than normal from around the 18th month before the crisis date (Figures 7 and 8). However, monetary growth slowed from approximately the 9th or 6th month, suggesting perhaps a tightening of monetary conditions by the authorities in view of the above normal inflation. Domestic credit growth too remained above normal, although not significantly so at the 95 percent level (Figure 9). In real terms, M1 growth and M2 growth, although not unusually high, rose steeply from around the 24th month to at least the 12th month before a crisis and thereafter decelerated (Figures 10 and 11). Real domestic credit growth picked up as the crisis date approached (Figure 12), but not significantly so.

The behavior of the monetary variables showed some interesting variations across analytical groupings. For instance, growth of nominal M1, M2, and domestic credit in the pre-crisis phase on average did not exceed the tranquil period mean for severe crises nor for crises with fast recoveries. In contrast, for reserve crises and for crises with slow recoveries, growth of nominal M1, M2 and domestic credit, as well as growth of real domestic credit was significantly above normal during most of the pre-crisis phase. In brief, for many types of crises the overheating evident in the product markets was mirrored in the monetary sector.

---

[13]It should be recalled that the tranquil periods for the severe crisis category were different from those for all other crisis categories and for the entire crisis sample. When the severe crisis tranquil periods are replaced with the full sample tranquil periods, the pre-crisis inflation rates for severe crises are higher than with tranquil periods, on average, as in all of the other crisis categories. The lower inflation for the severe crises, therefore, is an artifact of the way the tranquil periods are defined for this crisis sub-sample.

Interest rate movements have played a significant role either in precipitating or in preventing currency crises, both directly through their effects on capital flows and indirectly as a signal of the authorities' commitment to defend an exchange rate peg and as a gauge of its monetary stance. For the full sample of crises, the real interest rate in the pre-crisis period was below the tranquil period average (Figure 13). However, close to the crisis, and when crisis broke, the real interest rate moved sharply upwards. This behavior was not uniform across the various crisis sub-samples. Indeed, except for crises in emerging market economies, the behavior of the real interest rate in the pre-crisis phase for the most part was not significantly different from that during tranquil periods. Furthermore, although in most crisis groupings there was a run up in real interest rates as the crisis approached, the level of real interest rates was significantly higher than the tranquil period level only among crises associated with banking problems and crises that ended with slow recoveries. What emerges from this discussion is that low real interest rates aided in keeping monetary conditions lax before emerging market crises (and to a lesser extent prior to other crises) and thereby added to the overheating problem. Whether or not real interest rates were low in the pre-crisis phase, an interest rate defense appears to have been attempted in almost all types of currency crises; however, in many cases, real interest rates were not increased above tranquil period levels.

Currency crises have often been preceded by declining *asset prices*. For instance, in almost all of the countries affected by the Asian crisis, real estate and equity prices rose steeply during the early 1990s and then declined sharply from around mid–1996. Consistent with this experience, the growth rate of equity prices, valued in either local or foreign currency, for the full crisis sample tended to decline somewhat, on average, starting around six months before the crisis (Figures 14 and 15). This decline before the crisis was not significantly different from the tranquil period growth rate for equity prices. Moreover, the experience is not uniform across different types of crises. For crises accompanied by banking sector problems, pre-crisis equity prices grew at a lower rate than the tranquil period rate although the difference was not significant. Perhaps, this was a reflection of the fact that banking crises were of much longer duration, and by the time they erupted in a currency crisis, asset markets had already suffered a corrective contraction. Similarly, for industrial countries, growth in equity prices was slower than tranquil period growth between the 24th and 12th month. Near the crisis date, however, the growth in equity prices was faster, on average, than during the tranquil period. For emerging market crises, currency crashes, severe crises, mild crises, and crises with slow recoveries, the decline in the growth rate was more perceptible than for the overall sample and other sub-samples. The boom in asset prices seemed to have peaked prior to the 24th month for the reserves crises and from around the 18th month, the growth in equity prices remained around or below normal. From these results, although there is some evidence of asset price collapses in the pre-crisis phase, it was by no means uniformly true across various types of crisis. In some cases, the asset market seemed to have collapsed earlier than the 24 month pre-crisis window, while in others there was no discernible difference in equity price behavior during the run up to a crisis.

The behavior of *international reserves*, measured in months of imports, failed to display any pronounced pattern, although in absolute dollar or deutsche mark terms, reserves declined precipitously as the crisis broke (Figure 16). The sharp fall occurred across all categories except for crises with banking problems and currency crashes. In some of the crisis samples, for example, the severe crises, the decline in reserves commenced more than a year before a crisis.

Many crises have been associated with a reversal and drying up of capital inflows. Furthermore, in some cases holders of liquid domestic bank liabilities try to convert them into foreign exchange. Thus, the banking system's ability to withstand pressures on the currency depends, in part, on the extent to which its domestic liabilities are backed by foreign reserves, for instance approximated inversely by the ratio of *broad money to official international reserves*. This ratio showed a remarkable pattern around the time of a crisis (Figure 17). Starting a little higher than its tranquil period average, it rose throughout the 24-month period prior to a crisis with the growth in the ratio increasing close to the crisis. Behavior of this kind was more dramatic, almost by construction, for reserves crises but also for severe crises, crises with slow recoveries, and currency crashes. The latter case shows that the increase in the ratio was not simply a reflection of reserves plummeting just before a crisis. Since this ratio in part captures an economy's ability to withstand speculative pressures without a sharp correction in the exchange rate, it can be viewed as an indicator of investors' confidence in the domestic financial system.

A number of studies have argued that hastily or badly sequenced financial reforms that open up the economy to an increased volume of intermediation without adequate prudential regulations have been important causes of currency crises. Using the changes in the M2-to-M1 ratio as a proxy for changes in financial intermediation and therefore, *financial liberalization*, we found that this ratio was significantly higher than normal for the overall sample between the 24th and 12th months prior to a crisis, falling sharply after that and then rising somewhat as the crisis neared (Figure 18). However, as in the case of other variables, this behavior was not robust across the crisis sub-samples. In particular, it was more or less absent for currency crashes as well as other crisis groupings.

For the entire crisis sample on average, growth in *real activity*, as measured by the 12–month change in industrial or manufacturing production, was significantly below normal around 24 months before a crisis, then rose slightly to be insignificantly below normal for most of the rest of the pre-crisis window (Figure 19). In the last few months close to the crisis, output growth slowed slightly, but not significantly. The lack of a significant pattern for output growth was robust across most of the analytical groupings. The exceptional cases were currency crashes and crises with slow recoveries, where growth slowed significantly below that in tranquil times around three to six months before a crisis. As well, for crises associated with banking problems, output growth was significantly below normal throughout the 24 month pre-crisis period, perhaps suggestive of deeper financial problems keeping the economy in a longer-term stagnant state. In contrast, for crises in industrial countries and those with fast recoveries,

growth was significantly lower than during the tranquil periods before the 18th month, while in the 12 months immediately prior to the crisis, output growth had essentially recovered to normal levels. These results suggest that the duration of the crises may partly depend on the *cyclical* positions of the economies prior to the crisis. In a crisis where activity after the crisis recovered relatively quickly, the economy may have already commenced a cyclical recovery when the crisis occurred. On the other hand, for a crisis where the return to trend growth was slower, the economy may have just entered a cyclical contractionary phase when the crisis struck. Surprisingly, in industrial countries, the average currency crisis seems to have struck at a point when the economy was past the trough of a cycle and was on the way to recovery. For emerging market economies, the average crisis seemed to have set a cyclical downturn in motion.

Several studies have pointed to increases in *world interest rates* as potential triggers for currency crises, particularly given the increasing integration of world capital markets and the sensitivity of capital flows to changes in these rates. The results of this paper support that belief. World real interest rates increased rather sharply, on average, about five to six months prior to a crisis for the entire crisis sample and were significantly above normal periods in the final pre-crisis months (Figure 20). This pre-crisis pattern generally appeared in all crisis sub-samples with varying levels of significance. It was more pronounced in industrial countries compared to emerging market countries, in currency crashes compared to reserves crises, in crises with slow recoveries compared to crises with fast recoveries, and somewhat surprisingly, in mild crises compared to severe crises.

Second generation theoretical models usually focus on policy trade-offs to help explain the onset of currency crises. One example of such a trade-off might occur when a government faces a decision on whether to defend a currency peg by implementing policies, such as raising interest rates, which may slow down real economic activity. In instances of high or rising *unemployment*, a government may be unwilling to accept that trade-off. In fact, many analysts believed that this was a significant factor in contributing to the 1992 ERM crisis. For the industrial country crisis sample, the unemployment rate rose much faster than normal, and significantly so, throughout the pre-crisis window (Figure 21).[14]

Some previous studies have found that large external current account and fiscal deficits have played significant roles in currency crises. Other studies have suggested that excessively large movements in short-term capital may influence crisis events, particularly if these movements are reversed. Since monthly data were not available for these variables, annual data were used in this paper to examine their impact. Figures 22–24 present these results. These figures are similar to the figures which include monthly data, except they depict a 5–year

[14]Note that Figure 21 has only two panels: one for the overall crisis sample and one for industrial countries. Because unemployment data is unavailable for almost all of the emerging market economies, the two samples are essentially the same for this variable.

window centered around the crisis as well one additional year prior to this window and one year after this window.[15]

The *current account deficit* was significantly larger than during tranquil periods in the years leading up to a crisis for the overall crisis sample and many of the crisis sub-samples (Figure 22). This result was strongest for crises associated with banking crises and for crises with slow recoveries and weakest for reserves crises (except for the year of the crisis), for industrial country crises, and for crises with fast recoveries. The *fiscal deficit* was also larger, on average, than in normal times for the overall crisis sample, but this result was neither significant (except for the year of the crisis) nor robust across the crisis sub-samples (Figure 23). Only in reserves crises and crises with fast recoveries was the deficit significantly larger than normal for any pre-crisis year. The fiscal deficit, however, increased on average for most of the crisis groupings in the years preceding a crisis. *Short-term capital* as a ratio to GDP was at or below normal (though not significantly, except for the year of the crisis), on average, during the pre-crisis period for the overall sample and many of the crisis sub-groups. On two occasions, however, the ratio during the pre-crisis period was significantly above that during tranquil periods: at two years prior to a crisis for crises associated with banking problems and at one year prior to a crisis for crises with slow recoveries. There was some evidence, moreover, of a reversal of these capital flows as shown by a decline in these movements in the years close to the crisis for many of the crisis groupings. These results tentatively suggest that while unsustainable current account deficits tended to be part of the general overheating of the economy preceding a crisis, large fiscal deficits played a less regular role, and excessive short-term capital played even a smaller role.

V. Outcomes of Crises

Almost immediately after the crisis date (for the full sample), the *real exchange rate* typically fell to a level significantly below its average during tranquil periods, remained near that depreciated level for many months, and only began to rise slowly close to 24 months after the crisis (see Figure 2). This pattern occurred despite a significant rise in the rate of *inflation*, which peaked, on average about 12 months after a crisis (see Figure 6). Similar behavior was evident for the real exchange rate in most of the crisis sub-samples, though with differing levels of significance. The two exceptions were reserves crises and crises with slow recoveries. For the former grouping, the real exchange rate remained above normal levels even after a crisis but continued to decline gradually until after ten months the rate was below the tranquil period average, though not significantly. For the latter grouping, the exchange rate dropped sharply at the crisis date but only fell to the tranquil period level. Upon stabilizing for about six months, the exchange rate depreciated again over the subsequent six months before leveling off. This further depreciation six months later for the slow recovery group could be the result of inappropriate policy responses to these crises by the authorities; however, it might equally have

[15]The five year window was considered the crisis period. Years outside these crisis windows were considered the tranquil periods.

resulted from the relatively slower recovery in GDP growth, by construction. It is interesting to note that evidence of exchange rate overshooting, at least in real terms, on average, was present in only the banking and currency crises, currency crashes, and severe crisis groupings, despite the post-crisis acceleration of inflation.

The increase in inflation was generally the case across the analytical crisis categories. The exceptions were industrial country crises and mild crises, and to a lesser extent, crises with fast recoveries. In even these three samples, however, inflation was significantly higher than normal times in the post-crisis period. The relatively sharper increase for crises with slow recoveries compared to crises with fast recoveries, despite the similar pre-crisis inflation pattern for these two groups, is particularly noteworthy. In all the crisis sub-samples, inflation tended to peak at or not rise after 12 months following a crisis.

Export growth rebounded soon after the crisis date for the overall crisis sample and all the crisis sub-samples and by 12 months later, was generally at or near normal levels (see Figure 3). Similarly, the *trade balance* and *current account balance* also improved for all the groupings, though by differing amounts and with differing lags (see Figures 4 and 22). Export growth recovered relatively less for crises with slow recoveries than those with fast recoveries, perhaps reflecting the higher real exchange rate compared to normal for the former sub-sample. The trade and current account balances for the slow recovery group, however, increased more sharply post-crisis than that for fast recovery group, although the sharper rebound probably reflects slower GDP growth leading to relatively lower demand for imports. The improvement in external sector was helped by an improvement in the *terms-of-trade* after crises with serious banking problems, emerging market crises, currency crashes, and severe crises (see Figure 5). For the overall sample, however, there was no evidence of an improvement. In fact for some categories, particularly crises with slow recoveries, terms-of-trade continued to fall.

The rebound in the external balances, including the short-term capital balance (see Figure 24) helped improve *foreign reserves* (see Figure 16). Within one year, the growth rate of reserves had returned to normal for all crisis groupings, and in most cases, foreign reserves began to accumulate at a significantly faster rate than normal soon after. The lack of a significant difference in short-term capital flows between crises with fast recoveries and those with slow recoveries is surprising given the poorer growth recovery in the latter as well as significantly higher *world interest rates*, on average, after crises with slow recoveries (see Figure 20).[16]

After a crisis, *monetary growth*, particularly in real terms, contracted relatively sharply. Real M1 and M2 growth remained significantly below tranquil period averages for at least the first year of the post-crisis period in every crisis sub-sample (see Figures 10 and 11), despite reductions in the *real interest rate* to levels significantly below normal (see Figure 13). The

[16]Note that in every other sub-sample and the full sample, the post-crisis world interest rates are not significantly different from normal.

contraction also occurred for real domestic credit growth in all the categories, but growth was not significantly less than normal, except for a few months, in the post-crisis period in many of these categories (see Figure 12). Because inflation rates also generally rose in the first twelve months after a crisis, the evidence of a monetary slow down was weaker for nominal M1, M2, and domestic credit growth (see Figures 7, 8, and 9).

It is interesting to compare the behavior of the monetary variables, the real interest rate, and inflation between crises with fast recoveries and those with slow recoveries. For crises with fast recoveries, real interest rates were lowered less, inflation rose less, and nominal M1, M2, and domestic credit growth remained near normal. As a result, the real money supply did not contract significantly. For the crises with slow recoveries, the real money supply contracted more, despite lower real interest rates, because inflation rose much more. This may have caused GDP growth to recover more slowly.

The decline in broad money along with the improving foreign reserves position caused the ratio of *broad money to foreign reserves* to return to more normal levels in the post-crisis period (see Figure 17). As this ratio fell, confidence in the domestic currency was restored leading to a more stable currency. It is noteworthy that in crises with faster recoveries, this ratio was back to normal within six months after the outbreak of crisis, but for crises with slower recoveries, the ratio was not back to normal, on average, even after two years.

By construction, industrial *output growth* declined much more following crises with slow recoveries than those with fast recoveries (see Figure 19). In fact, for the latter group, output growth was not significantly different from normal. For the overall crisis sample and most of the other sub-samples, output was significantly below normal at some stage during the post-crisis period, although the timing and duration of the below normal output varied by group. The two exceptions were industrial country crises, for which output increased, on average, after a crisis and was at or above normal times, and currency crashes, where output also increased after a crisis but remained insignificantly below normal for about six months.

The output slowdown, along with the decline in confidence in the currency, led to *stock prices* growing more slowly than normal, on average, after a crisis (see Figures 14 and 15). By construction, the decrease in stock prices was larger, and generally significant, when valued in foreign currency. In domestic currency, however, stock price growth was insignificantly different from normal generally, except for after crises with slow recoveries.
In fact, stock prices continued to grow at normal rates, on average, for industrial country crises and crises with fast recoveries.

Lastly, the *fiscal balance*, typically, deteriorated on the crisis date and remained weak, though not always significantly, for the entire crisis sample and most of the crisis sub-samples in the post-crisis period (see Figure 23). For crises with slow recoveries, the fiscal deficit grew larger, though this might be more a result of rather than a cause of relatively slower GDP

growth, as well as a result of the greater costs of financial and economic restructuring after a relatively deeper crisis. After a reserves crisis, the post-crisis fiscal balance generally improved.

VI. Costs of Crises

Financial crises can be very costly, both in terms of the fiscal and quasi-fiscal costs of restructuring the financial sector and more broadly in terms of the effect on economic activity of the inability of financial markets to function effectively. In particular, financial crises may lead to misallocation and underutilization of resources, and thus to losses of real output. In some instances, however, crises may have not led to output losses, such as when a crisis simply brought about a needed correction of a misaligned exchange rate. To provide a rough assessment of the costs in terms of lost output, GDP growth after a crisis was compared to trend GDP growth. The cost in lost output was then estimated by adding up the differences between trend growth and actual growth in the years following the crisis until the time when annual output growth returned to its trend. It is important to note that the results presented below were for the group of countries and time period used in the analysis in this paper; results will obviously differ from case to case.

For the entire sample of currency crises, on average, output growth returned to trend in a little over 1½ years, and the cumulative loss in output growth per crisis was 4¼ percentage points (relative to trend) (Table 1).[17] For approximately 40 percent of the currency crises, there were no significant output losses estimated using this technique.[18] Although the average recovery time was shorter in emerging market countries than in industrial countries, the cumulative output loss was on average larger. The differences in recovery time and cumulative output losses may have resulted, in part, from the higher mean and variance of output growth in emerging market countries compared to industrial countries.[19] The recovery time and output losses were similar on average in currency crashes and reserves crises (respectively, 2 years and 7 percentage points, on average). However, in a relatively larger proportion of reserves crises (about 40 percent compared to 30 percent for currency crashes), countries suffered no output losses.

---

[17]This cost estimate may be biased downward because instances where output growth did not return to trend over the sample period were excluded from the calculation.

[18]This may be, in part, because in some cases it took several years for the consequences of financial sector weaknesses to materialize or because the "crisis" brought about a much needed correction of the exchange rate.

[19]The mean and standard deviation of output growth were 4.5 percent and 3.7 percent, respectively, for emerging market countries, while they were 2.7 percent and 2.3 percent, respectively, for industrial countries.

Currency crises which occurred within two years of banking crises, not surprisingly, were more prolonged and more costly those not associated with banking crises: on average it took 2½ years for output growth to return to trend and the average cumulative loss in output growth was 9 percentage points.[20] Although this may seem intuitively convincing, some caution is in order, since the criteria used to identify banking crises may tend to select occasions when financial sector problems were severe whereas the statistical criteria used to identify currency crises are independent of such judgments. Similarly, in severe crises output losses were higher on average (8¼ percentage points) than in mild crises (5 percentage points), although average recovery times were similar (2¼ years for severe crises and 2 years for mild crises). By construction, crises with fast recoveries had shorter average recovery times and smaller average output losses than crises with slow recoveries.

VII. CONCLUSIONS

No two crises have ever been alike. And it is difficult to fit the characteristics of crises into a single mold—even when the crises themselves are grouped into distinct types. Some common features nonetheless stand out from the analysis of the behavior of various macroeconomic and financial variables.

Typically, prior to a currency crisis the economy was overheated: inflation was relatively high and the domestic currency was overvalued, affecting the export sector and the current account balance. Monetary policy was significantly expansionary, with domestic credit growing strongly, compromising the exchange rate objective for countries with fixed or inflexible exchange rate systems. The financial vulnerability of the economy was increasing, with rising liabilities of the banking system unbacked by foreign reserves and falling asset prices. Furthermore, some trigger, such as increasing world real interest rates or declining terms of trade, usually exacerbated the vulnerability of an economy to a crisis. These observations are, of course, specific to the technique used to identify crisis episodes and the sample of countries and are not always robust even for all crisis sub-samples examined in this paper. Moreover, the behavior of variables in particular crises has, on many occasions, differed from this average pattern—to take one example, in a number of the Asian countries affected by the recent crisis, inflation was relatively low.

---

[20]This should be viewed only as indicative of the macroeconomic costs associated with banking crises and not as suggesting that the banking crises caused these output losses. Recessions may give rise to banking crises, which then amplify the recessions. Furthermore the magnitude of output losses for different countries may depend on their specific cyclical positions prior to the crisis. While it is, in principle, possible to derive output losses correcting for each country's cyclical position, since the cyclical positions of the 50 countries in the sample have not been closely synchronized, the effect of the correction on average losses will be limited.

Crises in emerging market economies have tended to be deeper than crises in industrial countries, but recoveries have tended to be faster. Generally, faster recoveries have been associated with stronger rebounds in export growth. While currency crises can be very costly in terms of lost output, not all are—output losses are more likely in crises in which the currency "crashes" than in those in which exchange market pressures are reflected mainly in large reserves losses. Most costly and most prolonged are currency crises accompanied by banking sector difficulties.

REFERENCES

Bordo, Michael D., 1985, "Financial Crises, Banking Crises, Stock Market Crashes and the Money Supply: Some International Evidence, 1870–1933," in Forrest Capie and Geoffrey Wood, *Financial Crises and the World Banking System* (New York: St. Martin's).

Calvo, Guillermo A., Leonardo Leiderman, and Carmen M. Reinhart, 1993, "Capital Inflows and Real Exchange Rate Appreciation in Latin America: The Role of External Factors," *Staff Papers*, IMF, Vol. 40, pp.108–51 (March).

———, 1996, "Inflows of Capital to Developing Countries in the 1990s," *Journal of Economic Perspectives*, Vol. 10, No.2, pp. 123–39 (Spring).

Caprio, Jr., Gerard and Daniela Klingebiel, 1996, "Bank Insolvencies: Cross-country Experience," Policy Research Working Paper No. 1620 (Washington, DC: The World Bank), (July).

———, 1997, "Banking Insolvency: Bad Luck, Bad Policy, or Bad Banking," in *Annual World Bank Conference on Development Economics 1996* (Washington: The World Bank).

Caramazza, Francesco, Luca Ricci and Ranil Salgado, 2000, "Trade and Financial Contagion in Currency Crises," IMF Working Paper, forthcoming February 2000.

Cole, Harold, L. and Timothy J. Kehoe, 1998, "Self-fulfilling Debt Crises," Federal Reserve Bank of Minneapolis, Staff Report (U.S.) No. 211 (July).

Demirguc-Kunt, Asli and Enrica Detragiache, September 1997, "The Determinants of Banking Crises: Evidence from Developing and Developed Countries," IMF Working Paper 97/106.

Eichengreen, Barry, Andrew K. Rose, and Charles Wyplosz, 1995, "Exchange Market Mayhem: The Antecedents and Aftermath of Speculative Attacks" *Economic Policy*.

Eichengreen, Barry, Andrew K. Rose, and Charles Wyplosz, 1996, "Contagious Currency Crises: First Tests" *Scandinavian Journal of Economics*, Vol. 98, No. 4, pp. 463–484.

Eichengreen, Barry and Andrew Rose, 1997, "Staying Afloat When the Wind Shifts: External Factors and Emerging-Market Banking Crises," mimeo, IMF and UCLA, Berkeley.

Flood, Robert and Peter Garber, 1984, "Collapsing Exchange-Rate Regimes: Some Linear Examples," *Journal of International Economics,* Vol. 17, pp. 1–13.

Frankel, Jeffrey A. and Andrew K. Rose, January 1996, "Currency Crashes in Emerging Markets: Empirical Indicators," NBER Working Paper No. 5437 (Cambridge, Massachusetts: National Bureau of Economic Research).

Glick, Reuven and Andrew K. Rose, 1999, "Contagion and Trade: Why are Currency Crises Regional," *Journal of International Money and Finance,* Vol. 18.

Gavin, Michael and Ricardo Hausmann, 1996, "The Roots of Banking Crises: The Macroeconomic Context, *Banking Crises in Latin America,* ed. by R. Hausmann and L. Rojas-Suarez (Washington: Inter American Development Bank).

Goldfajn, Ilan and Rodrigo O. Valdés, 1997, "Capital Flows and the Twin Crises: The Role of Liquidity," IMF Working Paper 97/87 (July).

Goldstein, Morris, January 1996, "Presumptive Indicators/Early Warning Signals of Vulnerability to Financial Crises in Emerging Market Economies," mimeo, Institute for International Economics, January 1996.

Kaminsky, Graciela L. and Carmen M. Reinhart, March 1996, "The Twin Crises: The Causes of Banking and Balance-of-Payments Problems," International Finance Discussion Paper No. 544 (Washington, DC: Board of Governors of the Federal Reserve System).

Kaminsky, Graciela L., Saul Lizondo,and Carmen M. Reinhart, 1997, "Leading Indicators of Currency Crises," IMF Working Paper 97/79 (July).

Krugman, Paul, 1979, "A Model of Balance of Payments Crises," *Journal of Money, Credit, and Banking*, Vol. 11, pp 311–325.

Lindgren, Carl-Johan, Gillian Garcia, and Matthew I. Saal, 1996, *Bank Soundness and Macroeconomic Policy* (Washington: International Monetary Fund).

Masson, Paul and Michael Mussa, 1995, "The Role of the IMF: Financing and Its Interactions with Adjustment and Surveillance," Pamphlets Series No. 50 (Washington: International Monetary Fund).

Masson, Paul, 1998, "Contagion: Monsoonal Effects, Spillovers, and Jumps Between Multiple Equilibria," IMF Working Paper 98/142 (September).

Mishkin, Frederic S., 1994, "Preventing Financial Crises: An International Perspective," NBER Working Paper No. 4636.

———, 1996, "Understanding Financial Crises: A Developing Country Perspective," NBER Working Paper No. 5600 (Cambridge, Massachusetts: National Bureau of Economic Research), (June).

Obstfeld, Maurice, 1986, "Rational and Self-fulfilling Balance of Payments Crises," *American Economic Review*, Vol. 76 (March), pp. 72–81.

———, 1994, "The Logic of Currency Crises," *Cahiers Economiques et Monetaires,* Vol. 43, pp. 189–123.

Sachs, Jeffrey, Aaron Tornell, and Andrés Velasco, 1996, "Financial Crises in Emerging Markets: The Lessons from 1995," *Brookings Papers on Economic Activity*1, pp. 147–198.

Schwartz, Anna, 1986, "Real and Pseudo-Financial Crises," in *Financial Crises and the World Banking System*, ed. by Forrest Capie and Geoffrey E. Wood (New York: St Martin's Press).

Taylor, Mark P. and Lucio Sarno, September 1997, "Capital Flows to Developing Countries: Long- and Short-Term Determinants," *The World Bank Economic Review*, Vol. 11 (September 1997), pp. 451–70.

BANKING CRISES

Banking crises are more difficult to identify empirically, partly because of the nature of the problem and partly because of the lack of relevant data. While data on bank deposits are readily available for most countries, and thus could be used to identify crises associated with runs on banks, most modern-day banking problems do not originate on the liabilities side of banks' balance sheets. Thus, among the industrial countries, neither the banking crises in Finland, Norway, and Sweden in the late 1980s and early 1990s, nor the earlier banking problems in several other countries, such as in Spain in the early 1980s, nor the more recent banking problems in Japan were associated with runs on deposits. Among the developing countries, large withdrawals of deposits and runs on banks have been more frequent—for instance, the banking crises in the 1980s and 1990s in Argentina, the Philippines, Thailand, Turkey, Uruguay, and Venezuela were associated with bank runs. A failure to roll over interbank deposits, as in Korea during the 1997–98 Asian crisis, can have results similar to those of a run on banks. Instances of large deposit withdrawals, however, as in the recent financial crisis in Indonesia, have tended to follow the disclosure of difficulties on the assets side or widespread uncertainty as to whether the currency would maintain its value. Generally, runs on banks are the result rather than the cause of banking problems.

Banking crises generally stem from the assets side of banks' balance sheets—from a protracted deterioration in asset quality. This suggests that variables such as the share of nonperforming loans in banks' portfolios, large fluctuations in real estate and stock prices, and indicators of business failures could be used to identify crisis episodes. The difficulty is that data for such variables are not readily available for many developing countries or are incomplete, as with data on nonperforming loans in many countries. In cases where central banks have detailed information on nonperforming loans, it is usually laxity in the analysis of, and in follow-up action in response to, the data that allows the situation to deteriorate to the point of crisis.

Reflecting these limitations, banking crises have usually been dated by researchers on the basis of a combination of events—such as the forced closure, merger, or government take-over of financial institutions, runs on banks, or the extension of government assistance to one or more financial institutions—or in-depth assessments of financial conditions, as in many case studies. As a result of this methodology, the dating of banking crises is much more approximate than that of currency crises as it depends on the occurrence of "events" such as the closure or government takeover of financial institutions, bank runs, etc. There is therefore a greater risk of dating crises either "too late"—as financial problems usually begin well before bank closures or bank runs occur—or "too early," since the peak of a crisis is generally reached much later.

Banking crises were compiled from previous studies for the analysis in this paper. The list of banking crises was compiled from Caprio and Klingebiel (1996), Kaminsky and Reinhart (1996), and Demirguc-Kunt and Detragiache (1997).

Between 1975 and 1997, the sample of 50 countries had 54 banking crises. Of these, 12 occured in industrial countries while 42 were in developing countries. Forty-five of the banking crises were within two years of currency crises. Twelve were contemporaneous with currency crises[21] and another 12 preceded currency crises by one year, while ten others preceded them by two years. In seven cases currency crises were followed in one year by a banking crisis, while in four instances currency crises preceded banking crises by two years. This evidence, while suggestive, should be interpreted with caution in view of the difficulties in dating the beginning of banking crises.[22]

[21]Currency and banking crises seem to have become more contemporaneous since the late 1980s: 10 of 12 instances in which banking and currency crises occured in the same year have taken place since 1989.

[22]It should be noted that others have found evidence that banking crises are statistically significant in helping to predict currency crises, but not conversely. See Kaminsky and Reinhart (1996), for example.

Table 1. Costs of Crises in Lost Output Relative to Trend

Crises Groupings [1]	Number of Crises	Average Recovery time [2] (in years)	Cumulative loss of output per crisis [3] (in percentage points)	Crises with output losses [4] (in percent)	Cumulative loss of output per crisis with output loss [5] (in percentage points)
All Currency crises	158	1.6	4.4	62	7.1
Industrial	42	1.9	3.1	55	5.6
Emerging Market	116	1.5	4.9	64	7.6
Currency crashes	55	2.0	7.1	71	10.1
Industrial	13	2.1	5.0	62	8.0
Emerging Market	42	1.9	7.9	74	10.7
Reserves crises	55	2.1	6.8	61	11.2
Industrial	12	1.9	4.6	50	9.1
Emerging Market	43	2.2	7.5	64	11.7
Banking and currency crises	45	2.4	9.0	73	12.3
Industrial	6	4.7	12.7	83	15.2
Emerging Market	39	1.9	8.3	71	11.7
Severe crises	52	2.2	8.3	70	11.9
Industrial	3	1.3	2.5	33	7.4
Emerging Market	49	2.2	8.7	72	12.0
Mild crises	84	2.0	5.0	59	8.5
Industrial	33	2.1	3.2	55	5.8
Emerging Market	51	1.9	6.5	63	10.3
Crises with fast recoveries	98	1.2	2.3	48	4.7
Industrial	30	1.2	1.0	37	2.7
Emerging Market	68	1.2	2.9	54	5.3
Crises with slow recoveries	60	4.8	18.4	100	18.4
Industrial	12	5.9	16.6	100	16.6
Emerging Market	48	4.5	18.9	100	18.9

[1] See text for definitions of crises groupings.

[2] Average amount of time until GDP growth returned to trend. As GDP growth data is available for all countries only on an annual basis, the minimum recovery time was one year by construction.

[3] Calculated by summing the differences between trend growth and output growth from the first year of the crisis until the time when annual output growth returned to its trend and averaging over all the crises.

[4] Percent of crises in which output was lower than trend after the crisis began.

[5] Calculated by summing the differences between trend growth and output growth from the first year of the crisis until the time when annual output growth returned to its trend and averaging over all the crises which had output losses.

Figure 1: Incidence of Currency Crises

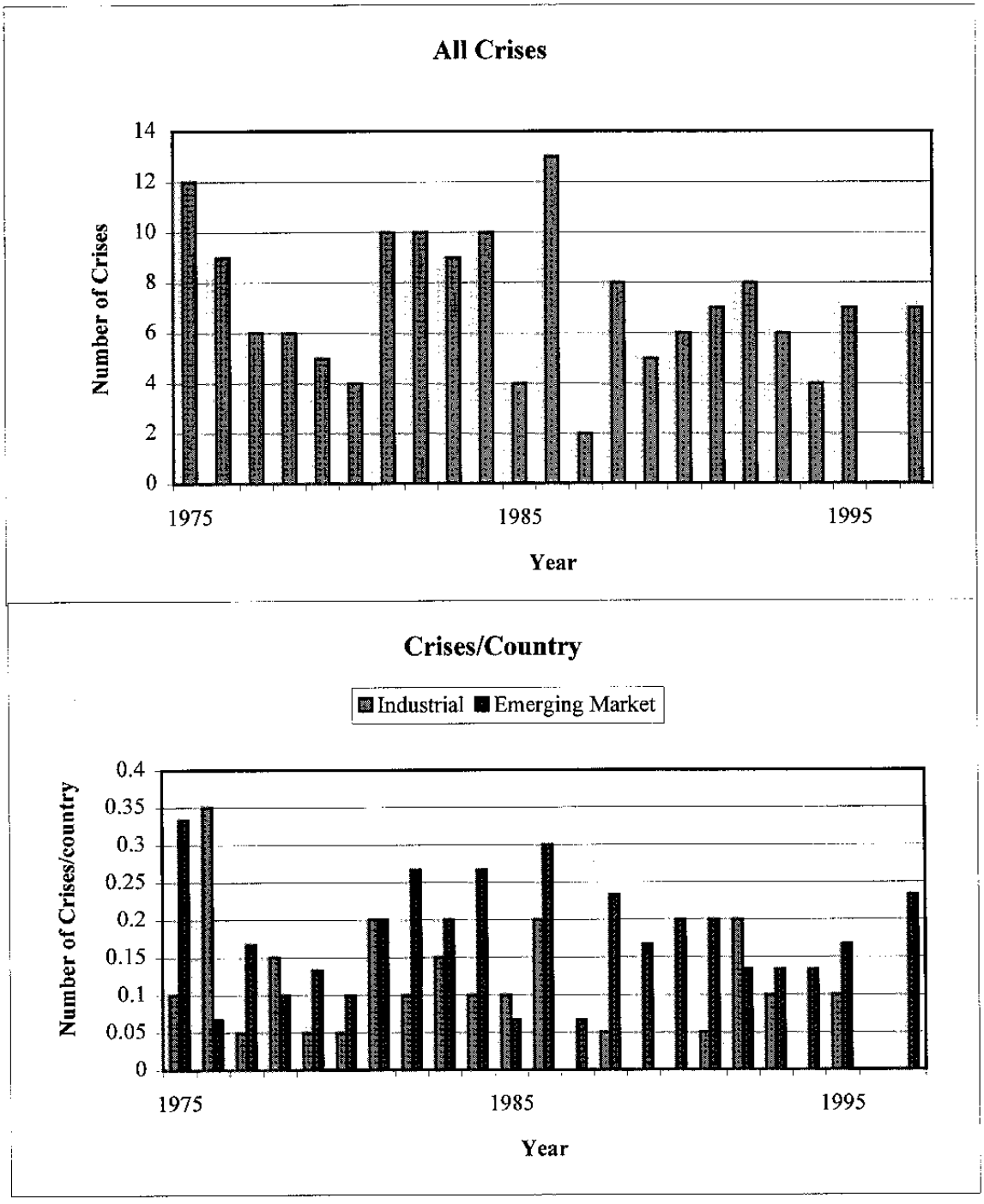
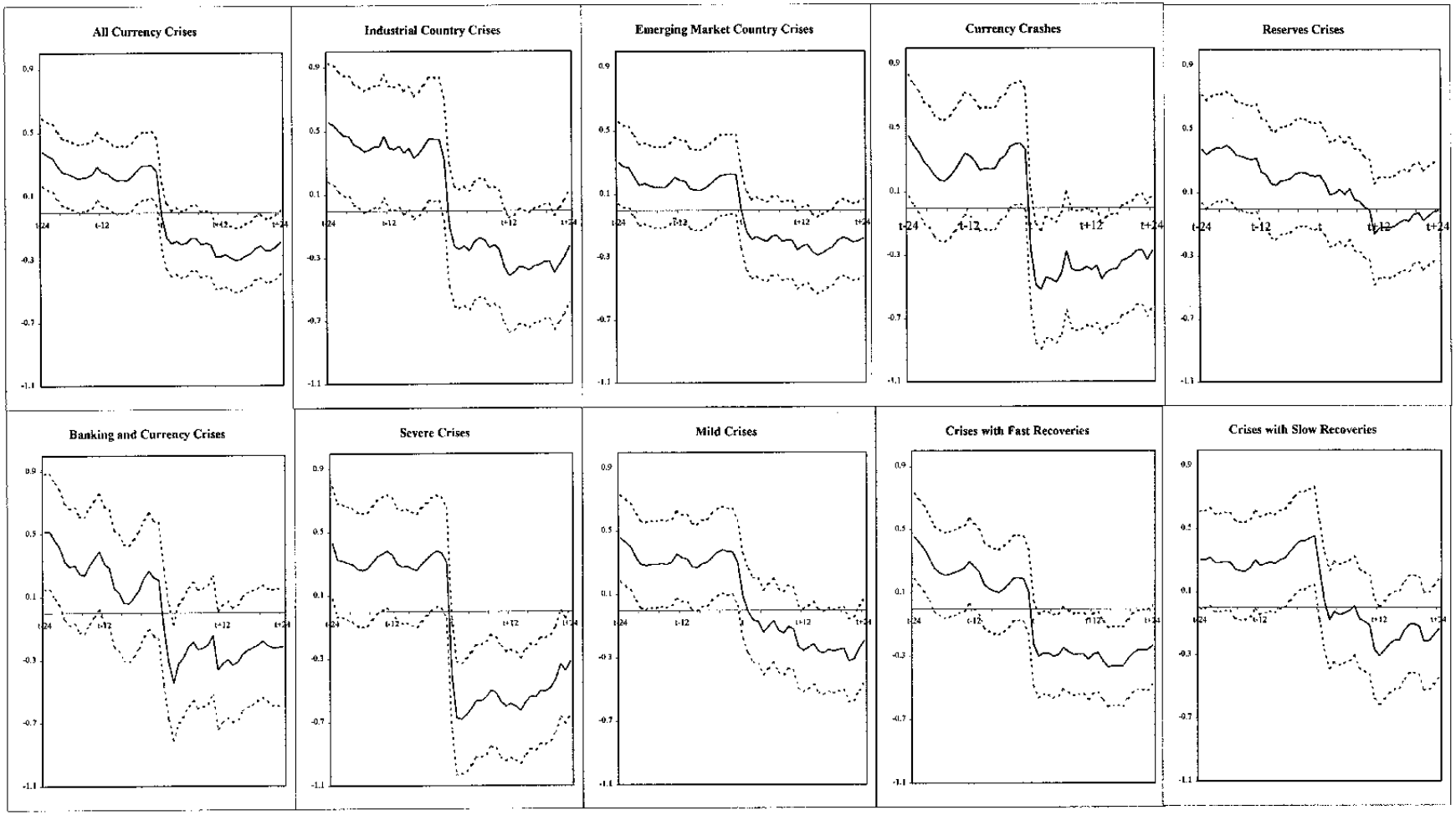


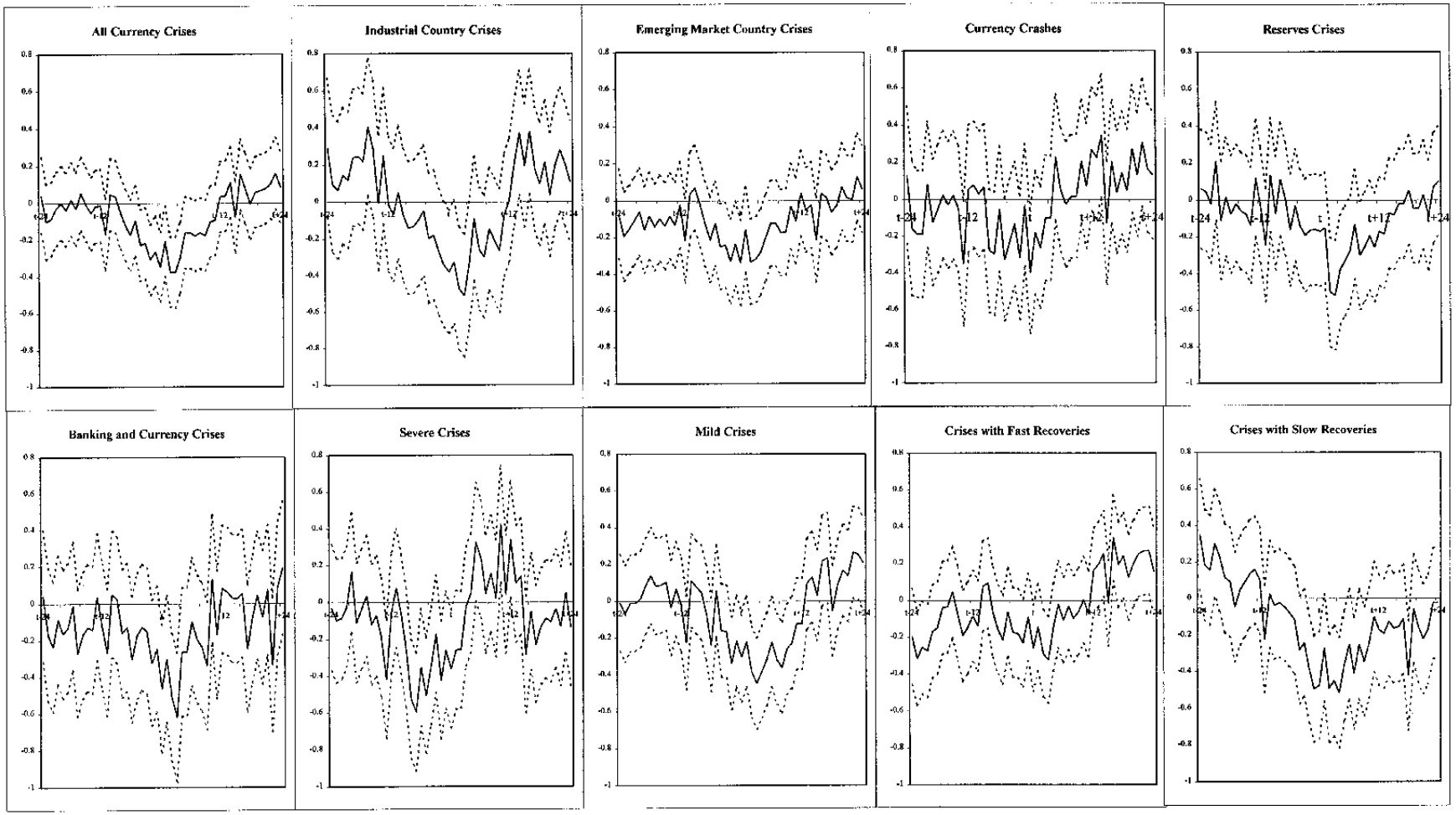
Figure 2. Real Effective Exchange Rate [1,2]



[1] The real effective exchange rate was calculated using weights from the Information Notice System (INS) database and transformed by taking logs (index is 0.0 for 1990). The units for each panel are country-specific standard deviations from the country-specific mean. All crises for which the preceding 12-month inflation rate exceeded 80 percent were removed. Outliers were also removed by rejecting data which did not fall within variable-specific, symmetric, and wide cut-off parameters. The cut-off parameters for the real exchange rate outliers were 6.0 and -6.0. The data was then normalized by subtracting the country-specific mean and dividing by the country-specific standard deviation.

[2] The solid line in each panel portrays the behavior of the variable during the crisis window (which includes the 24 months before a crisis, the month of the crisis, and 24 months after the crisis) for the selected sample of crises, relative to its tranquil-period mean and averaged across all crises. The dashed lines in each panel represent the two times standard error bands, using both standard errors for the crisis window and tranquil-period means.

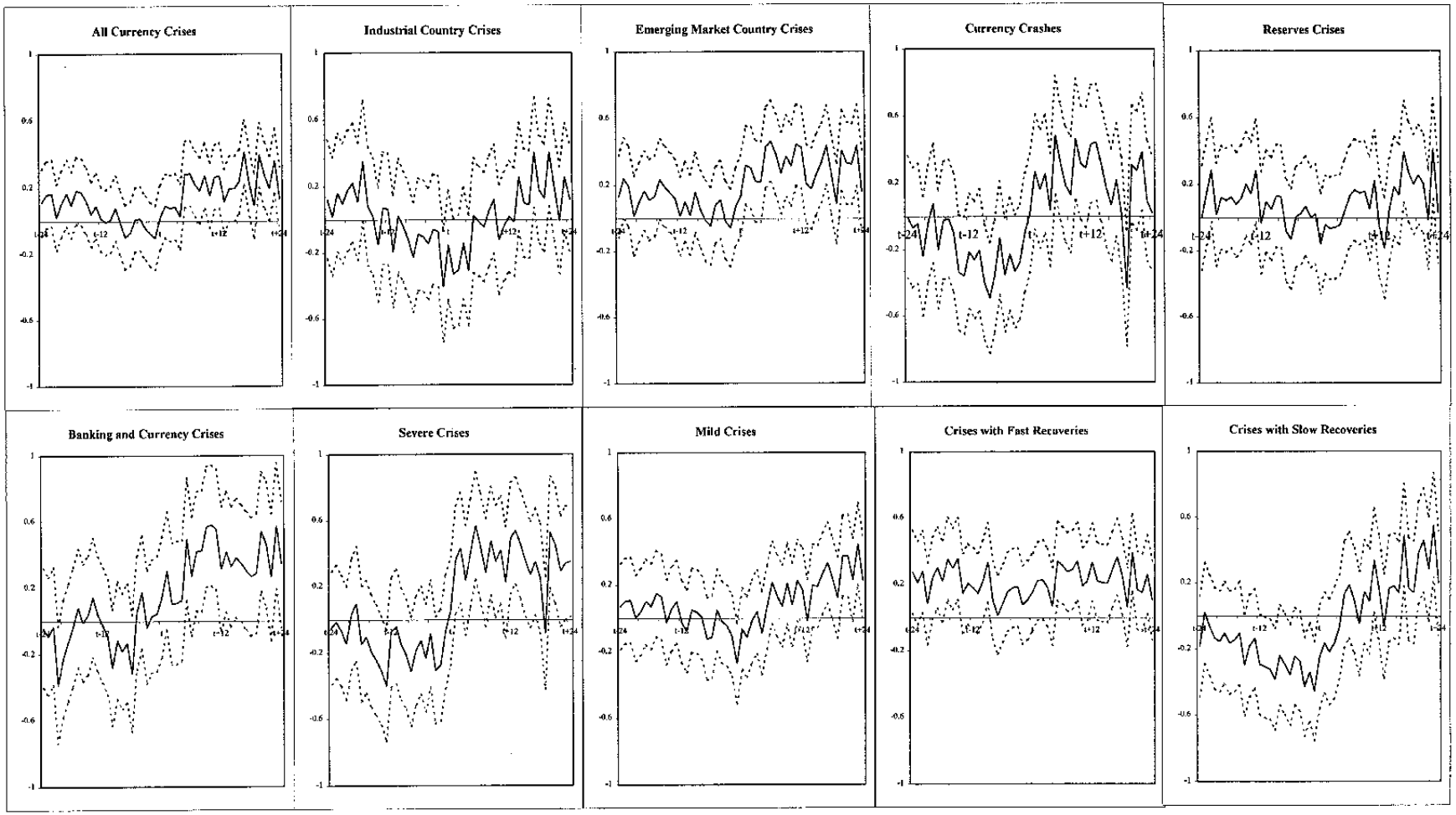
Figure 3. Export Growth [1,2]



[1] Export growth was defined as the 12-month logarithmic growth in exports. The units for each panel are country-specific standard deviations from the country-specific mean. All crises for which the preceding 12-month inflation rate exceeded 80 percent were removed. Outliers were also removed by rejecting data which did not fall within variable-specific, symmetric, and wide cut-off parameters. The cut-off parameters for the export growth outliers were 1.0 and -1.0. The data was then normalized by subtracting the country-specific mean and dividing by the country-specific standard deviation.

[2] The solid line in each panel portrays the behavior of the variable during the crisis window (which includes the 24 months before a crisis, the month of the crisis, and 24 months after the crisis) for the selected sample of crises, relative to its tranquil-period mean and averaged across all crises. The dashed lines in each panel represent the two times standard error bands, using both standard errors for the crisis window and tranquil-period means.

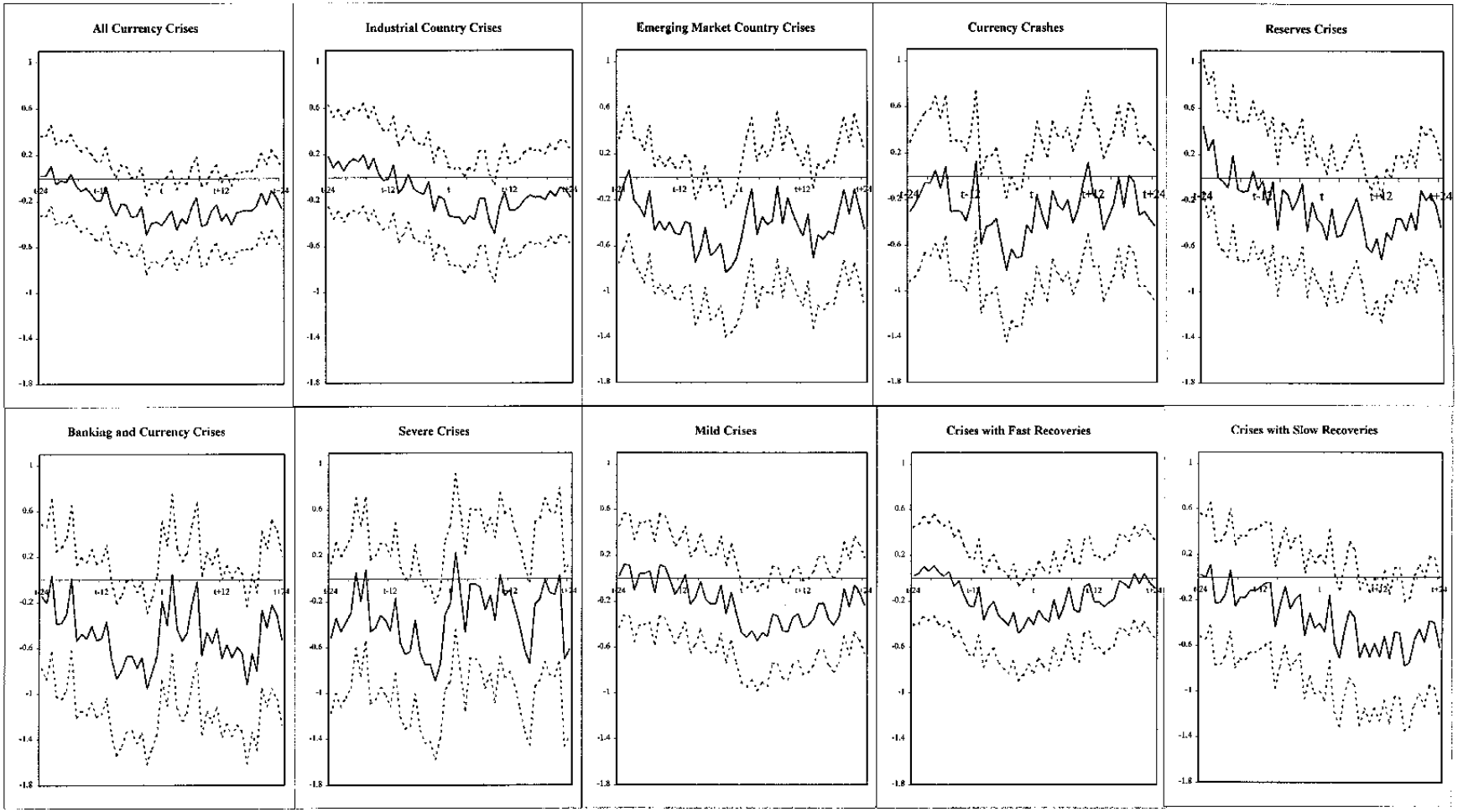
Figure 4. Trade Balance [1,2]



[1] The trade balance is defined as the logarithm of exports divided by imports. The units for each panel are country-specific standard deviations from the country-specific mean. All crises for which the preceding 12-month inflation rate exceeded 80 percent were removed. Outliers were also removed by rejecting data which did not fall within variable-specific, symmetric, and wide cut-off parameters. The cut-off parameters for the trade balance outliers were 1.0 and -1.0. The data was then normalized by subtracting the country-specific mean and dividing by the country-specific standard deviation.

[2] The solid line in each panel portrays the behavior of the variable during the crisis window (which includes the 24 months before a crisis, the month of the crisis, and 24 months after the crisis) for the selected sample of crises, relative to its tranquil-period mean and averaged across all crises. The dashed lines in each panel represent the two times standard error bands, using both standard errors for the crisis window and tranquil-period means.

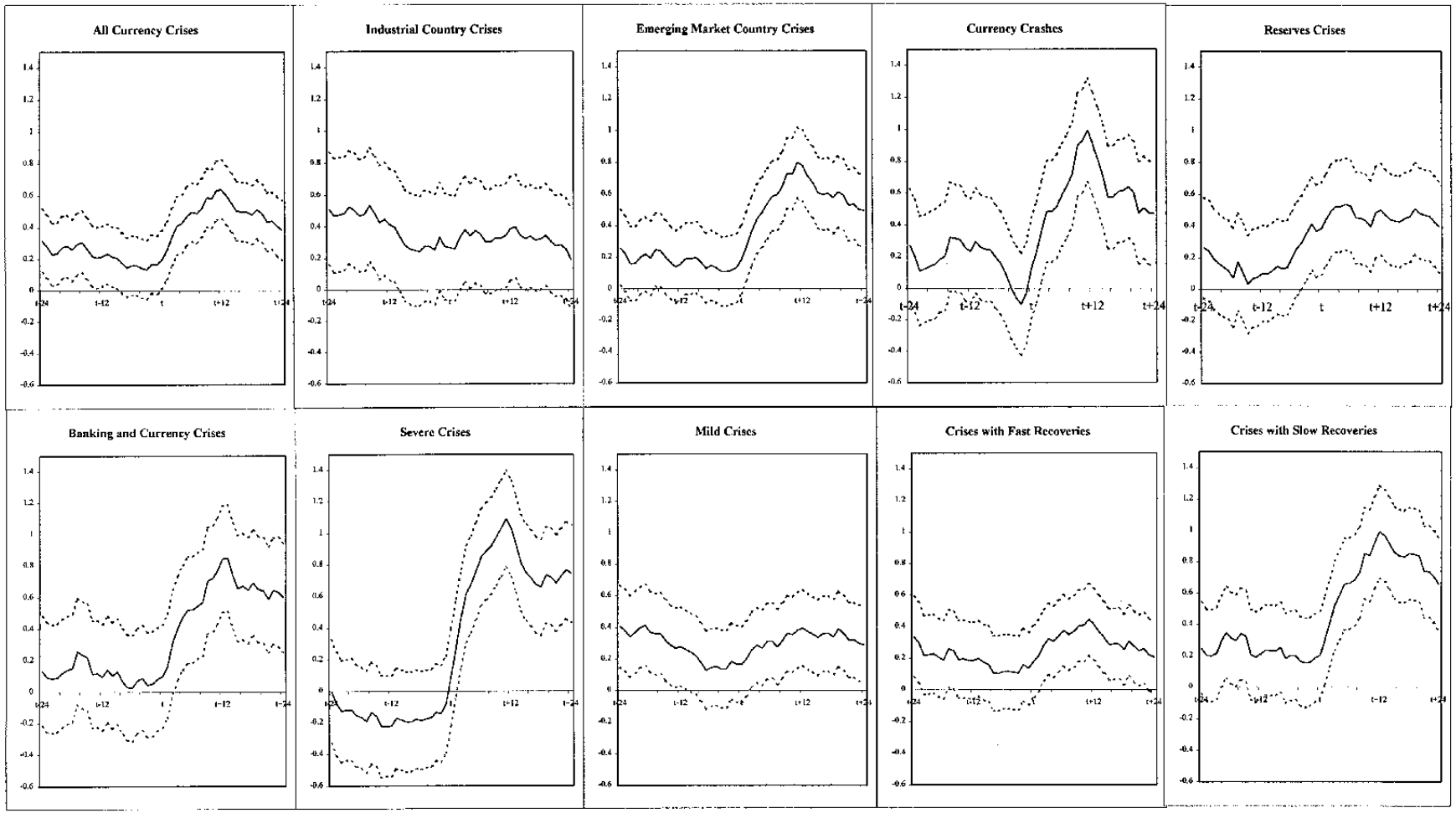
Figure 5. Terms-of-Trade [1,2]



[1] The terms-of-trade were defined as export prices divided by import prices. The units for each panel are country-specific standard deviations from the country-specific mean. All crises for which the preceding 12-month inflation rate exceeded 80 percent were removed. Outliers were also removed by rejecting data which did not fall within variable-specific, symmetric, and wide cut-off parameters. The cut-off parameters for the terms-of-trade outliers were 2.0 and -2.0. The data was then normalized by subtracting the country-specific mean and dividing by the country-specific standard deviation.

[2] The solid line in each panel portrays the behavior of the variable during the crisis window (which includes the 24 months before a crisis, the month of the crisis, and 24 months after the crisis) for the selected sample of crises, relative to its tranquil-period mean and averaged across all crises. The dashed lines in each panel represent the two times standard error bands, using both standard errors for the crisis window and tranquil-period means.

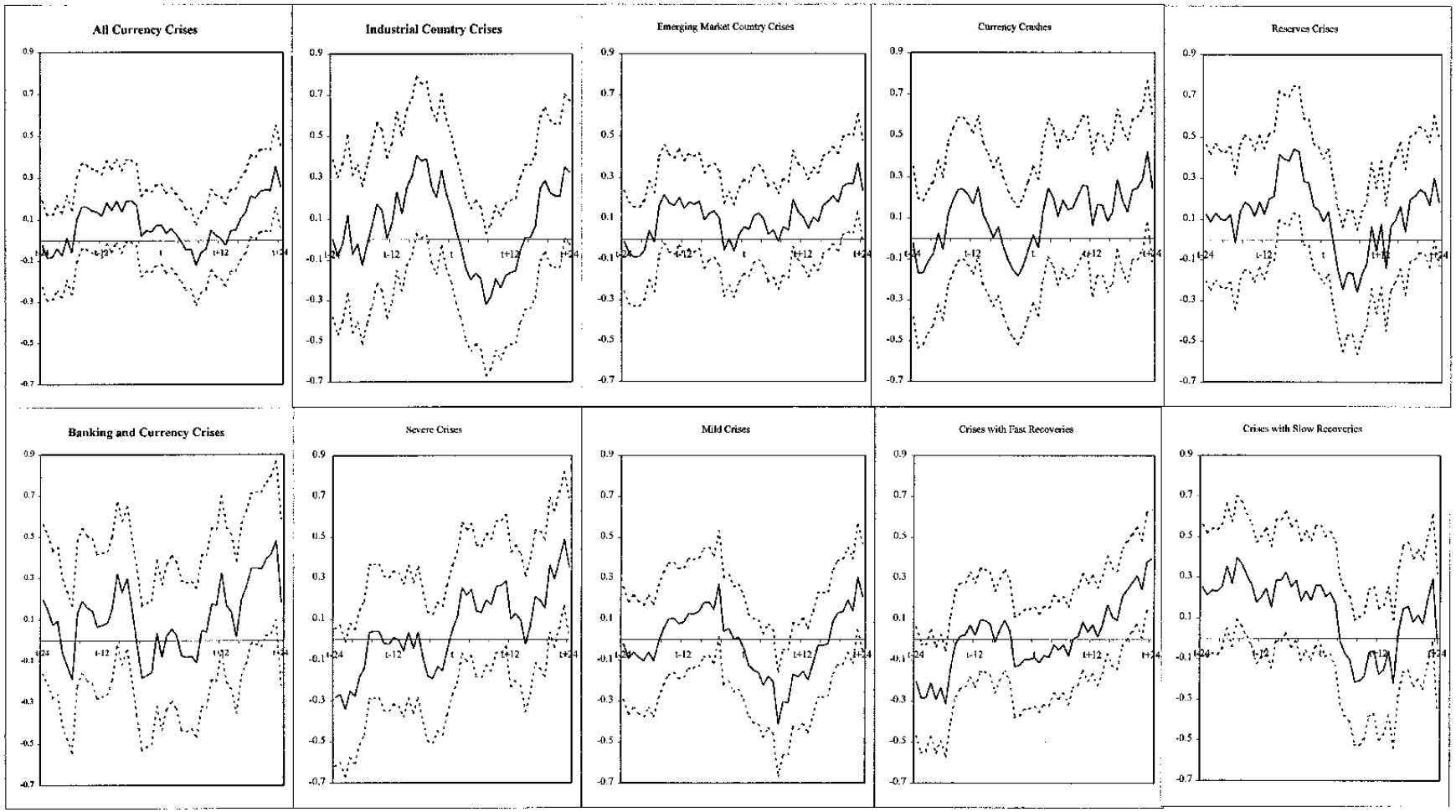
Figure 6. Inflation [1,2]



[1] Inflation was defined as the 12-month logarithmic change in prices. The units for each panel are country-specific standard deviations from the country-specific mean. All crises for which the preceding 12-month inflation rate exceeded 80 percent were removed. Outliers were also removed by rejecting data which did not fall within variable-specific, symmetric, and wide cut-off parameters. The cut-off parameters for the inflation outliers were 1.5 and -1.5. The data was then normalized by subtracting the country-specific mean and dividing by the country-specific standard deviation.

[2] The solid line in each panel portrays the behavior of the variable during the crisis window (which includes the 24 months before a crisis, the month of the crisis, and 24 months after the crisis) for the selected sample of crises, relative to its tranquil-period mean and averaged across all crises. The dashed lines in each panel represent the two times standard error bands, using both standard errors for the crisis window and tranquil-period means.

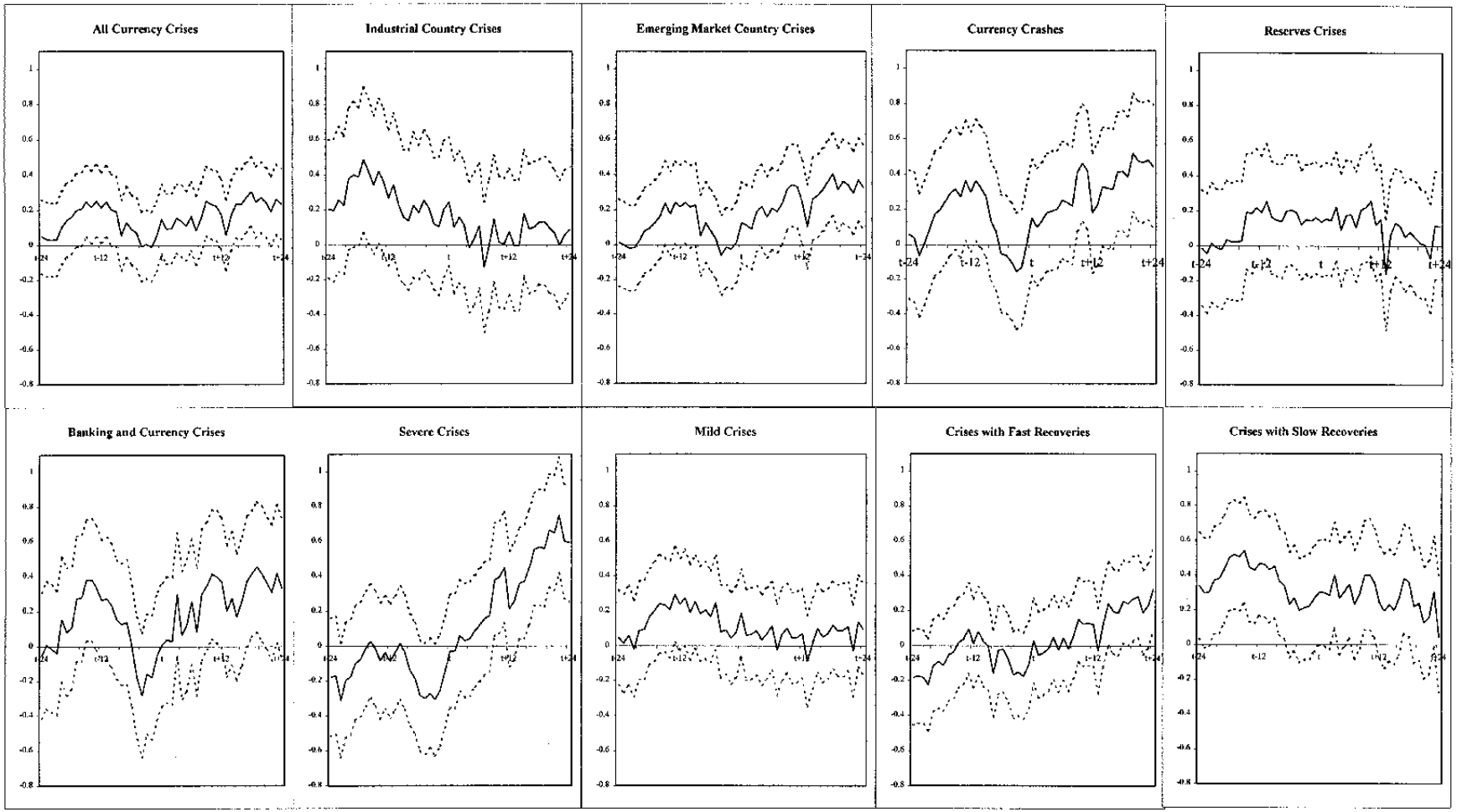
Figure 7. Nominal M1 Growth [1,2]



[1] Nominal M1 growth was defined as the 12-month logarithmic growth in M1. The units for each panel are country-specific standard deviations from the country-specific mean. All crises for which the preceding 12-month inflation rate exceeded 80 percent were removed. Outliers were also removed by rejecting data which did not fall within variable-specific, symmetric, and wide cut-off parameters. The cut-off parameters for the nominal M1 growth outliers were 2.0 and -2.0. The data was then normalized by subtracting the country-specific mean and dividing by the country-specific standard deviation.

[2] The solid line in each panel portrays the behavior of the variable during the crisis window (which includes the 24 months before a crisis, the month of the crisis, and 24 months after the crisis) for the selected sample of crises, relative to its tranquil-period mean and averaged across all crises. The dashed lines in each panel represent the two times standard error bands, using both standard errors for the crisis window and tranquil-period means.

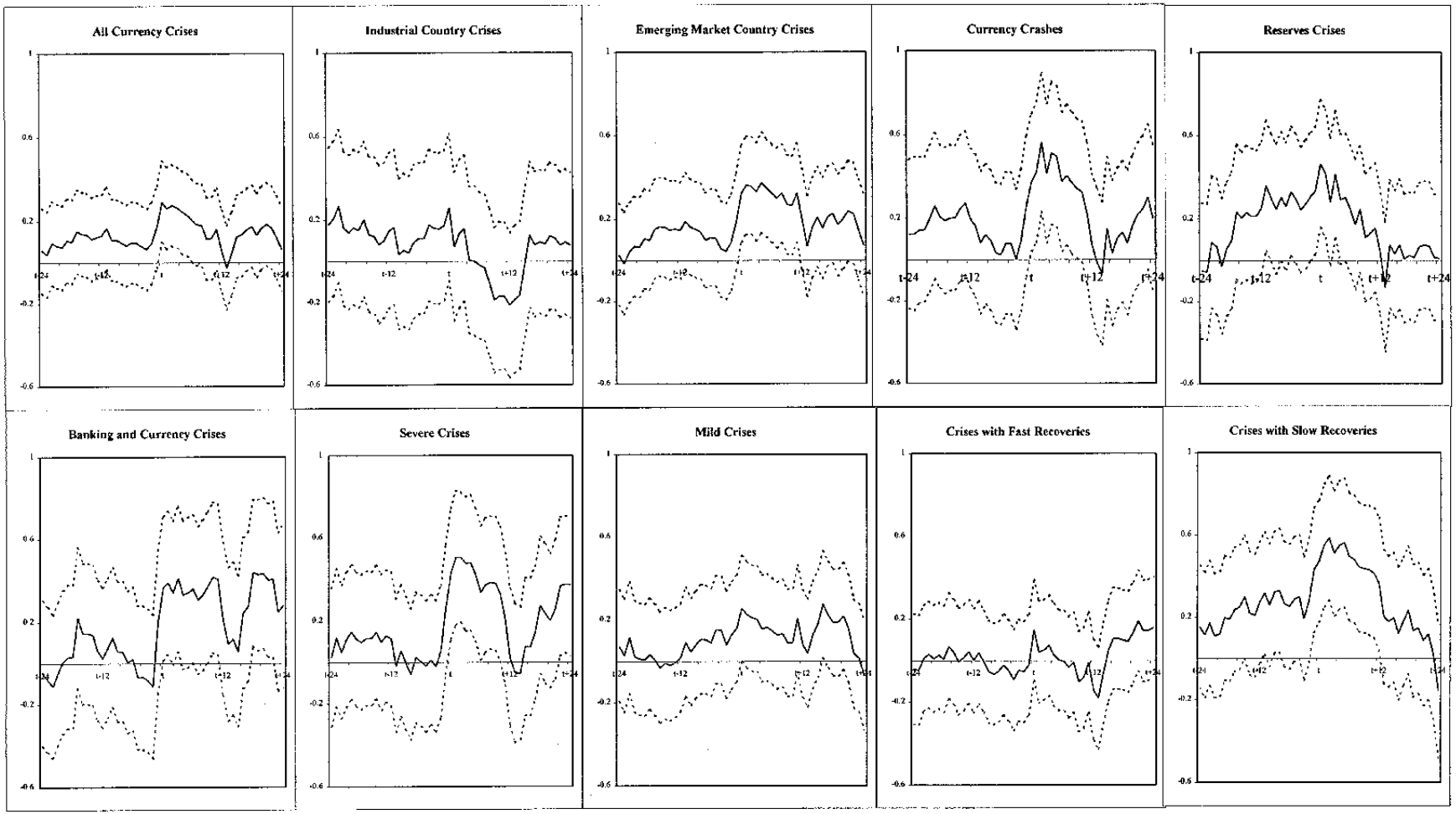
Figure 8. Nominal M2 Growth [1,2]



[1] Nominal M2 growth was defined as the 12-month logarithmic growth in M2. The units for each panel are country-specific standard deviations from the country-specific mean. All crises for which the preceding 12-month inflation rate exceeded 80 percent were removed. Outliers were also removed by rejecting data which did not fall within variable-specific, symmetric, and wide cut-off parameters. The cut-off parameters for the nominal M2 growth outliers were 2.0 and -2.0. The data was then normalized by subtracting the country-specific mean and dividing by the country-specific standard deviation.

[2] The solid line in each panel portrays the behavior of the variable during the crisis window (which includes the 24 months before a crisis, the month of the crisis, and 24 months after the crisis) for the selected sample of crises, relative to its tranquil-period mean and averaged across all crises. The dashed lines in each panel represent the two times standard error bands, using both standard errors for the crisis window and tranquil-period means.

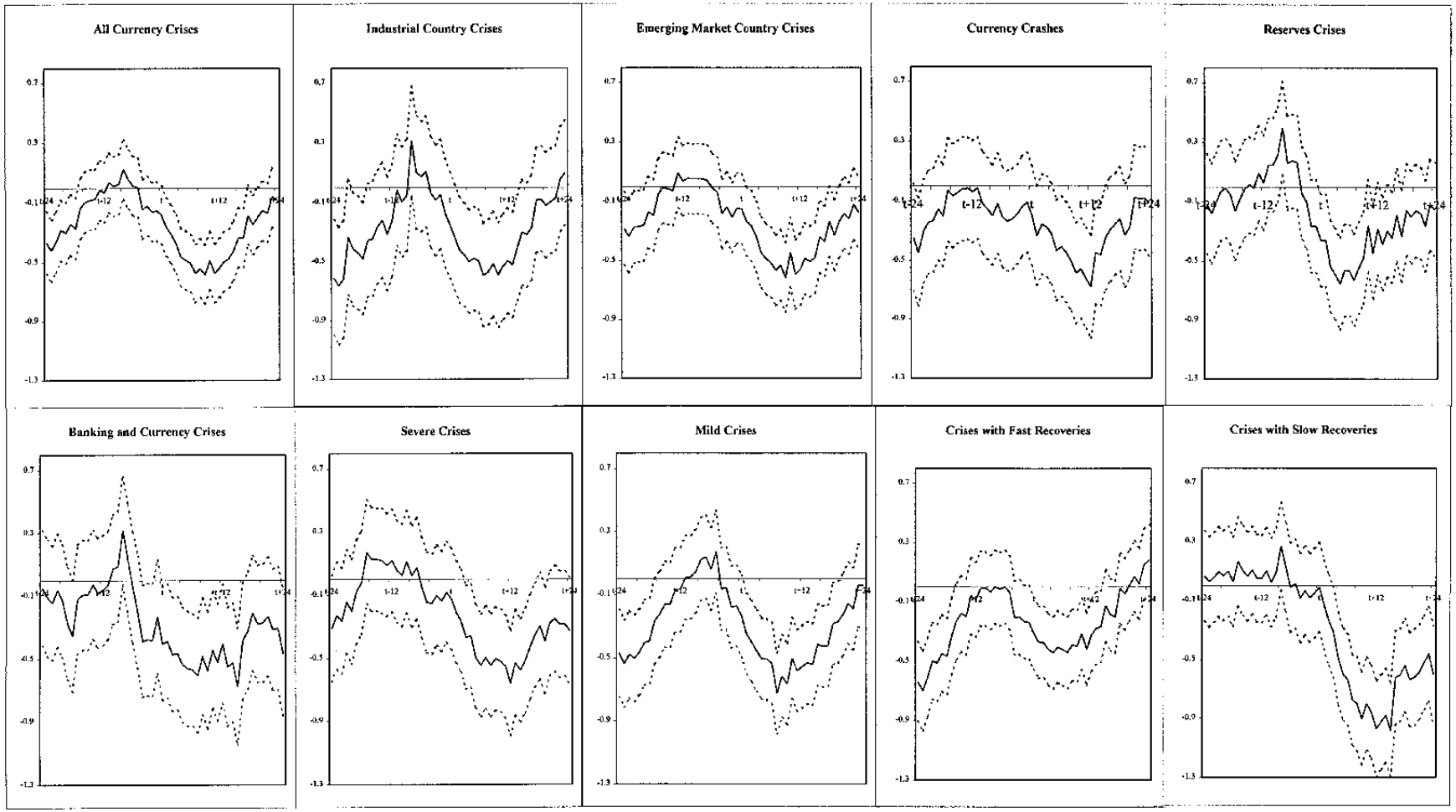
Figure 9. Nominal Domestic Credit Growth [1,2]



[1] Nominal domestic credit growth was defined as the 12-month logarithmic growth in domestic credit. The units for each panel are country-specific standard deviations from the country-specific mean. All crises for which the preceding 12-month inflation rate exceeded 80 percent were removed. Outliers were also removed by rejecting data which did not fall within variable-specific, symmetric, and wide cut-off parameters. The cut-off parameters for the nominal domestic credit growth outliers were 2.0 and -2.0. The data was then normalized by subtracting the country-specific mean and dividing by the country-specific standard deviation.

[2] The solid line in each panel portrays the behavior of the variable during the crisis window (which includes the 24 months before a crisis, the month of the crisis, and 24 months after the crisis) for the selected sample of crises, relative to its tranquil-period mean and averaged across all crises. The dashed lines in each panel represent the two times standard error bands, using both standard errors for the crisis window and tranquil-period means.

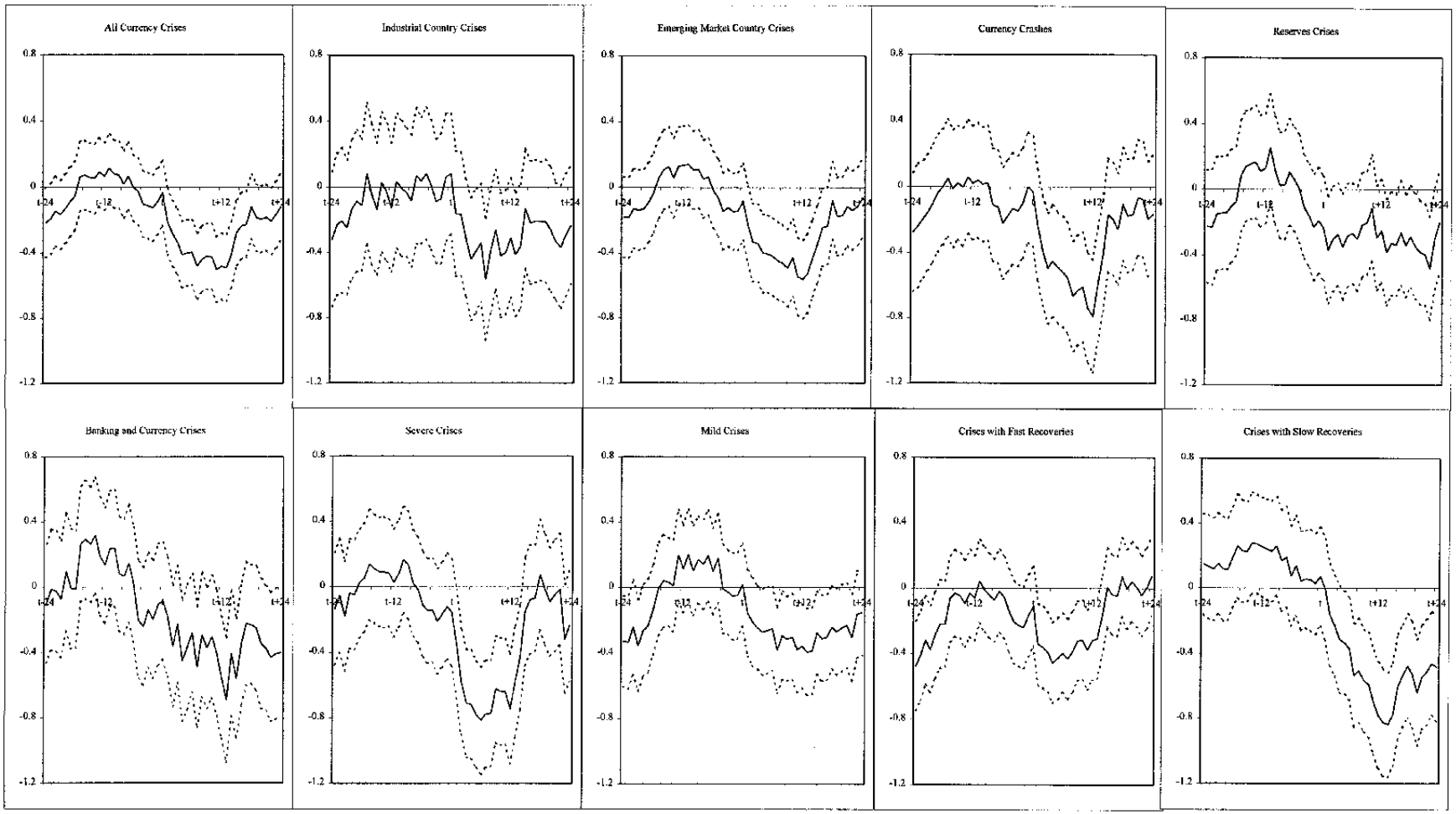
Figure 10. Real M1 Growth [1,2]



[1] Real M1 growth was defined as the 12-month logarithmic growth in real M1. The units for each panel are country-specific standard deviations from the country-specific mean. All crises for which the preceding 12-month inflation rate exceeded 80 percent were removed. Outliers were also removed by rejecting data which did not fall within variable-specific, symmetric, and wide cut-off parameters. The cut-off parameters for the real M1 growth outliers were 0.75 and -0.75. The data was then normalized by subtracting the country-specific mean and dividing by the country-specific standard deviation.

[2] The solid line in each panel portrays the behavior of the variable during the crisis window (which includes the 24 months before a crisis, the month of the crisis, and 24 months after the crisis) for the selected sample of crises, relative to its tranquil-period mean and averaged across all crises. The dashed lines in each panel represent the two times standard error bands, using both standard errors for the crisis window and tranquil-period means.

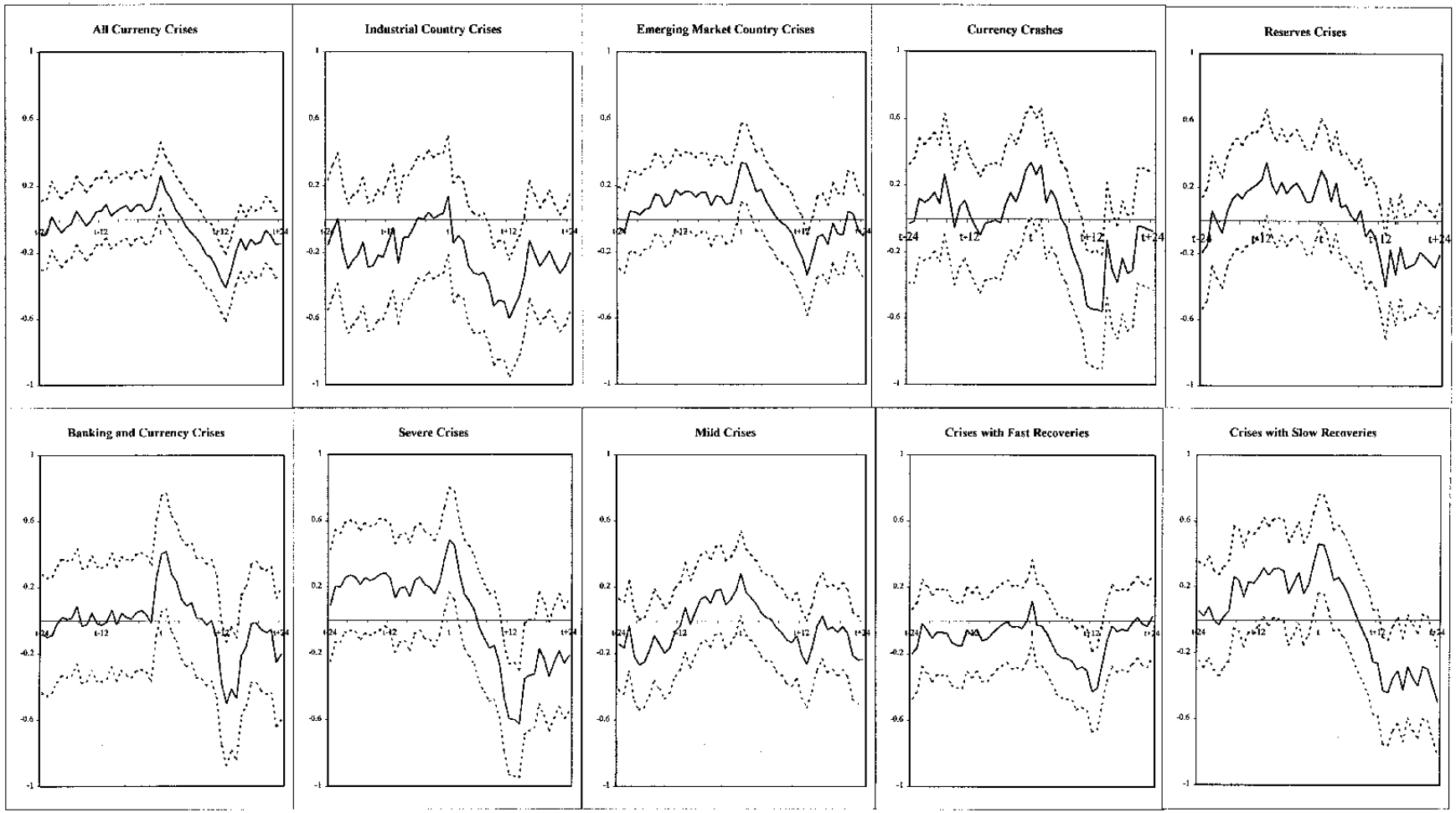
Figure 11. Real M2 Growth [1,2]



[1] Real M2 growth was defined as the 12-month logarithmic growth in real M2. The units for each panel are country-specific standard deviations from the country-specific mean. All crises for which the preceding 12-month inflation rate exceeded 80 percent were removed. Outliers were also removed by rejecting data which did not fall within variable-specific, symmetric, and wide cut-off parameters. The cut-off parameters for the real M2 growth outliers were 0.75 and -0.75. The data was then normalized by subtracting the country-specific mean and dividing by the country-specific standard deviation.

[2] The solid line in each panel portrays the behavior of the variable during the crisis window (which includes the 24 months before a crisis, the month of the crisis, and 24 months after the crisis) for the selected sample of crises, relative to its tranquil-period mean and averaged across all crises. The dashed lines in each panel represent the two times standard error bands, using both standard errors for the crisis window and tranquil-period means.

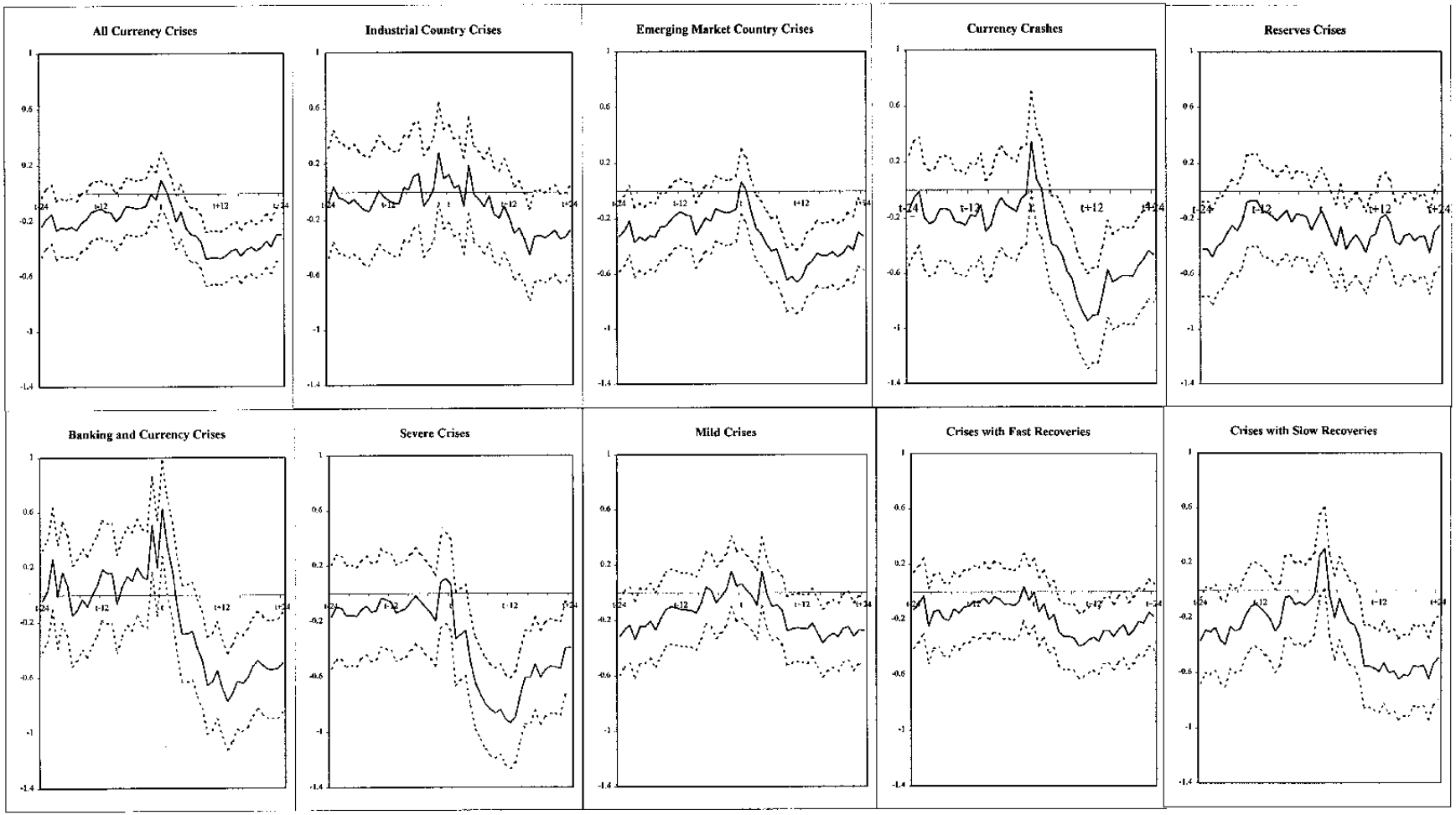
Figure 12. Real Domestic Credit Growth [1,2]



[1] Real domestic credit growth was defined as the 12-month logarithmic growth in real domestic credit. The units for each panel are country-specific standard deviations from the country-specific mean. All crises for which the preceding 12-month inflation rate exceeded 80 percent were removed. Outliers were also removed by rejecting data which did not fall within variable-specific, symmetric, and wide cut-off parameters. The cut-off parameters for the real domestic credit growth outliers were 0.75 and -0.75. The data was then normalized by subtracting the country-specific mean and dividing by the country-specific standard deviation.

[2] The solid line in each panel portrays the behavior of the variable during the crisis window (which includes the 24 months before a crisis, the month of the crisis, and 24 months after the crisis) for the selected sample of crises, relative to its tranquil-period mean and averaged across all crises. The dashed lines in each panel represent the two times standard error bands, using both standard errors for the crisis window and tranquil-period means.

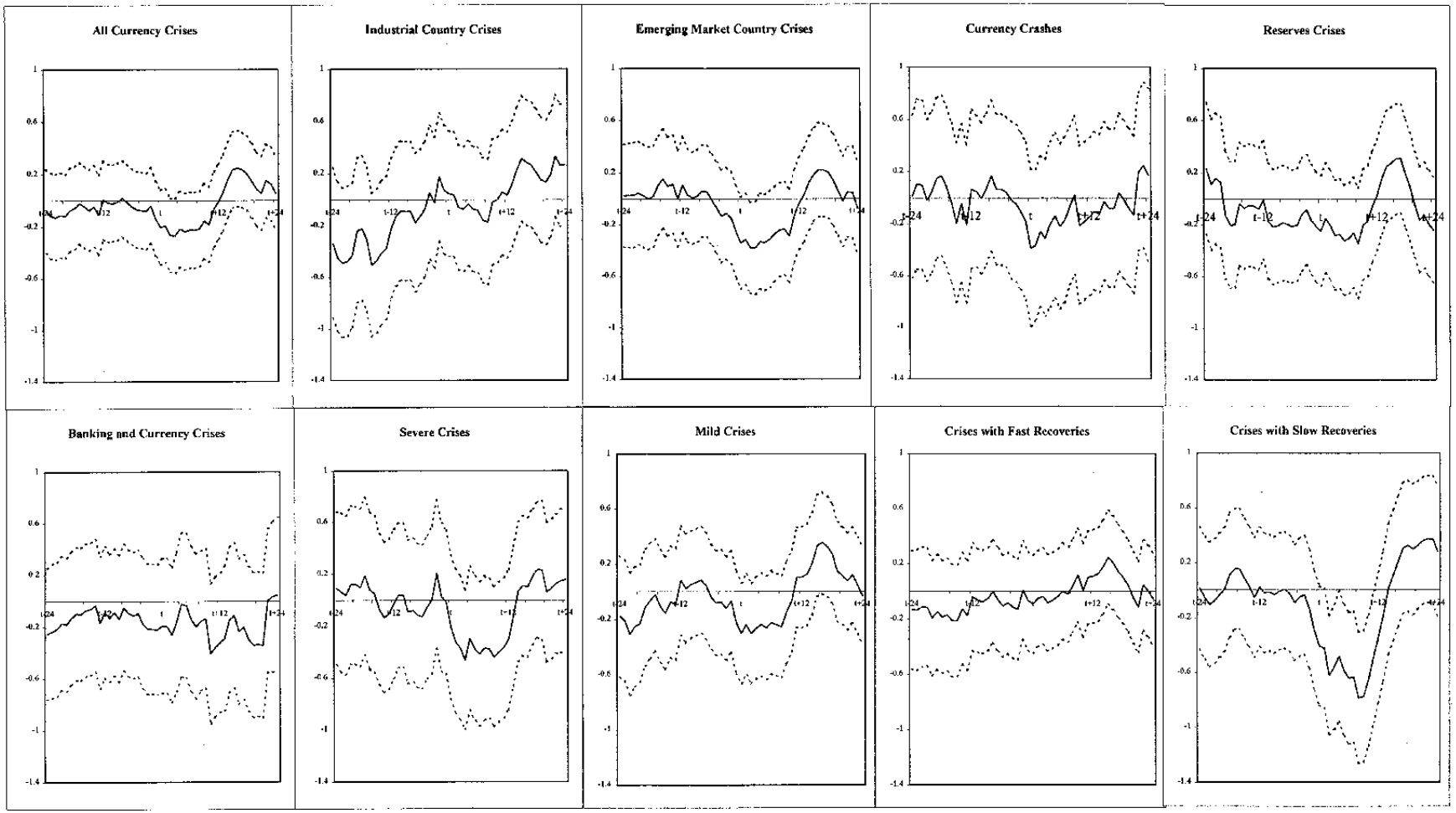
Figure 13. Real Interest Rate [1,2]



[1] The real interest rate was defined as the nominal short-term interest rate less 12-month inflation. The units for each panel are country-specific standard deviations from the country-specific mean. All crises for which the preceding 12-month inflation rate exceeded 80 percent were removed. Outliers were also removed by rejecting data which did not fall within variable-specific, symmetric, and wide cut-off parameters. The cut-off parameters for the real interest rate outliers were 2.5 and -2.5. The data was then normalized by subtracting the country-specific mean and dividing by the country-specific standard deviation.

[2] The solid line in each panel portrays the behavior of the variable during the crisis window (which includes the 24 months before a crisis, the month of the crisis, and 24 months after the crisis) for the selected sample of crises, relative to its tranquil-period mean and averaged across all crises. The dashed lines in each panel represent the two times standard error bands, using both standard errors for the crisis window and tranquil-period means.

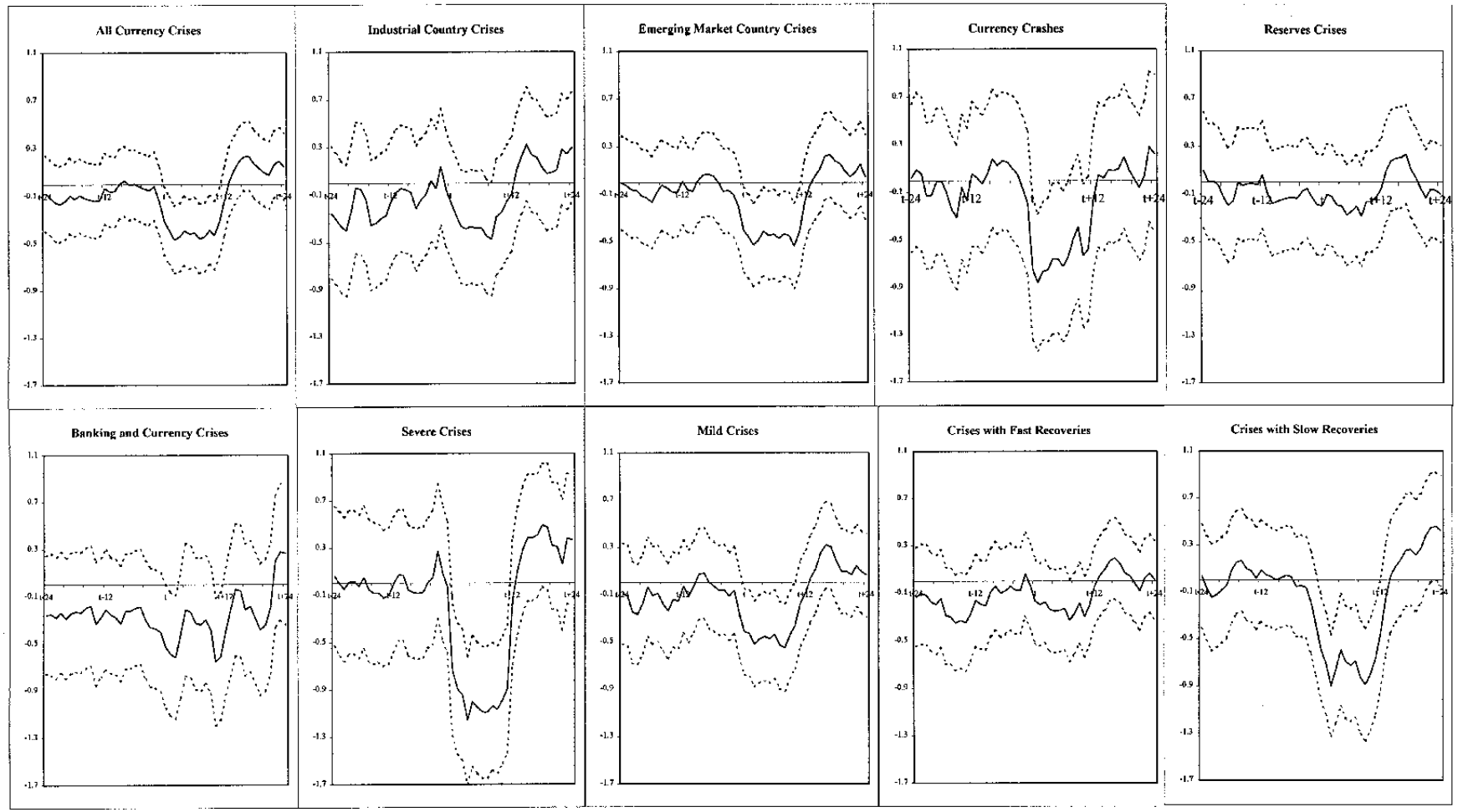
Figure 14. Change in Real Stock Prices [1,2]



[1] The change in real stock prices was defined as the 12-month logarithmic change in stock prices less 12-month inflation. The units for each panel are country-specific standard deviations from the country-specific mean. All crises for which the preceding 12-month inflation rate exceeded 80 percent were removed. Outliers were also removed by rejecting data which did not fall within variable-specific, symmetric, and wide cut-off parameters. The cut-off parameters for the change in real stock prices outliers were 2.0 and -2.0. The data was then normalized by subtracting the country-specific mean and dividing by the country-specific standard deviation.

[2] The solid line in each panel portrays the behavior of the variable during the crisis window (which includes the 24 months before a crisis, the month of the crisis, and 24 months after the crisis) for the selected sample of crises, relative to its tranquil-period mean and averaged across all crises. The dashed lines in each panel represent the two times standard error bands, using both standard errors for the crisis window and tranquil-period means.

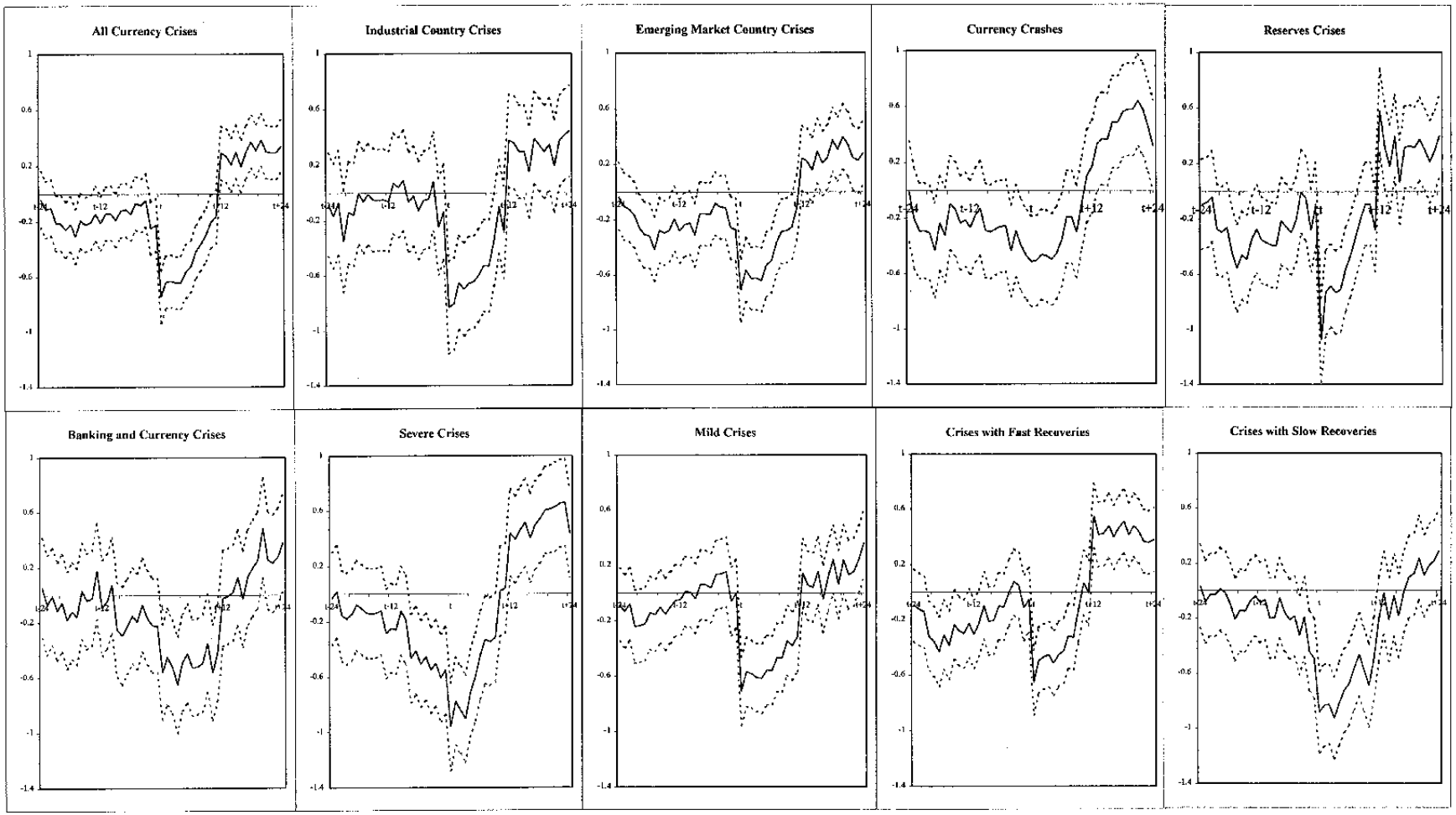
Figure 15. Change in Stock Prices (Valued in Foreign Currency) [1,2]



[1] The change in stock prices was defined as the 12-month logarithmic change in stock prices valued in U.S. dollars (non-European countries) or deutche mark (European countries). The units for each panel are country-specific standard deviations from the country-specific mean. All crises for which the preceding 12-month inflation rate exceeded 80 percent were removed. Outliers were also removed by rejecting data which did not fall within variable-specific, symmetric, and wide cut-off parameters. The cut-off parameters for the change in stock prices outliers were 2.0 and -2.0. The data was then normalized by subtracting the country-specific mean and dividing by the country-specific standard deviation.

[2] The solid line in each panel portrays the behavior of the variable during the crisis window (which includes the 24 months before a crisis, the month of the crisis, and 24 months after the crisis) for the selected sample of crises, relative to its tranquil-period mean and averaged across all crises. The dashed lines in each panel represent the two times standard error bands, using both standard errors for the crisis window and tranquil-period means.

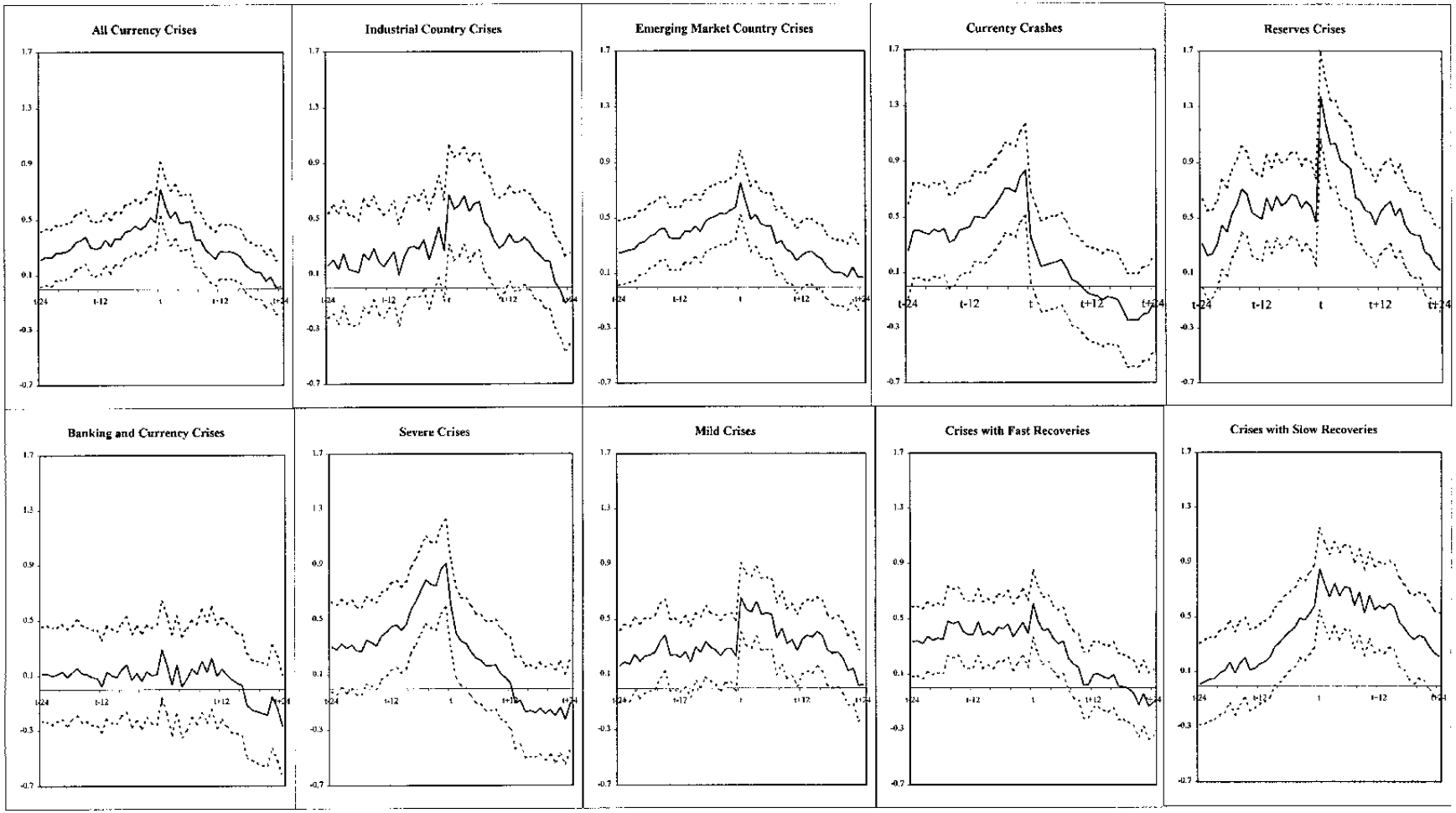
Figure 16. Change in Foreign Reserves [1,2]



[1] The change in foreign reserves was defined as the 12-month logarithmic change in reserves valued in U.S. dollars (non-European countries) or deutche marks (European countries). The units for each panel are country-specific standard deviations from the country-specific mean. All crises for which the preceding 12-month inflation rate exceeded 80 percent were removed. Outliers were also removed by rejecting data which did not fall within variable-specific, symmetric, and wide cut-off parameters. The cut-off parameters for the change in foreign reserves outliers were 1.5 and -1.5. The data was then normalized by subtracting the country-specific mean and dividing by the country-specific standard deviation.

[2] The solid line in each panel portrays the behavior of the variable during the crisis window (which includes the 24 months before a crisis, the month of a crisis, and 24 months after a crisis) for the selected sample of crises, relative to its tranquil-period mean and averaged across all crises. The dashed lines in each panel represent the two times standard error bands, using both standard errors for the crisis window and tranquil-period means.

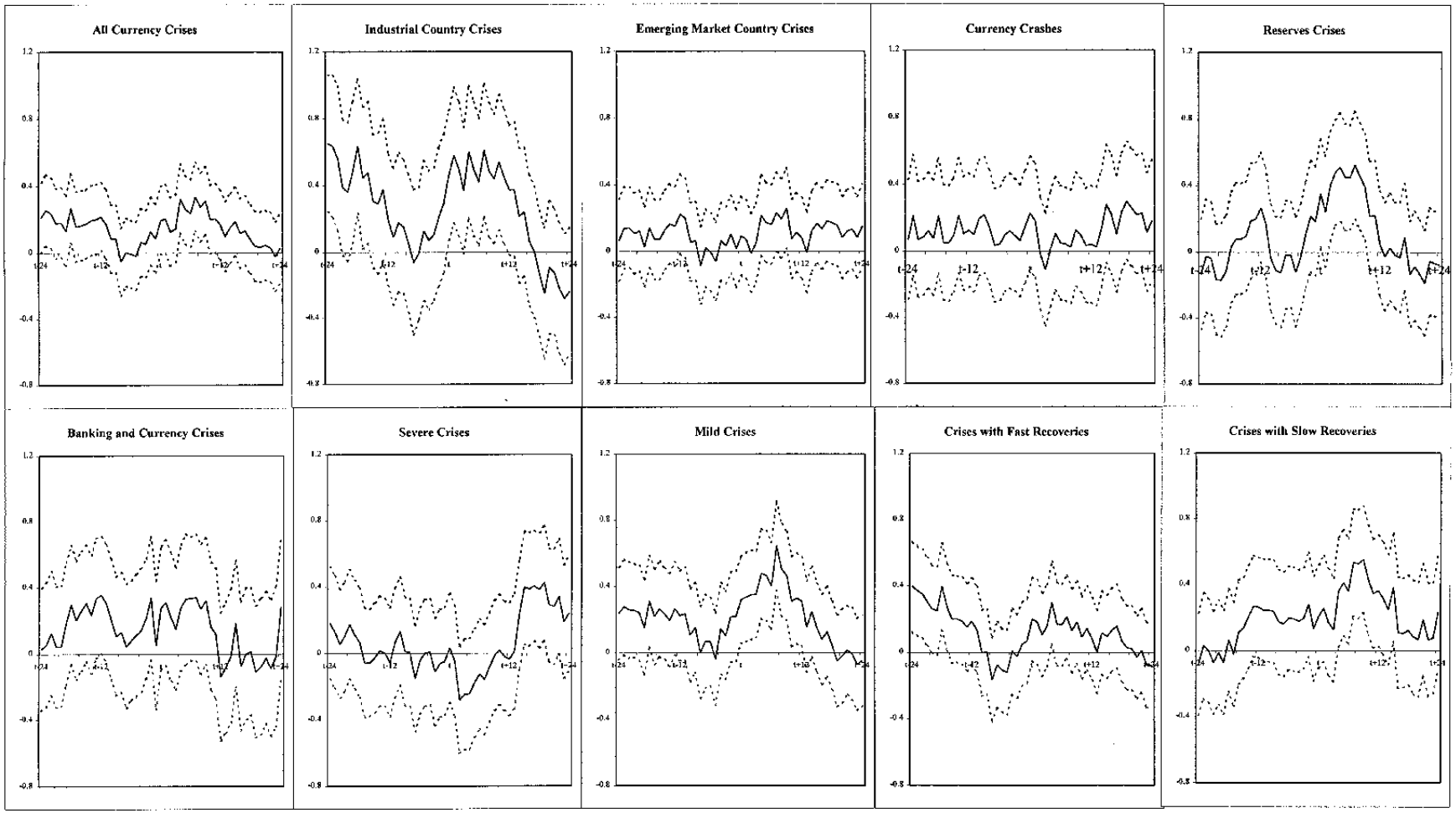
Figure 17. M2-to-Reserves Ratio [1,2]



[1] The M2-to-reserves ratio was defined as the logarithm of M2 divided reserves. The units for each panel are country-specific standard deviations from the country-specific mean. All crises for which the preceding 12-month inflation rate exceeded 80 percent were removed. Outliers were also removed by rejecting data which did not fall within variable-specific, symmetric, and wide cut-off parameters. The cut-off parameters for the M2-to-reserves ratio outliers were 5.0 and -5.0. The data was then normalized by subtracting the country-specific mean and dividing by the country-specific standard deviation.

[2] The solid line in each panel portrays the behavior of the variable during the crisis window (which includes the 24 months before a crisis, the month of the crisis, and 24 months after the crisis) for the selected sample of crises, relative to its tranquil-period mean and averaged across all crises. The dashed lines in each panel represent the two times standard error bands, using both standard errors for the crisis window and tranquil-period means.

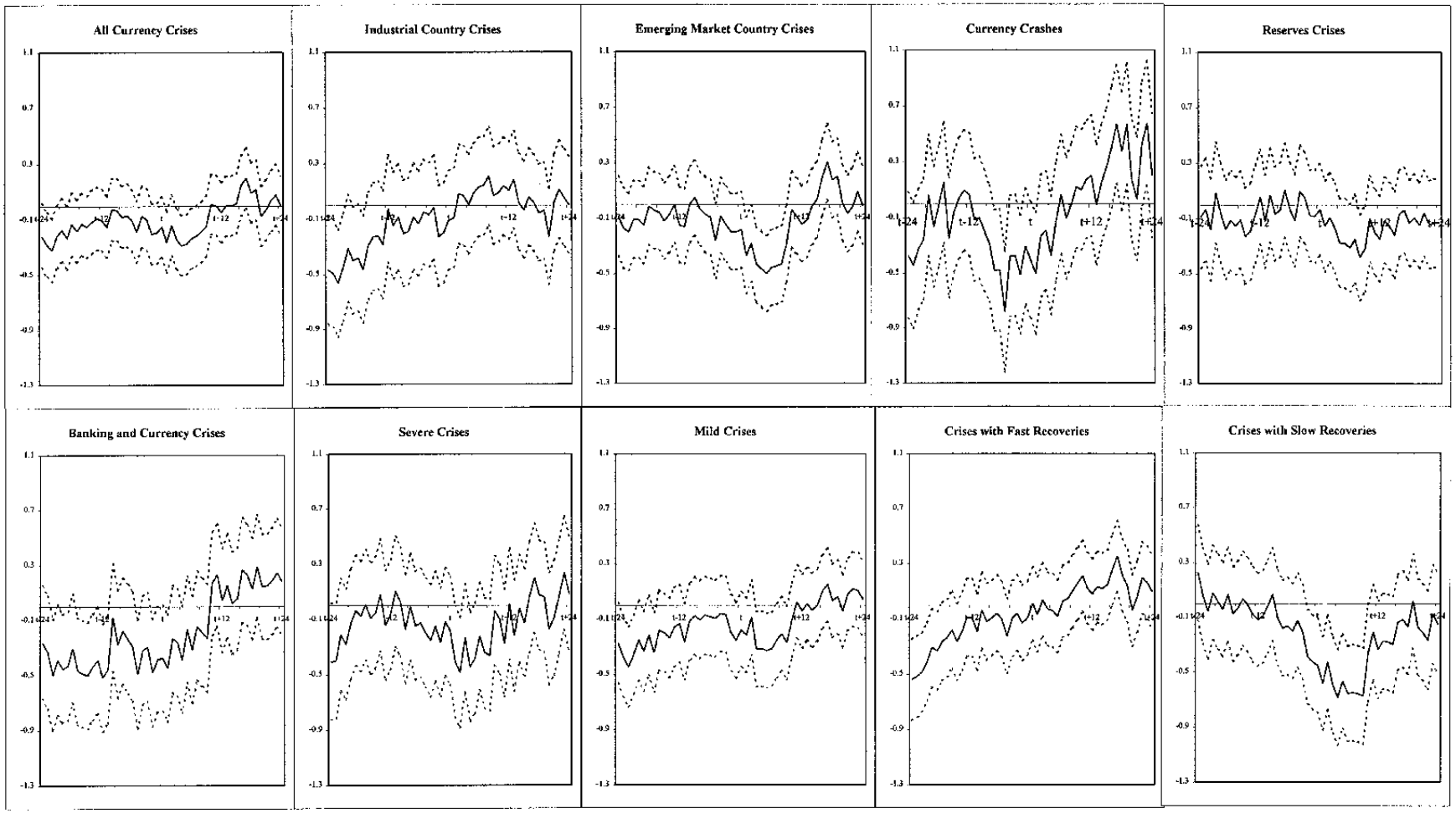
Figure 18. Change in M2-to M1 Ratio [1,2]



[1] The change in the M2-to-M1 ratio was defined as the 12-month change in the logarithm of M2 divided by M1. The units for each panel are country-specific standard deviations from the country-specific mean. All crises for which the preceding 12-month inflation rate exceeded 80 percent were removed. Outliers were also removed by rejecting data which did not fall within variable-specific, symmetric, and wide cut-off parameters. The cut-off parameters for the change in M2-to-M1 ratio outliers were 0.75 and -0.75. The data was then normalized by subtracting the country-specific mean and dividing by the country-specific standard deviation.

[2] The solid line in each panel portrays the behavior of the variable during the crisis window (which includes the 24 months before a crisis, the month of the crisis, and 24 months after the crisis) for the selected sample of crises, relative to its tranquil-period mean and averaged across all crises. The dashed lines in each panel represent the two times standard error bands, using both standard errors for the crisis window and tranquil-period means.

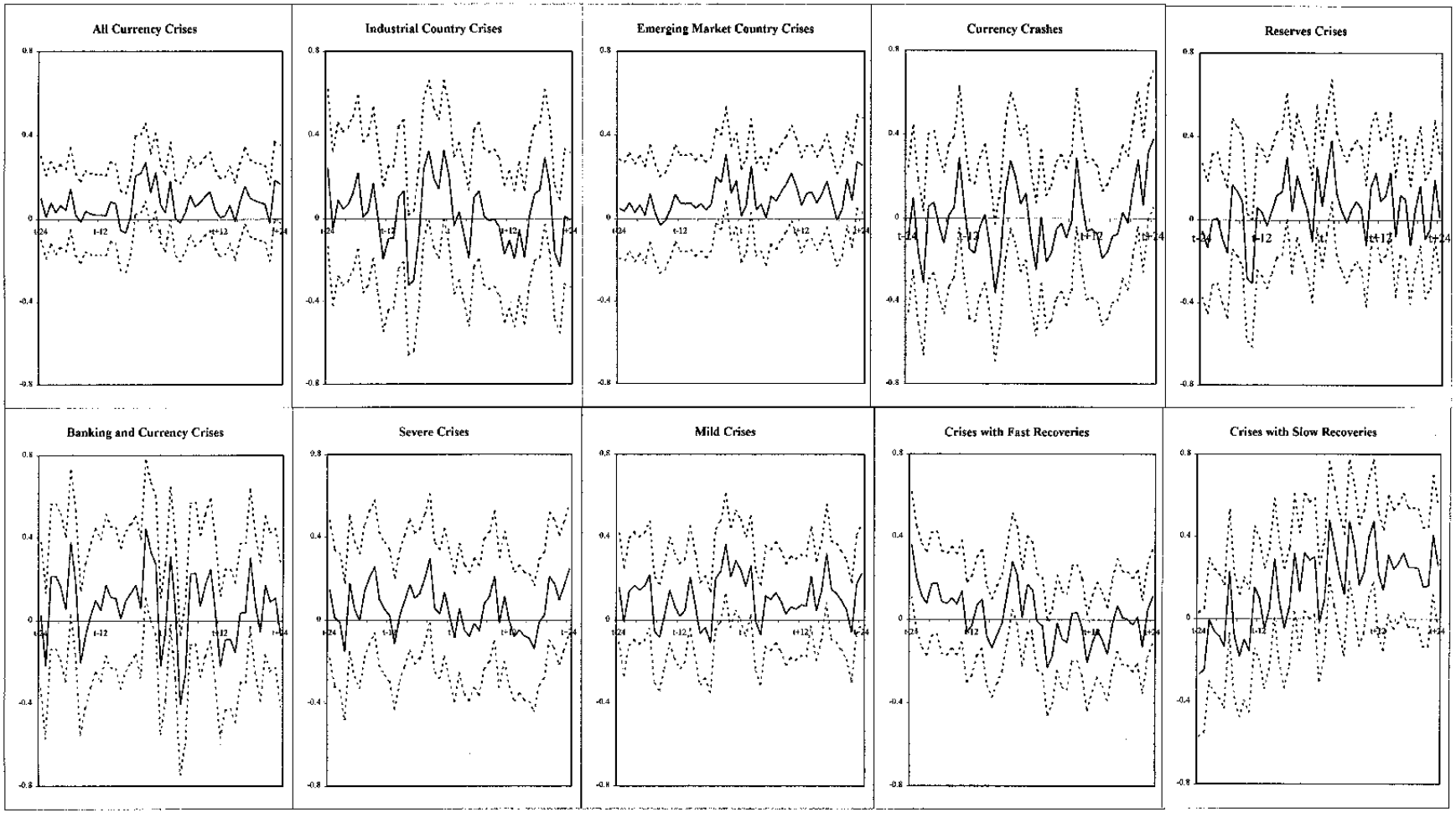
Figure 19. Output Growth [1,2]



[1] Output growth was defined as the 12-month logarithmic growth in industrial or manufacturing output. The units for each panel are country-specific standard deviations from the country-specific mean. All crises for which the preceding 12-month inflation rate exceeded 80 percent were removed. Outliers were also removed by rejecting data which did not fall within variable-specific, symmetric, and wide cut-off parameters. The cut-off parameters for the output growth outliers were 0.5 and -0.5. The data was then normalized by subtracting the country-specific mean and dividing by the country-specific standard deviation.

[2] The solid line in each panel portrays the behavior of the variable during the crisis window (which includes the 24 months before a crisis, the month of the crisis, and 24 months after the crisis) for the selected sample of crises, relative to its tranquil-period mean and averaged across all crises. The dashed lines in each panel represent the two times standard error bands, using both standard errors for the crisis window and tranquil-period means.

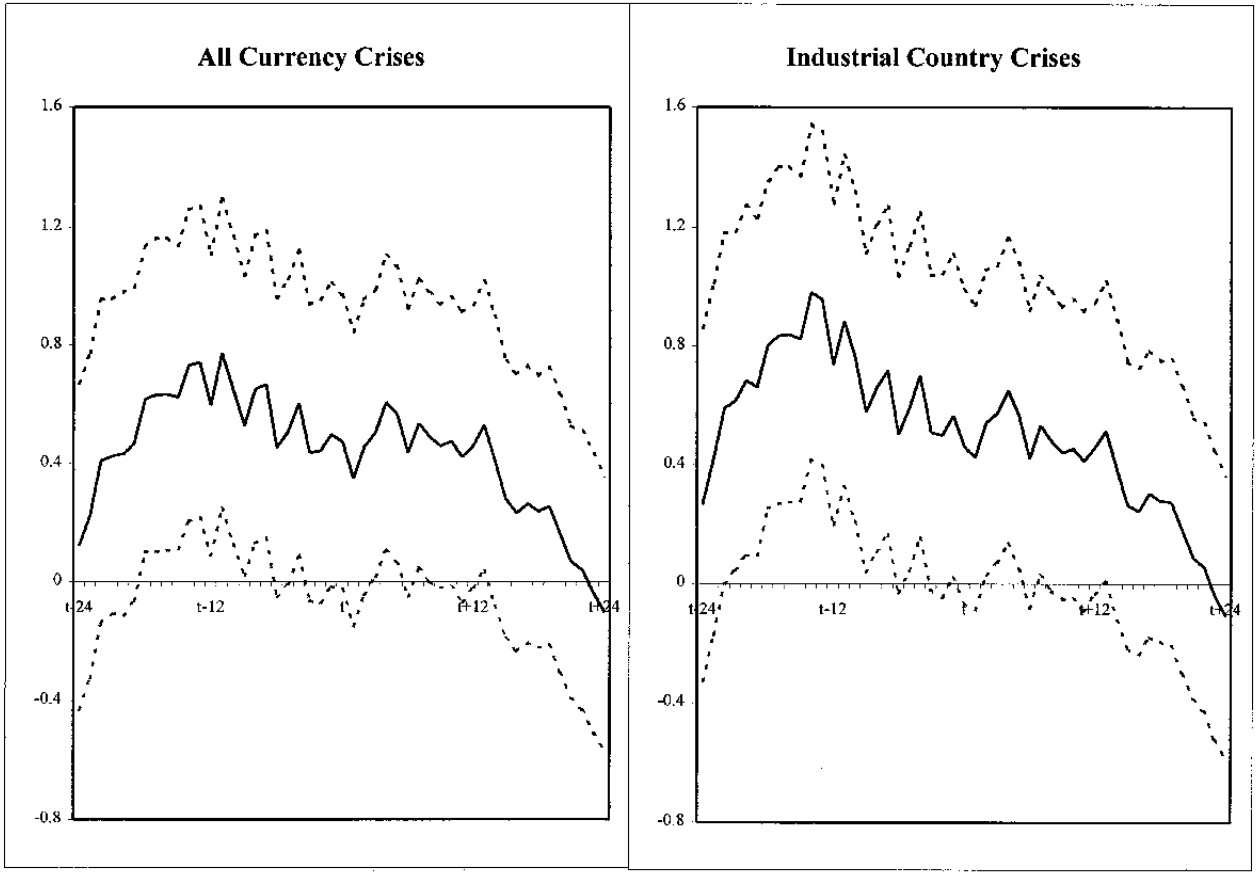
Figure 20. World Real Interest Rate [1,2]



[1] The world real interest rate was defined as the real short-term U.S. (for non-European countries) or German (for European countries) interest rate. The units for each panel are country-specific standard deviations from the country-specific mean. All crises for which the preceding 12-month inflation rate exceeded 80 percent were removed. Outliers were also removed by rejecting data which did not fall within variable-specific, symmetric, and wide cut-off parameters. The cut-off parameters for the world interest rate outliers were 2.0 and -2.0. The data was then normalized by subtracting the country-specific mean and dividing by the country-specific standard deviation.

[2] The solid line in each panel portrays the behavior of the variable during the crisis window (which includes the 24 months before a crisis, the month of the crisis, and 24 months after the crisis) for the selected sample of crises, relative to its tranquil-period mean and averaged across all crises. The dashed lines in each panel represent the two times standard error bands, using both standard errors for the crisis window and tranquil-period means.

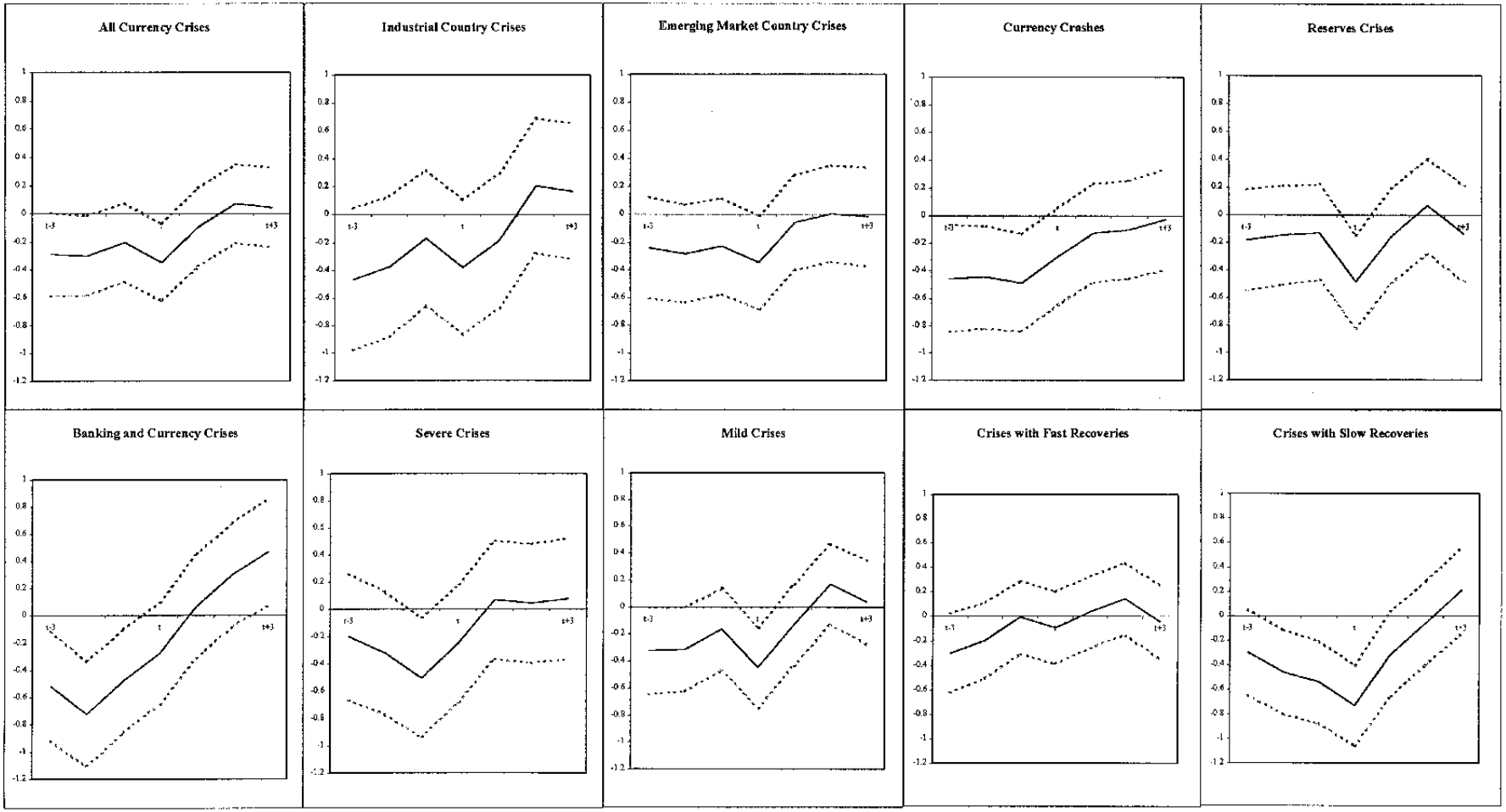
Figure 21. Change in the Unemployment Rate [1,2]



1 The change in the unemployment rate was defined as the 12-month change in the unemployment rate (OECD-standardised, where available). The units for each panel are country-specific standard deviations from the country-specific mean. All crises for which the preceding 12-month inflation rate exceeded 80 percent were removed. Outliers were also removed by rejecting data which did not fall within variable-specific, symmetric, and wide cut-off parameters. The cut-off parameters for the change in the unemployment rate outliers were 0.25 and -0.25. The data was then normalized by subtracting the country-specific mean and dividing by the country-specific standard deviation.

2 The solid line in each panel portrays the behavior of the variable during the crisis window (which includes the 24 months before a crisis, the month of a crisis, and 24 months after a crisis) for the selected sample of crises, relative to its tranquil-period mean and averaged across all crises. The dashed lines in each panel represent the two times standard error bands, using both standard errors for the crisis window and tranquil-period means.

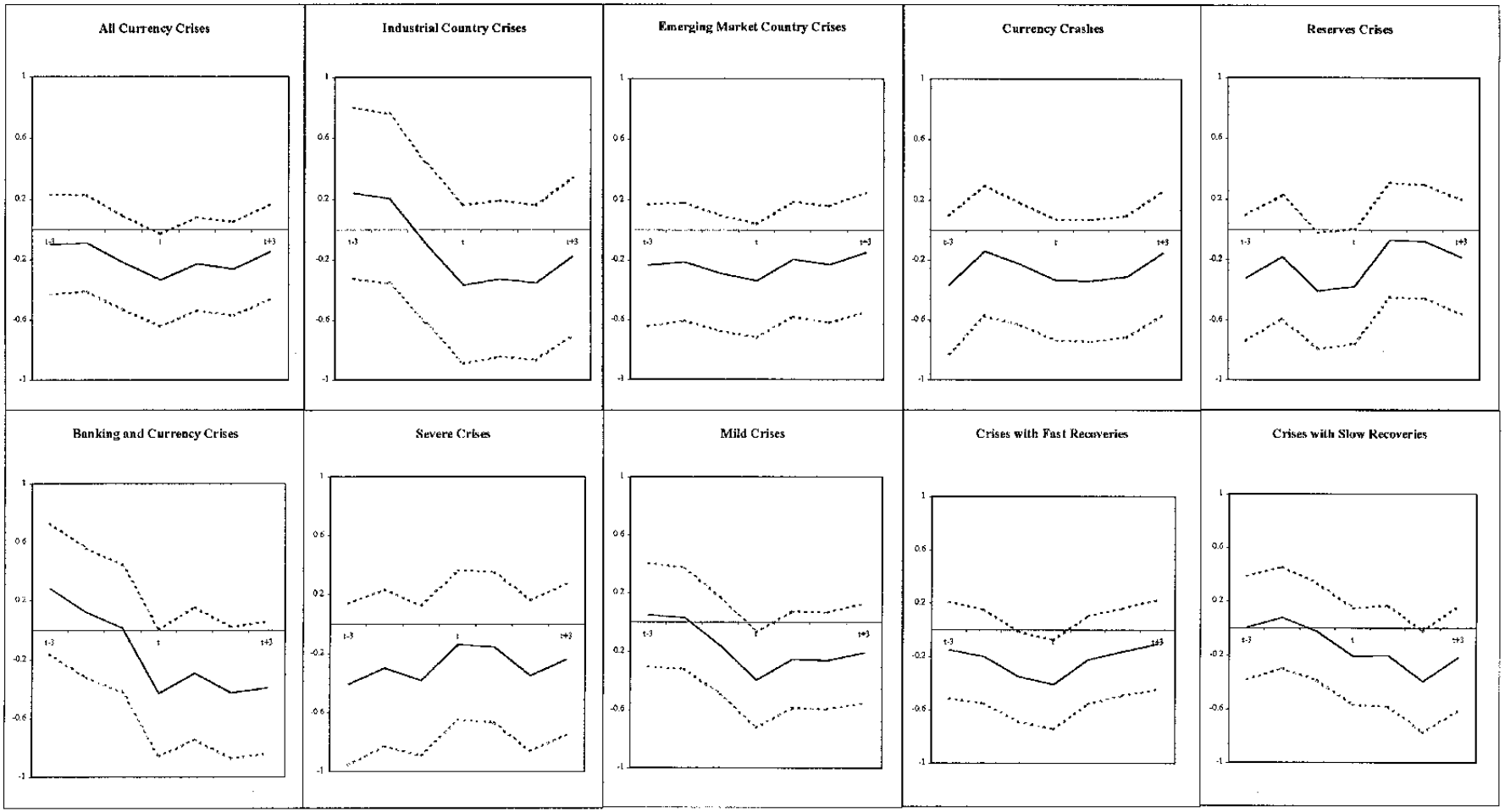
Figure 22. Current Account Balance [1,2]



[1] The current account balance was defined as the external current account balance as a percent of GDP. The units for each panel are country-specific standard deviations from the country-specific mean. All crises for which the preceding 12-month inflation rate exceeded 80 percent were removed. The data was then normalized by subtracting the country-specific mean and dividing by the country-specific standard deviation.

[2] The solid line in each panel portrays the behavior of the variable during the crisis window (which includes the 2 years before a crisis, the year of a crisis, and 2 years after a crisis), plus an additional year before and after the crisis window, for the selected sample of crises, relative to its tranquil-period mean and averaged across all crises. The dashed lines in each panel represent the two times standard error bands, using both standard errors for the crisis window and tranquil-period means.

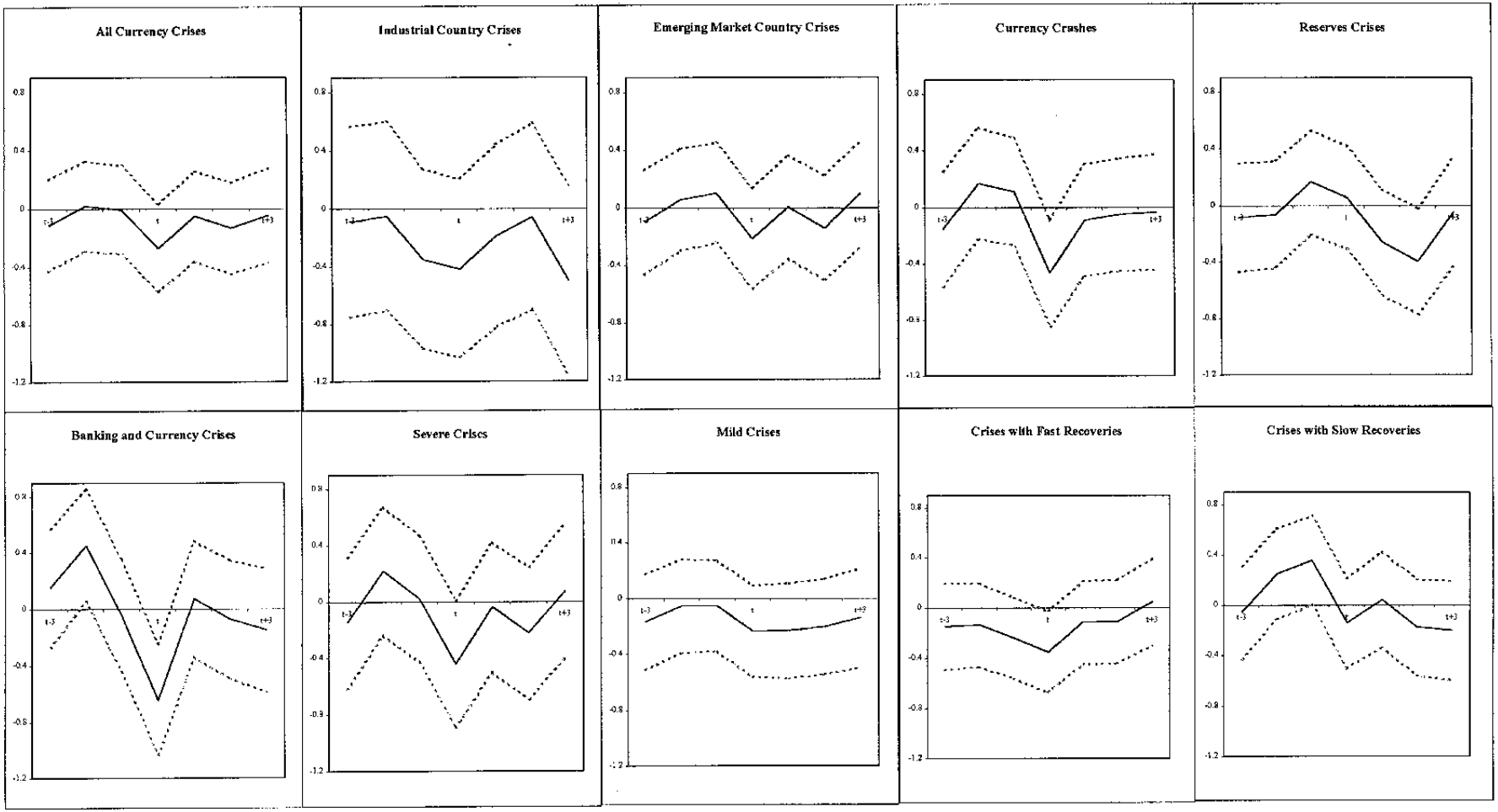
Figure 23. Fiscal Balance [1,2]



[1] The fiscal balance was defined as the fiscal balance as a percent of GDP. The units for each panel are country-specific standard deviations from the country-specific mean. All crises for which the preceding 12-month inflation rate exceeded 80 percent were removed. The data was then normalized by subtracting the country-specific mean and dividing by the country-specific standard deviation.

[2] The solid line in each panel portrays the behavior of the variable during the crisis window (which includes the 2 years before a crisis, the year of a crisis, and 2 years after a crisis), plus an additional year before and after the crisis window, for the selected sample of crises, relative to its tranquil-period mean and averaged across all crises. The dashed lines in each panel represent the two times standard error bands, using both standard errors for the crisis window and tranquil-period means.

Figure 24. Short-term Capital Inflows [1,2]



[1] The short-term capital inflows were defined as short-term capital as a percent of GDP. The units for each panel are country-specific standard deviations from the country-specific mean. All crises for which the preceding 12-month inflation rate exceeded 80 percent were removed. The data was then normalized by subtracting the country-specific mean and dividing by the country-specific standard deviation.

[2] The solid line in each panel portrays the behavior of the variable during the crisis window (which includes the 2 years before a crisis, the year of a crisis, and 2 years after a crisis), plus an additional year before and after the crisis window, for the selected sample of crises, relative to its tranquil-period mean and averaged across all crises. The dashed lines in each panel represent the two times standard error bands, using both standard errors for the crisis window and tranquil-period means.