DEUTSCHE BUNDESBANK
EUROSYSTEM

TECHNISCHE UNIVERSITÄT DRESDEN

Measuring and Forecasting Financial Stability

Workshop by Deutsche Bundesbank and Technische Universität Dresden
Dresden, 15-16 January 2009

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„Twin Crisis: An Examination of the Empirical Links“

Twin Crises: An Examination of the Empirical Links

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October 2008

First Draft

Abstract

This paper examines the empirics of twin crises. We treat banking and currency crises equally in terms of methodology. We construct an index of money market pressure and an index of speculative pressure to identify banking and currency crises, respectively. We include 49 countries spanning 1980-2004 in our sample, and have identified 85 currency crises, 63 banking crises, and 27 twin crises.

Our results indicate that the findings of existing research should be regarded as temporary and require further examination. First, it is common accepted that banking crises and twin crises have increased over time. However, we find that banking crises and twin crises were more frequent in the early 1980s. Twin crises are not new phenomena because they already appeared in the early 1980s. Twin crises are perceived to be new phenomena possibly because their number and frequency declined in mid-1980s and had returned toward the previous level in the early 1990s. Second, existing research had found banking crises to be good leading indicators of currency crises. We find that banking crises are equally likely to lead or to follow currency crises, and vice versa. Third, existing research had found an asymmetric result between banking and currency crises. It means that past banking crises helped to predict currency crises, but the vice versa was not true. In contrast, we find the opposite causality as reported in most empirical studies. In addition, we find a symmetric result not reported in the literature, in the sense that past banking crises helped to predict currency crises, and the converse is also true.

JEL codes: F31, F41, C35

Key words: twin crises, signal approach, multivariate probit model

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1 Introduction

Twin crises refer to the association of banking crises with currency crises. Well-known examples include Chile in 1982, Finland in 1992, Sweden in 1992, Mexico in 1994, and the recent Asian financial crisis. Despite the fact that they involve crises on more than one front and are associated with large economic recessions and bailout costs, empirical research on twin crises is rather rare. Kaminsky and Reinhart (1996, 1999) were the first to investigate systematically the links between banking and currency crises. Subsequent work by Glick and Hutchison (2001) extended their investigation to a much larger data set of sample countries. Eichengreen and Bordo (2002) compare crises in the 19th and 20th century, while Hutchison and Noy (2005) study the output effects of twin crises.

Empirical research into the causes and dynamics of financial crises requires a method for defining and identifying crisis episodes. The conventional approach uses large and visible *market events* for this purpose. Examples for *market events* identifying currency crises are formal breakdowns of fixed exchange rate pegs, large devaluations, realignments, or changes in exchange rate bands. Examples for *market events* identifying banking crises include runs on banks, large government interventions such as forced bank holidays, forced mergers or takeovers, and bailouts of failed banks. However, the literature has long noted that relying on *market events* to identify crises is not satisfactory. Eichengreen, Rose and Wyplosz (1995) discuss the critical issues in the context of currency crises. They argue that not all *market events* treated as such are the result of financial crises. For example, a realignment may be an orderly adjustment of a currency peg to past inflation differentials. Furthermore, not all crises lead to the type of *market events* typically considered. For example, a central bank may be able to defend its peg successfully against speculative attacks, so that a realignment never becomes necessary. The latter point implies that research relying on *market events* to identify currency crises suffers from a sampling bias against successful policies dealing with incipient currency crises, as crises that are kept from leading to large *market events* will be ignored. In view of this, Eichengreen, Rose, and Wyplosz propose to identify crises as periods of very large excess demand in the market for foreign currency and to measure excess demand based on an index of *foreign exchange market pressure*. The use of this index has by now become standard in the literature.

Relying on *market events* to identify banking crises can be criticized for much the same and more reasons (von Hagen and Ho, 2007). Large government interventions in the banking sector can be part of an effort to solve long-lasting structural problems in the banking industry in an orderly way and not involve an acute crisis. Central banks may be successful in fending off bank runs by providing ample liquidity or declaring their willingness to pay out depositors.

This, again, implies that research relying on *market events* suffers from a sampling bias against successful crisis management. Furthermore, public reports about government interventions in the banking sector often come out much later than they actually happened, with the result of introducing errors in the timing of crisis episodes. Finally, deciding what is a "large" government intervention and what is not involves an element of arbitrariness that has lead to significant differences in the timing of banking crises in existing literature (von Hagen and Ho, 2007).

Kaminsky and Reinhart (1996, 1999), Glick and Hutchison (2001) and Hutchison and Noy (2005) follow Eichengreen, Rose and Wyplosz's approach in identifying currency crises, but they identify banking crises based on market events. This creates an unsatisfactory asymmetry between the definition and identification of banking and currency crises. In this paper, we use the index of money market pressure developed in von Hagen and Ho (2007) to identify banking crises along with an index of foreign exchange market pressure to identify currency crises. Thus, we treat currency and banking crises symmetrically. Our index of money market pressure is constructed along the conceptual lines of Eichengreen, Rose and Wyplosz's (1995). More specifically, it is based on data for money market interest rates, central bank loans to the banking sector and non-bank deposits in the banking sector. The index is large in periods of sharp increases in the banking sector's demand for central bank reserves, which we take as periods of banking crises. In von Hagen and Ho (2007), we show that this indicator can be used to identify and empirically analyze banking crises. In this paper, we use it to study the dynamics and the incidence of twin crises.

This paper is organized as follows. Section 2 provides a brief review of the empirical findings of existing research. Section 3 discusses the methodology we employ to identify banking, currency, and twin crises. Section 4 reports the empirical results, followed by a brief discussion by robustness. The final section concludes.

2 Twin Crises

Theoretical work points to three causal linkages between banking crises and currency crises.[1] The first runs from currency crisis to banking crisis. Stocker (1994) argues that under a specie standard, a speculative attack on the gold parity leads to a loss of gold reserves which results in a credit crunch causing bankruptcies and a financial crisis. In a modern context, a similar pattern emerges in the case of a speculative attack on a fixed exchange rate, if the loss of foreign reserves incurred by the central bank is not sterilized. Alternatively,

1 Models explicitly making a connection between banking and currency usually fall within the group of third-generation models of currency crises. See Breuer (2004) for a survey.

a currency crisis can spill over to the banking sector, if the central bank defends an exchange-rate peg by sharply raising interest rates, as this weakens the banking sector's financial position (Rojas-Suárez and Weisbrod, 1995; Obstfeld, 1994). Furthermore, a large depreciation due to a successful speculative attack can weaken the banks' financial position, if much of their outstanding debts are unhedged and denominated in foreign currencies (Mishkin, 1996).[2]

The second causal link runs from banking problems to currency crises. A central bank that finances the bailout of troubled financial institutions by printing money can erode its commitment to a fixed exchange rate.[3] The presence of a troubled domestic banking sector can undermine the central bank's ability to defend the exchange rate by its inability to raise interest rates when the currency is under attack (Obstfeld, 1994). If rational speculators understand that the authorities are not willing to tolerate the pain this would inflict on the banking sector, they will launch a speculative attack. Therefore, a weak banking sector can be an important ingredient of a model of self-fulfilling currency crisis.[4]

Finally, twin crises may be the result of common factors affecting both the banking industry and the currency market. Theoretical studies have identified possible common factors such as the effects of international capital flows,[5] exchange rate-based inflation stabilization plans,[6] improper financial liberalization,[7] shortage of international liquidity,[8]

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2 Gonzalez-Hermosillo (1996) made the same conclusion that "If banks (or their borrowers) are heavily exposed to unhedged currency risk, or if the monetary authorities attempted to defend the value of the currency by raising interest rates to such high levels that debtors would be forced to default on their outstanding bank loans".

3 Diaz-Alejandro (1985) was the first one to point out this causal link between twin crises. Based on the Chilean experience in 1982, he argues that government bailout of the private financial institutions led to massive credit expansion and to the collapse of fixed exchange rate. Velasco (1987) formalizes the idea of Diaz-Alejandro (1985) and presents a simple model, which explicitly modeled the private banking sector. Calvo (1996) follows a similar argument as Diaz-Alejandro (1985).

4 Rojas-Suárez and Weisbrod (1995) arrive at a similar conclusion. They argue that a sound (weak) banking system increases (decreases) the credibility of central bank's commitment to exchange rate when there is a speculative attack on domestic currency.

5 Goldfajn and Valdés (1997a) show in a model how financial intermediation could magnify the external (capital flows) and internal shocks and simultaneously cause balance-of-payments crisis and banking crisis.

6 Reinhart and Vegh (1995) survey twelve exchange rate-based inflation stabilization plans and find that despite differences in main aspects, most of these programs ended in severe banking and balance-of-payments crises.

7 McKinnon and Pill (1997, 1998) model how financial liberalization with microeconomic distortions like implicit deposits insurance or exchange rate arrangement could generate boom-burst dynamics with twin crises as its results.

8 Chang and Velasco (1999) stress the role of international liquidity as the common factor behind financial and currency distress. They define international illiquidity as "a situation in which a country's consolidated financial system has potential short-term obligations in foreign currency that exceed the amount of foreign currency it can have access to on short notice". International illiquidity emerges endogenously as an optimal choice of banks because holding liquidity is costly and banks may choose to become illiquid in the short run.

sudden reversals of capital flows[9], and strategic complementarities between bank creditors and currency speculators.[10]

Turning to empirical studies, Kaminsky and Reinhart (1996, 1999) were the first to investigate systematically the empirical links between twin crises.[11] Their work is based on a data set including 20 countries that experienced crises between 1970 and the mid-1990s. Kaminsky and Reinhart (1999) find that banking and currency crises first became closely entwined in the 1980s, when the liberalization of financial markets gave rise to twin crises. Bordo et al. (2001) find that due to establishment of central banks and their functions as lender of last resort as well as regulation over domestic banking system and capital flows, only one banking crisis is recorded over the period 1940-1976. This makes twin crises a rare event during that period. Glick and Hutchison (2001) examine twin crises for 90 industrial and developing countries during 1975-1997. They find that the number and frequency of twin crises in the 1980s and 1990s exceeded that of the 1970s by a factor of three to four, and that banking and currency crises as well as twin crises are more frequent in developing countries and emerging markets than in industrial countries. Furthermore, they find that the incidence of currency is correlated with the incidence of banking crises in the same year for emerging markets and developing countries, but not so for the entire sample.

Kaminsky and Reinhart (1996) estimate a probit model where a binary index of currency crises is regressed on a binary index of banking crises with alternative lag specifications. It turns out that past banking crises help predict currency crises, but that the opposite is not true. Rossi (1999) finds a similar result. He estimates a logit regression for banking crises covering 15 developing countries over the period 1990-97. While currency crises do not help to predict banking crises, lagged banking crises do help to predict currency crises. Similarly, Glick and Hutchison (2001) find that the onset of a banking crisis is a leading indicator for a subsequent currency crisis, but that the opposite is not true. Hutchison and Noy (2005) likewise find a significant correlation between lagged banking crises and

9 Calvo and Reinhart (2000).

10 Goldstein (2005) shows that strategic complementarities between creditors and speculators cause an increase in the probability of one type of crisis to generate an increase in the probability of the other type. This yields a vicious circle between banking and currency crises. This vicious circle and the common macroeconomic fundamentals are the sources for the correlation between the two types of crisis. Goldstein (2005) shows that in some cases, each crisis should not occurred on its own, however twin crises occur just because agents believe that the other crisis is going to occur.

11 There are papers discussing twin crises in individual countries. For instance, Chapman and Marcella (2001) depict Russian currency and financial crisis in 1998. Bordo et al. (2001) provide a historical record of currency and banking crises dating back to the 1880s. They, however, did not discuss the links between the two types of crises.

contemporaneous currency crises but not vice versa. These results hint at causality running from banking to currency crises.[12]

An important question is, to what extent crises are driven by economic fundamentals and to what extent they are caused purely by expectations. Although there is no direct evidence regarding this question, the authors mentioned above find that economic fundamentals tended to be worse preceding the crises. Kaminsky and Reinhart (1999) use a signals approach and find that indicators based on fundamentals such as real interest rates, foreign reserves, exports, and real interest-rate differential accurately signaled the majority of the crises in their sample. Kaminsky (1999), using the same sample as Kaminsky and Reinhart (1999), shows that both the number of the signs of and the severity of distress increase before the crises erupt. Glick and Hutchison (2001) estimate a multivariate probit model that includes a parsimonious set of macroeconomic variables. They find that currency crises are associated with overvalued domestic currencies and a large ratio of M2 to foreign reserves, while banking crises are associated with severe recessions and financial liberalization. These results support the view that twin crises are driven mainly by fundamental inconsistencies in macro economic policies. Saxena (2004) graphically depicts the main features of twin crises. Based on seven episodes of twin crises,[13] her visual analysis reveals that M2 multiplier, ratio of M2 to reserves, ratio of domestic credit to GDP, bank deposits, and interest rates rise rapidly before the crisis. The crisis starts as capital outflows that are triggered by revelation of the weaknesses in the economy. The exchange rate is initially defended by the loss of foreign reserves or high interest rates. But eventually the currency crashes and this leads to the collapse of the banking sector as well.

Crises are harmful to the economy. A currency crisis may cause a contraction in output through balance sheet deterioration of firms and financial institutions having foreign currency liabilities. Banking crises may likewise cause output to contract by disrupting the process of credit intermediation (Hutchison and Noy, 2005). Kaminsky and Reinhart (1999) suggest that the presence of vicious circles implies that twin crises are more severe than banking or currency crises that occur in isolation. Goldstein (2005), from a theoretical point of view, shows that in emerging markets twin crises are more costly than banking and currency crises, but this is not necessarily the case in industrial countries.

Bordo and Eichengreen (2002) compare the features of financial crises between 1880-1913 and 1973-1998 by using a sample of 21 countries. Both eras were characterized

12 It is observed that the frequency of banking crises associated with currency crises was higher than the frequency of currency crises associated with banking crises (Kaminsky and Reinhart, 1996; Glick and Hutchison, 2001). But this could be artificial because more currency crises than banking crises were identified in the studies, so that banking crises were naturally more frequently followed by currency crises than the other way around.

13 These are the Chilean crisis of 1981-83, the Danish crisis of 1987-90, the Indonesian crisis of 1997, the Korean crisis of 1997, the Norwegian crisis of 1988-91, and the Venezuelan crisis of 1989 and 1993-94.

by expansion of international capital markets. They find that while the frequency of banking crises was roughly the same between the two eras, currency crises were much more frequent in the post Bretton Wood era. Bordo and Eichengreen (2002) calculate output losses as the sum of the differences between annual GDP growth and the five-year average preceding the crisis until growth returns to trend. On average, output losses were larger in the pre-1914 period than in the post Bretton Wood period for both currency crises and banking crises. Twin crises are exception. When limited to only those crises with output losses, the output losses from financial crises are slightly larger in the pre-1914 period than in the post Bretton Wood era. Currency crises were associated with a larger output loss than banking crises in the pre-1914 period. The opposite is true for the post Bretton Wood period. The same authors report that the results are sensitive the measures of output loss, and the point estimates of output losses are associated with large standard deviations. In the same paper, recovery time is calculated as the number of years before the rate of GDP growth returns to its pre-crisis trend. The authors find no evidence of faster recovery in the pre-1914 period.

Gupta, Mishra, and Sahay (2003) use a sample of 195 currency crises in 91 countries from 1970 to 1998 and establish some stylized facts on the behavior of output growth before and after crises. They find that only 28 percent of the crises are associated with a decline in growth rate. They further measure the effect of a currency crisis on growth as the difference in the average growth rate between the nearest 3 tranquil pre-crisis years and 2 post-crisis years. If that measure is positive, it is termed expansionary and if it is negative, it is termed contractionary. In their sample, 43 percent of the crises are expansionary and 57 percent of the crises are contractionary. Pre-crisis capital inflows, capital account restrictions, pre-crisis business cycle condition, and per capita income are main factors that explain the growth response during crises. They also report that the ratio of expansionary to contractionary crises did not change much in the 1970s, 1980s, and 1990s.

Hutchison and Noy (2005) measure separately the output costs of a currency crisis and a banking crisis, as well as their joint effect, using a panel of 24 emerging market economies over 1975-97. Having controlled for domestic and external factors, they find that output growth in emerging markets declines for 2 years following a currency crisis. The cumulative loss in output associated with a currency crisis is about 5.5 percent of GDP over a 2-year period. For banking crises, about 3-3.5 percent of GDP growth is lost for each crisis year. As the average duration of a banking crisis is 3.3 years, the cumulative loss of a banking crisis is 10 percent of GDP. They do not find additional interactive effects associated with twin crises that further damage the economy.

In summary, empirical studies of twin crises coincidently conclude that twin crises are more severe in terms of output losses and more prolonged than banking or currency crises separately (Breuer, 2004). Twin crises are more damaging for emerging markets and

developing countries than for industrial countries. Bordo et al. (2001), however, find no evidence that crises have grown more severe in terms of output losses or duration.

3 Defining Currency and Banking Crises

3.1 Currency Crises

A currency crisis is defined as a situation in which a sharp decline in the demand for the domestic currency and a sharp increase in the demand for foreign currency leads to substantial loss of foreign reserves at the central bank, a sharp increase in short-term interest rates, a depreciation of the currency, or a combination of all three (Goldstein et al., 2000). Eichengreen, Rose, and Wyplosz (1996) use an index of foreign exchange market pressure, EMP, to identify currency crises. The index is calculated as a weighted average of changes in the real exchange rate, changes in foreign currency reserves, and changes in the nominal interest rate. All of the variables are measured relative to the reference country, the choices of which follow Levy-Yeyati and Sturzenegger (2005). The weights are the inverse of the standard deviation of the individual components, ensuring that the three components have the same conditional volatility. The real exchange rate is used instead of the nominal exchange rate so that nominal depreciations that simply keep up with inflation differentials, even if fairly large, are not considered as currency crises.[14] The index is defined as

$$\mathrm{EMP}_{j,t} = \frac{\left(\Delta q_{j,t} / q_{j,t}\right)}{\sigma_{q,j}} - \frac{\left(\Delta FR_{j,t} / FR_{j,t}\right) - \left(\Delta FR_t^* / FR_t^*\right)}{\sigma_{FR,j}} + \frac{\Delta\left(i_{j,t} - i_t^*\right)}{\sigma_{i,j}}, \qquad (1)$$

where the index j denotes countries, t denotes time, $q_{j,t}$ denotes country j's real exchange rate, an increase meaning real depreciation; $FR_{j,t}$ denotes country j's ratio of foreign reserves to narrow money; $i_{j,t}$ its nominal interest rate; Δ is the difference operator; and $\sigma_{q,j}$, $\sigma_{FR,j}$ and $\sigma_{i,j}$ are the sample standard deviations of changes in these three variables, respectively. An asterisk denotes variables of the reference country. A period, in which EMP is two standard deviations or more above the mean and the increase in EMP from the previous period is at least fifteen percent, is defined as the beginning of a currency crisis.

3.2 Banking Crises

Our approach to identifying banking crises focuses on the banking sector's aggregate demand for central bank reserves. A banking crisis is a situation, in which the demand for

14 Cf. Goldfajn and Valdés (1997b), Esquivel and Larrain (1998), and Glick and Hutchison (2001).

bank reserves increases sharply. As explained in von Hagen and Ho (2007), this may be due to (combinations of) three reasons: A sharp decline in the quality of bank loans or an increase in non-performing loans, a large-scale withdrawal of deposits by the non-bank public, or a drying-up of interbank credit. All three lead to a loss of liquidity in the banking sector, forcing banks to turn to the central bank for refinancing. As a monopolistic supplier of central bank money, the central bank can react to the sudden increase in the demand for bank reserves in two basic ways. If bank reserves are the operating target, the total supply is kept constant and the money market interest rate, the opportunity cost of holding bank reserves, will increase sharply. If, instead, the central bank targets the money market rate, bank reserves will increase while the interest rate remains flat. The demand for bank reserves increases sharply because of a sudden withdrawal of deposits and/or a drying up of the interbank market. Obviously, combinations of both are possible, as well. This reasoning leads us to define an *index of money market pressure*, IMP, similar to the index of foreign exchange market pressure. We define the *reserves to bank deposits ratio*, $\gamma_{j,t}$, as the ratio of total reserves to total non-bank deposits held by the banking system in country j during period t. In a period of high tension in the money market, this ratio increases either because the central bank makes additional reserves available to the banking system, or because depositors withdraw their funds from the banks. The index of money market pressure is calculated as a weighted average of changes in reserves to bank deposits ratio and changes in money market rate. We weight the two components by dividing each component by its own standard deviation so that the two components have equal conditional volatility. The index is defined as

$$\mathrm{IMP}_{j,t} = \frac{\Delta\gamma_{j,t}}{\sigma_{\gamma,j}} + \frac{\Delta r_{j,t}}{\sigma_{r,j}}, \qquad (2)$$

where $r_{j,t}$ denotes the money market rate in real terms and Δ, $\sigma_{\gamma,j}$ and $\sigma_{r,j}$ are defined as before. As in von Hagen and Ho (2007), we define the beginning of a banking crisis as a period in which the index is larger than the 98.5 percentile of the sample distribution for that country, and the increase in IMP from the previous period is at least five percent. The first criterion ensures that only exceptional events are identified as crises, while the second criterion screens out observations that are insufficiently large in an economic sense and allows the possibility that countries had no banking crisis during the sample period.

3.3 Defining Twin Crises

Twin crises are commonly understood as the association of banking with currency crises. Here, we follow Glick and Hutchison (2001) who define twin crises as "instances in which a bank crisis is accompanied by a currency crisis in either the previous, current, or following year".[15]

4. The Incidence of Twin Crises: Descriptive Evidence

4.1 Data Sources and Crisis Dates

All data are taken from the CD-ROM version of the IMF's *International Financial Statistics*. Our sample countries are determined by the availability of data. It includes 49 countries; see Table 1. Following Glick and Hutchison (2001), we divide the countries into industrialized countries, emerging markets and other developing countries. The number of our sample countries is twice that used by Kaminsky and Reinhart (1999), and our sample has all the countries in their sample except Bolivia, Colombia and the Philippines.[16] Compared to Glick and Hutchison (2001), our number of countries is about half of theirs.[17] The main difference is that they have more emerging markets and other developing countries in their sample. We are forced to confine ourselves to a fewer number of sample countries because we need quarterly interest rate data, which are not available in many developing countries, to identify banking crises. Our sample ranges from 1980 to 2004 and covers as many years as the other two papers.

To include as large a number of countries as possible in the sample, we compute the index of money market pressure based on quarterly data. In order to avoid counting the same crisis twice, we drop the next 8 quarters for the country under consideration every time we identify a banking crisis in the data. Following Kaminsky and Reinhart (1999), we calculate the index of foreign exchange market pressure using monthly data. In order to avoid counting the same crisis more than once, we ignore the subsequent twelve months every time we identify the beginning of a currency crisis in the data. We translate the currency crisis

15 Kaminsky and Reinhart (1999) define twin crises as "episodes in which the beginning of a banking crisis is followed by a balance-of-payments crisis within 48 months". Under this definition, the currency crisis must follow the banking crisis by definition.

16 These three countries are excluded from our sample because quarterly interest rates, which are necessary for construction of the index of money market pressure for identifying banking crises, are not available.

17 There are six countries in our sample that are not included in Glick and Hutchison (2001). These are Israel, Niger, Senegal, Togo, Papua New Guinea, and Seychelles.

episodes thus identified into quarterly frequency. Altogether, we identify the 85 currency crises reported in Table 2.[18]

We also find 63 banking crises in our data set. They are reported in Table 3.[19] Finally, we report the incidence of twin crises in Table 4. There are 27 twin crises. To compare our timing of twin crises with existing research, we include in the last few columns of Table 4 the twin crises recorded by Kaminsky and Reinhart (1999) and by Glick and Hutchison (2001). In general, our timing of twin crises is quite consistent with both studies. Conditional on our timing of twin crises, the probability that we also observe the same twin crises be reported in Kaminsky and Reinhart (1999) is 54 percent, and the probability to observe the same twin crises be reported in Glick and Hutchison (2001) is 60 percent. Nearly 43 percent of the banking crises we identify were twin crises. This result is similar to Glick and Hutchison (2001), who find that 41 percent of banking crises were twin crises.

4.2 Occurrences of Currency and Banking Crises

Table 5 reports the distribution of banking and currency crises over time. We observe that relatively many banking crises occurred in the early 1980s. Their number and frequency declined slightly in the late 1980s, and was relative constant throughout the 1990s. The number and frequency of currency crises was relatively large in the early 1980s and again in the early 1990s. Twin crises were most frequent in the early 1980s. Contrary to popular perceptions, they are not a new problem of the 1990s. Their frequency declined in the mid-1980s, and then increased again in early 1990s. Overall, we find that currency crises are more frequent than banking crises. Unlike Glick and Hutchison (2001), we do not find that the number and frequency of banking crises and twin crises has increased over time.

Table 6 reports the distribution of banking and currency crises over different groups of countries. Individual banking crises as well as twin crises are more frequent in emerging markets and in developing countries than in industrialized countries. However, currency crises are more frequent in industrialized countries than in developing countries and in emerging markets. This is different from Glick and Hutchison (2001), who find that industrialized countries have less frequent financial crises of both types than developing countries. Goldstein (2005), from a theoretical point of view, shows that twin crises are expected to be more frequent in financially liberalized emerging markets than in industrial

18 Actually, we have experimented with different thresholds (1.5 SDEV, 2 SDEV, 2.5 SDEV, 3.0 SDEV) and different window widths (6 months, 12 months, 18 months, 24 months). The results reported here are with 2 standard deviations and 12-month window width.

19 We have experimented with different percentile thresholds (98.5, 97.5, 96.5) and different window widths (8, 12 and 16 quarters). Here we report the results with 98.5 threshold and 8 quarters window width. The banking crisis sample in Demirgüc-Kunt and Detragiache (1998) has an average duration of four years.

countries and in developing countries that are not financially liberalized. Our results are supportive of his conjecture.

To gain a first impression about the dynamics of twin crises, we follow the signal accounting of Glick and Hutchison (2001). Consider the following matrix.

	Currency Crisis in Period t	No Currency Crisis in Period t
Banking Crisis in Period t	$A_{t,t}$	$B_{t,t}$
No Banking Crisis in Period t	$C_{t,t}$	$D_{t,t}$

The above matrix considers the occurrence of a banking crisis as an indicator for a contemporaneous currency crisis. The cell $A_{t,t}$ denotes the number of instances in which a banking crisis is a *good signal* for the occurrence of a currency crisis, that is, a banking crisis is accompanied by a currency crisis in the same period. Cell $B_{t,t}$ denotes the number of instances in which a banking crisis is a *bad signal* for the occurrence of a currency crisis, that is, the banking crisis is not accompanied by a currency crisis. Cell $C_{t,t}$ denotes the number of instances, in which there is no banking crises but a currency crisis does occur. Cell $D_{t,t}$ denotes the number of instances in which there is neither a banking nor a currency crisis. Similar matrices can be constructed to show the number of instances in which a banking crisis in period *t* is preceded or followed by a currency crisis in period *t-j* or *t+j*. We denote them by $A_{t,t-j}$ or $A_{t,t+j.}$ Table 7 reports the frequency with which a banking crisis in period *t* was accompanied by a currency crisis in period *t+k*, where k = (-4,…,4). They are calculated as $A_{t,t}/(A_{t,t}+B_{t,t})$, $A_{t,t-n}/(A_{t,t-n}+B_{t,t-n})$, and $A_{t,t+n}/(A_{t,t+n}+B_{t,t+n})$, respectively. The cumulative frequency with which a banking crisis in period *t* was accompanied by a currency crisis in any of the periods of the four quarters prior to or the four quarters after the banking crisis is calculated as $(A_{t,t-4}+A_{t,t-3}+\ldots+A_{t,t}+A_{t,t+1}+\ldots+A_{t,t+4})/(A_{t,t}+B_{t,t})$. We find that banking crises are more frequently associated with contemporaneous currency crises in emerging markets than in industrialized countries. About 11 percent of the banking crises in industrialized countries were accompanied by currency crises during the same period. For emerging markets that share is 27 percent. Furthermore, banking crises in period *t* are more frequently associated with currency crises in preceding periods than with currency crises in subsequent periods, albeit by only a small margin. That is, currency crises tend to lead banking crises. This result is different from Kaminsky and Reinhart (1999), Glick and Hutchison (2001).

If banking crises were a perfect indicator of currency crises, we should observe the former if, and only if, there is a currency crisis. Thus a perfect indicator would have many observations in cells A and D ($A_{t,t}>0$, $D_{t,t}>0$), but no observations in cells B and C ($B_{t,t}=0$ and $C_{t,t}=0$). In contrast, a bad indicator would have as many entries in cells A and D, as in B and C. The *signal-to-noise ratio* of an indicator is defined as $[A_{t,t}/(A_{t,t}+C_{t,t})]/[B_{t,t}/(B_{t,t}+D_{t,t})]$. The larger the signal-to-noise ratio, the better is the indicator. A practical defect in this definition arises

when, as in our case, there are many more entries under D_t (no signal in either market), than under A_t, because this makes the signal-to-noise ratio look artificially good. To correct for this defect, we define the signal-to-noise ratio simply as A_t/B_t, the ratio of correct to false positive signals. We also allow for different signaling windows. A signaling window of quarter *N* prior to (after) the crises means that signals issued within *N* periods prior to (after) the crises are counted as good signal.[20] Table 8 reports the modified signal-to-noise ratio of banking crises as leading or lagging indicators of currency crises. In general, banking crises are now equally likely to lead or to follow currency crises.[21] Only for emerging markets are banking crises more likely to be leading than be lagging indicators of currency crises. But in no case does the signal-to-noise ratio exceed one.

Next, we repeat the same exercise, but with currency crises as indicators of banking crises. Table 9 shows the frequency with which a currency crisis in period *t* is accompanied by a banking crisis in any of the periods between *t-4* and *t+4*. Again, currency crises are more frequently associated with contemporaneous banking crises in emerging markets than in industrialized countries. We also find that the frequency of currency crises associated with banking crises is lower than the frequency of banking crises associated with currency crises. The cumulative frequency with which a banking crisis is accompanied by a currency crisis within four quarters before or after is 46 percent, while the cumulative frequency with which a currency crisis is accompanied by a banking crisis within four quarters before or after is 33 percent. The emerging markets sample has the highest cumulative frequency among different country groups.

Table 10 reports the performance of currency crises as indicators of banking crises. In general, there is no clear tendency for currency crises to lead or to follow banking crises. The modified signal-to-noise ratios are lower than 0.5 in all cases.

Combining the results of the previous section, we find that banking crises are equally likely to lead or to follow currency crises, and vice versa. The signals approach shows that in no cases were banking or currency crises good indicators for another type of crises.

4.3 Output Costs of Currency and Banking Crises

We follow Bordo et al. (2001) to quantify the depth of financial crises. We compute the trend rate of GDP growth using average of GDP growth five years preceding the crisis. Recovery time is defined as the year when the GDP growth returns to that trend. Crisis depth

20 We set the maximum value of signaling window N equal to 8 quarters. Kaminsky and Reinhart (1999) used a signaling window of plus 24 months for currency crises, and a signaling window of plus and minus 12 months for banking crises.

21 In Table 8, signal-to-noise ratios of period T+N are not different from that of period T-N.

is calculated as the cumulative output loss from the onset of the crisis to the recovery. The results are reported in Table 11, in which the results for banking, currency, and twin crises are arranged in separate panel. The first row of each panel reports the percentage of crises that are followed by negative GDP growth. We find that not every financial crisis is associated with a decline in output. About 52 percent of banking crises are associated with output losses. That ratio is 64 percent for currency crises and 78 percent for twin crises. The next two rows report the cumulative GDP loss and its standard deviation. On average a banking crisis causes cumulative GDP losses up to 10 percent. This number, similar to that reported in Hutchison and Noy (2005), does not include crises that are not associated with output losses. The cumulative GDP losses due to twin crises are not much different from that of banking crises. Our results indicate that currency crises are the most devastating one. On average they cause a cumulative GDP loss of 17 percent. Next, we report the recovery time for each type of crisis. It takes an economy 2.8 years to recover from a banking crisis, 3.9 years to recover from a currency crisis, and 2.3 years to recover from twin crises. Dividing the cumulative GDP loss by the recovery time gives us the GDP loss for each crisis year. For banking crises, about 4.1 percent of GDP growth is lost for each crisis year. That figure is 3.9 percent for currency crises and 4.6 percent for twin crises. Combining these results, twin crises are the most damaging, followed by banking crises and currency crises. However, since currency crises cause longer staggered GDP growth than banking and twin crises, the cumulative loss associated with currency crises is the largest among the three types of crisis.

Columns 2-4 of the same table report the results for each country group. The above-mentioned patterns remain the same across different country groups. For all types of financial crises, output losses are much larger in emerging markets and developing countries than in industrial countries. The cumulative GDP loss following a financial crisis in emerging markets can be two- to four-fold larger than that in industrial country. Our finding that currency crises are more harmful than banking crises is uncommon, but it is far from unique. Bordo and Eichengreen (2002) reports that in the pre-1914 era output losses from currency crises are larger than that from banking crises. We have experimented with trend rate of GDP growth using average of GDP growth four or three years preceding the crisis. The results do not change qualitatively.

The second method we employ to estimate the output cost of currency crises follows Gupta, Mishra, and Sahay (2003). We measure the effect of a currency crisis on growth as the difference in the average growth rate between the nearest 3 tranquil pre-crisis years and 2 post-crisis years. We also apply the same method to banking and twin crises. This implicitly assumes that output growth declines for 2 years following a financial crisis. Table 12 reports the results. Notice that the measure of Gupta et al. (2003) indicates GDP lost in each crisis year. GDP losses reported in Table 12 are smaller than their counterparts reported in Table 11,

and GDP losses following three types of crisis are not much different. This is probably because that a two-year window is too short for a crisis to fully unfold its damaging effects to the economy. Table 12 also indicates that output losses are much larger in emerging markets and developing countries than in industrial countries. This is the same as we have found using the measure of Bordo et al. (2001).

To examine whether there is variation across decades, we regress the output changes following a financial crisis (include only crisis episodes that are associated with output losses) on three decade-dummies, 1980s, 1990s, and the 2000s. Table 13 shows the results. The same table also reports the Wald coefficient restriction tests. For banking and currency crises, the null hypothesis that the coefficients are identical across the three decades cannot be rejected. There is no evidence to support the view that crises have become more severe over time. We are not able to carry out the same exercise for twin crises because our sample includes two twin crises during 2000-04, and only one of them is followed by GDP losses. In Table 14 we regress output changes on grouping dummies. A common feature is that all types of crisis are more contractionary in emerging markets and other developing countries than in industrial countries. The differences are statistically significant.

5. Empirical Models of Banking and Currency Crises

In this section, we develop an econometric model for the interaction of banking and currency crises. As in Kaminsky and Reinhart (1996) and Glick and Hutchison (2001), we convert the quarterly crisis dummies used in the previous section into annual crisis dummies, because the macroeconomic control variables used below are available in annual frequency only for many countries. We begin by estimating multivariate probit models for currency crises and banking crises, which use these dummies as dependent variables. As before, we drop the observations immediately following the start of either a currency or banking crisis.

Consider the following model.

$$y^*_{j,t} = \gamma z_{j,t} + \beta' X_{j,t} + u_{j,t} \qquad (3)$$

where $y^*_{j,t}$ is a latent variable indicating the potential for a currency crisis or a banking crisis, $X_{j,t}$ is a vector of control variables, and $u_{j,t}$ is a normal random error. We also have an observable binary variable, $y_{j,t}$,

$$y_{j,t} = \begin{cases} 1, & \text{if } y^*_{j,t} > 0 \\ 0, & \text{otherwise} \end{cases} \qquad (4)$$

This variable indicates the occurrence of a currency crisis or a banking crisis. Finally, the variable $z_{j,t}$ is a binary variable indicating the occurrence of the other type of crisis. The model thus says that a crisis occurs, if the (latent) crisis potential crosses a threshold normalized to zero. The crisis potential is determined by the control variables, the occurrence of a crisis of the other type, and the random shock.

We use a set of macroeconomic control variables commonly employed in empirical studies of currency and banking crises, see Table 15. Calvo (2003) argues that a common feature underlying emerging market crises is a *sudden stop*, namely, a large reversal of capital inflows. To investigate that possibility, we include a dummy variable standing for periods of sudden stop as an explanatory variable. The construction of that variable follows Calvo, Izquierdo and Mejia (2004).[22] To avoid problems with simultaneity, all control variables are lagged by one year.

To estimate the models, we use the random-effects maximum likelihood estimator proposed by Hsiao (2003). The results for currency crises are reported in Table 16.[23] Confirming previous research, currency crises are preceded by an overvaluation of the real exchange rate (Goldstein, Kaminsky and Reinhart, 2000). The M2 to foreign reserves ratio is a measure of the central bank's ability to defend a currency peg when there is adverse foreign exchange speculation. This variable is significantly and positively correlated with currency crises in developing countries and emerging markets, which means that currency crises are more likely to happen when the central bank does not have sufficient foreign reserves to defend the currency. Rapid credit growth tends to precede a currency crisis in developing countries and emerging markets. We find that a higher M2 to reserve money multiplier is associated with a lower probability of currency crisis in the whole sample as well as in the subgroups. Thus, high value of this variable may reflect a high degree of financial development in our sample countries.

With the exception of industrialized countries, sudden stop variable has significant effects on the probability of currency crises. Periods of sudden stop are strongly associated with currency crises. Having controlled for the effects of macroeconomic variables, we find that currency crises are positively correlated with contemporaneous banking crises for all groups of countries. The correlation is statistically significant for the whole sample as well as the developing countries and emerging markets. We also find that past banking crises *do not*

22 We approximate capital inflows as the difference between overall balance and current account balance. That is, errors and omissions are counted as capital inflows. The start of sudden stop is determined by the time when the annual change in capital inflows first falls one standard deviation below the mean, and sudden stop ends once the annual change in capital inflows exceeds one standard deviation below the mean. In addition, sudden stop must contain at least one observation where the annual change in capital inflows lies at least two standard deviations below the mean. We have identified totally 51 episodes of sudden stop.

23 The complete tables are included as appendix at the end of the paper.

help predict the occurrence of currency crises. An exception are the industrial countries, where we find that banking crises occur within the past two years help predict currency crises. Overall, we are able to explain about 26 percent of the variation in currency crisis dummy for emerging markets. That share is only 7 percent for industrial countries, implying that currency crises in industrialized countries are less easy to predict.

The results for banking crises are reported in Table 17. Overall, our probit model is able to explain about 22-38 percent of the variation in the banking crisis dummy. The probability of a banking crisis generally increases with a slowdown in real growth. This effect is re-enforced in times of severe recession. Exchange rate depreciations decrease the probability of a banking crisis. The effects are significant for emerging markets. A decrease in short-term real interest rates tends to precede banking crises. Rising inflation contributes to the likelihood of banking crises. This effect is re-enforced in times of high inflation. Budget deficits contribute to the likelihood of banking crises in developing countries and emerging markets. An increase in monetary base growth tends to precede banking crises in emerging markets. Over-valuation of real exchange rate, credit growth, and ratio of credit to private sector to GDP are not informative. Bank liquid reserves help to reduce the probability of banking crises. Financial liberalization makes banking crises more likely. The presence of an explicit deposits insurance scheme raises the likelihood of a banking crisis in the case of industrial countries. There is some regularity when we inspect the coefficient of the sudden stop variable. That variable is positive and significant in developing countries and emerging markets samples, but is not significant in industrial countries sample. However, sudden stop variable becomes insignificant once the currency crisis dummy is included. Combined with the previous results, this suggests that sudden stop is an important explanatory variable to currency crises in developing countries and emerging markets, so that its effects on banking fragility have been already taken up by the currency crisis dummy. The results also indicate that sudden stop is not a problem for industrial countries, in the sense that financing current account deficits with capital inflows does not increase the probability of financial crises. Together with the previous results, sudden stop is an important factor to twin crises in emerging and developing countries.

There is a strong contemporaneous correlation between banking crises and currency crises for the groups of developing countries and emerging markets. In addition, past currency crises *do* help predict banking crises in both cases. That is, for the samples of developing countries and emerging markets, past currency crises do increase the probability of banking crises, and the reverse is not true. This is in sharp contrast to most empirical studies in which the opposite causality is reported. Our results also suggest that twin crises in developing countries tend to show up first as currency crises and then as banking crises. In the case of industrial countries, twin crises seem to start with a banking crisis.

Since the two multivariate probit regressions suggest a significant contemporaneous correlation between banking and currency crises, our next step is to estimate a simultaneous equation model for both types of crises together. Consider the following model:

$$y^*_{1,j,t} = \gamma_1 y^*_{2,j,t} + \beta_1^{'} X_{1,j,t} + u_{1,j,t}$$
$$y^*_{2,j,t} = \gamma_2 y^*_{1,j,t} + \beta_2^{'} X_{2,j,t} + u_{2,j,t} \qquad (5)$$

where both $y^*_{1,j,t}$ and $y^*_{2,j,t}$ are latent variables indicating the potential for a currency crisis and a banking crisis respectively, $X_{1,j,t}$ and $X_{2,j.t}$ are the control variables, and $u_{i,j,t}$, $u_{2,j,t}$ are random errors . We also have two observable binary variables $y_{1,j,t}$ and $y_{2,j,t}$.

$$y_1 = \begin{cases} 1, & \text{if } y_1^* > 0 \\ 0, & \text{otherwise} \end{cases} \qquad y_2 = \begin{cases} 1, & \text{if } y_2^* > 0 \\ 0, & \text{otherwise} \end{cases} \qquad (6)$$

These variables indicate the occurrence of a currency crisis and a banking crisis, respectively. The model thus says that a crisis occurs, if the relevant latent variable crosses a threshold normalized to zero. Furthermore, if $y_i^* > 0$, $i = 1,2$, the potential for one type of crisis reinforces the potential for the other type of crisis. Alternatively, we consider the following model:

$$y^*_{1,j,t} = \gamma_1 y_{2,j,t} + \beta_1^{'} X_{1,j.t} + u_{1,j,t}$$
$$y^*_{2,j,t} = \gamma_2 y_{1,j,t} + \beta_2^{'} X_{2,j,t} + u_{2,j,t} \qquad (7)$$

Here, $y_i > 0$, $i = 1,2$ implies that the actual occurrence of a crisis of one type increases the occurrence of a crisis of the other type. Under model (5) and (6), explanatory variables contained in the vector $X_{2,j.t}$ affect the likelihood of currency crises through their impact on the potential for currency crises and vice versa. Under the model defined by (7) and (6), the actual event of a banking crises makes a currency crisis more likely, but as long as that event does not happen, the likelihood of a currency crisis is not affected.

To estimate these models, we apply the two-stage method suggested by Madalla (1983, pp.246-7). At the first stage, we estimate the reduced forms of each equation using a probit model that includes all exogenous and predetermined variables. At the second stage, we calculate the fitted values of the dependent variables using the reduced forms and substitute the predicted values into the structural probit equations.

Table 18 reports the results of simultaneous probit regression based on model (5) and (6). The framework allows one to estimate the residual effect of a banking (currency) crisis on the probability of currency (banking) crises, controlling for the endogeneity of the banking

crisis. The contemporaneous correlation between currency crises and banking crises becomes smaller, but is still significant. This suggests that the strong contemporaneous correlation between currency and banking crises, and the predictive power of currency crises for banking crises, are robust to the endogeneity problem. Notice that such a strong contemporaneous correlation exists in developing countries and emerging markets, and does not exist in industrial countries.

Table 19 reports the results of estimating model (7) and (6). For the currency crises equation, it indicates that the merely occurrence of a banking crisis increases the probability of currency crises, even though such a contagion may not be not fundamentally warranted. For the banking crises equation, such an unwarranted contagion from currency crises to banking crises is not observed. However, the sudden stop variable now becomes significant and is predictive of banking crises. Given that the sudden stop variable is highly correlated with currency crisis dummy, we interpret the results as still suggesting a strong spillover effect from currency sector to domestic money markets, whether it is fundamentally warranted or not.

6. Tests of Robustness

This study differs from existing research in that it uses a different method to identify banking crises. The above results are based on banking crises identified using a 98.5 percentile threshold and an 8 quarters window width. To see whether the above results are robust to different threshold and windows, we try different combinations of thresholds and window widths. Here we summarize the robustness test. Note that changing the window width does not change the results.[24] So using an 8 quarters window plus a 98.5 percentile threshold gives the same results as using a 12 quarters window and a 98.5 percentile threshold. What really matters is the threshold.

We discuss first the results that are robust to different threshold values. The distribution of financial crises over time is robust to different specifications. Currency crises, banking crises as well as twin cries were most frequent during 1980-1984. The results of the signals approach are robust too. Banking crises were equally likely to lead or to follow currency crises. Distribution of financial crises over different groups of countries remains the same. As before, banking and twin crises were most frequent in emerging markets, and currency crises were most frequent in industrial countries. The results of simultaneous equations are unchanged.

24 Except for the number of crises identified.

7. Conclusion

This paper examines the empirics of twin crises. We treat banking and currency crises equally in terms of identification. We construct an index of money market pressure and an index of foreign currency market pressure to identify banking and currency crises, respectively. Our sample includes 49 countries spanning the period 1980-2004.

Our results display similarities to and show differences with existing research. Most of our findings are robust to different specifications. Our results shed some new light on twin crises. First, earlier research concludes that the frequency of banking crises and twin crises has increased over time. However, we find that banking crises and twin crises were more frequent in the early 1980s. Twin crises are not new phenomena and appeared already in the early 1980s. Their frequency declined in mid-1980s but returned to the earlier level in the early 1990s. Second, existing research finds that banking crises are good leading indicators of currency crises. We find that banking crises are equally likely to lead or to follow currency crises. Third, existing research finds an asymmetrical result between banking and currency crises. It means that past banking crises help to predict currency crises, but the reverse is not true. We also find such an asymmetric character, but its causal direction is just the opposite. In other words, we find past currency crises help to predict banking crises, and the converse is not true.

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Table 1: Countries included in the study and the grouping

Industrialized countries	Emerging markets	Other developing countries
Austria	Argentina	Burundi
Denmark	Brazil	Cyprus
Finland	Chile	El Salvador
France	Ecuador	Guatemala
Germany	Egypt	Honduras
Greece	India	Jamaica
Ireland	Indonesia	Nepal
Italy	Israel	Niger
Japan	Kenya	Nigeria
Netherlands	Korea	Papua New Guinea
New Zealand	Mexico	Senegal
Portugal	Peru	Seychelles
Spain	South Africa	Swaziland
Sweden	Sri Lanka	Togo
Switzerland	Thailand	Uganda
United States	Turkey	
	Uruguay	
	Venezuela	
	Number of countries (totally 49 countries)	
16	18	15

Note:

1. The "all country" sample includes "industrial countries", "emerging markets", and "other developing countries". The "developing country" sample includes "emerging markets" as well as "other developing countries".
2. The classification follows Glick and Hutchison (2001), except for Israel, Niger, Senegal, Togo, Papua New Guinea, and Seychelles, which are not included in their sample.

Table 2: Occurrences of currency crises: 85 currency crises

THRESHOLD=2 STANDARD DEVIATIONS, WINDOW WIDTH=12 MONTHS, HYBRID=15%

Country	Currency Crisis	Country	Currency Crisis	Country	Currency Crisis
Argentina	1989Q2	Germany	1989Q2	Portugal	1982Q3
Austria	1983Q1	Greece	1983Q1	Portugal	1983Q3
Austria	1987Q4	Greece	1985Q4	Portugal	1993Q3
Austria	1992Q3	Guatemala	1981Q4	Senegal	1994Q1
Brazil	1990Q1	Guatemala	1990Q2	Seychelles	1982Q2
Brazil	1999Q1	Honduras	1990Q1	South Africa	1981Q4
Burundi	1982Q3	India	1981Q4	South Africa	1984Q4
Burundi	1998Q4	India	1991Q3	Spain	1982Q4
Burundi	2002Q1	Indonesia	1998Q1	Spain	1993Q2
Chile	1982Q3	Ireland	1992Q3	Sri Lanka	1980Q4
Chile	1984Q4	Israel	1984Q2	Sri Lanka	1995Q4
Cyprus	1986Q4	Israel	1985Q2	Swaziland	1983Q1
Cyprus	1992Q3	Italy	1992Q3	Swaziland	1991Q2
Denmark	1980Q1	Italy	1995Q1	Swaziland	1997Q2
Denmark	1982Q2	Jamaica	1983Q4	Sweden	1992Q3
Denmark	1992Q3	Japan	1989Q4	Switzerland	1983Q1
Ecuador	1982Q3	Kenya	1981Q4	Switzerland	1992Q3
Ecuador	1999Q1	Kenya	1993Q3	Thailand	1981Q1
Egypt	1981Q4	Korea	1997Q4	Thailand	1997Q3
Egypt	1983Q1	Mexico	1982Q3	Togo	1994Q1
Egypt	1990Q2	Mexico	1995Q1	Turkey	1994Q2
El Salvador	1986Q2	Nepal	1984Q4	Turkey	2001Q1
El Salvador	1991Q2	Netherlands	1981Q4	United States	1992Q3
El Salvador	1993Q1	New Zealand	1982Q1	Uruguay	1982Q4
Finland	1983Q1	New Zealand	1985Q1	Uruguay	2002Q3
Finland	1992Q3	Niger	1994Q1	Venezuela	1989Q1
France	1982Q1	Nigeria	1999Q2	Venezuela	1996Q2
Germany	1980Q3	Papua New Guinea	1998Q1		
Germany	1981Q4	Peru	1990Q2		

Table 3: Occurrences of banking crises: 63 banking crises

THRESHOLD=98.5 PERCENTILE, WINDOW WIDTH=8 QUARTERS, HYBRID=5%

Country	Banking Crisis	Country	Banking Crisis	Country	Banking Crisis
Argentina	1989Q2	Honduras	1985Q1	Papua New Guinea	2004Q1
Argentina	2002Q3	India	1999Q4	Peru	1990Q1
Austria	1985Q1	Indonesia	1984Q3	Portugal	1985Q3
Austria	1997Q4	Indonesia	1998Q1	Senegal	1995Q4
Brazil	1987Q4	Ireland	1992Q4	Seychelles	1982Q2
Brazil	1990Q1	Israel	1984Q3	South Africa	1984Q1
Burundi	1998Q4	Italy	1992Q3	South Africa	1990Q1
Chile	1984Q4	Jamaica	1997Q1	Spain	1983Q3
Cyprus	1986Q1	Japan	1998Q3	Sri Lanka	1983Q3
Denmark	1993Q1	Kenya	1993Q2	Swaziland	1982Q1
Ecuador	1984Q2	Korea	1981Q4	Sweden	1992Q3
Egypt	1990Q4	Korea	1998Q1	Switzerland	1998Q4
Egypt	1993Q1	Mexico	1989Q2	Thailand	1997Q3
El Salvador	1987Q4	Mexico	1995Q2	Togo	1980Q3
Finland	1989Q4	Netherlands	1986Q4	Togo	1995Q4
France	1981Q3	Netherlands	2003Q1	Turkey	2001Q1
Germany	1988Q4	New Zealand	1983Q1	Uganda	1989Q3
Germany	1993Q3	New Zealand	1988Q2	United States	1981Q3
Greece	1981Q2	Niger	1982Q3	Uruguay	1983Q1
Guatemala	1987Q2	Nigeria	1996Q2	Uruguay	2002Q3
Guatemala	1991Q4	Papua New Guinea	1981Q2	Venezuela	1997Q4

Note:

1. Argentina has outliers in interest rates in 1989. There are structural breaks in the variance of the data. We divide the Argentinean sample into two periods, 1980-1990 and 1991-2004, using the year of currency reform and the starting of currency board the splitting point. By this way, we identify two crises: 1989Q2 and 2002Q3.
2. The Indonesian IMP in 1998Q1 fails to be identified as crisis by only a small margin, so we decide to keep that crisis episode.
3. The Japanese data provide by IFS has undergone tremendous revisions (line 26g, credit from monetary authorities). The crisis timing of the old dataset and the new dataset differs by five quarters (1998Q3 versus 2000Q1). We take the 1998 crisis and disregard the 2000 crisis because it is in the window of ignored observations.
4. The Kenyan IMP in 1993Q2 fails to satisfy the second criterion by only a small margin. Since that crisis is documented in other studies, we decide to keep that crisis episode.
5. Uruguay has outliers in interest rates in 2002. There are structural breaks in the variance of the data, similar to the case of Argentina. We divide the sample into two periods and treat the two periods as two independent sets of observations. By this way, we identify two crises: 1983Q1 and 2002Q3.

Table 4: Occurrence of twin crises

	This study		Kaminsky and Reinhart (1999)		Glick and Hutchison (2001)	
Country	Bank	Currency	Bank	Currency	Bank	Currency
Argentina	1989Q2	1989Q2	March 1980 May 1985 December 1994	February 1981 September 1986 February 1990	1980-1982 1989-1990	1982 1989
Austria						
Brazil	1990Q1	1990Q1	November 1985 December 1994	November 1986 October 1991	1990 1994-1997	1990 1995
Burundi	1998Q4	1998Q4			1994-1997	1997
Chile	1984Q4	1984Q4	September 1981	August 1982	1981-1983	1985
Cyprus	1986Q1	1986Q4				
Denmark	1993Q1	1992Q3	March 1987	August 1983		
Ecuador					1980-1982	1982
Egypt	1990Q4	1990Q2			1980-1985 1991-1995	1979 1989
El Salvador					1989	1990
Finland			September 1991	November 1991	1991-1994	1991
France	1981Q3	1982Q1				
Germany	1988Q4	1989Q2				
Greece						
Guatemala					1991-1992	1989
Honduras						
India					1993-1997	1991,1995
Indonesia	1998Q1	1998Q1	November 1992	September 1986	1997	1997
Ireland	1992Q4	1992Q3				
Israel	1984Q3	1984Q2, 1985Q2	October 1983	October 1983		
Italy	1992Q3	1992Q3			1990-1995	1992,1995
Jamaica						
Japan						
Kenya	1993Q2	1993Q3			1985-1989 1992-1997	1985 1993,1995,1997
Korea	1998Q1	1997Q4			1997	1997
Mexico	1995Q2	1995Q1	September 1982 October 1992	December 1982 December 1994	1981-1991 1995-1997	1982,1985 1994
Nepal					1988-1994	1991,1995
Netherlands						
New Zealand	1983Q1	1982Q1			1987-1990	1988,1991
Niger						
Nigeria					1993-1997	1992
Papua New Guinea						
Peru	1990Q1	1990Q2	March 1983	October 1987	1983-1990	1987
Portugal						
Senegal						
Seychelles	1982Q2	1982Q2				
South Africa	1984Q1	1984Q4			1977 1985	1975,1978 1984
Spain	1983Q3	1982Q4	November 1978	July 1977 (December 1982)	1977-1985	1976,1983
Sri Lanka						
Swaziland	1982Q1	1983Q1				
Sweden	1992Q3	1992Q3	November 1991	November 1992	1990-1993	1992

Switzerland						
Thailand	1997Q3	1997Q3	March 1979	November 1978	1983-1987	1981,1984
				(July 1981)	1997	1997
			October 1983	November 1984		
Togo						
Turkey	2001Q1	2001Q1	January 1991	March 1994	1994-1995	1994
Uganda						
United States						
Uruguay	1983Q1	1982Q4	March 1971	December 1971	1981-1984	1982
	2002Q3	2002Q3	March 1981	October 1982		
Venezuela			October 1993	May 1994	1978-1986	1984,1986
					1994-1997	1994

Table 5: Distribution of currency and banking crises over time

	1980-2004	1980-1984	1985-1989	1990-1994	1995-1999	2000-2004
			Banking crises			
Number	63	18	14	12	14	5
Frequency %	5.1	7.3	5.7	4.9	5.7	2.0
			Currency crises			
Number	85	34	10	25	13	3
Frequency %	6.9	13.9	4.1	10.2	5.3	1.2
			Twin crises			
Number	27	9	3	8	5	2
Frequency %	2.2	3.7	1.2	3.3	2.0	0.8

Note: Frequency is defined as number of crises divided by total sum of country-years.

Table 6: Distribution of currency and banking crises over different groups of countries

	Industrialized countries	Developing countries	Emerging markets
		Banking crises	
Number	20	43	26
Frequency %	5.0	5.2	5.8
		Currency crises	
Number	30	55	33
Frequency %	7.5	6.7	7.3
		Twin crises	
Number	8	19	15
Frequency %	2.0	2.3	3.3

Note: "Developing countries" include "emerging markets" and "other developing countries" as defined in Table 1.

Table 7: Banking crises and the frequency of accompanying currency crises (percent)

Groups	Number of banking crises	Frequency of accompanying currency crisis									Cumulative frequency of accompanying currency crisis
		T-4	T-3	T-2	T-1	T	T+1	T+2	T+3	T+4	
All	63	2	2	3	8	18	3	3	5	2	46
Industrial	20	5	5	5	5	11	0	11	0	0	42
Developing	43	0	0	2	10	21	5	0	7	2	48
Emerging	26	0	0	4	15	27	8	0	8	0	62

Note: T refers to quarter.

Table 8: Banking crisis as indicator of currency crisis

	Signal-to-noise ratio								
Groups	T-4	T-3	T-2	T-1	T	T+1	T+2	T+3	T+4
All	0.5	0.4	0.4	0.3	0.2	0.3	0.3	0.4	0.4
Industrial	0.4	0.3	0.2	0.2	0.1	0.1	0.2	0.2	0.2
Developing	0.5	0.5	0.5	0.4	0.3	0.3	0.3	0.5	0.5
Emerging	0.9	0.9	0.9	0.7	0.4	0.5	0.5	0.7	0.7

Note:

1. T refers to quarter.
2. Signal-to-noise ratio is defined as A/B. T-N (T+N) refers to signaling window of quarter N after (prior to) the crises.

Table 9: Currency crises and the frequency of accompanying banking crises (percent)

Groups	Number of currency crises	Frequency of accompanying banking crisis									Cumulative frequency of accompanying banking crisis
		T-4	T-3	T-2	T-1	T	T+1	T+2	T+3	T+4	
All	85	1	4	2	2	13	6	2	1	1	33
Industrial	30	0	0	7	0	7	3	3	3	3	28
Developing	55	2	6	0	4	16	7	2	0	0	36
Emerging	33	0	6	0	6	21	12	3	0	0	48

Note: T refers to quarter.

Table 10: Currency crisis as indicator of banking crisis

	Signal-to-noise ratio								
Groups	T-4	T-3	T-2	T-1	T	T+1	T+2	T+3	T+4
All	0.3	0.3	0.2	0.2	0.1	0.2	0.3	0.3	0.3
Industrial	0.2	0.2	0.2	0.1	0.1	0.1	0.2	0.2	0.2
Developing	0.4	0.3	0.2	0.2	0.2	0.3	0.3	0.3	0.3
Emerging	0.5	0.5	0.4	0.4	0.3	0.5	0.6	0.6	0.6

Note:

1. T refers to quarter.
2. Signal-to-noise ratio is defined as A/B. T-N (T+N) refers to signaling window of quarter N after (prior to) the crises.

Table 11: Average crisis depth

1980-2004	All	Industrial	Developing	Emerging
		Banking crises		
Percentage contractionary	52%	65%	47%	62%
Cumulative GDP loss	-10.42	-6.54	-12.95	-13.74
Standard deviation	(11.14)	(8.85)	(11.94)	(12.39)
Recovery time	2.79	2.77	2.80	3.00
Standard deviation	(2.57)	(3.00)	(2.33)	(2.56)
Average GDP loss	-4.13	-1.87	-5.59	-5.98
Standard deviation	(3.75)	(1.02)	(4.15)	(4.36)
		Currency crises		
Percentage contractionary	64%	67%	62%	79%
Cumulative GDP loss	-16.56	-6.82	-22.29	-23.20
Standard deviation	(28.86)	(8.43)	(34.72)	(35.10)
Recovery time	3.89	3.35	4.21	4.42
Standard deviation	(4.76)	(2.56)	(5.69)	(6.02)
Average GDP loss	-3.88	-1.78	-5.11	-5.47
Standard deviation	(3.15)	(1.02)	(3.34)	(3.46)
		Twin crises		
Percentage contractionary	78%	75%	79%	87%
Cumulative GDP loss	-10.37	-3.28	-13.21	-14.46
Standard deviation	(12.01)	(2.50)	(13.18)	(13.71)
Recovery time	2.33	1.67	2.60	2.77
Standard deviation	(2.08)	(0.82)	(2.38)	(2.52)
Average GDP loss	-4.62	-1.80	-5.75	-6.18
Standard deviation	(3.95)	(0.98)	(4.15)	(4.28)

Table 12: Average crisis depth, alternative measure

1980-2004	All	Industrial	Developing	Emerging
		Banking crises		
Percentage contractionary	48% (30/63)	55% (11/20)	44% (19/43)	27% (7/26)
Average GDP loss	-2.40	-0.81	-3.31	-3.34
Standard deviation	(2.31)	(0.44)	(2.47)	(2.33)
Average GDP gain	3.87	3.25	4.11	4.65
Standard deviation	(3.65)	(0.87)	(4.24)	(4.62)
		Currency crises		
Percentage contractionary	35% (30/85)	30% (9/30)	38% (21/55)	33% (11/33)
Average GDP loss	-2.48	-1.10	-3.07	-2.40
Standard deviation	(2.72)	(0.84)	(3.04)	(2.10)
Average GDP gain	3.71	2.02	4.75	6.13
Standard deviation	(3.90)	(1.75)	(4.49)	(4.61)
		Twin crises		
Percentage contractionary	30% (8/27)	63% (5/8)	16% (3/19)	7% (1/15)
Average GDP loss	-2.43	-1.13	-4.59	-4.72
Standard deviation	(2.73)	(0.40)	(3.81)	(NA)
Average GDP gain	4.69	3.50	4.91	5.23
Standard deviation	(4.49)	(0.20)	(4.89)	(5.17)

Table 13: Output losses across decades (contractionary crises only)

	Coefficient	T-statistic	P-value	B1=B2	B1=B3	B2=B3	B1=B2=B3
			Banking crises				
D (1980s)	-2.03	-4.03	0.00	0.21	0.82	0.23	0.37
D (1990s)	-3.18	-3.90	0.00				
D (2000s)	-1.79	-1.94	0.06				
			Currency crises				
D (1980s)	-1.90	-4.33	0.00	0.16	0.31	0.09	0.17
D (1990s)	-4.14	-2.69	0.01				
D (2000s)	-1.45	NA	0.00				

Note: Newey-West Heteroskedasticity Consistent Coefficient Covariance.

Table 14: Output losses across groups of countries (contractionary crises only)

	Coefficient	T-statistic	P-value	B1=B2	B1=B3	B2=B3	B1=B2=B3
			Banking crises				
D (industrial)	-0.81	-5.92	0.00	0.00	0.01	0.97	0.00
D (other developing)	-3.30	-4.37	0.00				
D (emerging)	-3.34	-3.68	0.00				
			Currency crises				
D (industrial)	-1.10	-4.03	0.00	0.04	0.09	0.28	0.05
D (other developing)	-3.81	-3.17	0.00				
D (emerging)	-2.40	-3.48	0.00				
			Twin crises				
D (industrial)	-1.13	-5.62	0.00	0.36	0.00	0.96	0.00
D (other developing)	-4.52	-1.33	0.24				
D (emerging)	-4.72	NA	0.00				

Note: Newey-West Heteroskedasticity Consistent Coefficient Covariance.

Table 15: Description of variables and data sources, multivariate probit regression

Variable Name	Definition	Sources
	CURRENCY CRISES	
OVERRER	Overvaluation of real exchange rate (Increase in number means real depreciation)	IFS line RF, line 64, and line 64 of center country. We specify the trend by H-P filter
M2/RESERVES	M2 to foreign reserves ratio	M2 from IFS line 34 plus line 35; Foreign reserves from IFS line 11 (or 1d.d)
CA/GDP	Current account to GDP ratio	Current account from IFS line 78ALD; GDP from line 99b
M2GROR	Real M2 growth	M2 from IFS line 34 plus line 35. Then deflated by line 64
CREDITGRON	Nominal credit growth	IFS line 32d
M2MUL	M2 to reserve money multiplier	M2 from IFS line 34 plus line 35; Reserve money from line 14 (For EURO countries, reserve money is line 14A plus line 14C)
SUDS	Variable standing for potential of a sudden stop. Calculated as the difference between capital and current accounts divided by nominal GDP	Capital account from IFS line 78bjd; Current account from IFS line 78ald; GDP from line 99b
	BANKING CRISES	
GROWTH	Real GDP growth	IFS line 99bvp or 99b.p
DEPRECIATION	Changes of nominal exchange rates	IFS line RF
OVERRER	Overvaluation of real exchange rate (Increase in number means real depreciation)	IFS line RF, line 64, and line 64 of center country. We specify the trend by H-P filter
RLINTEREST	Real interest rates	Nominal interest rates are from IFS line 60b; Inflation rates are from IFS line 64
INFLATION	Inflation	IFS line 64
SURPLUS/GDP	Budget surplus to GDP ratio	Surplus from IFS line 80; GDP from line 99b
DGROWTH (dummy)	Dummy for severe recession	GROWTH<-5%
DINFLATION (dummy)	Dummy for high inflation	INFLATION>20%
MBGRO	Growth rate of monetary base	IFS line 14
CREDITGRO	Growth rate of real domestic credit	IFS line 32d ÷ line 64
PRIVATE/GDP	Ratio of domestic credit to private sector to GDP	Domestic credit to private sector from IFS line 32d
CASH/BANK	Ratio of bank liquid reserves to bank assets	Bank liquid reserves from IFS line 20; Bank assets from IFS line 21 plus lines 22a to 22f
GDP/CAP (1000 dollars/person)	Real GDP per capita	Population is IFS line 99z
FL	Dummy for financial liberalization	Bekaert, Harvey, and Lundblad (2005)
DEPOSITEX	Dummy variable for existence of explicit deposit insurance	Demirgüc-Kunt and Karacaovali, and Laeven (2005)
SUDS	Dummy variable standing for periods of sudden stop. The construction of the variable follows Calvo, Izquierdo and Mejia (2004).	Approximate capital inflows as the difference between overall balance (IFS line 78cbd) and current account balance (IFS line 78ald).

Note: All variables are compiled from IMF *International Financial Statistics*, except for FL and DEPOSITEX.

Table 16: Multivariate probit regression for currency crises

	ALL COUNTRIES	INDUSTRIAL COUNTRIES	DEVELOPING COUNTRIES	EMERGING MARKETS
OVERRER (T-1)	-2.68e-06	-0.01	-2.27e-06	-1.79e-06
	(-0.43)	(-1.41)	(-0.37)	(-0.30)
M2_RESERVES (T-1)	0.002	-0.007	0.005*	0.04**
	(0.96)	(-1.04)	(1.66)	(2.00)
CREDITGRON (T-1)	0.0002	-0.01	0.0002	0.0003
	(0.63)	(-0.71)	(0.64)	(0.87)
M2MUL (T-1)	-0.01	-0.03	-0.03	-0.06
	(-0.73)	(-1.27)	(-0.76)	(-1.26)
SUDS (T-1)	0.43*	-6.99	0.59**	0.97***
	(1.68)	(-0.00)	(2.14)	(2.93)
B_CRISIS (T)	1.18***	0.35	1.46***	1.65***
	(5.85)	(0.86)	(5.97)	(5.43)
B_CRISIS (T-1)	0.09	0.33	-0.17	-6.94
	(0.28)	(0.73)	(-0.37)	(-0.00)
		Summary statistics		
Nr. of crises	78	25	53	32
Nr. of observations	979	275	704	414
LR statistic	44.76***	7.03	49.81***	44.80***
McFadden R^2	0.09	0.07	0.14	0.26
AIC	498.52	169.51	332.95	182.08
		Prediction classification (cutoff=25%)		
Percentage of observations correctly called	90	92	91	92
Percentage of crises correctly called	24	12	34	44
Percentage of non-crises correctly called	96	99	96	96
		Prediction classification (cutoff=10%)		
Percentage of observations correctly called	85	52	86	86
Percentage of crises correctly called	29	60	38	56
Percentage of non-crises correctly called	89	51	90	88

Note:

1. T refers to year.
2. The table reports the coefficients of probit estimation with the associated z-statistic in parentheses below. Significance at 10 percent level is denoted by "*"; at the 5 percent level by "**"; at the 1 percent level by "***". A constant term is included in estimates, but not reported.

Table 17: Multivariate probit regression for banking crises

	ALL COUNTRIES	INDUSTRIAL COUNTRIES	DEVELOPING COUNTRIES	EMERGING MARKETS
GROWTH (T-1)	-0.08***	-0.04	-0.10***	-0.16***
	(-3.08)	(-0.54)	(-3.23)	(-3.65)
DEPRECIATION (T-1)	-0.005	-0.007	-0.004	-0.009*
	(-1.61)	(-0.46)	(-1.31)	(-1.78)
RLINTEREST (T-1)	-0.0003	-0.06	-0.0002	-0.002
	(-0.46)	(-0.81)	(-0.28)	(-1.61)
INFLATION (T-1)	0.003	0.14**	0.003	0.002
	(1.25)	(2.14)	(1.20)	(0.71)
SURPLUS/GDP (T-1)	-0.01	0.04	-0.03	-0.06*
	(-0.37)	(0.77)	(-1.56)	(-1.78)
DGROWTH (T-1)	-1.27**	-7.17	-1.59**	-1.99*
	(-2.09)	(-0.00)	(-2.21)	(-1.90)
DINFLATION (T-1)	0.69***	-0.39	0.70***	0.23
	(3.15)	(-0.37)	(2.87)	(0.71)
MBGRO (T-1)	0.002	-0.002	0.001	0.006*
	(0.78)	(-0.14)	(0.41)	(1.74)
CASH/BANK (T-1)	-0.02*	-0.05	-0.02	-0.05**
	(-1.93)	(-0.96)	(-1.31)	(-2.30)
FL (T-1)	-0.001	0.09	0.36	0.32
	(-0.00)	(0.14)	(1.24)	(0.90)
DEPOSITEX (T-1)	-0.08	1.24**	-0.35	-0.56
	(-0.39)	(2.07)	(-1.21)	(-1.52)
SUDS (T-1)	0.40	-6.58	0.47	0.68
	(1.21)	(-0.00)	(1.22)	(1.52)
C_CRISIS (T)	0.96***	0.39	1.19***	1.47***
	(4.61)	(0.90)	(4.49)	(4.13)
C_CRISIS (T-1)	0.75***	0.33	1.06***	1.17**
	(2.99)	(0.72)	(3.18)	(2.46)
		Summary statistics		
Nr. of crises	52	17	35	26
Nr. of observations	850	246	604	385
LR statistic	57.96***	18.00	54.11***	44.65***
McFadden R2	0.19	0.22	0.29	0.38
AIC	347.35	132.91	225.34	153.06
		Prediction classification (cutoff=25%)		
Percentage of observations correctly called	92	90	93	93
Percentage of crises correctly called	29	35	40	58
Percentage of non-crises correctly called	96	94	96	96

	Prediction classification (cutoff=10%)			
Percentage of observations correctly called	82	76	83	84
Percentage of crises correctly called	60	65	66	73
Percentage of non-crises correctly called	84	77	84	85

Note:

1. T refers to year.
2. The table reports the coefficients of probit estimation with the associated z-statistic in parentheses below. Significance at 10 percent level is denoted by "*"; at the 5 percent level by "**"; at the 1 percent level by "***". A constant term is included in estimates, but not reported.
3. The table contains blank cells because the variable was dropped out in estimation due to collinearity.

Table 18: Simultaneous probit regression for currency and banking crises

	ALL COUNTRIES		INDUSTRIAL COUNTRIES		DEVELOPING COUNTRIES		EMERGING MARKETS	
Variables	Currency crisis	Banking crisis	Currency crisis	Banking crisis	Currency crisis	Banking crisis	Currency crisis	Banking crisis
OVERRER (T-1)	-1.01e-06		-0.009		-1.61e-06		-2.53e-07	
	(-0.15)		(-1.11)		(-0.24)		(-0.04)	
M2_RESERVES (T-1)	0.001		0.007		0.002		0.27	
	(0.26)		(0.51)		(0.35)		(1.28)	
CA/GDP (T-1)	-2.73e-06		0.006		-3.00e-06		-7.51e-06	
	(-0.32)		(0.70)		(-0.33)		(-0.64)	
M2GROR (T-1)	-0.001		0.001		-0.001		6.64e-06	
	(-0.13)		(0.06)		(-0.24)		(0.00)	
CREDITGRON (T-1)	0.0001		-0.01		0.0002		0.0002	
	(0.30)		(-0.68)		(0.60)		(0.41)	
M2MUL (T-1)	-0.009		-0.03		-0.02		-0.03	
	(-0.58)		(-1.11)		(-0.58)		(-0.82)	
SUDS (T-1)	0.48*		-6.65		0.65**		0.85***	
	(1.89)		(-0.00)		(2.29)		(2.61)	
B_CRISIS (T)	0.42***		0.05		0.36***		0.50***	
	(2.95)		(0.41)		(2.65)		(3.45)	
GROWTH (T-1)		-0.05		-0.02		-0.07**		-0.12***
		(-1.34)		(-0.27)		(-2.26)		(-2.67)
DEPRECIATION (T-1)		-0.0004		-0.009		0.003		-0.0005
		(-0.11)		(-0.55)		(0.68)		(-0.06)
OVERRER (T-1)		-2.43e-06		0.002		-8.58e-07		-1.50e-06
		(-0.19)		(0.13)		(-0.08)		(-0.16)
RLINTEREST (T-1)		-0.0002		-0.03		0.0002		-0.0006
		(-0.37)		(-0.50)		(0.30)		(-0.49)
INFLATION (T-1)		0.00005		0.15**		-0.001		-0.001
		(0.02)		(2.18)		(-0.43)		(-0.28)
SURPLUS/GDP (T-1)		0.01		0.03		-0.01		-0.02
		(0.50)		(0.50)		(-0.37)		(-0.53)
DGROWTH (T-1)		-0.64		-9.49		-0.09		-0.85
		(-0.99)		(-0.00)		(-0.10)		(-0.90)
DINFLATION (T-1)		0.52**		-0.12		0.44		0.02
		(2.26)		(-0.10)		(1.61)		(0.05)
MBGRO (T-1)		0.0004		0.003		-0.002		0.002
		(0.20)		(0.22)		(-0.63)		(0.40)
CREDITGRO (T-1)		0.003		-0.02		0.001		-0.0002
		(0.63)		(-0.48)		(0.29)		(-0.02)

PRIVATE/GDP (T-1)		-0.21		-0.63		0.11		-0.53
		(-0.53)		(-1.14)		(0.17)		(-0.56)
CASH/BANK (T-1)		-0.01		-0.06		-0.01		-0.03
		(-1.10)		(-1.04)		(-0.99)		(-1.22)
GDP/CAP (T-1)		-0.005		0.04		0.002		-0.002
		(-0.41)		(1.37)		(0.05)		(-0.04)
FL (T-1)		0.45		0.34		0.63*		0.41
		(1.27)		(0.41)		(1.92)		(0.98)
DEPOSITEX (T-1)		-0.21		1.14*		-0.35		-0.50
		(-1.04)		(1.89)		(-1.32)		(-1.42)
SUDS (T-1)		-0.42		-5.14		-0.49		-0.13
		(-0.66)		(-0.00)		(-0.70)		(-0.12)
C_CRISIS (T)		1.24*		0.23		1.28**		0.78
		(1.69)		(0.67)		(2.08)		(1.23)
				Summary statistics				
Nr. of crises	71	52	24	17	47	35	30	26
Nr. of observations	852	887	247	275	605	612	384	384
Wald statistic	20.69***	39.11***	4.17	18.22	22.48***	40.76***	31.02***	36.60**
McFadden R2	0.05	0.13	0.05	0.23	0.07	0.20	0.19	0.28
AIC	464.84	373.86	160.36	133.52	314.41	245.80	183.68	170.67
				Prediction classification (cutoff=25%)				
Percentage of observations correctly called	91	94	90	92	91	94	91	92
Percentage of crises correctly called	8	15	0	35	17	34	33	50
Percentage of non-crises correctly called	98	99	99	95	97	97	96	95
				Prediction classification (cutoff=10%)				
Percentage of observations correctly called	74	81	44	80	78	81	79	81
Percentage of crises correctly called	42	42	75	65	38	57	53	77
Percentage of non-crises correctly called	77	83	40	81	82	83	81	82

Note:

1. T refers to year.
2. The table reports the coefficients of probit estimation with the associated z-statistic in parentheses below. Significance at 10 percent level is denoted by "*"; at the 5 percent level by "**"; at the 1 percent level by "***". A constant term is included in estimates, but not reported.
3. The table contains blank cells because the variable was dropped out in estimation due to collinearity.

Table 19: Simultaneous probit regression for currency and banking crises, using predicted crisis dummy

	ALL COUNTRIES		INDUSTRIAL COUNTRIES		DEVELOPING COUNTRIES		EMERGING MARKETS	
Variables	Currency crisis	Banking crisis	Currency crisis	Banking crisis	Currency crisis	Banking crisis	Currency crisis	Banking crisis
OVERRER (T-1)	-3.91e-06		-0.01		-3.41e-06		-1.82e-06	
	(-0.50)		(-1.30)		(-0.44)		(-0.31)	
M2_RESERVES (T-1)	0.001		0.01		0.002		0.04**	
	(0.20)		(0.91)		(0.35)		(2.10)	
CA/GDP (T-1)	-2.24e-06		0.01		-2.63e-06		-3.70e-06	
	(-0.28)		(1.08)		(-0.30)		(-0.38)	
M2GROR (T-1)	-0.007		-0.003		-0.004		-0.004	
	(-1.22)		(-0.13)		(-0.73)		(-0.58)	
CREDITGRON (T-1)	0.0002		-0.008		0.0001		0.0003	
	(0.54)		(-0.52)		(0.37)		(0.75)	
M2MUL (T-1)	-0.004		-0.03		-0.002		-0.004	
	(-0.26)		(-1.18)		(-0.06)		(-0.09)	
SUDS (T-1)	0.66***		-7.52		0.90***		1.26***	
	(2.67)		(-0.00)		(3.39)		(4.05)	
B_CRISIS (T)	0.93		-8.08		1.49**		1.62***	
	(1.18)		(-0.00)		(2.18)		(3.32)	
GROWTH (T-1)		-0.09***		-0.04		-0.10***		-0.15***
		(-3.61)		(-0.60)		(-3.51)		(-3.84)
DEPRECIATION (T-1)		-0.001		-0.006		0.0007		-0.008*
		(-0.36)		(-0.37)		(0.20)		(-1.91)
OVERRER (T-1)		-5.59e-06		-0.0007		-4.10e-06		-2.19e-06
		(-0.52)		(-0.06)		(-0.46)		(-0.28)
RLINTEREST (T-1)		-0.004		-0.04		-0.005		-0.002*
		(-1.05)		(-0.58)		(-1.30)		(-1.65)
INFLATION (T-1)		0.0002		0.15**		-0.0005		0.002
		(0.06)		(2.28)		(-0.13)		(0.74)
SURPLUS/GDP (T-1)		-0.02		0.04		-0.04**		-0.05
		(-1.02)		(0.66)		(-1.99)		(-1.58)
DGROWTH (T-1)		-1.26**		-7.50		-1.47**		-1.36
		(-2.23)		(-0.00)		(-2.35)		(-1.63)
DINFLATION (T-1)		0.63***		-0.32		0.69***		0.36
		(2.79)		(-0.30)		(2.76)		(1.17)
MBGRO (T-1)		0.001		-0.002		-0.0001		0.006*
		(0.50)		(-0.22)		(-0.03)		(1.83)
CREDITGRO (T-1)		0.002		-0.03		0.005		0.003
		(0.38)		(-0.90)		(0.93)		(0.42)

PRIVATE/GDP (T-1)		0.14		-0.63		0.84		0.02
		(0.41)		(-1.17)		(1.47)		(0.03)
CASH/BANK (T-1)		-0.03**		-0.05		-0.02*		-0.05**
		(-2.36)		(-0.83)		(-1.77)		(-2.43)
GDP/CAP (T-1)		-0.002		0.03		-0.04		-0.05
		(-0.14)		(1.52)		(-1.05)		(-1.02)
FL (T-1)		0.001		0.48		0.30		0.07
		(0.01)		(0.48)		(1.14)		(0.23)
DEPOSITEX (T-1)		-0.10		1.20**		-0.33		-0.36
		(-0.53)		(1.99)		(-1.25)		(-1.15)
SUDS (T-1)		0.56**		-6.89		0.85**		1.00***
		(1.97)		(-0.00)		(2.57)		(2.63)
C_CRISIS (T)		28.24		0.74		35.79		0.97
		(0.00)		(0.66)		(0.00)		(1.18)
Summary statistics								
Nr. of crises	71	52	24	17	47	35	30	26
Nr. of observations	852	887	247	275	605	612	384	384
Wald statistic	13.84*	32.06***	4.80	19.21	21.14***	33.63***	31.95***	36.26***
McFadden R2	0.03	0.13	0.06	0.22	0.07	0.20	0.17	0.28
AIC	472.73	373.48	158.77	133.71	316.87	245.44	186.38	171.02
Prediction classification (cutoff=25%)								
Percentage of observations correctly called	92	94	90	92	90	93	90	93
Percentage of crises correctly called	6	15	4	35	23	29	40	42
Percentage of non-crises correctly called	99	98	99	96	96	97	94	97
Prediction classification (cutoff=10%)								
Percentage of observations correctly called	84	82	44	79	88	80	84	81
Percentage of crises correctly called	18	48	67	59	23	54	50	77
Percentage of non-crises correctly called	90	84	41	81	94	82	87	81

1. T refers to year.
2. The table reports the coefficients of probit estimation with the associated z-statistic in parentheses below. Significance at 10 percent level is denoted by "*"; at the 5 percent level by "**"; at the 1 percent level by "***". A constant term is included in estimates, but not reported.
3. The table contains blank cells because the variable was dropped out in estimation due to collinearity.

APPENDIX

Table 16: Multivariate probit regression for currency crises

	ALL COUNTRIES					INDUSTRIAL COUNTRIES				
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 1	Model 2	Model 3	Model 4	Model 5
OVERRER (T-1)	-3.82e-06	-2.68e-06	-2.68e-06	-2.47e-06	-2.43e-06	-0.01	-0.01	-0.01	-0.01	-0.01
	(-0.50)	(-0.43)	(-0.43)	(-0.40)	(-0.39)	(-1.52)	(-1.41)	(-1.41)	(-1.55)	(-1.56)
M2_RESERVES (T-1)	0.002	0.002	0.002	0.003	0.003	-0.007	-0.006	-0.007	-0.005	-0.006
	(0.72)	(0.97)	(0.96)	(1.23)	(1.24)	(-1.02)	(-1.00)	(-1.04)	(-0.86)	(-0.92)
CA/GDP (T-1)	-2.56e-06	-4.20e-06	-4.20e-06	-4.47e-06	-4.54e-06	0.003	0.003	0.003	0.004	0.003
	(-0.31)	(-0.49)	(-0.49)	(-0.51)	(-0.52)	(0.47)	(0.46)	(0.43)	(0.48)	(0.44)
M2GROR (T-1)	-0.008*	-0.005	-0.005	-0.006	-0.006	0.002	0.004	0.003	-0.007	-0.005
	(-1.67)	(-0.99)	(-1.00)	(-1.06)	(-1.06)	(0.11)	(0.16)	(0.16)	(-0.33)	(-0.24)
CREDITGRON (T-1)	0.0004	0.0002	0.0002	0.0002	0.0002	-0.01	-0.01	-0.01	-0.002	-0.004
	(1.52)	(0.63)	(0.63)	(0.64)	(0.64)	(-0.70)	(-0.69)	(-0.71)	(-0.12)	(-0.26)
M2MUL (T-1)	-0.009	-0.01	-0.01	-0.01	-0.01	-0.03	-0.03	-0.03	-0.03	-0.03
	(-0.66)	(-0.71)	(-0.73)	(-0.65)	(-0.65)	(-1.30)	(-1.27)	(-1.27)	(-1.27)	(-1.26)
SUDS (T-1)	0.56**	0.43*	0.43*	0.45*	0.45*	-7.18	-7.38	-6.99	-7.14	-7.12
	(2.38)	(1.69)	(1.68)	(1.73)	(1.75)	(-0.00)	(-0.00)	(-0.00)	(-0.00)	(-0.00)
B_CRISIS (T)		1.18***	1.18***	1.34***	1.35***		0.33	0.35	0.55	0.57
		(5.86)	(5.85)	(6.33)	(6.35)		(0.81)	(0.86)	(1.26)	(1.31)
B_CRISIS (T-1)			0.09					0.33		
			(0.28)					(0.73)		
B_CRISIS (T-2)				0.008					0.64	
				(0.03)					(1.56)	
B_CRISIS (T-1) or (T-2)					0.08					0.53*
					(0.36)					(1.67)
Summary statistics										
Nr. of crises	78	78	78	70	70	25	25	25	23	23
Nr. of observations	983	983	979	934	934	276	276	275	261	261
Wald statistic	11.90*	44.83***	44.76***	51.64***	51.74***	5.91	6.55	7.03	9.42	9.76
McFadden R^2	0.02	0.09	0.09	0.11	0.11	0.06	0.06	0.07	0.09	0.09
AIC	527.78	497.20	498.52	449.89	449.77	166.86	168.23	169.51	159.60	159.22
Prediction classification (cutoff=25%)										
Percentage of observations correctly called	92	90	90	91	91	99	92	92	89	89
Percentage of crises correctly called	4	24	24	29	29	25	12	12	17	17
Percentage of non-crises correctly called	99	96	96	96	96	99	99	99	96	96
Prediction classification (cutoff=10%)										
Percentage of observations correctly called	82	85	85	85	85	51	52	52	56	57
Percentage of crises correctly called	19	29	29	33	33	64	56	60	57	57
Percentage of non-crises correctly called	87	89	89	89	89	50	51	51	56	57

Note:

1. T refers to year.
2. The table reports the coefficients of probit estimation with the associated z-statistic in parentheses below. Significance at 10 percent level is denoted by "*"; at the 5 percent level by "**"; at the 1 percent level by "***". A constant term is included in estimates, but not reported.

Table 16: Multivariate probit regression for currency crises, continue…

	DEVELOPING COUNTRIES					EMERGING MARKETS				
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 1	Model 2	Model 3	Model 4	Model 5
OVERRER (T-1)	-3.51e-06	-2.23e-06	-2.27e-06	-2.15e-06	-2.15e-06	-3.16e-06	-1.73e-06	-1.79e-06	-1.26e-06	-1.33e-06
	(-0.46)	(-0.37)	(-0.37)	(-0.35)	(-0.35)	(-0.41)	(-0.29)	(-0.30)	(-0.22)	(-0.23)
M2_RESERVES (T-1)	0.004	0.005*	0.005*	0.005*	0.005*	0.05**	0.04**	0.04**	0.04*	0.04*
	(1.46)	(1.68)	(1.66)	(1.74)	(1.73)	(2.44)	(2.02)	(2.00)	(1.92)	(1.90)
CA/GDP (T-1)	-2.93e-06	-5.70e-06	-5.61e-06	-6.36e-06	-6.33e-06	-4.82e-06	-8.32e-06	-8.13e-06	-0.00001	-0.00001
	(-0.34)	(-0.61)	(-0.60)	(-0.66)	(-0.66)	(-0.47)	(-0.81)	(-0.79)	(-0.97)	(-0.96)
M2GROR (T-1)	-0.008	-0.004	-0.004	-0.004	-0.004	-0.003	-0.001	-0.001	-0.001	-0.001
	(-1.51)	(-0.69)	(-0.72)	(-0.70)	(-0.73)	(-0.57)	(-0.24)	(-0.24)	(-0.22)	(-0.22)
CREDITGRON (T-1)	0.0005*	0.0002	0.0002	0.0003	0.0003	0.0006**	0.0003	0.0003	0.0004	0.0004
	(1.76)	(0.65)	(0.64)	(0.81)	(0.76)	(2.12)	(0.88)	(0.87)	(1.15)	(1.14)
M2MUL (T-1)	-0.01	-0.03	-0.03	-0.03	-0.03	-0.04	-0.06	-0.06	-0.07	-0.07
	(-0.47)	(-0.73)	(-0.76)	(-0.88)	(-0.91)	(-1.10)	(-1.28)	(-1.26)	(-1.33)	(-1.31)
SUDS (T-1)	0.76***	0.59**	0.59**	0.63**	0.63**	1.17***	0.98***	0.97***	1.11***	1.09***
	(3.03)	(2.14)	(2.14)	(2.22)	(2.24)	(4.00)	(2.97)	(2.93)	(3.23)	(3.18)
B_CRISIS (T)		1.47***	1.46***	1.57***	1.57***		1.67***	1.65***	1.86***	1.84***
		(6.03)	(5.97)	(6.22)	(6.20)		(5.49)	(5.43)	(5.78)	(5.72)
B_CRISIS (T-1)			-0.17					-6.94		
			(-0.37)					(-0.00)		
B_CRISIS (T-2)				-6.66					-7.04	
				(-0.00)					(-0.00)	
B_CRISIS (T-1) or (T-2)					-0.49					-6.44
					(-1.19)					(-0.00)
				Summary statistics						
Nr. of crises	53	53	53	47	47	32	32	32	27	27
Nr. of observations	707	707	704	673	673	414	414	414	397	397
Wald statistic	16.36**	49.82***	49.81***	52.98***	55.98***	23.26***	45.79***	44.80***	47.85***	46.89***
McFadden R2	0.05	0.14	0.14	0.19	0.19	0.11	0.25	0.26	0.34	0.34
AIC	364.76	331.47	332.95	287.92	289.65	209.32	181.18	182.08	145.93	145.16
				Prediction classification (cutoff=25%)						
Percentage of observations correctly called	92	91	91	92	92	90	92	92	93	93
Percentage of crises correctly called	9	34	34	38	38	31	44	44	52	52
Percentage of non-crises correctly called	99	96	96	96	96	95	96	96	96	96
				Prediction classification (cutoff=10%)						
Percentage of observations correctly called	84	86	86	87	87	83	86	86	88	88
Percentage of crises correctly called	23	38	38	43	43	44	56	56	63	63
Percentage of non-crises correctly called	89	90	90	90	90	86	88	88	89	90

Note:

1. T refers to year.
2. The table reports the coefficients of probit estimation with the associated z-statistic in parentheses below. Significance at 10 percent level is denoted by "*"; at the 5 percent level by "**"; at the 1 percent level by "***". A constant term is included in estimates, but not reported.

Table 17: Multivariate probit regression for banking crises

	ALL COUNTRIES					INDUSTRIAL COUNTRIES				
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 1	Model 2	Model 3	Model 4	Model 5
GROWTH (T-1)	-0.10***	-0.09***	-0.08***	-0.07**	-0.05**	-0.04	-0.04	-0.04	-0.03	-0.02
	(-3.76)	(-3.30)	(-3.08)	(-2.36)	(-1.96)	(-0.60)	(-0.60)	(-0.54)	(-0.49)	(-0.39)
DEPRECIATION (T-1)	-0.005*	-0.003	-0.005	-0.003	-0.004	-0.005	-0.006	-0.007	-0.01	-0.01
	(-1.71)	(-1.20)	(-1.61)	(-1.11)	(-1.42)	(-0.31)	(-0.40)	(-0.46)	(-0.64)	(-0.69)
OVERRER (T-1)	-5.97e-06	-5.70e-06	-5.74e-06	-5.76e-06	-5.22e-06	-0.002	0.002	0.002	0.002	0.0001
	(-0.53)	(-0.48)	(-0.46)	(-0.46)	(-0.42)	(-0.21)	(0.18)	(0.14)	(0.18)	(0.01)
RLINTEREST (T-1)	-0.0001	-0.0001	-0.0003	-0.0003	-0.0005	-0.03	-0.05	-0.06	-0.06	-0.06
	(-0.17)	(-0.17)	(-0.46)	(-0.46)	(-0.70)	(-0.45)	(-0.70)	(-0.81)	(-0.83)	(-0.84)
INFLATION (T-1)	0.003	0.002	0.003	0.001	0.002	0.16**	0.15**	0.14**	0.14*	0.13*
	(1.56)	(1.08)	(1.25)	(0.79)	(0.92)	(2.38)	(2.18)	(2.14)	(1.84)	(1.78)
SURPLUS/GDP (T-1)	-0.02	-0.01	-0.01	-0.02	-0.01	0.03	0.04	0.04	0.01	0.01
	(-0.92)	(-0.54)	(-0.37)	(-0.85)	(-0.70)	(0.55)	(0.73)	(0.77)	(0.18)	(0.24)
DGROWTH (T-1)	-1.21**	-1.07*	-1.27**	-0.78	-0.76	-6.84	-6.85	-7.17	-7.17	-7.01
	(-2.18)	(-1.90)	(-2.09)	(-1.36)	(-1.28)	(-0.00)	(-0.00)	(-0.00)	(-0.00)	(-0.00)
DINFLATION (T-1)	0.68***	0.66***	0.69***	0.61***	0.62***	-0.54	-0.42	-0.39	-7.82	-7.91
	(3.30)	(3.07)	(3.15)	(2.63)	(2.64)	(-0.52)	(-0.40)	(-0.37)	(-0.00)	(-0.00)
MBGRO (T-1)	0.001	0.001	0.002	0.002	0.002	-0.001	-0.002	-0.002	-0.004	-0.004
	(0.60)	(0.42)	(0.78)	(0.67)	(0.99)	(-0.11)	(-0.16)	(-0.14)	(-0.35)	(-0.32)
CREDITGRO (T-1)	0.0005	0.001	0.001	-0.001	-0.0003	-0.02	-0.02	-0.02	-0.01	-0.01
	(0.11)	(0.26)	(0.17)	(-0.13)	(-0.05)	(-0.83)	(-0.60)	(-0.59)	(-0.48)	(-0.44)
PRIVATE/GDP (T-1)	0.12	0.11	0.07	0.05	-0.06	-0.60	-0.70	-0.69	-0.71	-0.71
	(0.36)	(0.31)	(0.19)	(0.14)	(-0.15)	(-1.11)	(-1.24)	(-1.22)	(-1.22)	(-1.22)
CASH/BANK (T-1)	-0.02**	-0.02*	-0.02*	-0.02	-0.02	-0.06	-0.06	-0.05	-0.06	-0.05
	(-2.16)	(-1.86)	(-1.93)	(-1.58)	(-1.60)	(-1.07)	(-1.00)	(-0.96)	(-0.99)	(-0.96)
GDP/CAP (T-1)	-0.001	0.005	0.004	0.01	0.01	0.03	0.04	0.04	0.04	0.04
	(-0.09)	(0.33)	(0.31)	(0.69)	(0.88)	(1.48)	(1.54)	(1.53)	(1.49)	(1.52)
FL (T-1)	-0.04	-0.04	-0.001	-0.06	-0.04	-0.01	-0.01	0.09	-0.25	-0.22
	(-0.22)	(-0.20)	(-0.00)	(-0.29)	(-0.16)	(-0.02)	(-0.02)	(0.14)	(-0.33)	(-0.28)
DEPOSITEX (T-1)	-0.05	-0.03	-0.08	-0.06	-0.08	1.26**	1.27**	1.24**	1.17*	1.15*
	(-0.30)	(-0.17)	(-0.39)	(-0.31)	(-0.40)	(2.09)	(2.12)	(2.07)	(1.84)	(1.79)
SUDS (T-1)	0.54*	0.36	0.40	0.34	0.41	-6.86	-6.11	-6.58	-6.40	-6.20
	(1.93)	(1.10)	(1.21)	(1.02)	(1.23)	(-0.00)	(-0.00)	(-0.00)	(-0.00)	(-0.00)
C_CRISIS (T)		0.89***	0.96***	1.02***	1.10***		0.34	0.39	0.44	0.49
		(4.36)	(4.61)	(4.78)	(5.07)		(0.79)	(0.90)	(0.95)	(1.04)
C_CRISIS (T-1)			0.75***					0.33		
			(2.99)					(0.72)		
C_CRISIS (T-2)				-0.14					-0.24	

				(-0.40)					(-0.43)	
C_CRISIS (T-1) or (T-2)					0.55**					0.19
					(2.56)					(0.46)
				Summary statistics						
Nr. of crises	52	52	52	47	47	17	17	17	14	14
Nr. of observations	888	853	850	810	810	275	247	246	233	233
Wald statistic	36.92**	52.43***	57.96***	51.99***	55.52***	18.65	17.82	18.00	13.40	13.04
McFadden R2	0.12	0.17	0.19	0.18	0.19	0.22	0.22	0.22	0.19	0.19
AIC	374.99	354.06	347.35	325.73	319.70	132.16	131.42	132.91	122.79	122.77
				Prediction classification (cutoff=25%)						
Percentage of observations correctly called	94	93	92	93	93	91	89	90	91	92
Percentage of crises correctly called	17	27	29	32	32	35	35	35	21	21
Percentage of non-crises correctly called	98	97	96	97	96	95	93	94	95	97
				Prediction classification (cutoff=10%)						
Percentage of observations correctly called	81	83	82	86	83	79	77	76	79	77
Percentage of crises correctly called	42	48	60	47	55	59	65	65	64	64
Percentage of non-crises correctly called	83	85	84	88	85	81	78	77	80	78

Note:

1. T refers to year.
2. The table reports the coefficients of probit estimation with the associated z-statistic in parentheses below. Significance at 10 percent level is denoted by "*"; at the 5 percent level by "**"; at the 1 percent level by "***". A constant term is included in estimates, but not reported.
3. The table contains blank cells because the variable was dropped out in estimation due to collinearity.

Table 17: Multivariate probit regression for banking crises, continue…

	DEVELOPING COUNTRIES					EMERGING MARKETS				
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 1	Model 2	Model 3	Model 4	Model 5
GROWTH (T-1)	-0.11***	-0.10***	-0.10***	-0.08**	-0.07**	-0.15***	-0.15***	-0.16***	-0.13***	-0.14***
	(-3.63)	(-3.20)	(-3.23)	(-2.47)	(-2.35)	(-3.86)	(-3.64)	(-3.65)	(-3.09)	(-3.00)
DEPRECIATION (T-1)	-0.004	-0.002	-0.004	-0.003	-0.004	-0.009**	-0.006	-0.009*	-0.007	-0.01*
	(-1.49)	(-0.74)	(-1.31)	(-0.90)	(-1.30)	(-2.24)	(-1.40)	(-1.78)	(-1.46)	(-1.84)
OVERRER (T-1)	-4.66e-06	-4.59e-06	-4.41e-06	-4.53e-06	-3.66e-06	-2.81e-06	-2.46e-06	-2.08e-06	-2.45e-06	-1.38e-06
	(-0.50)	(-0.44)	(-0.41)	(-0.43)	(-0.37)	(-0.33)	(-0.26)	(-0.21)	(-0.23)	(-0.13)
RLINTEREST (T-1)	0.00003	0.0001	-0.0002	-0.0003	-0.001	-0.002	-0.001	-0.002	-0.002	-0.002**
	(0.04)	(0.11)	(-0.28)	(-0.39)	(-0.69)	(-1.52)	(-1.21)	(-1.61)	(-1.52)	(-1.99)
INFLATION (T-1)	0.003*	0.002	0.003	0.001	0.002	0.003	0.001	0.002	0.001	0.001
	(1.66)	(0.95)	(1.20)	(0.67)	(0.84)	(1.37)	(0.52)	(0.71)	(0.27)	(0.37)
SURPLUS/GDP (T-1)	-0.04*	-0.04	-0.03	-0.04*	-0.04*	-0.06**	-0.06*	-0.06*	-0.06*	-0.06*
	(-1.84)	(-1.63)	(-1.56)	(-1.72)	(-1.79)	(-2.15)	(-1.95)	(-1.78)	(-1.78)	(-1.75)
DGROWTH (T-1)	-1.36**	-1.08*	-1.59**	-0.79	-0.96	-1.39	-1.13	-1.99*	-0.76	-1.24
	(-2.24)	(-1.78)	(-2.21)	(-1.26)	(-1.42)	(-1.63)	(-1.33)	(-1.90)	(-0.88)	(-1.26)
DINFLATION (T-1)	0.75***	0.68***	0.70***	0.62**	0.62**	0.40	0.22	0.23	0.03	-0.01
	(3.28)	(2.84)	(2.87)	(2.47)	(2.42)	(1.35)	(0.69)	(0.71)	(0.08)	(-0.04)
MBGRO (T-1)	0.0004	-0.0002	0.001	0.001	0.002	0.006*	0.005	0.006*	0.006*	0.008**
	(0.17)	(-0.06)	(0.41)	(0.44)	(0.82)	(1.78)	(1.34)	(1.74)	(1.65)	(2.12)
CREDITGRO (T-1)	0.003	0.002	0.001	-0.002	-0.001	0.005	0.005	0.003	0.003	0.001
	(0.46)	(0.40)	(0.19)	(-0.23)	(-0.23)	(0.87)	(0.88)	(0.45)	(0.49)	(0.10)
PRIVATE/GDP (T-1)	0.78	0.56	0.55	0.59	0.45	0.07	-0.53	-0.65	-0.93	-1.28
	(1.38)	(0.88)	(0.84)	(0.91)	(0.66)	(0.10)	(-0.59)	(-0.68)	(-0.99)	(-1.24)
CASH/BANK (T-1)	-0.02	-0.01	-0.02	-0.01	-0.01	-0.04**	-0.04**	-0.05**	-0.04**	-0.05**
	(-1.43)	(-1.12)	(-1.31)	(-0.94)	(-1.13)	(-2.42)	(-2.14)	(-2.30)	(-2.14)	(-2.36)
GDP/CAP (T-1)	-0.04	-0.03	-0.03	-0.03	-0.03	-0.05	-0.03	-0.04	-0.02	-0.02
	(-1.13)	(-0.77)	(-0.81)	(-0.72)	(-0.61)	(-1.08)	(-0.57)	(-0.70)	(-0.35)	(-0.31)
FL (T-1)	0.21	0.31	0.36	0.29	0.36	0.07	0.25	0.32	0.22	0.33
	(0.83)	(1.09)	(1.24)	(1.03)	(1.22)	(0.23)	(0.74)	(0.90)	(0.63)	(0.90)
DEPOSITEX (T-1)	-0.24	-0.30	-0.35	-0.28	-0.33	-0.32	-0.46	-0.56	-0.50	-0.62
	(-0.95)	(-1.06)	(-1.21)	(-1.02)	(-1.13)	(-1.02)	(-1.32)	(-1.52)	(-1.38)	(-1.62)
SUDS (T-1)	0.83**	0.42	0.47	0.37	0.45	1.12***	0.58	0.68	0.47	0.59
	(2.54)	(1.10)	(1.22)	(0.97)	(1.14)	(3.10)	(1.34)	(1.52)	(1.05)	(1.27)
C_CRISIS (T)		1.11***	1.19***	1.21***	1.31***		1.37***	1.47***	1.64***	1.79***
		(4.29)	(4.49)	(4.47)	(4.71)		(4.00)	(4.13)	(4.35)	(4.47)
C_CRISIS (T-1)			1.06***					1.17**		
			(3.18)					(2.46)		
C_CRISIS (T-2)				-0.08					0.35	

				(-0.17)					(0.62)	
C_CRISIS (T-1) or (T-2)				0.75***						1.04***
				(2.66)						(2.63)
				Summary statistics						
Nr. of crises	35	35	35	33	33	26	26	26	25	25
Nr. of observations	613	606	604	577	577	385	385	385	370	370
Wald statistic	37.84***	50.43***	54.11***	50.04***	51.78***	35.89***	44.53***	44.65***	45.11***	44.31***
McFadden R2	0.18	0.25	0.29	0.26	0.29	0.27	0.35	0.38	0.37	0.41
AIC	248.82	232.86	225.34	221.64	215.07	170.42	156.74	153.06	150.10	143.73
				Prediction classification (cutoff=25%)						
Percentage of observations correctly called	94	94	93	94	93	93	93	93	93	92
Percentage of crises correctly called	29	40	40	42	45	50	58	58	60	64
Percentage of non-crises correctly called	98	97	96	97	96	96	96	96	96	94
				Prediction classification (cutoff=10%)						
Percentage of observations correctly called	80	83	83	85	84	81	84	84	86	85
Percentage of crises correctly called	57	54	66	58	67	77	77	73	76	72
Percentage of non-crises correctly called	81	85	84	86	85	81	84	85	87	86

Note:

1. T refers to year.
2. The table reports the coefficients of probit estimation with the associated z-statistic in parentheses below. Significance at 10 percent level is denoted by "*"; at the 5 percent level by "**"; at the 1 percent level by "***". A constant term is included in estimates, but not reported.