FINANCIAL CRISES IN EMERGING ECONOMIES: A DESCRIPTIVE STATISTICS ANALYSIS

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ÖZET

Bu çalışma 22 gelişmekte olan ülkede 1984 - 2001 yılları arasında meydana gelen borsa ve döviz krizlerinin zamansal ve bölgesel dağılımları ve göreceli olarak vuku bulmaları hakkında detaylı istatistiksel bilgi sağlamakta ve ayrıcada borsa ve döviz krizlerinin birbiriyle ilişkili olup olmadığını incelemektedir. Sonuçlar göstermiştir ki, borsa ve "ikiz" krizlerin sayısı ve yıllık ortalaması (frekansı) zamanla artmış (azalmış) buna karşılık döviz krizlerinin sayısı, yıllık ortalaması ve frekansı sabit kalmıştır. Ayrıca sonuçlar göstermiştir ki, borsa ve döviz krizleri genellikle eş zamanlı olarak meydana gelmektedir ve borsa krizleri azda olsa döviz krizlerinin öncü göstergesidir. Aynı zamanda, borsa krizlerinin döviz krizlerini tahmin etme gücü döviz krizlerinin borsa krizlerini tahmin etme gücünden daha yüksektir. Son olarak, borsa ve döviz krizleriyle alakalı olan kötü sinyallerin iyi sinyallere oranının 1'den az olması, borsa krizleri (döviz krizleri) olduğu zaman döviz krizlerinin (borsa krizlerinin) olma olasılığının olmama olasılığından yüksek olduğuna işaret etmektedir.

ABSTRACT

This study provides a detailed statistical overview of the time and regional distribution and relative timing occurrence of stock market and currency crises in 22 emerging economies over the 1984 - 2001 periods and examines whether stock market and currency crises are related or not. We find that the number and annual average (frequency) of stock market and "twin" crises have increased (decreased) over time while the number, average per year and frequency of currency crises tends to be stable. We also find that stock market and currency crises tend to occur simultaneously and stock market crises slightly lead currency crises rather than vice-versa. At the same time, the predictive power of the stock market crises on set currency crises are higher than the predictive power of currency crises on set stock market crises. Finally, all the noise-to-signal ratios associated with stock market and currency crises are less than 1 implying that when stock market crises occur currency crises are more likely than not and vice-versa.

1. Introduction

Emerging market currency crises have become a central debate issue in international finance since the early 1980s when many developing countries suffered from foreign debt crises and high inflation. Emerging stock markets' (ESM) returns have become a central issue in international finance since the early 1990s when many developing countries completed their transition and adjustment from import-substitution development strategies to export-led development strategies in various levels. As a result, capitalization, trading, return, risk, predictability, and integration of ESMs rose. Therefore, studies related to ESMs have increased since the early 1990s.

Previous studies showed that stock market returns and currency crises are driven by a set of common factors (money supply, industrial production, political risk factor, capital inflows, inflation, contagion etc.). Therefore, both stock market returns and currency crises should simultaneously respond to changes in those common factors. In the last decade, many of the countries that have had currency crises have also had stock market crises around the time when they were experiencing problems in their foreign exchange market with recent examples including Mexico 1994, Thailand 1997 and Turkey 2001. Although there are a lot of theoretical and empirical studies related to the currency crises and a few studies related to the stock market crises, the issue of whether currency crises and stock market crises are related or not have not received significant attention even if both crises seems to occur at the same time or appeared closely timed in the last decade.

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This study tries to fill up this gap. The main purpose of this study is to examine whether currency crises and stock market crises are related or not and find the direction of causality between both crises if they are related by using descriptive statistics analysis. This study focuses on the emerging economies specially the Latin American and the East Asian emerging economies because a particular feature of the 1994 Latin American and 1997 East Asian crisis was the almost simultaneous decline in both exchange and stock markets.

The organization of this paper is as follows: Section 2 reviews the links between the stock market crises and currency crises through the stock market returns and exchange rates. Section 3 defines the stock market crises and currency crises. Sections 4 provide a detailed statistical overview of the data sample, time and regional distribution and relative timing occurrence of stock market and currency crises by using descriptive statistic analysis. The final section concludes the study.

2. The Link Between Stock Market Crises And Curency Crises Through Stock Market Returns And Exchange Rates

2.1 Influence of exchange rates on stock returns

Most empirical studies argue that exchange rates would affect stock market returns through two channels[1]. First, a depreciation of the domestic currency increases exports and decrease imports. An increase in export raises earning expectations of the domestic export firms, leading to increases in domestic export firms' stock prices. Therefore, export-dominated economies' stock market return increases while import-dominated economies' stock market return decreases. Second, a depreciation of the domestic currency lowers returns on domestic currency-denominated assets relative to dollar-denominated assets. Therefore, investors will prefer dollar-denominated assets to equity, which is a domestic currency-denominated asset. At the same time, exchange rate risk is priced factor for foreign investors in the stock market return model and a depreciation of the domestic currency causes foreign investment shifts from stock market to foreign currencies. As a

result, a depreciation of domestic currency lowers stock prices and increases the probability of stock market crisis.

2.2 Influence of stock returns on exchange rates

Even if most studies consider causality from exchange rates to stock prices, there are some studies that consider the inverse causality. Stock market returns would affect exchange rates through two channels[2]. First, according to the portfolio approach to exchange rate determination, decreasing stock prices decrease foreign portfolio inflows and increase foreign portfolio outflows, leading to lower demand for domestic currencies and depreciation of the exchange rates. In this approach, domestic stock prices affect domestic currencies' values through capital flows between countries. Second, according to the monetary approach to exchange rate determination, a decrease in stock prices lowers the domestic wealth of investors, leading to lower demand for domestic currencies and lower domestic interest rates. As a result of lower domestic interest rates, investors switch their funds from interest bearing domestic assets to foreign currency dominated assets, causing domestic currencies to depreciate. In this approach, domestic stock prices affect domestic currencies' values through a reallocation of wealth. As a result, a decrease in stock market return causes the depreciation of domestic currency and increases the probability of the currency crises.

We can reach several conclusions from the extant literature. First, there is a significant negative relationship between stock prices and exchange rates. Second, although most of the studies found causality from exchange rates to stock prices, there is feedback system and bi-directional causality between stock prices and exchange rates.

3. Definition of the Currency Crises and Stock Market Crises

First, we define currency crises and stock market crises as our dependent variables. There are several different definitions of currency

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[1] Aggarwal (1981), Chen, Roll, and Ross (1986), Ma and Kao (1990), Jorion (1991), Ferson and Harvey (1994), Thorbecke (1994), Dumas and Solnik (1995), Abdalla and Murinde (1997).

[2] Solnik (1974), Smith (1992), Bahmani-Oskooee and Sohrabian (1992), Kaminsky, Lizondo and Reinhart(1997), Kaminsky and Reinhart (1999).

crises in the existing literature[3]. However, there is only one definition of stock market crises[4].

In the empirical work, first, we will construct "the market pressure index" (MPI) from the weighted average of exchange rate changes and reserve changes, which can be formalized as:

$$MPI_{i,t} = \frac{(\%\Delta\ e_{i,t})}{\sigma_{\Delta e,\ i}} - \frac{(\%\Delta\ r_{i,t})}{\sigma_{\Delta r,\ i}} \qquad (3.1)$$

where e and r are the bilateral exchange rate and reserves of country "i" at time "t", respectively. Δ is first difference and σ is the standard deviation. An increase in market pressure index indicates increased pressure on the domestic currency. Equation (3.1) shows that government has two choices at the time of attack: to devalue the exchange rate or sell foreign reserves.

Second, we define a currency crisis from MPI as:

Pcc(crisis)$_{it}$ = 1 if   MPI$_{it}$ > μ$_i$ + 1.5 * σ $_i$

Pcc(crisis)$_{it}$ = 0, otherwise.

Where μ, and σ are the mean and standard deviation of the MPI, respectively.

We consider that a stock market crisis exists when there is a sharp decline in the stock market index. The decline in the index has to be "large" relative to what is considered standard from the viewpoint of each country. Also, we define a stock market crisis using both the dollar-denominated stock market index and the domestic currency-denominated stock market index.

In our empirical work, a stock market crisis is considered to occur when one of the following conditions is met:

Condition 1.

Psmc(crisis)$_{it}$ = 1   if %Δ SMI$_{it}$ < -1.5*σ$_i$ - μ$_i$

Psmc(crisis)$_{it}$ = 0,   otherwise.

Condition 2.

Psmc(crisis)$_{it}$ = 1   if %Δ SMI $_{it}$ < -30 for dollar-denominated stock market crises

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[3]   Frankel and Rose (1996), Eichengren, Rose and Wyplosz (1996), Kaminsky and Reinhart (1999).
[4]   Patel and Sarkar (1998).

Psmc(crisis)$_{it}$ = 1   if   %Δ SMI $_{it}$ < -25 for local-currency denominated stock market crises

Psmc(crisis)$_{it}$ = 0,   otherwise.

%Δ SMI is percentage change of the dollar-denominated (the local currency-denominated) quarterly stock market index, μ and σ are the mean of the %Δ SMI, and standard deviation of the %Δ SMI, respectively. Condition 1 attempts to capture declines in the dollar-denominated (the local currency-dominated) stock market indexes that are sufficiently large relative to the historical country-specific decline of stock market indexes. It states that a percentage decline of the dollar-denominated (the local currency-denominated) quarterly stock market index has to be larger than the country specific mean of the %Δ SMI plus one and half standard deviation of the country specific %Δ SMI. Condition 2 states that a percentage decline of the dollar-denominated (the local currency-denominated) quarterly stock market index has to be larger than at least 30 percent for dollar-denominated stock market index and 25 percent for the local currency-denominated stock market index.

Finally, we consider the continuity of the stock market and currency crises and impose a one-quarter window to avoid double counting of the stock market and currency crises. After we identify a crisis, we treat any crisis in the next quarter as a part of the same crisis and skip it before continuing to identify a new crisis.

4. Data Sample and Descriptive Statistics

In this section, we examine occurrence of stock market crises and currency crises by providing some summary statistics. Descriptive statistics gives some information about time distribution, regional distribution and performance of crises as a predictor of each other.

The data set in this study covers 22 Emerging Market Economies from different regions[5], including 7 from Asia, 7 from Latin America, 3 from Europe, 2 from Africa and 3 from the Middle East. The data consist of quarterly stock market indexes and exchange rates from 1984.I

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[5]   List of the countries : Argentina, Brazil, Chile, Colombia, Mexico, Peru, Venezuela, Indonesia, Korea, Malaysia, Philippines, Thailand, India, Pakistan, Greece, Portugal, Turkey, South Africa, Nigeria, Jordan,Israel and Egypt.

to 2001.IV. The selection of the sample size and the countries are dictated by the availability of data.

Most of the data are from the International Financial Statistics CD-ROM database. International Financial Corporation's Emerging Market Dataset and Morgan Stanley Countries Index provide stock market indexes.
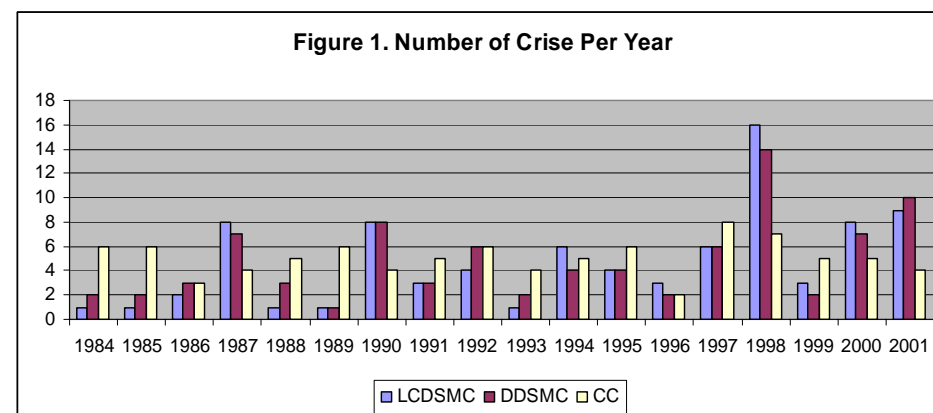
4.1. Data Sample

The sample period includes 91 currency crisis episodes, 85 stock market crisis episodes based on the local currency-denominated stock market index and 86 stock market crisis episodes based on the dollar-denominated stock market index.

Figure 1 shows the number of currency and stock market crises per year during the sample period 1984-2001. LCDSMC and DDSMC are stock market crises based on the local currency-denominated stock market index and the dollar-denominated stock market index, respectively and CC is currency crises.

Stock market crises are relatively more frequent in 1987, 1990-1992, 1994-1995, 1997-1998 and 2000-2001. The first peak is observed in 1987, when the Latin American stock markets declined sharply after the United States stock market crashed. The second peak is observed in 1990-1992, when Portugal, Greece, Turkey and some Asian countries stock markets declined sharply. A third peak is observed in 1994-1995, when the Latin American stock markets crashed, again related to Mexican financial crisis of December 1994. The fourth peak is observed in 1997-1998, when Asian stock markets crashed.   The fifth peak observed in 2000-2001 reflects a crisis around the world[6].

Currency crises were relatively more frequent in 1992, 1997-98 and 1999-2000. In 1992, financial instability in Europe caused currency crises in Portugal, Greece and Turkey.   The currency crisis in 1997-1998 reflected the Asian crises' effects on other countries. Finally, the peak observed in 1999-2000 was due to the Brazilian currency crisis and a global crisis.

Figure 1. Number of Crise Per Year

4.2. The time and regional distribution of the local currency-denominated stock market crises, currency crises and "twin" crises

Tables 1a and 1b provide a quick overview of the time distribution and regional distribution of the local currency-denominated stock market crises, currency crises and "twin" crises[7]. A total of 85 stock market crises (5.9 percent of observations), 91 currency crises (6.3 percent of observations) and 33 "twin" crises (2.3 percent observations) are identified in the sample period 1984.I-2001.IV. We can reach the following conclusions from Tables 1a and 1b: First, the number and average per year[8] (frequency)[9] of stock market and "twin" crises has increased (decreased) over time while the number, average per year and frequency of currency crises tend to be stable. As can be seen from Table 1a, the number of stock market crises tripled and "twin" crises doubled over time in our sample period while the number of currency crises was constant. Also, the average stock market crises per year almost tripled and "twin" crises per year almost doubled over time. However, average currency crises per year are steady. Finally, the frequency of crises shows that in 1996-2001 there was a stock market crisis on average every 2.9 years and "twin" crisis every 8.3 years while in 1984-1989 we had a

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[6]   Stock market and currency crises around 2000 were different from the other major crises. Crises were wide speared around the world instead of a specific region.

[7]   "Twin" crises are defined as a stock market crisis accompanied by a currency crisis in either the previous, current, or following quarter.

[8]   Average crises per year is calculated as the number of crises multiplied by number of countries in sample and the result divided by total sum of country-years.

[9]   Frequency of crises is calculated as the total sum of country-years divided by number of crises.

stock market crisis an average every 7.4 years and "twin" crises every 14.7 years.

Table 1b shows the distribution of crises by regions. Asia has the highest number of stock market and "twin" crises[10]. Also, Asia has the highest average stock market and "twin" crises per year. Finally, currency crises are equally distributed among all the regions.

Table 1a. Time distribution of local currency-denominated stock market crises and currency crises

	1984-2001	1984-1989	1990-1995	1996-2001
Stock Market Crises				
Number of Crises	85	14	26	45
Average Crises Per Year	5.1	3.0	4.6	7.5
Frequency of Crises	4.2	7.4	4.8	2.9
Currency Crises				
Number of Crises	91	28	31	32
Average Crises Per Year	5.4	5.3	5.5	5.3
Frequency of Crises	3.9	3.7	4.0	4.1
Twin Crises				
Number of Crises	33	7	10	16
Average Crises Per Year	2.0	1.5	1.8	2.7
Frequency of Crises	10.8	14.7	12.4	8.3

Table 1b. Regional distribution of local currency-denominated stock market crises and currency crises

	Asia	Latin America	Others
Stock Market Crises			
Number of Crises	38	23	24
Average Crises Per Year	2.2	1.3	1.6
Frequency of Crises	3.2	5.2	4.9
Currency Crises			
Number of Crises	31	29	31
Average Crises Per Year	1.8	1.7	2.1
Frequency of Crises	4.0	4.0	3.8
Twin Crises			
Number of Crises	16	10	6
Average Crises Per Year	0.9	0.6	0.5
Frequency of Crises	6.4	12.0	16.8

4.3. The time and regional distribution of the dollar-denominated stock market crises, currency crises and "twin" crises

Tables 2a and 2b show the time distribution and regional distribution of the dollar-denominated stock market crises, currency crises and "twin" crises. A total of 86 stock market crises (6.0 percent of observations), 91 currency crises (6.3 percent of observations), and 42 "twin" crises (2.9 percent of observations) are identified in the sample period 1984.I-2001.IV.

As can be seen from Tables 1a, 1b, 2a, and 2b, the time distribution and regional distribution of the dollar-denominated stock market crises is not much different than the local currency-denominated stock market crises. However, the number and the regional distribution of "twin" crises show significant differences. First, the number of "twin" crises increased from 33 to 42 in our sample periods 1984.I-2001.IV. Others have the highest increase with 50 percent, followed by the Latin America with 20 percent. It is obvious that using the dollar-denominated stock market index to define stock market crises will increase "twin" crises because a huge depreciation decreases the dollar-denominated stock

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[10] The Latin American countries included are Argentina, Brazil., Chile, Columbia, Mexico, Peru, and Venezuela. Asian countries included are Indonesia, Korea, Malaysia, Philippines, Thailand, India, and Pakistan. Other countries included are Greece, Portugal, Turkey, Nigeria, South Africa and Jordan.

market index[11] while it leaves the local currency-denominated stock market index unchanged. In this scenario, we identify a dollar-denominated stock market crisis and a "twin" crisis but we could not identify a local currency-denominated stock market crisis and a "twin" crisis. Second, dollar-denominated "twin" crises are equally distributed among all the regions contrast to local currency-denominated "twin" crises.

Table 2a. Time distribution of dollar-denominated stock market crises andcurrency crises

	1984-2001	1984-1989	1990-1995	1996-2001
Stock Market Crises				
Number of Crises	86	18	26	37
Average Crises Per Year	5.2	3.8	4.8	6.8
Frequency of Crises	4.2	5.7	4.6	3.2
Currency Crises				
Number of Crises	91	28	31	32
Average Crises Per Year	5.4	5.3	5.5	5.3
Frequency of Crises	3.9	3.7	4.0	4.1
Twin Crises				
Number of Crises	42	7	14	21
Average Crises Per Year	2.6	1.5	2.5	3.5
Frequency of Crises	8.5	14.7	8.9	6.3

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[11] In this scenario, it is assumed that local currency-denominated stock market index unchanged. Therefore, decrease in the dollar-dominated stock market reflects pure currency depreciation.

Table 2b. Regional distribution of dollar-denominated stock market crises andcurrency crises

	Asia	Latin America	Others
Stock Market Crises			
Number of Crises	32	28	26
Average Crises Per Year	1.9	1.6	1.8
Frequency of Crises	3.8	4.3	4.5
Currency Crises			
Number of Crises	31	29	31
Average Crises Per Year	1.8	1.7	2.1
Frequency of Crises	4.0	4.0	3.8
Twin Crises			
Number of Crises	16	12	14
Average Crises Per Year	0.9	0.7	0.9
Frequency of Crises	7.5	10.0	8.4

4.4. Performance of crises as a predictor of each other

Kaminsky and Reinhart (1999) and Glick and Hutckinson (2001) used the signal approach to link banking crises and currency crises. In this section, the same procedure is adopted to discuss the link between stock market and currency crises, the method of Kaminsky and Reinhart (1999) is followed.

The following matrix is used to measure the performance of stock market crises and currency crises as predictors of each other.

	Currency Crisis (t)	No Currency Crisis (t)
Stock Market Crisis (t)	A (t)	B (t)
No Stock Market Crisis (t)	C (t)	D (t)

A(t) is the number of instances in which a stock market crisis issues a signal in a particular quarter t and a currency crisis occurred in quarter t (i.e. A(t) is the number of quarters the stock market crisis provides "good signal" about the occurrence of currency crisis). B(t) is the number of instances in which a stock market crisis issues a signal in

a particular quarter t and a currency crisis did not occur in quarter t (i.e. B(t) is the number of quarters the stock market crisis provide "bad signal" or "noise" about the occurrence of currency crises). C(t) is the number of instances in which a stock market crisis did not issue a signal in a particular quarter t when there was a currency crisis in quarter t (i.e. C(t) is the number of quarters the stock market crisis did not provide a good signal about the occurrence of currency crises). D(t) is the number of instances in which a stock market crisis did not issue a signal in a particular quarter t when there was no currency crisis in quarter t (i.e. D(t) is the number of quarters in which neither a stock market crisis or currency crises occurred). It is obvious from the above matrix that the perfect predictor will produce only observations A and D.

Table 3a shows the local currency-denominated stock market crises in quarter t, which followed by currency crises in quarter (t-1), t and (t+1). The first column shows the number of the local currency-denominated stock market crises. The second, third and fourth columns show whether the local currency-denominated stock market crises in quarter t was accompanied by a currency crisis one period before, contemporaneously and one period ahead, respectively. The last column shows the predictive power of stock market crises[12]. Table 3b shows whether currency crises in quarter t are accompanied by local currency-denominated stock market crises quarter in (t-1), t and (t+1).

Based on the comparison of tables 3a and 3b, we can reach several conclusions.

The percentage of local currency-denominated stock market crises associated with currency crises at time t-1, t and t+1 is 7 percent, 22 percent and 10 percent, respectively. The percentage of currency crises associated with local currency-denominated stock market crises at time t-1, t and t+1 is 10 percent, 21 percent and 7 percent, respectively. Based on Tables 3a and 3b, we can conclude that both crises appear to occur at the same time and the local currency-denominated stock market crises slightly lead currency crises rather than vice-versa[13]. The last columns show that the predictive power of local currency-denominated stock

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market crises about the onset of currency crises (33 percent) is higher than the predictive power of currency crises (27 percent). In Asia, the predictive power of local currency-denominated stock market crises (34 percent) is lower than the predictive power of currency crises (40 percent). In Latin America, the predictive power of local currency-denominated stock market crises (34 percent) is higher than the predictive power of currency crises (30 percent).

Table 3a. Local Currency-Denominated Stock Market Crises as a Predictor of Currency Crises

	Number of Stock Market Crises	Number (**Percentage**) of Stock Market Crises Accompanied by Currency Crises			Stock Market Crises Predicting Currency Crises
		A (t-1)	A (t)	A (t+1)	A (t,t+1))
All Countries	86	6 (**7**)	19 (**22**)	9 (**10**)	28 (**33**)
Asia	38	2 (**5**)	10 (**26**)	4 (**8**)	14 (**34**)
Latin America	23	2 (**8**)	7 (**30**)	1 (**4**)	8 (**34**)
Others	20	2 (**8**)	2 (**8**)	4 (**17**)	6 (**25**)

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[12] Number of stock market crises was accompanied by currency crises at time t and (t+1).

[13] Tables 3a and 3b show that the percentage of local currency-denominated stock market crises preceding a currency crisis (10 percent) is higher than the percentage of currency crises preceding a local currency-dominated stock market crisis (7 percent).

Table 3b. Currency Crises as a Predictor of Local Currency-Denominated Stock Market Crises

	Number of Currency Crises	Number (**Percentage**) of Currency Crises Accompanied by Stock Market Crises			Currency Crises Predicting Stock Market Crises
		A (t-1)	A (t)	A (t+1)	A (t,t+1))
All Countries	91	9 (**10**)	19 (**21**)	6 (**7**)	25 (**27**)
Asia	31	4 (**13**)	10 (**33**)	2 (**7**)	12 (**40**)
Latin America	29	1 (**3**)	7 (**23**)	2 (**7**)	9 (**30**)
Others	31	4 (**13**)	2 (**6**)	2 (**6**)	4 (**13**)

Tables 4a and 4b show the performance of the dollar-denominated stock market crises and currency crises as predictors of each other. The percentage of the dollar-dominated stock market crises associated with currency crises at time t-1, t and t+1 are 6 percent, 32 percent and 12 percent, respectively. The percentage of currency crises associated with dollar-denominated stock market crises at time t-1, t and t+1 are 11 percent, 31 percent and 6 percent, respectively. Based on Tables 4a and 4b, one concludes that both crises appear to occur at the same time and the dollar-denominated stock market crises lead currency crises rather than vice-versa. The last columns show that the predictive power of the dollar-denominated stock market crises (44 percent) is higher than the predictive power of currency crises (36 percent).

It can be seen from the last columns of the Tables 3a and 4a that the predictive power of dollar-denominated stock market crises (44 percent) is higher than the predictive power of local currency-dominated stock market crises (33 percent). Also, the predictive power of currency crises (36 percent)) is higher than the predictive power of currency crises (27 percent) as can be seen from the last columns of Tables 3b and 4b. It is clear that sharp currency depreciation can decrease the dollar-denominated stock market index while leaving local currency-denominated stock market index unchanged. Therefore, we can identify

more "twin" crises when we use dollar-denominated stock market index.

Table 4a. Dollar-Denominated Stock Market Crises as a Predictor of Currency Crises

	Number of Stock Market Crises	Number (**Percentage**) of Stock Market Crises Accompanied by Currency Crises			Stock Market Crises Predicting Currency Crises
		A (t-1)	A (t)	A (t+1)	A (t,t+1))
All Countries	86	5 (**6**)	28 (**32**)	10 (**12**)	38 (**44**)
Asia	32	1 (**3**)	12 (**38**)	3 (**9**)	15 (**47**)
Latin America	28	2 (**7**)	9 (**32**)	1 (**4**)	10 (**36**)
Others	26	2 (**8**)	7 (**27**)	6 (**23**)	13 (**50**)

Table 4b. Currency Crises as a Predictor of Dollar-Denominated Stock Market Crises

	Number of Currency Crises	Number (**Percentage**) of Currency Crises Accompanied by Stock Market Crises			Currency Crises Predicting Stock Market Crises
		A (t-1)	A (t)	A (t+1)	A (t,t+1))
All Countries	91	10 (**11**)	28 (**31**)	5 (**6**)	33 (**36**)
Asia	31	3 (**10**)	12 (**40**)	1 (**3**)	13 (**43**)
Latin America	29	1 (**3**)	9 (**30**)	2 (**6**)	11 (**36**)
Others	31	6 (**19**)	7 (**23**)	2 (**6**)	9 (**29**)

4.5. Performance of crises as a signal of each other

Tables 5a and 5b are constructed from the previous matrix. Tables 5a and 5b report calculations of the noise-to-signal ratio associated with

the local currency-dominated stock market crises and currency crises. The noise-to-signal ratio for currency crises (the local currency-denominated stock market crises) is calculated by dividing number of bad signals issued by the local currency-denominated stock market crises (currency crises) as a percentage of number of quarters where bad signals could have been issued, by the number of good signals issued by the local currency-denominated stock market crises (currency crises) as a percentage of the number of quarters where a good signal could have been issued[14]. An increase in good signals and decrease in bad signals (noise) lowers the above ratio therefore we prefer lower noise-to-signal ratio.

Tables 5a and 5b show that the contemporaneous (t) noise-to-signal ratios are lower than the leading (t+1) noise-to-signal ratios. Also, the contemporaneous noise-to-signal ratio of currency crises and the local currency-denominated stock market crises are not much different from each other both for the full sample and regional. However, for Asia (Latin America) the leading (t+1) noise-to-signal ratio of stock market crises is higher (lower) than currency crises. The overall performance of the local currency-denominated stock market crises (currency crises) as a signal of currency crises (the local currency-denominated stock market crises) can be seen from the last column of Tables 5a and 5b. All numbers are less than 1 implying that when local currency-denominated stock market crises occur currency crises are more likely than not and vice-versa.

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[14] Noise-to-Signal Ratio is [B/ (B+D)/ (A/A+C)], where B is the number of the local currency-denominated stock market crises not accompanied by a currency crises, (B+D) is the total number of quarters without a currency crises, A is the number of the local currency-dominated stock market crises accompanied by a currency crises and (A+C) is the total number of currency crises.

Table 5a. Performance of Local Currency-Denominated Stock Market Crises as a Signal of Currency Crises

	Noise-to-Signal Ratio of Currency Crises		
	t	t+1	(t) + (t+1)
All Countries	0.22	0.90	0.16
Asia	0.18	0.56	0.10
Latin America	0.15	1.46	0.12
Others	0.92	0.38	0.22

Table 5b. Performance of Currency Crises as a Signal of Local Currency-Denominated Stock Market Crises

	Noise-to-Signal Ratio of Stock Market Crises		
	t	t+1	(t) + (t+1)
All Countries	0.22	0.82	0.15
Asia	0.17	1.20	0.13
Latin America	0.17	0.70	0.12
Others	1.24	0.62	0.38

Tables 6a and 6b report calculation of the noise-to-signal ratio associated with dollar-denominated stock market crises and currency crises. In general, the noise-to-signal ratio associated with dollar-denominated stock market crises and currency crises are lower than the noise-to-signal ratio associated with local-denominated stock market crises and currency crises.

Table 6a. Performance of Dollar-Denominated Stock Market Crises as a Signal of Currency Crises

	Noise-to-Signal Ratio of Currency Crises		
	t	t+1	(t) + (t+1)
All Countries	0.13	0.70	0.09
Asia	0.11	0.62	0.08
Latin America	0.14	1.80	0.13
Others	0.13	0.30	0.07

Table 6b. Performance of Currency Crises as a Signal of Dollar-Denominated Stock Market Crises

	Noise-to-Signal Ratio of Stock Market Crises		
	t	t+1	(t) + (t+1)
All Countries	0.13	0.85	0.10
Asia	0.10	0.74	0.07
Latin America	0.14	0.87	0.12
Others	0.15	0.45	0.10

5. Summary And Conclusion

The main purpose of this study is to investigate individual and joint ("twin") occurrence of stock market and currency crises for 22 emerging economies over the 1984.I-2001.IV periods. In order to do that, we used descriptive statistics analysis.

First, the descriptive statistic analysis shows that the number and annual average (frequency) of stock market and "twin" crises have increased (decreased) over time while the number, average per year and frequency of currency crises tends to be stable. Over time increases in stock market crises can be explained by increases in stock market capitalization, trading and integration. Increases in "twin" crises are a result of increases in stock market crises. Also, Asia has the highest number and annual average of stock market and "twin" crises.

Second, descriptive statistic analysis indicates that most stock market and currency crises tend to occur simultaneously and stock market crises slightly lead currency crises rather than vice-versa. This can be seen as evidence in favor of the existence of contemporaneous relationship between stock market and currency crises. At the same time, we can conclude that the predictive power of the stock market crises on set currency crises are higher than the predictive power of currency crises on set stock market crises. Also, Asia has the highest performance of crises as a predictor of each other.

Finally, all the noise-to-signal ratios associated with stock market and currency crises are less than 1 implying that when stock market crises occur currency crises are more likely than not and vice-versa. The lowest noise-to-signal ratio in Asia indicates that Asia has the best performance of crises as a signal of each other.

Our finding is helpful for investors because investors can try to predict the stock market crises (currency crises) using the information about currency crises (stock market crises). However, descriptive statistics analysis shows that there is a link between stock market crises and currency crises; however, it has a few shortcomings. First, it deals with each variable separately and therefore ignores correlations between variables. Second, there is no test to assess the statistical significance of the results based on the descriptive statistics.

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