

Measuring and Forecasting Financial Stability

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„Twin Crisis: An Examination of the Empirical Links“

Twin Crises: An Examination of the Empirical Links

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First Draft

1 Motivation

- Twin crises refer to the association of banking crises with currency crises.
- Well-known episodes include Chile in 1982, Finland in 1992, Sweden in 1992, Mexico in 1994, 1997 Asian financial crisis, and 2001 Argentinean and Turkish crises.
- Empirical research on twin crises is rather rare.
- Kaminsky and Reinhart (1996, 1999); Glick and Hutchison (2001); Eichengreen and Bordo (2002); Saxena (2004); Hutchison and Noy (2005)

- The conventional approach uses large and visible market events to identify crisis episodes.
- However, the literature has long noted that relying on market events to identify crises is not satisfactory.
- Eichengreen, Rose and Wyplosz (1995) in the context of currency crises; von Hagen and Ho (2007) in the context of banking 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.
- I skip the review on the theoretical causal linkages between banking crises and currency crises, as well as the review on empirical studies.
- The current conclusion is: banking crises lead currency crises; lagged banking crises help to predict currency crises.
- Twin crises are more severe in terms of output losses and more prolonged than banking or currency crises separately (Breuer, 2004).

2 Defining Currency and Banking Crises

- An index of foreign exchange market pressure:

$$EMP_{j,t} = \frac{(\Delta q_{j,t}/q_{j,t})}{\sigma_{q,j}} - \frac{(\Delta FR_{j,t}/FR_{j,t}) - (\Delta FR_t^*/FR_t^*)}{\sigma_{FR,j}} + \frac{\Delta(i_{j,t} - i_t^*)}{\sigma_{i,j}} \quad (1)$$

- 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.

- An index of money market pressure:

$$IMP_{j,t} = \frac{\Delta\gamma_{j,t}}{\sigma_{\gamma,j}} + \frac{\Delta r_{j,t}}{\sigma_{r,j}} \quad (2)$$

- 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.
- We define twin crises as instances in which a bank crisis is accompanied by a currency crisis in either the previous, current, or following year.

3 The Incidence of Twin Crises: Descriptive Evidence

- CD-ROM version of the IMF's International Financial Statistics.
- 49 countries over the period 1980-2004.
- Sample countries and crisis dates: Tables 1, 2, 3, and 4.

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

Groups	Signal-to-noise ratio								
	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

Groups	Signal-to-noise ratio								
	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.

4 Empirical Models of Banking and Currency Crises

- Multivariate probit models for currency crises and banking crises:

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

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

- We use a set of macroeconomic control variables commonly employed in empirical studies of currency and banking crises, see Table 15.

- The results for currency crises are reported in Table 16.
- Periods of sudden stop are strongly associated with currency crises.
- We also find that past banking crises do not help predict the occurrence of currency crises.
- The results for banking crises are reported in Table 17.
- Sudden stop is an important explanatory variable to currency crises in developing countries and emerging markets.

- 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.
- A simultaneous equation model for both types of crises together:

$$y_{1,j,t}^* = \gamma_1 y_{2,j,t}^* + \beta_1' X_{1,j,t} + u_{1,j,t} \quad (5)$$

$$y_{2,j,t}^* = \gamma_2 y_{1,j,t}^* + \beta_2' X_{2,j,t} + u_{2,j,t} \quad (6)$$

$$y_{j,t} = \begin{cases} 1, & \text{if } y_{j,t}^* > 0 \\ 0, & \text{otherwise} \end{cases}, \quad j = 1, 2$$

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

- Table 18 reports the results of simultaneous probit regression based on model (5) and (6).
- 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.

5 Contrasting to the literature

- Twin crises were most frequent in the early 1980s. They are not a new problem of the 1990s.
- The number and frequency of banking crises and twin crises has not increased over time.
- Currency crises are more frequent in industrialized countries than in developing countries and in emerging markets.
- 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.
- 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.