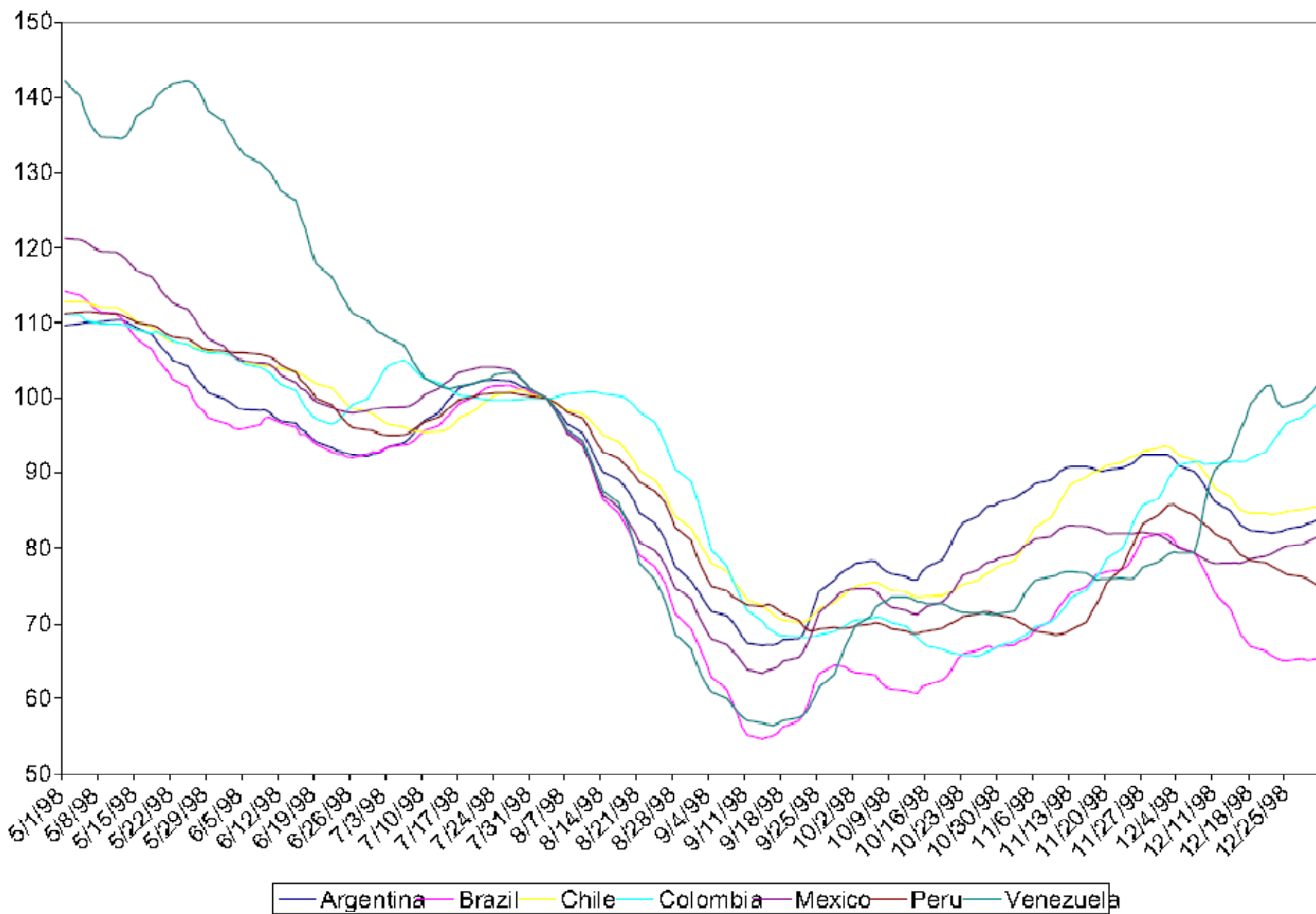
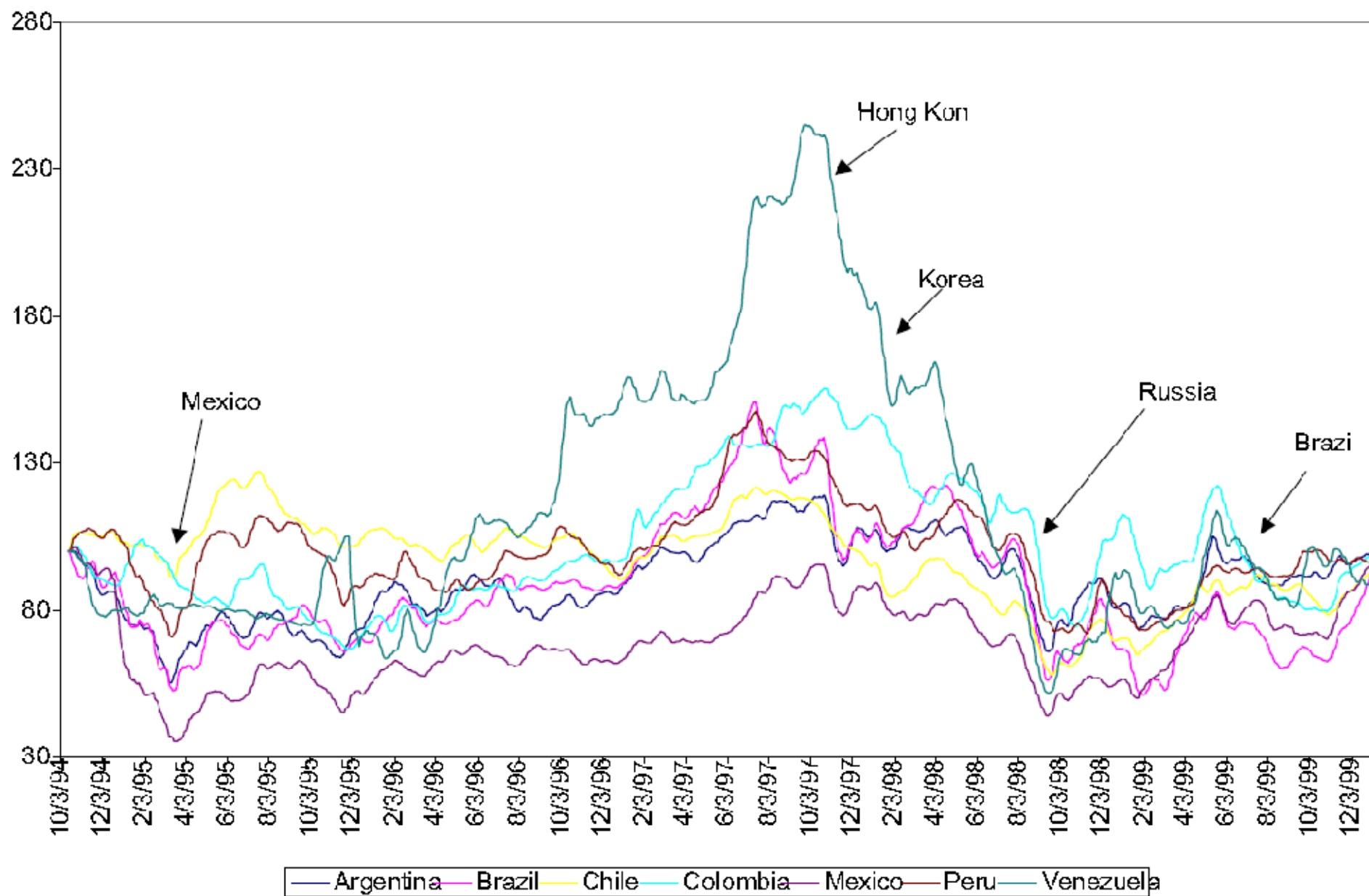


EE 459: Seminar in International  
Economics

**Financial Contagion**

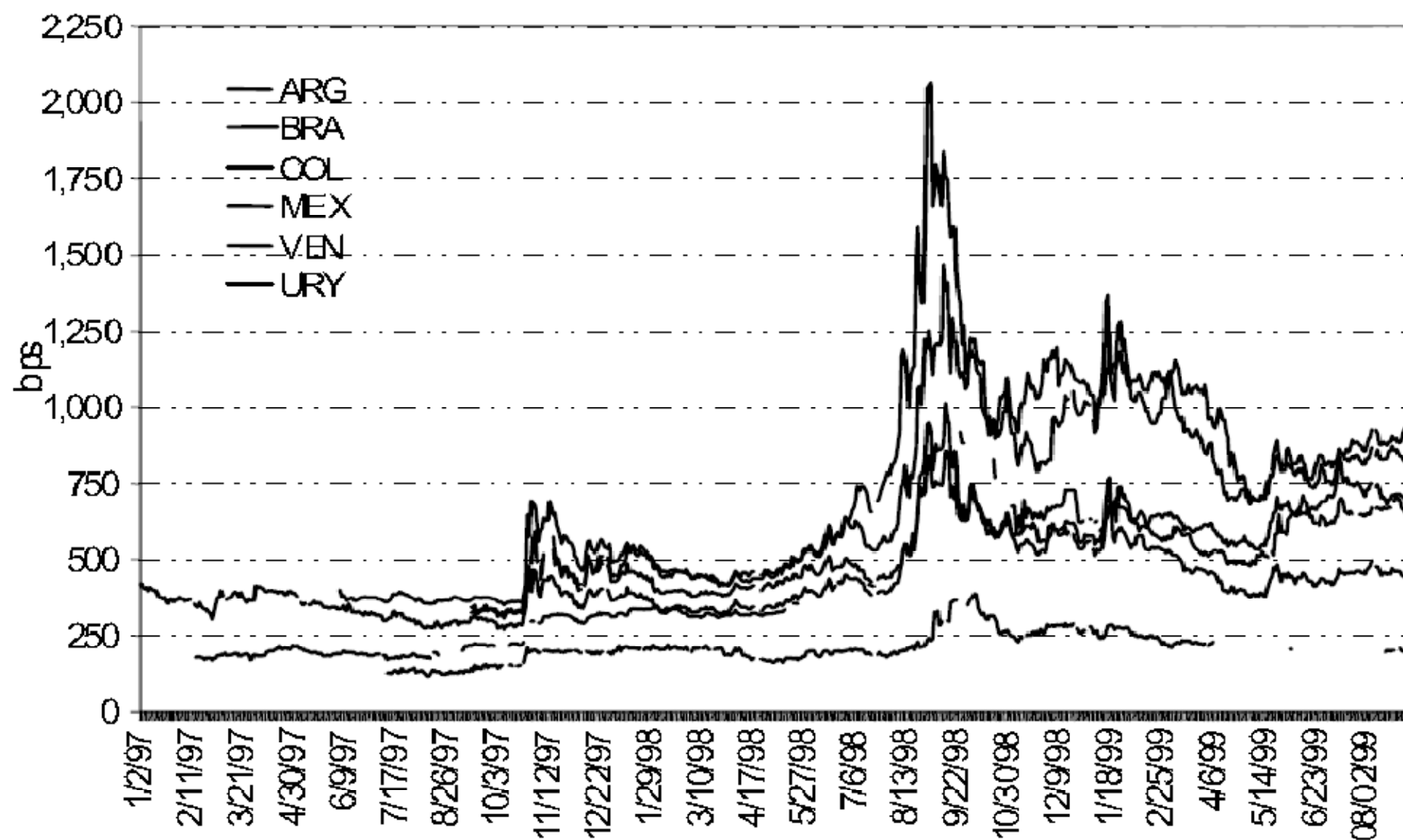
# Latin American Stock Markets





# Stable Relative Valuations

## Spread on Long-term Sovereign Bonds



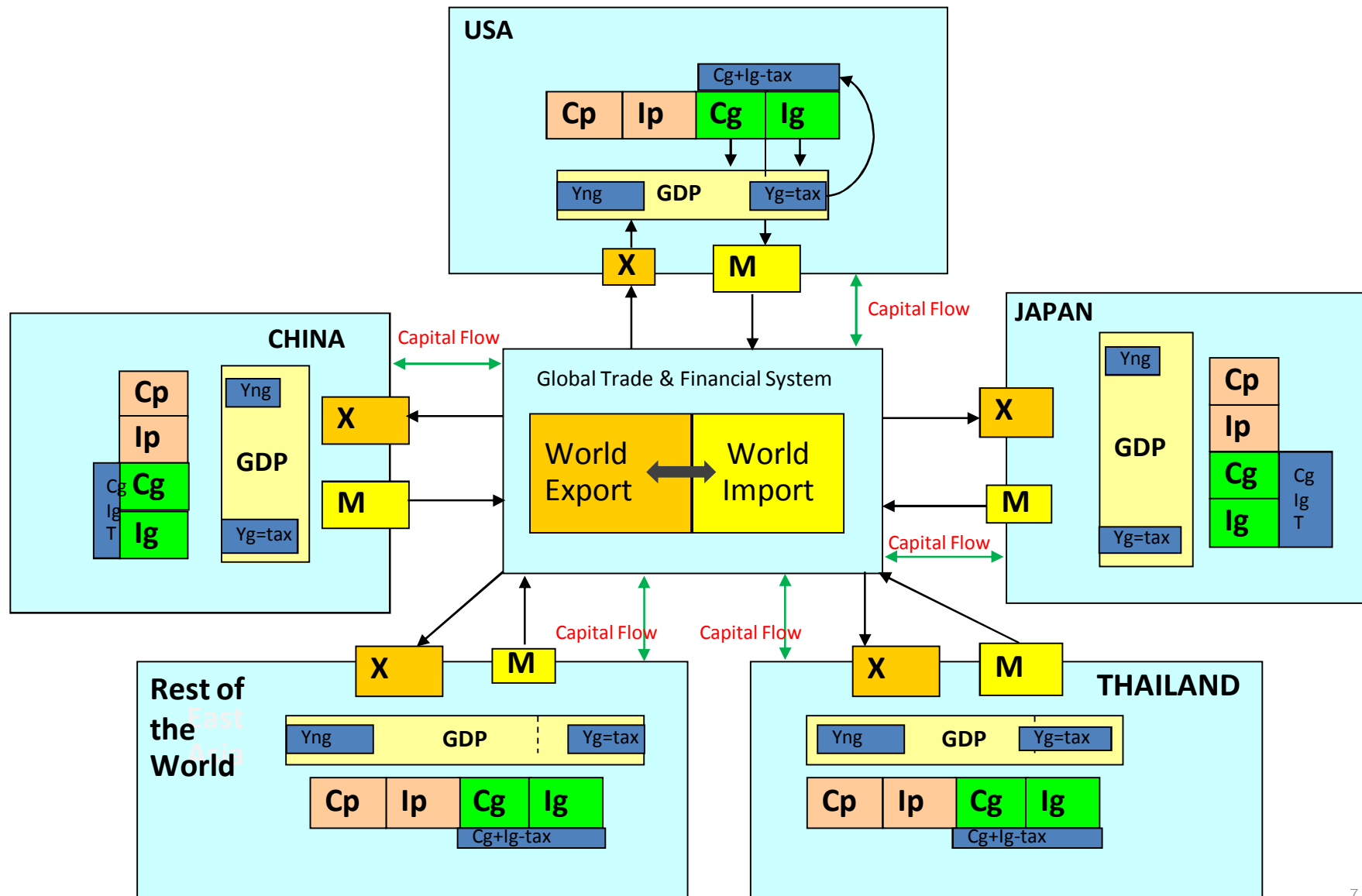
|     | Arg  | Bra  | Bul  | Ecu  | Mex  | Mor  | Nig  | Pan  | Per  | Phi  | Pol  | Rus  | Ven  |
|-----|------|------|------|------|------|------|------|------|------|------|------|------|------|
| Arg | 1.00 | 0.99 | 0.96 | 0.98 | 0.99 | 0.99 | 0.99 | 0.98 | 0.99 | 0.96 | 0.97 | 0.87 | 0.97 |
| Bra |      | 1.00 | 0.93 | 0.98 | 0.97 | 0.99 | 0.99 | 0.98 | 0.99 | 0.97 | 0.95 | 0.92 | 0.99 |
| Bul |      |      | 1.00 | 0.95 | 0.96 | 0.95 | 0.94 | 0.92 | 0.94 | 0.87 | 0.89 | 0.81 | 0.92 |
| Ecu |      |      |      | 1.00 | 0.97 | 0.98 | 0.97 | 0.97 | 0.98 | 0.94 | 0.92 | 0.93 | 0.98 |
| Mex |      |      |      |      | 1.00 | 0.97 | 0.97 | 0.97 | 0.98 | 0.93 | 0.96 | 0.84 | 0.95 |
| Mor |      |      |      |      |      | 1.00 | 0.98 | 0.99 | 0.99 | 0.94 | 0.94 | 0.90 | 0.97 |
| Nig |      |      |      |      |      |      | 1.00 | 0.98 | 0.99 | 0.97 | 0.97 | 0.89 | 0.98 |
| Pan |      |      |      |      |      |      |      | 1.00 | 0.99 | 0.96 | 0.96 | 0.89 | 0.97 |
| Per |      |      |      |      |      |      |      |      | 1.00 | 0.96 | 0.96 | 0.91 | 0.98 |
| Phi |      |      |      |      |      |      |      |      |      | 1.00 | 0.97 | 0.89 | 0.96 |
| Pol |      |      |      |      |      |      |      |      |      |      | 1.00 | 0.80 | 0.93 |
| Rus |      |      |      |      |      |      |      |      |      |      |      | 1.00 | 0.95 |
| Ven |      |      |      |      |      |      |      |      |      |      |      |      | 1.00 |

Table 1: Correlations in Stripped Yields on Brady Bonds for select Emerging Markets

|     | Arg  | Bra  | Chl   | Ecu   | Egy   | Hun   | Mex   | Mor   | Per   | Phi   | Pol   | Rus  | Ven   |
|-----|------|------|-------|-------|-------|-------|-------|-------|-------|-------|-------|------|-------|
| Arg | 1.00 | 0.78 | -0.14 | -0.31 | 0.48  | 0.78  | 0.71  | 0.38  | 0.41  | -0.26 | 0.57  | 0.76 | 0.54  |
| Bra |      | 1.00 | 0.08  | -0.12 | 0.80  | 0.88  | 0.27  | 0.53  | 0.62  | -0.20 | 0.43  | 0.87 | 0.52  |
| Chl |      |      | 1.00  | 0.63  | 0.04  | -0.28 | -0.06 | -0.59 | 0.73  | 0.70  | -0.22 | 0.31 | 0.43  |
| Ecu |      |      |       | 1.00  | -0.17 | -0.42 | -0.07 | -0.60 | 0.43  | 0.45  | -0.30 | 0.14 | 0.36  |
| Egy |      |      |       |       | 1.00  | 0.78  | -0.08 | 0.66  | 0.43  | -0.23 | 0.20  | 0.74 | 0.29  |
| Hun |      |      |       |       |       | 1.00  | 0.24  | 0.75  | 0.31  | -0.47 | 0.51  | 0.70 | 0.34  |
| Mex |      |      |       |       |       |       | 1.00  | -0.16 | 0.25  | -0.02 | 0.45  | 0.56 | 0.48  |
| Mor |      |      |       |       |       |       |       | 1.00  | -0.13 | -0.73 | 0.14  | 0.13 | -0.24 |
| Per |      |      |       |       |       |       |       |       | 1.00  | 0.32  | 0.12  | 0.75 | 0.69  |
| Phi |      |      |       |       |       |       |       |       |       | 1.00  | 0.07  | 0.02 | 0.25  |
| Pol |      |      |       |       |       |       |       |       |       |       | 1.00  | 0.50 | 0.38  |
| Rus |      |      |       |       |       |       |       |       |       |       |       | 1.00 | 0.90  |
| Ven |      |      |       |       |       |       |       |       |       |       |       |      | 1.00  |

Table 2: Correlations in Stock Market Returns for select Emerging Markets

# Structure of Global Linkages



# Contagion through Financial Markets

- A strong correlation of weekly stock market returns in country A and returns in neighboring countries will give an indication whether private investors' behavior in A contaminates investors' attitude in the other countries.
- Obviously, other factors (e.g., fundamentals and incentive policies) have to be taken into account to correct for their influence in investors' decision



# Contagion through International Trades

- Another line of contagion process is through trade activities (competitive devaluation), e.g., when China devalued Yuan in 1994, currency pressures were detected throughout the region, especially in those countries that have similar trade patterns with China (the collapse of the Thai's baht could be the result of a contagion from the yuan devaluation).
- Subsequently, the collapse of the rupiah, peso and ringgit was the result of contagion from the baht's devaluation.

# Studies of Contagion

- The key factor in the argument is the similarity of economic-cum-trade structures (composition and destination (i.e., Singapore is not infected by the contagion because it has a markedly different trade structure than other Southeast Asian countries)).
- But some Southeast Asian countries, e.g., Malaysia, had a similar composition of exports and destination with another crisis stricken country, i.e., Korea (semiconductors & capital goods, and apparel & household goods).
- Furthermore, for the same market, e.g., the U.S market, these two countries' trade composition moves to the same direction: rising semiconductors and declining share of apparel and household goods.

# Financial Market Contagion in the Asian Crisis

TAIMUR BAIG and ILAN GOLDFAJN\*

*This paper tests for evidence of contagion between the financial markets of Thailand, Malaysia, Indonesia, Korea, and the Philippines. We find that correlations in currency and sovereign spreads increase significantly during the crisis period, whereas the equity market correlations offer mixed evidence. We construct a set of dummy variables using daily news to capture the impact of own-country and cross-border news on the markets. We show that after controlling for own country news and other fundamentals, there is evidence of cross-border contagion in the currency and equity markets. [JEL F30, F40, G15]*

# **Financial Market Contagion in the Asian Crisis**

*TAIMUR BAIG and ILAN GOLDFAJN\**

## **I. Overview of Trade Share**

## **II. Financial Market Correlations (Evidence and Tests)**

- Currency Market Correlations
- Stock Market Correlations
- Interest Rate Correlations
- Sovereign Spread Correlations
- VAR Analysis

## **III. Testing for Significant Increase in Correlations**

- Crisis Countries

# I. Overview of Trade Share

Table 1. Export Share of the Asia-5 in 1997

*(As a percentage of total exports)*

|             | Thailand | Malaysia | Philippines | Indonesia | Korea | United States | Japan |
|-------------|----------|----------|-------------|-----------|-------|---------------|-------|
| Thailand    | —        | 4.6      | 1.2         | 2.0       | 1.8   | 19.8          | 15.0  |
| Malaysia    | 3.7      | —        | 1.3         | 1.5       | 3.2   | 18.3          | 12.4  |
| Philippines | 2.4      | 3.0      | —           | 0.4       | 1.8   | 34.7          | 16.1  |
| Indonesia   | 1.7      | 2.4      | 1.4         | —         | 7.1   | 16.3          | 24.7  |
| Korea       | 2.0      | 3.1      | 1.6         | 2.9       | —     | 16.6          | 10.6  |

Source: IMF, *Direction of Trade Statistics Quarterly*.

## **II. Financial Market Correlations (Evidence and Tests)**

- Currency Market Correlations
- Stock Market Correlations
- Interest Rate Correlations
- Sovereign Spread Correlations
- VAR Analysis

**Table 2. Exchange Rate Correlation**  
*(Full sample and rolling panel with three-month window)*

**7/1/1997 to 5/18/1998 (full sample) LR Test: 37.38\*\***

|             | Indonesia | Korea | Malaysia | Philippines |
|-------------|-----------|-------|----------|-------------|
| Korea       | 0.25      | —     | —        | —           |
| Malaysia    | 0.36      | 0.10  | —        | —           |
| Philippines | 0.26      | 0.14  | 0.28     | —           |
| Thailand    | 0.28      | 0.10  | 0.35     | 0.31        |

**7/1/1997 to 9/30/1997 LR Test: 5.11**

|             | Indonesia | Korea | Malaysia | Philippines |
|-------------|-----------|-------|----------|-------------|
| Korea       | -0.01     | —     | —        | —           |
| Malaysia    | 0.28      | -0.10 | —        | —           |
| Philippines | 0.08      | 0.10  | 0.27     | —           |
| Thailand    | 0.01      | -0.12 | 0.05     | -0.22       |

**8/1/1997 to 10/31/1997 LR Test: 5.79**

|             | Indonesia | Korea | Malaysia | Philippines |
|-------------|-----------|-------|----------|-------------|
| Korea       | 0.05      | —     | —        | —           |
| Malaysia    | 0.38      | -0.09 | —        | —           |
| Philippines | 0.12      | 0.11  | 0.08     | —           |
| Thailand    | 0.04      | -0.06 | 0.22     | -0.01       |

**9/1/1997 to 11/30/1997 LR Test: 11.66**

|             | Indonesia | Korea | Malaysia | Philippines |
|-------------|-----------|-------|----------|-------------|
| Korea       | 0.02      | —     | —        | —           |
| Malaysia    | 0.60      | 0.03  | —        | —           |
| Philippines | -0.01     | 0.09  | 0.07     | —           |
| Thailand    | 0.03      | -0.10 | 0.20     | 0.04        |

**10/1/1997 to 12/31/1997 LR Test: 18.08\***

|             | Indonesia | Korea | Malaysia | Philippines |
|-------------|-----------|-------|----------|-------------|
| Korea       | 0.53      | —     | —        | —           |
| Malaysia    | 0.31      | 0.05  | —        | —           |
| Philippines | 0.30      | 0.16  | 0.06     | —           |
| Thailand    | 0.17      | 0.14  | 0.23     | 0.46        |

**11/1/1997 to 1/31/1998 LR Test: 16.81\***

|             | Indonesia | Korea | Malaysia | Philippines |
|-------------|-----------|-------|----------|-------------|
| Korea       | 0.28      | —     | —        | —           |
| Malaysia    | 0.12      | 0.14  | —        | —           |
| Philippines | 0.30      | 0.20  | 0.48     | —           |
| Thailand    | 0.19      | 0.16  | 0.36     | 0.62        |

**12/1/1997 to 2/28/1998 LR Test: 25.08\*\***

|             | Indonesia | Korea | Malaysia | Philippines |
|-------------|-----------|-------|----------|-------------|
| Korea       | 0.28      | —     | —        | —           |
| Malaysia    | 0.31      | 0.11  | —        | —           |
| Philippines | 0.39      | 0.23  | 0.40     | —           |
| Thailand    | 0.39      | 0.21  | 0.58     | 0.75        |

**1/1/1998 to 3/31/1998 LR Test: 26.03\*\***

|             | Indonesia | Korea | Malaysia | Philippines |
|-------------|-----------|-------|----------|-------------|
| Korea       | 0.16      | —     | —        | —           |
| Malaysia    | 0.35      | 0.22  | —        | —           |
| Philippines | 0.45      | 0.23  | 0.53     | —           |
| Thailand    | 0.49      | 0.08  | 0.57     | 0.63        |

**2/1/1998 to 4/30/1998 LR Test: 26.34\*\***

|             | Indonesia | Korea | Malaysia | Philippines |
|-------------|-----------|-------|----------|-------------|
| Korea       | 0.09      | —     | —        | —           |
| Malaysia    | 0.57      | 0.04  | —        | —           |
| Philippines | 0.30      | 0.02  | 0.40     | —           |
| Thailand    | 0.45      | -0.06 | 0.51     | 0.59        |

Notes: LR test attempts to reject the null that all pairwise correlations are zero. One and two asterisks imply rejection at the 10 percent and 5 percent level, respectively.

**Table 3. Stock Index Correlation**  
*(Full sample and rolling panel with three-month window)*

| <b>7/1/1997 to 5/18/1998 (full sample) LR Test: 60.53**</b> |           |       |          |             |
|-------------------------------------------------------------|-----------|-------|----------|-------------|
|                                                             | Indonesia | Korea | Malaysia | Philippines |
| Korea                                                       | 0.09      | —     | —        | —           |
| Malaysia                                                    | 0.45      | 0.26  | —        | —           |
| Philippines                                                 | 0.44      | 0.16  | 0.38     | —           |
| Thailand                                                    | 0.38      | 0.23  | 0.39     | 0.27        |

| <b>7/1/1997 to 9/30/1997 LR Test: 13.37</b> |           |       |          |             |
|---------------------------------------------|-----------|-------|----------|-------------|
|                                             | Indonesia | Korea | Malaysia | Philippines |
| Korea                                       | 0.11      | —     | —        | —           |
| Malaysia                                    | 0.37      | 0.11  | —        | —           |
| Philippines                                 | 0.43      | 0.06  | 0.23     | —           |
| Thailand                                    | 0.38      | -0.05 | 0.19     | -0.03       |

| <b>8/1/1997 to 10/31/1997 LR Test: 27.17**</b> |           |       |          |             |
|------------------------------------------------|-----------|-------|----------|-------------|
|                                                | Indonesia | Korea | Malaysia | Philippines |
| Korea                                          | 0.23      | —     | —        | —           |
| Malaysia                                       | 0.48      | 0.09  | —        | —           |
| Philippines                                    | 0.61      | 0.15  | 0.35     | —           |
| Thailand                                       | 0.57      | 0.19  | 0.40     | 0.26        |

| <b>9/1/1997 to 11/30/1997 LR Test: 23.85**</b> |           |       |          |             |
|------------------------------------------------|-----------|-------|----------|-------------|
|                                                | Indonesia | Korea | Malaysia | Philippines |
| Korea                                          | 0.07      | —     | —        | —           |
| Malaysia                                       | 0.52      | 0.24  | —        | —           |
| Philippines                                    | 0.52      | 0.15  | 0.27     | —           |
| Thailand                                       | 0.41      | 0.30  | 0.35     | 0.28        |

| <b>10/1/1997 to 12/31/1997 LR Test: 21.80**</b> |           |       |          |             |
|-------------------------------------------------|-----------|-------|----------|-------------|
|                                                 | Indonesia | Korea | Malaysia | Philippines |
| Korea                                           | 0.05      | —     | —        | —           |
| Malaysia                                        | 0.46      | 0.31  | —        | —           |
| Philippines                                     | 0.47      | 0.14  | 0.35     | —           |
| Thailand                                        | 0.26      | 0.46  | 0.33     | 0.39        |

| <b>11/1/1997 to 1/31/1998 LR Test: 27.56**</b> |           |       |          |             |
|------------------------------------------------|-----------|-------|----------|-------------|
|                                                | Indonesia | Korea | Malaysia | Philippines |
| Korea                                          | 0.02      | —     | —        | —           |
| Malaysia                                       | 0.51      | 0.32  | —        | —           |
| Philippines                                    | 0.51      | 0.18  | 0.40     | —           |
| Thailand                                       | 0.47      | 0.31  | 0.55     | 0.53        |

| <b>12/1/1997 to 2/28/1998 LR Test: 29.63**</b> |           |       |          |             |
|------------------------------------------------|-----------|-------|----------|-------------|
|                                                | Indonesia | Korea | Malaysia | Philippines |
| Korea                                          | 0.11      | —     | —        | —           |
| Malaysia                                       | 0.50      | 0.29  | —        | —           |
| Philippines                                    | 0.48      | 0.23  | 0.56     | —           |
| Thailand                                       | 0.47      | 0.23  | 0.70     | 0.52        |

| <b>1/1/1998 to 3/31/1998 LR Test: 36.14**</b> |           |       |          |             |
|-----------------------------------------------|-----------|-------|----------|-------------|
|                                               | Indonesia | Korea | Malaysia | Philippines |
| Korea                                         | 0.13      | —     | —        | —           |
| Malaysia                                      | 0.48      | 0.26  | —        | —           |
| Philippines                                   | 0.47      | 0.27  | 0.60     | —           |
| Thailand                                      | 0.46      | 0.17  | 0.69     | 0.51        |

| <b>2/1/1998 to 4/30/1998 LR Test: 17.23**</b> |           |       |          |             |
|-----------------------------------------------|-----------|-------|----------|-------------|
|                                               | Indonesia | Korea | Malaysia | Philippines |
| Korea                                         | 0.20      | —     | —        | —           |
| Malaysia                                      | 0.09      | 0.41  | —        | —           |
| Philippines                                   | 0.03      | 0.27  | 0.46     | —           |
| Thailand                                      | 0.18      | 0.26  | 0.51     | 0.36        |

Notes: LR test attempts to reject the null that all pairwise correlations are zero. Two asterisks imply rejection at the 5 percent level.



**Table 4. Sovereign Spreads Correlation**  
*(Full sample and rolling panel with three-month window)*

| <b>7/1/1997 to 5/18/1998 (full sample) LR Test: 538.95**</b> |           |       |          |             |
|--------------------------------------------------------------|-----------|-------|----------|-------------|
|                                                              | Indonesia | Korea | Malaysia | Philippines |
| Korea                                                        | 0.74      | —     | —        | —           |
| Malaysia                                                     | 0.91      | 0.69  | —        | —           |
| Philippines                                                  | 0.73      | 0.83  | 0.59     | —           |
| Thailand                                                     | 0.66      | 0.82  | 0.51     | 0.90        |

| <b>7/1/1997 to 9/30/1997 LR Test: 166.13**</b> |           |       |          |             |
|------------------------------------------------|-----------|-------|----------|-------------|
|                                                | Indonesia | Korea | Malaysia | Philippines |
| Korea                                          | 0.95      | —     | —        | —           |
| Malaysia                                       | 0.60      | 0.60  | —        | —           |
| Philippines                                    | 0.60      | 0.62  | 0.52     | —           |
| Thailand                                       | 0.92      | 0.89  | 0.58     | 0.76        |

| <b>8/1/1997 to 10/31/1997 LR Test: 211.44**</b> |           |       |          |             |
|-------------------------------------------------|-----------|-------|----------|-------------|
|                                                 | Indonesia | Korea | Malaysia | Philippines |
| Korea                                           | 0.95      | —     | —        | —           |
| Malaysia                                        | 0.13      | 0.17  | —        | —           |
| Philippines                                     | 0.75      | 0.89  | 0.30     | —           |
| Thailand                                        | 0.92      | 0.93  | 0.26     | 0.87        |

| <b>9/1/1997 to 11/30/1997 LR Test: 236.46**</b> |           |       |          |             |
|-------------------------------------------------|-----------|-------|----------|-------------|
|                                                 | Indonesia | Korea | Malaysia | Philippines |
| Korea                                           | 0.92      | —     | —        | —           |
| Malaysia                                        | 0.50      | 0.66  | —        | —           |
| Philippines                                     | 0.87      | 0.95  | 0.68     | —           |
| Thailand                                        | 0.95      | 0.97  | 0.62     | 0.94        |

| <b>10/1/1997 to 12/31/1997 LR Test: 136.56**</b> |           |       |          |             |
|--------------------------------------------------|-----------|-------|----------|-------------|
|                                                  | Indonesia | Korea | Malaysia | Philippines |
| Korea                                            | 0.89      | —     | —        | —           |
| Malaysia                                         | 0.66      | 0.76  | —        | —           |
| Philippines                                      | 0.60      | 0.56  | 0.19     | —           |
| Thailand                                         | 0.64      | 0.53  | 0.18     | 0.88        |

| <b>11/1/1997 to 1/31/1998 LR Test: 78.29**</b> |           |       |          |             |
|------------------------------------------------|-----------|-------|----------|-------------|
|                                                | Indonesia | Korea | Malaysia | Philippines |
| Korea                                          | 0.47      | —     | —        | —           |
| Malaysia                                       | 0.81      | 0.71  | —        | —           |
| Philippines                                    | 0.29      | -0.06 | 0.15     | —           |
| Thailand                                       | 0.65      | 0.16  | 0.56     | 0.46        |

| <b>12/1/1997 to 2/28/1998 LR Test: 58.86**</b> |           |       |          |             |
|------------------------------------------------|-----------|-------|----------|-------------|
|                                                | Indonesia | Korea | Malaysia | Philippines |
| Korea                                          | 0.09      | —     | —        | —           |
| Malaysia                                       | 0.69      | 0.14  | —        | —           |
| Philippines                                    | 0.53      | 0.50  | 0.08     | —           |
| Thailand                                       | 0.56      | 0.41  | 0.25     | 0.70        |

| <b>1/1/1998 to 3/31/1998 LR Test: 80.30**</b> |           |       |          |             |
|-----------------------------------------------|-----------|-------|----------|-------------|
|                                               | Indonesia | Korea | Malaysia | Philippines |
| Korea                                         | 0.19      | —     | —        | —           |
| Malaysia                                      | -0.09     | -0.54 | —        | —           |
| Philippines                                   | 0.57      | 0.69  | -0.63    | —           |
| Thailand                                      | 0.31      | 0.88  | -0.52    | 0.78        |

| <b>2/1/1998 to 4/30/1998 LR Test: 31.80**</b> |           |       |          |             |
|-----------------------------------------------|-----------|-------|----------|-------------|
|                                               | Indonesia | Korea | Malaysia | Philippines |
| Korea                                         | 0.16      | —     | —        | —           |
| Malaysia                                      | 0.50      | 0.06  | —        | —           |
| Philippines                                   | 0.16      | 0.03  | -0.42    | —           |
| Thailand                                      | 0.42      | 0.16  | 0.85     | -0.46       |

Notes: LR test attempts to reject the null that all pairwise correlations are zero. Two asterisks imply rejection at the 5 percent level.

# VAR Analysis

Table 5. Correlations Summary

| Exchange Rates                                                                                    | Stock Markets                                                                                              | Interest Rates                                                                      | Sovereign Spreads                                                                                                 |
|---------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------|
| From October onward, correlations between Indonesia and Korea increase substantially.             | The Malaysian and the Indonesian stock markets have the highest degree of correlation among all the pairs. | With the exception of the Philippines, all the countries had positive correlations. | From July to December 1997, the Philippines' spreads are strongly correlated with Thailand, Korea, and Indonesia. |
| Rolling correlations reveal high volatility.                                                      | In general, correlations are greater than the currency markets'.                                           |                                                                                     |                                                                                                                   |
| Indonesia and Malaysia are consistently correlated.                                               |                                                                                                            |                                                                                     |                                                                                                                   |
| In general, the Korean won is uncorrelated with the rest of the countries (exception: Indonesia). |                                                                                                            |                                                                                     |                                                                                                                   |

# VAR Analysis

Table 6. Impulse Response Summary  
(Response to one standard deviation innovation)

|                          | Exchange Rates |          |             |       |           |
|--------------------------|----------------|----------|-------------|-------|-----------|
|                          | Thailand       | Malaysia | Philippines | Korea | Indonesia |
| Shocks originating from: |                |          |             |       |           |
| Thailand                 | —              | +        | +           |       | +         |
| Malaysia                 | +              | —        | +           |       | +         |
| Philippines              | +              | +        | —           |       |           |
| Korea                    |                |          |             | —     |           |
| Indonesia                | +              | +        |             |       | —         |
|                          | Stock Markets  |          |             |       |           |
|                          | Thailand       | Malaysia | Philippines | Korea | Indonesia |
| Thailand                 | —              | +        | +           | +     | +         |
| Malaysia                 | +              | —        | +           |       | +         |
| Philippines              | +              | +        | —           |       | +         |
| Korea                    | +              |          |             | —     |           |
| Indonesia                | +              | +        | +           |       | —         |

Note: Only significant results are reported; we omit the country responses to own shocks.

# VAR Analysis

- For a given country, the sample starts from the day that country's currency peg unraveled and ends on May 18, 1998.
- Running a five-variable VAR for the exchange rates, obtain the estimated impulse response function for the shocks originating from the given country, and then do the same for the stock market data.
- Choosing a lag length of one day, and do not find improvement in our model by including more lags.
- This exercise was repeated for all five countries, giving a total of ten impulse responses.

# VAR Analysis

- The impulse responses show that shocks originating from Thailand's currency market have a significant impact on the markets of Malaysia, Indonesia, and the Philippines.
- A depreciation of the baht led to an immediate depreciation of the currencies in these countries. The impact of the shocks tends to disappear after about four days.
- In the stock market, Thailand's movements had a significant and corresponding reaction from all of the countries in discussion.

### **III. Testing for Significant Increase in Correlations**

- Running the same cross-correlations, and then test for a significant increase in correlations during the crisis period. The results are presented in Tables 7–10.
- The crisis period correlations that are greater than the corresponding tranquil period correlation within a 1 percent level of significance are highlighted.

Table 7. Exchange Rates

| <b>Crisis Period (7/1/97–5/18/98)</b>    |           | <b>LR Test: 37.38**</b> |          |             |
|------------------------------------------|-----------|-------------------------|----------|-------------|
|                                          | Indonesia | Korea                   | Malaysia | Philippines |
| Korea                                    | 0.25***   | —                       | —        | —           |
| Malaysia                                 | 0.36***   | 0.10***                 | —        | —           |
| Philippines                              | 0.26***   | 0.04***                 | 0.28***  | —           |
| Thailand                                 | 0.28***   | 0.10***                 | 0.35***  | 0.31***     |
| <b>Tranquil Period (1/1/95–12/31/96)</b> |           | <b>LR Test: 2.84</b>    |          |             |
| Korea                                    | –0.03     | —                       | —        | —           |
| Malaysia                                 | 0.008     | 0.05                    | —        | —           |
| Philippines                              | 0.025     | –0.03                   | –0.04    | —           |
| Thailand                                 | 0.03      | –0.003                  | 0.09     | –0.05       |

Notes: LR test attempts to reject the null that all pairwise correlations are zero. Two and three asterisks imply rejection at the 5 percent and 1 percent level, respectively, of the null hypothesis that the crisis period is not significantly different from the tranquil period correlation.

Table 8. Stock Market Returns

| <b>Crisis Period (7/1/97–5/18/98)</b>    |           | <b>LR Test: 60.53**</b>  |          |             |
|------------------------------------------|-----------|--------------------------|----------|-------------|
|                                          | Indonesia | Korea                    | Malaysia | Philippines |
| Korea                                    | 0.09***   | —                        | —        | —           |
| Malaysia                                 | 0.45***   | 0.26***                  | —        | —           |
| Philippines                              | 0.44      | 0.16***                  | 0.38     | —           |
| Thailand                                 | 0.38***   | 0.23***                  | 0.39     | 0.27        |
| <b>Tranquil Period (1/1/95–12/31/96)</b> |           | <b>LR Test: 111.46**</b> |          |             |
| Korea                                    | –0.03     | —                        | —        | —           |
| Malaysia                                 | 0.37      | 0.06                     | —        | —           |
| Philippines                              | 0.46      | 0.02                     | 0.41     | —           |
| Thailand                                 | 0.32      | 0.005                    | 0.41     | 0.30        |

Notes: LR test attempts to reject the null that all pairwise correlations are zero. Two and three asterisks imply rejection at the 5 percent and 1 percent level, respectively, of the null hypothesis that the crisis period is not significantly different from the tranquil period correlation.



Table 9. Interest Rates

| <b>Crisis Period (7/1/97–5/18/98)</b>    |           | <b>LR Test: 64.60**</b> |          |             |
|------------------------------------------|-----------|-------------------------|----------|-------------|
|                                          | Indonesia | Korea                   | Malaysia | Philippines |
| Korea                                    | 0.41***   | —                       | —        | —           |
| Malaysia                                 | 0.07***   | 0.43***                 | —        | —           |
| Philippines                              | –0.17     | –0.32                   | –0.06    | —           |
| Thailand                                 | 0.37***   | 0.42***                 | 0.27***  | –0.25       |
| <b>Tranquil Period (1/1/95–12/31/96)</b> |           | <b>LR Test: 54.95**</b> |          |             |
| Korea                                    | –0.14     | —                       | —        | —           |
| Malaysia                                 | –0.14     | –0.10                   | —        | —           |
| Philippines                              | 0.05      | –0.12                   | 0.06     | —           |
| Thailand                                 | –0.07     | 0.370                   | –0.22    | 0.13        |

Notes: LR test attempts to reject the null that all pairwise correlations are zero. Two and three asterisks imply rejection at the 5 percent and 1 percent level, respectively, of the null hypothesis that the crisis period is not significantly different from the tranquil period correlation.

Table 10. Sovereign Spreads

| <b>Crisis Period (7/1/97–5/19/98)</b>    |           | <b>LR Test: 538.37**</b> |          |             |
|------------------------------------------|-----------|--------------------------|----------|-------------|
|                                          | Indonesia | Korea                    | Malaysia | Philippines |
| Korea                                    | 0.74***   | —                        | —        | —           |
| Malaysia                                 | 0.91***   | 0.69***                  | —        | —           |
| Philippines                              | 0.73***   | 0.83***                  | 0.59***  | —           |
| Thailand                                 | 0.66***   | 0.82***                  | 0.51***  | 0.90***     |
| <b>Tranquil Period (4/11/97–6/30/97)</b> |           | <b>LR Test: 24.37**</b>  |          |             |
| Korea                                    | 0.12      | —                        | —        | —           |
| Malaysia                                 | 0.47      | −0.28                    | —        | —           |
| Philippines                              | −0.11     | −0.32                    | 0.27     | —           |
| Thailand                                 | 0.18      | −0.21                    | 0.48     | −0.08       |

Notes: LR test attempts to reject the null that all pairwise correlations are zero. Two and three asterisks imply rejection at the 5 percent and 1 percent level, respectively, of the null hypothesis that the crisis period is not significantly different from the tranquil period correlation.

# Summary

## Definition of Contagion

Cross market linkages can be measured by:

- 1. Simple correlation
- 2. Probability of a speculative attack (e.g., MPI)
- 3. Transmission of shocks
- 4. Volatility

Shift Contagion: a significant increase in cross market linkages after a shock to an individual country (or groups of countries)

- Brazil and Argentina are closely connected: lots of similarities (geography, market structure, history, trade and finance).
- If the transmission of the shock from one country to another is a continuation of the same cross-market linkages that exists during non-crisis period, then it is not a contagion

# Summary

- Some tests on contagion overstated the magnitude of cross-market relationships (hence bias), because they did not adjust for heteroscedasticity.
- ***Most tests tend to suggest that contagion occurred. Yet, the cross-market transmission mechanisms (a co-movement) are stable and a shift-contagion does not occur (Forbes & Rigobon, 2000).***
- When the problems of (1) heteroscedasticity, (2) endogeneity, and (3) omitted variables are taken into account, a strong link or co-movement after the shock is a **mere continuation of, and not** significantly stronger than, a strong link before the shock. Hence, it does not prove that there is a shift contagion.

# Summary

- If a crisis is transmitted largely through temporary channels which exist only after the occurrence of a crisis, then a short-run policy such as capital control may be appropriate.
- But if the transmission is through permanent channels which exist in many states of the world (as indicated by co-movement), capital controls will not be effective.