CHAPTER 8

Crisis, contagion, and country funds: Effects on East Asia and Latin America

Jeffrey A. Frankel and Sergio L. Schmukler

8.1 Introduction

Among the debates that gained – or regained – interest after the Mexican crisis of December 1994 has been one concerning "contagion." Although contagion effects have been much discussed, relatively little research has studied this phenomenon directly. In the present chapter we study spillover effects using data on closed-end country funds. We look at contagion from Mexico City to the international investor community in New York City, and from there to various local markets in Asia and Latin America. We study spillover effects not only between regions but also within them.

Country funds provide a useful tool to study contagion or spillover effects, because two values are available for each fund. Country funds trade in New York City, while their underlying assets trade in the equity markets of each respective country at their net asset value (NAV).[1] Even though the country fund is a different way of holding the underlying assets, the fund price is not typically equal to its NAV. In consequence, we are able to compare the investor demand for basically the same assets in two different parts of the world. This enables us to look separately at how changes in Mexican asset prices affect other country fund prices and NAVs.

The authors would like to thank Neil Ericsson, Reuven Glick, Steve Kamin, Graciela Kaminsky, Richard Lyons, Carmen Reinhart, and Paul Wood for helpful comments. We also thank Don Cassidy, of Lipper Analytical Services, and Thierry Wizman for the country fund data. Sergio Schmukler would like to acknowledge support from the Consejo Nacional de Investigaciones Científicas y Técnicas, República Argentina.

[1] In addition to locally traded assets, some country funds hold American Depository Receipts (ADRs).

One of the present authors used the message of country fund prices in 1994 to warn about the possibility of a coming repeat of the international debt crisis of 1982, originating again in Latin America. We take the liberty of quoting at length:

> An interesting possible hypothesis regarding recent capital inflows is that foreign residents are more optimistic about domestic assets than are domestic residents. A widely-held interpretation of the massive capital flight from Latin America that took place in 1982 and the years immediately preceding it is that residents of these countries correctly perceived dangers ahead, at a time when foreign banks were foolish enough to be still lending eagerly. . . . Nevertheless, anyone who is concerned about a possible replay of 1982 – as are Calvo, Leiderman, and Reinhart (1993) – wants to be vigilant to any future signs that the locals are again losing confidence. Unfortunately, capital flight can only be estimated with a lag of a quarter or two (and, even then, very imperfectly).
>
> Another place where it might be useful to look are the prices of country-funds that invest in the stock markets of a number of Latin American and Asian countries. . . . Fluctuations in the premium of the U.S. price of the fund over the net asset value could be a measure of fluctuations in the difference in expectations of U.S. versus local investors.
>
> For most of these funds this premium has been higher (or the discount has been lower) during the period 1990–1992 than during the preceding three years, suggesting bullish sentiment on the part of foreign investors. . . . Mexico and Brazil . . . show a clearly higher level of relative U.S. investor confidence in the three years from 1990 . . . Taiwan and Thailand . . . show a clearly *lower* level of U.S. investor confidence, again as compared to the end of the 1980s. If our interpretation of the data is correct, that they represent the confidence of U.S. investors relative to local investors, [the results] suggest a possible replay of the period leading up to 1982: booms based relatively firmly on the ground in the case of East Asia, but based excessively on the enthusiasm of U.S. investors in the case of Latin America.[2]

In Frankel and Schmukler (1996a), we study how the three Mexican funds each turned from discounts to premia at the time of the December 1994 Mexican devaluation. We interpret this change as an indication of Mexican investors reacting first to the Mexican devaluation, given that they seemed to have better information about Mexico. In this chapter, we extend that work, by looking at how the Mexican crisis had spillover effects on other markets. In particular, we study how markets in Latin

[2] Frankel (1995), pp. 180–87. The same warning was made in Frankel (1994a), p. 17; (1994b), p. 254.

America and Asia were hit by the crisis. In addition, country funds allow us to see the reaction of the New York community of investors that buy emerging-market securities. This may shed light on the nature of international contagion.

Among the questions that we are able to address in this chapter are the following. Is there contagion from shocks such as the Mexican crisis? Is there evidence that financial markets are more closely linked within regions than in a global perspective? Are countries hit in different ways within each region? Does a shock in Mexican equities go through local markets to Wall Street or the other way around? Does Chile behave more like an Asian country and the Philippines more like a Latin American country (and, if so, why)? Do fundamentals seem to be correlated with the extent of contagion?

The chapter is organized as follows. Section 8.2 summarizes the contagion literature that appeared after the Mexican crisis, and distinguishes between different types of contagion. It also presents some known facts about country funds, summarizing the findings of Frankel and Schmukler (1996a, 1997). Section 8.3 displays some descriptive statistics, documenting the correlation across countries generally observed. Section 8.4, the heart of the chapter, contains Granger-causality tests of contagion. It first focuses on how country fund prices and net asset values are linked. Then, it studies through what channel a change in Mexican equities affects fund prices and NAVs in other regions, using a different methodology from previous contagion papers. Section 8.5 explores differences in patterns across countries, and relates the magnitude of spillovers to balance-of-payments fundamentals. Section 8.6 presents conclusions.

8.2 Contagion of different types

8.2.1 *Previous contagion studies*

The Mexican crisis of December 1994 has generated concerns that are specific to this crisis as well as other issues that had been raised previously, but are now being reexamined in light of the new evidence. Among them, the issue of contagion, in this episode dubbed the "tequila effect," has particularly regained attention.

A subset of the contagion papers approaches the issue as part of more comprehensive models of international financial linkages. Burki and Edwards (1995) and Folkerts-Landau et al. (1995) describe how different countries, particularly those in Latin America and Asia, were hit after the Mexican collapse. Goldfajn and Valdés (1995) provide theoretical

Support for how shocks are propagated to other countries, focusing on the role of financial intermediation.

Calvo and Reinhart (1995) address the issue directly by looking at weekly returns on equities and Brady bonds, for Asian and Latin American emerging markets. They find evidence of higher comovement after the Mexican crisis than before. They also find differential regional patterns, suggesting regional rather than global contagion. Valdés (1996) uses secondary market debt prices and country credit ratings to show contagion in Latin America. He demonstrates that fundamentals are unable to explain cross-country comovement of creditworthiness. On the other hand, Wolf (Chapter 9, this volume) fails to find strong evidence of contagion after controlling for sectoral composition – using data on total returns of individual stocks published by the International Finance Corporation. However, he finds a higher correlation among Asian markets, even when he controls for market fundamentals, consistent with contagion.

Several of the contagion studies mentioned earlier are either purely descriptive or use simple correlation coefficients to draw conclusions about transmission effect. Some also control for fundamentals, and look at the correlation matrix of the residuals. Comparing correlations calculated with different subsamples is one way to study links among variables. Principal component analysis has also been used. A finding of high correlation has often been claimed as evidence of contagion. However, there exist two very different interpretations of this finding, since there is no universally accepted definition of the term.

On the one hand, high cross-country correlation coefficients may be due to similar fundamentals or to common external shocks – as one would expect in a very wide variety of models. We can call these high correlations "fundamentals contagion." Bordo, Mizrach, and Schwartz (1995), for example, find high correlation among stock prices in emerging markets over the period 1984 to 1995, and yet are able to attribute most of it to fundamentals (either a correlation of in-country fundamentals, or a sharing of external fundamentals). They describe such contagion as "pseudo systemic risk."

At the other extreme, we would also find high cross-country correlations if self-fulfilling expectations make investors leave all emerging markets when a shock hits one of them. In this context, some use the term to refer to simultaneous speculative attacks or bubble-burstings that are unrelated to fundamentals. We can call this type of contagion "herding behavior contagion" or "true contagion."

An example of herding behavior modeling can be found in Calvo (1995). He shows that the tequila effect can be explained in a context of

costly information and diversification opportunities. When investors have a set of investment alternatives they have less incentive to obtain costly information regarding individual countries. Investment in each particular country becomes more sensitive when investment opportunities increase. Investors are able to switch to other countries when they receive bad news about one nation. Therefore diversification leads to more ignorance and herding behavior on the part of international investors.

This tendency has been remarked upon in the past. It was said that Colombia suffered from a loss in banker confidence in the 1982 crisis along with the rest of Latin America, even though it had followed better policies than the other debtors. More recently, it has been said that many unlikely countries attracted capital inflows in 1991–93 because they were identified in investors' minds with other borrowers that had undertaken more serious reforms (Calvo, Leiderman, and Reinhart, 1993).

In between the two extreme types of contagion lie some institutional explanations for high correlations. For example, a fund that invests in Latin America markets or in all emerging markets may be led by capital losses on its Mexico holdings to sell other holdings (in order to keep its country shares in proper proportion), thereby depressing prices in other countries' stock markets. In the case of open-end funds, managers may be also forced to raise cash to meet redemptions whenever there is a price fall in one country.

We are particularly interested in the hypothesis that mutual fund managers or holders on Wall Street respond to an adverse shock in one emerging market by selling securities in other emerging markets, and that this is the specific mechanism whereby the shock is transmitted. If markets were perfectly efficient and integrated, there would be no discernible difference in the reactions of prices of country funds in New York versus the corresponding equity prices in emerging markets themselves. Standard models of correlation based on fundamentals assume perfect efficiency and integration, as do standard models of contagion based on speculative bubbles or currency crises. But the country funds do not behave in this way, as we shall see.

8.2.2 *Country fund contagion*

Country fund data are well suited to get at a particular aspect of what we mean by contagion. They offer an opportunity to test whether the transmission of a negative shock from one emerging market to another "passes through" the community of New York mutual funds on the way.

It also gives us the opportunity to study the effects on different regions as well as the effects on separate countries within each region. Contagion transmitted via New York may be the consequence of institutional practices, but it may also reflect herding behavior on the part of country fund managers or holders.

This chapter uses weekly data from several Asian and Latin American country funds to investigate spillover effects from one market to others. Closed-end country funds have been established as vehicles to hold equities from different foreign markets. They provide a way to invest in remote countries without having to buy equities directly in local markets. Each consists of a fixed number of shares, invested in stocks from a particular country. They are traded for a price in New York City. Their net asset value (NAV) is calculated by aggregating the values of the underlying assets at their individual prices in the domestic market and converting to U.S. dollars.

Closed-end country funds are known usually to trade on average at a discount,[3] a phenomenon called the discount puzzle. Because the price and the NAV ultimately represent the price of the same asset, one would expect them to be equal to each other, so that the discounts would be zero. However, since the shares cannot be redeemed, holding shares of a country fund is not equivalent to holding the basket of constituent stocks. In Frankel and Schmukler (1996a), we show that there is little possibility of direct or pure arbitrage. Nevertheless, one would still expect investors to react to large discounts (or premiums) by doing some kind of indirect arbitrage, which works to correct gradually over time unusually large gaps between the fund price and NAV.

Different hypotheses have been suggested to explain the gaps between country fund prices and NAVs. They necessarily rely on imperfect liquidity or frictions in the markets. Hardouvelis, La Porta, and Wizman (1994) suggest that discounts reflect international investors' sentiments. They test the idea expressed in De Long, Shleifer, Summers, and Waldmann (1990) and in Lee, Shleifer, and Thaler (1991) that noise traders interact with rational investors by driving prices away from fundamentals.

In Frankel and Schmukler (1996a) we propose that discounts may reflect expectations of international investors that differ from those of domestic investors. It is assumed that country funds are mostly held by foreign investors, while domestic investors mostly buy securities directly in the local stock markets. If foreign investors know that they are further

[3] Discounts are equal to $\log(NAV_t/price_t)$.

away from information, they are willing to pay on average a lower value for the same asset. This is an instance of asymmetric information studied in Frankel and Schmukler (1997).

Frankel and Schmukler (1996a) extend that argument by hypothesizing that movement in the discount reflects movement in the relative expectations of foreign investors. We test whether there is evidence of asymmetric information. We do find that before the Mexican crisis, local investors reacted as the front-runners of the crisis, as if they had a different information set. The evidence suggests that, while local investors lost confidence beforehand, the confidence of the international community collapsed only after the devaluation, and to a lesser degree.

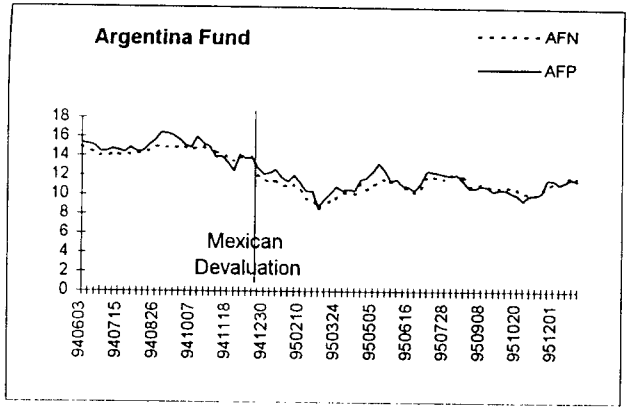
We also find cointegrating relationships between fund prices and NAVs. Frankel and Schmukler (1997) find that although most fund prices and NAVs are nonstationary, they tend to be linked by a linear relationship in the long run. The cointegrating vectors are in general $(1, -1)$, as theory suggests. A change in the NAV is fully transmitted to its country fund price in the long run, even though in the short run the transmission is only partial, since the adjustment coefficients are relatively small.

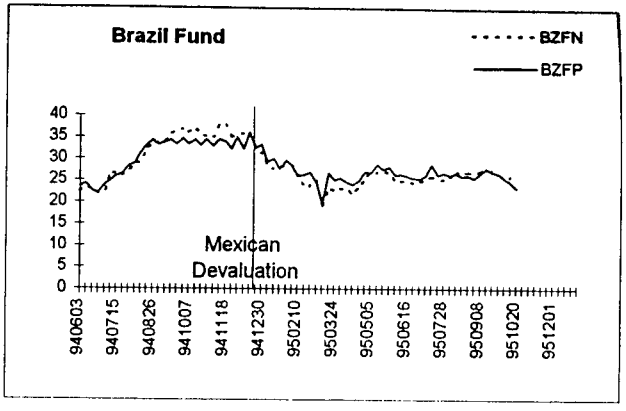
If a change in NAV were transmitted to its price instantaneously, we would not be able to test for Granger-causality between a local market and the corresponding country fund in New York. We would only be able to test for Granger-causality among country funds. It would be impossible to distinguish between a country fund's NAV and price at all, since they would move together. In fact, however, a change in NAV takes time to be fully transmitted to its price. This means that it can have a more immediate effect on equity prices in other countries, as measured by their NAVs, than on its own fund price. In consequence, country funds enable us to test the channel through which contagion takes place: whether a shock in Mexican NAVs is directly transmitted to other countries by affecting the other country fund NAVs, prices, or both.

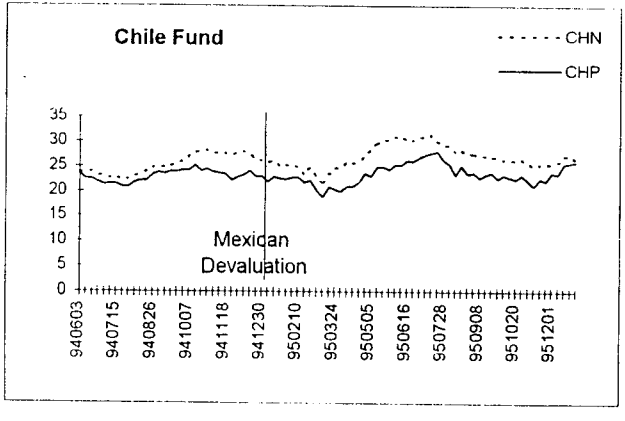
8.3 Correlation across countries: descriptive statistics

8.3.1 *Was there contagion?*

We begin by looking at how country funds behaved around the Mexican crisis. Figure 8.1 plots Latin American country fund NAVs and prices from mid-1994 until March 1996. The most dramatic box is the one that plots Mexican country funds around the week of the devaluation. Their NAVs and prices all turned down sharply just before the devaluation.







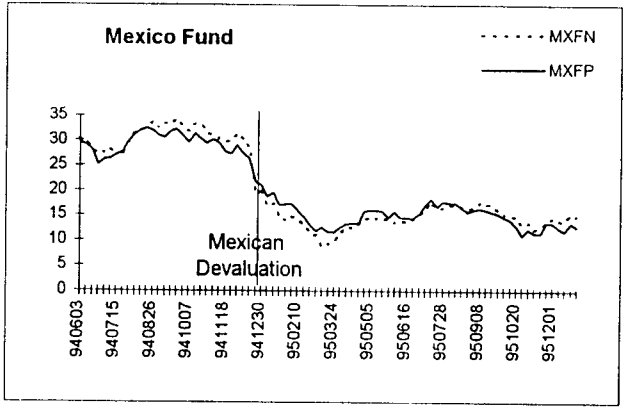


Figure 8.1. Latin American country fund NAVs and prices.

In the case of the other Latin American country funds, there was also a downturn of NAVs and prices after December 20, 1994. Although not plotted, the Latin American regional funds also fell at that time. (Their composition varies over time and a significant share of Mexican stocks might explain the fall.) The rest of the countries present less dramatic changes.

Most country funds had hit their lowest point by March 1995. Table 8.1 tabulates the percentage change in country fund prices relative to prices on December 2, 1994. It shows that most prices dropped by December 30 of that year. They continued falling by January 27, and reached their lowest prices by March 10. The percentage change was much more dramatic over the three-month period, particularly for the Latin American funds.

Emerging Asian country funds, plotted in Figure 8.2 (part A and part B), show comparable evidence, though the declines are smaller than in Latin America. Some funds, like the Korean ones, seemed initially to be unaffected by the devaluation. Other funds, including Latin American ones, display a downturn in the last quarter of 1994 (which may be due to increases in the U.S. interest rate). In summary, contagion was evident in most emerging markets by the end of January 1995, but was even more obvious by mid-March 1995. The largest decline in Asia occurred in the Philippines. The smallest decline in Latin America took place in Chile.

The Mexican crisis and its spillover effects on developing markets were also thought to cause pressures on currencies of industrial countries. The early 1995 decline in the U.S. dollar was partly attributed to this phenomenon. At that time, the Bank of Mexico used the U.S. swap facilities, and the Federal Reserve's Foreign Exchange Desk intervened to buy pesos for the account of the Bank of Mexico. The Canadian dollar also hit a nine-year low. In Europe, the Italian lira, the British pound, and the Spanish peseta declined against the stronger German deutschemark.

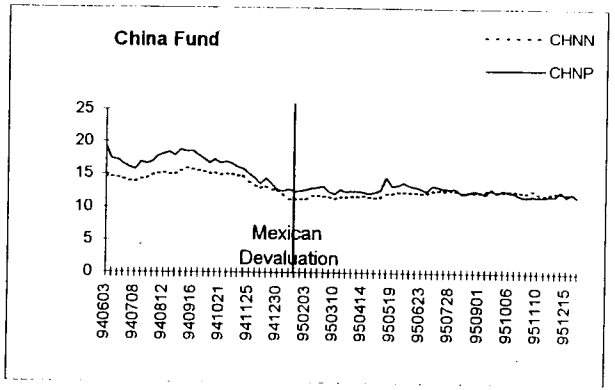
Several factors may explain the delay in contagion displayed in Table 8.1. The peso devaluation of December 20 was initially perceived as a Mexican balance-of-payments problem. It was after December that the fragile banking situation became evident.[4] In addition, the Mexican political situation turned more delicate by the end of February, when Raul Salinas, brother of the former president Carlos Salinas, was arrested in connection with Ruiz-Massieu assassination. The political conflict between Carlos Salinas and President Zedillo intensified by early March. Lastly, the announcement of an economic plan was postponed several

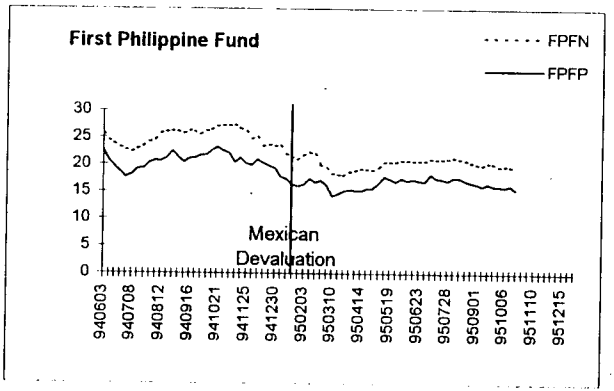
[4] In mid-March the Argentine financial sector was about to collapse due to large deposit withdrawals.

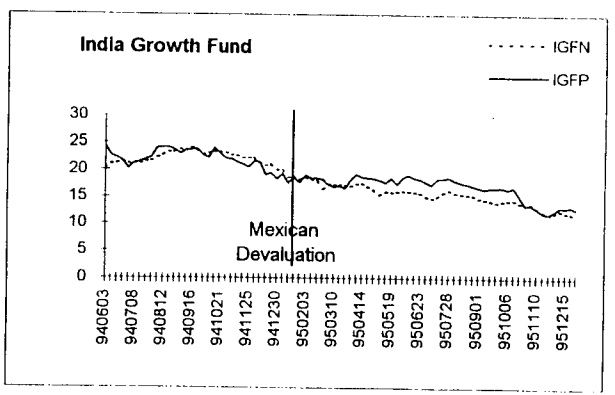
Table 8.1. *Percentage change in country fund prices, base date 12/2/94*

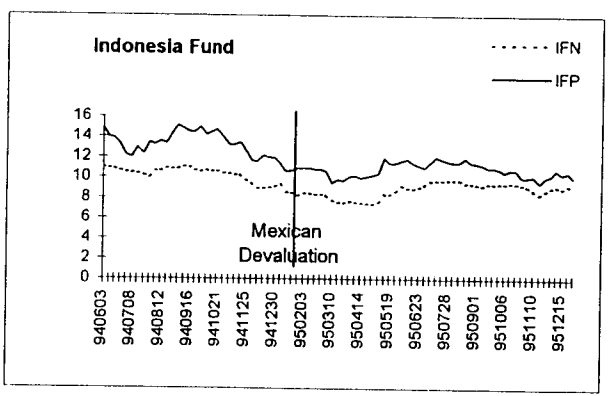
Country Fund	Symbol	By 12/30/94	By 1/27/95	By 3/10/95
Asia				
China Fund	CHN	−12.17	−13.04	−16.52
First Philippine Fund	FPF	−2.52	−19.50	−28.30
Greater China Fund	GCH	−16.38	−15.52	−16.38
India Fund	IFN	2.13	−6.38	−19.15
India Growth Fund	IGF	−15.08	−12.63	−21.79
Indonesia Fund	IF	−9.47	−18.43	−24.21
Jakarta Growth Fund	JGF	2.86	−18.10	−12.86
Jardine Fleming China Fund	JFC	−14.29	−16.22	−20.95
Jardine Fleming India Fund	JFI	−11.71	5.71	−24.32
Korea Equity Fund	KEF	−6.67	−18.67	−18.67
Korea Fund	KF	7.06	−8.24	−5.88
Korean Investment Fund	KIF	0.97	−2.91	−5.82
Malaysia Fund	MF	−10.32	−11.61	−18.06
Pakistan Investment Fund	PKF	−5.26	−18.42	−26.32
ROC Taiwan Fund	ROC	3.26	−4.35	−10.87
Singapore Fund	SGF	−6.30	−11.02	−14.96
Taiwan Equity Fund	TYW	2.15	−9.02	−15.05
Taiwan Fund	TWN	11.59	−14.29	−23.67
Templeton China World Fund	TCH	−16.33	−9.00	−21.43
Templeton Vietnam Oppty. Fund	TVF	−16.51	−13.76	−23.85
Thai Capital Fund	TC	0.00	2.41	−15.04
Thai Fund	TTF	−10.50	−9.68	−19.50
Latin America				
Argentina Fund	AF	−14.16	−19.47	−31.86
Brazil Equity	BZL	−5.00	−21.36	−43.57
Brazil Fund	BZF	−18.93	−15.71	−54.37
Chile Fund	CH	1.10	−1.64	−17.53
Emerging Mexico Fund	MEF	−30.14	−47.95	−57.53
Mexico Equity and Income Fund	MXE	−27.49	−35.67	−59.65
Mexico Fund	MXF	−27.31	−40.56	−56.63

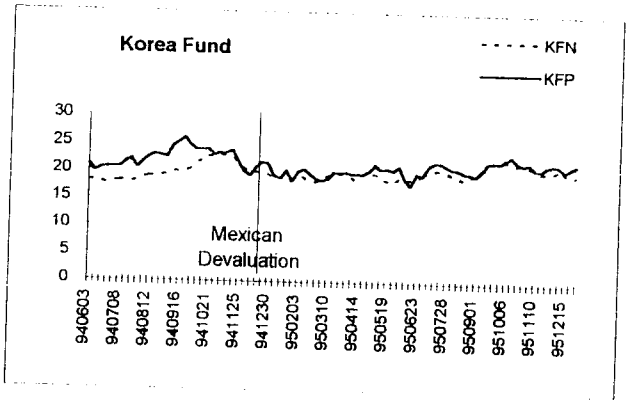
times, which was interpreted as political inability to deal with the crisis. According to some views, MeXico's government did not present a sound macroeconomic plan until mid-March 1995. Then, Mexican financial markets started to recover.


China Fund
CHNN
CHNP
25
20
15
10
5
0
Mexican
Devaluation
940603
940708
940812
940916
941021
941125
941230
950203
950310
950414
950519
950623
950728
950901
951006
951110
951215


First Philippine Fund
FPFN
FPFP
30
25
20
15
10
5
0
Mexican
Devaluation
940603
940708
940812
940916
941021
941125
941230
950203
950310
950414
950519
950623
950728
950901
951006
951110
951215


India Growth Fund
IGFN
IGFP
30
25
20
15
10
5
0
Mexican
Devaluation
940603
940708
940812
940916
941021
941125
941230
950203
950310
950414
950519
950623
950728
950901
951006
951110
951215


Indonesia Fund
IFN
IFP
16
14
12
10
8
6
4
2
0
Mexican
Devaluation
940603
940708
940812
940916
941021
941125
941230
950203
950310
950414
950519
950623
950728
950901
951006
951110
951215



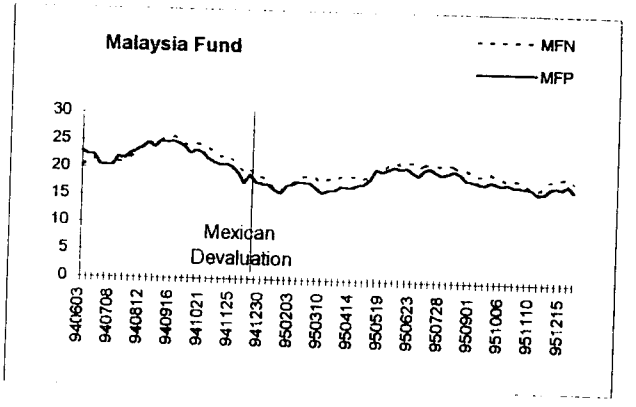
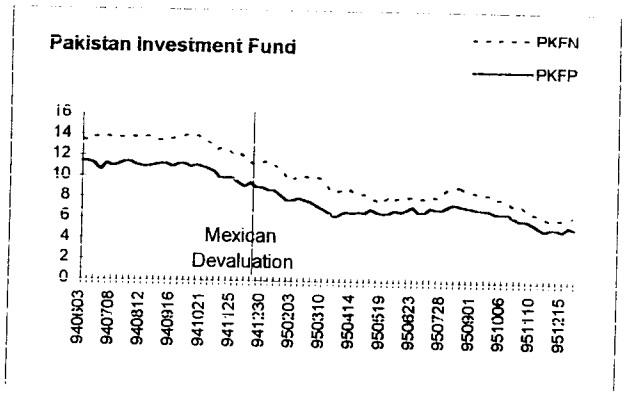
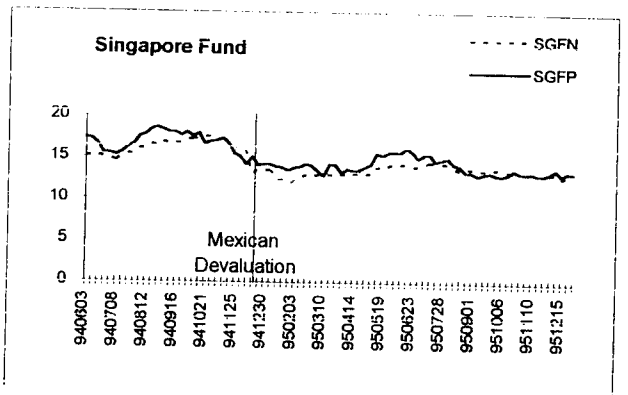
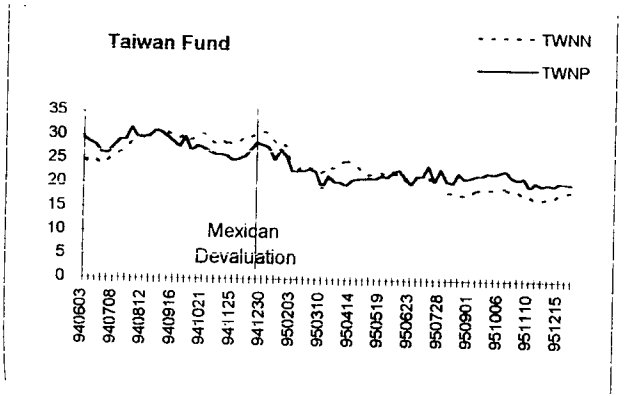
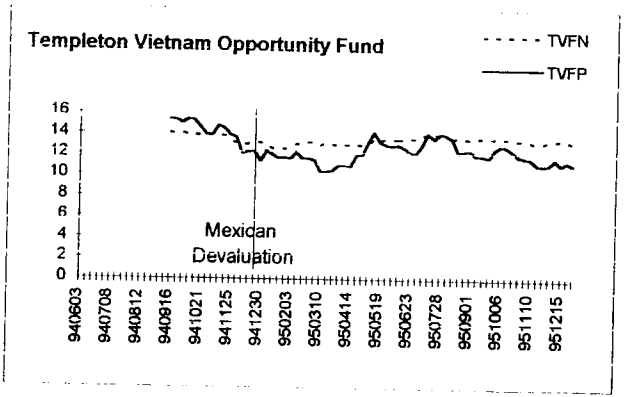


Figure 8.2. Part A: Asian country fund NAVs and prices.


Pakistan Investment Fund
PKFN
PKFP
16
14
12
10
8
6
4
2
0
Mexican
Devaluation
940603
940708
940812
940916
941021
941125
941230
950203
950310
950414
950519
950623
950728
950901
951006
951110
951215


Singapore Fund
SGFN
SGFP
20
15
10
5
0
Mexican
Devaluation
940603
940708
940812
940916
941021
941125
941230
950203
950310
950414
950519
950623
950728
950901
951006
951110
951215


Taiwan Fund
TWNN
TWNP
35
30
25
20
15
10
5
0
Mexican
Devaluation
940603
940708
940812
940916
941021
941125
941230
950203
950310
950414
950519
950623
950728
950901
951006
951110
951215


Templeton Vietnam Opportunity Fund
TVFN
TVFP
16
14
12
10
8
6
4
2
0
Mexican
Devaluation
940603
940708
940812
940916
941021
941125
941230
950203
950310
950414
950519
950623
950728
950901
951006
951110
951215

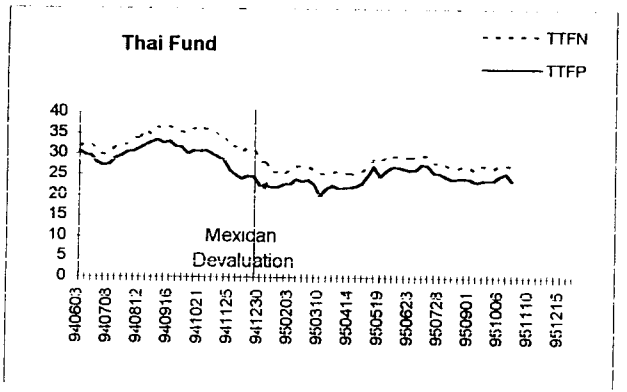


Figure 8.2. Part B: Asian country fund NAVs and prices.

Table 8.2. *Correlation of country fund prices and NAVs, Asia, 7/92–3/96*

Country fund	Symbol	CHNP	CHNN	FPFP	FPFN	GCHP	GCHN	IGFP	IGFN	IFP	IFN	JGFP	JGFN	JFCP	JFCN
China Fund	CHN	1.00	1.00	0.35	0.36	0.71	0.94	0.11	0.10	0.50	0.48	0.44	0.38	0.69	0.82
First Philippine Fund	FPF	0.35	0.36	1.00	1.00	0.32	0.28	0.13	0.07	0.37	0.34	0.34	0.29	0.31	0.23
Greater China Fund	GCH	0.71	0.94	0.32	0.28	1.00	1.00	0.10	0.08	0.42	0.50	0.36	0.39	0.74	0.85
India Growth Fund	IGF	0.11	0.10	0.13	0.07	0.10	0.08	1.00	1.00	0.17	0.05	0.15	0.03	0.02	0.08
Indonesia Fund	IF	0.50	0.48	0.37	0.34	0.42	0.50	0.17	0.05	1.00	1.00	0.60	0.79	0.47	0.43
Jakarta Growth Fund	JGF	0.44	0.38	0.34	0.29	0.36	0.39	0.15	0.03	0.60	0.79	1.00	1.00	0.40	0.36
Jardine Fleming China Fund	JFC	0.69	0.82	0.31	0.23	0.74	0.85	0.02	0.08	0.47	0.43	0.40	0.36	1.00	1.00
Korea Fund	KF	0.21	0.22	0.19	0.02	0.19	0.26	0.23	0.09	0.14	0.18	0.14	0.14	0.18	0.32
Korean Investment Fund	KIF	0.39	0.16	0.28	0.07	0.27	0.20	0.20	0.02	0.16	0.15	0.26	0.08	0.25	0.26
Malaysia Fund	MF	0.42	0.50	0.42	0.25	0.43	0.44	0.08	0.26	0.39	0.49	0.40	0.42	0.38	0.45
ROC Taiwan Fund	ROC	0.30	0.21	0.23	0.22	0.20	0.20	0.16	0.05	0.35	0.10	0.24	0.04	0.21	0.10
Singapore Fund	SGF	0.49	0.23	0.36	0.45	0.34	0.20	0.21	0.16	0.39	0.39	0.42	0.40	0.42	0.24
Taiwan Fund	TWN	0.13	0.23	0.21	0.21	0.12	0.21	0.17	−0.02	0.34	0.05	0.17	0.06	0.10	0.17
Thai Capital Fund	TC	0.53	0.55	0.42	0.31	0.46	0.52	0.11	0.17	0.38	0.47	0.45	0.36	0.45	0.51
Thai Fund	TTF	0.51	0.53	0.40	0.23	0.34	0.51	0.17	0.18	0.34	0.40	0.36	0.29	0.34	0.53

Table 8.2. *(cont.)*

Country fund	Symbol	KFP	KFN	KIFP	KIFN	MFP	MFN	ROCP	ROCN	SGFP	SGFN	TWNP	TWNN	TCP	TCN	TTFP	TTFN
China Fund	CHN	0.21	0.22	0.39	0.16	0.42	0.50	0.30	0.21	0.49	0.23	0.13	0.23	0.53	0.55	0.51	0.53
First Philippine Fund	FPF	0.19	0.02	0.28	0.07	0.42	0.25	0.23	0.22	0.36	0.45	0.21	0.21	0.42	0.31	0.40	0.23
Greater China Fund	GCH	0.19	0.26	0.27	0.20	0.43	0.44	0.20	0.20	0.34	0.20	0.12	0.21	0.46	0.52	0.34	0.51
India Growth Fund	IGF	0.23	0.09	0.20	0.02	0.08	0.26	0.16	0.05	0.21	0.16	0.17	−0.02	0.11	0.17	0.17	0.18
Indonesia Fund	IF	0.14	0.18	0.16	0.15	0.39	0.49	0.35	0.10	0.39	0.39	0.34	0.05	0.38	0.47	0.34	0.40
Jakarta Growth Fund	JGF	0.14	0.14	0.26	0.08	0.40	0.42	0.24	0.04	0.42	0.40	0.17	0.06	0.45	0.36	0.36	0.29
Jardine Fleming China Fund	JFC	0.18	0.32	0.25	0.26	0.38	0.45	0.21	0.10	0.42	0.24	0.10	0.17	0.45	0.51	0.34	0.53
Korea Fund	KF	1.00	1.00	0.58	0.83	0.23	0.16	0.07	0.02	0.18	0.07	0.12	0.05	0.17	0.17	0.34	0.26
Korean Investment Fund	KIF	0.58	0.83	1.00	1.00	0.28	0.04	0.08	−0.03	0.27	0.10	0.16	0.00	0.24	0.17	0.36	0.21
Malaysia Fund	MF	0.23	0.16	0.28	0.04	1.00	1.00	0.11	0.14	0.44	0.49	0.21	−0.02	0.49	0.49	0.37	0.46
ROC Taiwan Fund	ROC	0.07	0.02	0.08	−0.03	0.11	0.14	1.00	1.00	0.36	0.17	0.50	0.51	0.29	0.17	0.32	0.10
Singapore Fund	SGF	0.18	0.07	0.27	0.10	0.44	0.49	0.36	0.17	1.00	1.00	0.28	0.12	0.41	0.32	0.46	0.23
Taiwan Fund	TWN	0.12	0.05	0.16	0.00	0.21	0.07	0.50	0.51	0.28	0.12	1.00	1.00	0.27	0.21	0.38	0.15
Thai Capital Fund	TC	0.17	0.17	0.24	0.17	0.49	0.49	0.29	0.17	0.41	0.32	0.27	0.21	1.00	1.00	0.70	0.91
Thai Fund	TTF	0.34	0.26	0.36	0.21	0.37	0.46	0.32	0.10	0.46	0.23	0.38	0.15	0.70	0.91	1.00	1.00

Notes: Country fund symbols in column headings with "P" suffixes denote price correlations; symbols with "N" suffixes denote NAV correlations. All variables are first-differenced logarithms.

8.3.2 *Are comovements higher within regional markets than across them?*

As a more systematic approach to the empirical analysis, we look at whether the shock in Mexico may have affected Latin American markets more strongly than Asian markets. We find that there is some degree of intraregional comovement. However, it is evident that investors did not treat each country fund equally. This section analyzes the extent of comovement.

Table 8.2 shows correlations of first-differenced Asian country fund prices and NAVs over the period-July 1992 to March 1996; Tables 8.3 and 8.4 do so for Latin America, and for the cross-correlations between the two regions.[5] All the variables have been first-differenced, since we found in our previous work that most NAVs and prices cannot reject nonstationarity.

Two main conclusions can be drawn from the pattern of correlations. First, Latin American NAVs show higher comovement among themselves than do prices of Latin American funds. (For 30 out of 42 country pairs the NAV correlation is higher than the fund price correlation, in terms of changes.) These relationships hold especially for Mexican country funds. Second, the cross-correlations among fund prices are larger than the cross-correlations among Asian and Latin American NAVs. (For 83 out of 105 country pairs the country fund price cross-correlation is higher than the NAV correlation.) In the case of Asia, it is more difficult to suggest an overall conclusion.

The correlation pattern supports the idea that the Mexican crisis may have impacted Latin America more directly, and to a greater extent, than Asia. It also suggests that the shock to Asia may have been transmitted via changes in country fund prices. More generally, the correlations suggest that fund prices and NAVs tend to be more connected to the market where they are traded than to the country where the underlying assets are located.

If markets were perfectly integrated, country fund NAVs and prices would move in the same way. But the fact that there is segmentation allows us to study the reaction of different kinds of investors to shocks. If cross-country correlations were as high for NAVs as they are for fund prices, then one would most naturally attribute the correlations to common fundamentals. However, fund prices in Asia and Latin America are more highly correlated across regions than NAVs. This suggests the

[5] We excluded the country funds that started trading after 1992, in order to avoid working with a reduced sample.

Table 8.3. *Correlation of country fund prices and NAVs, Latin America, 7/92–3/96*

Country fund	Symbol	AFP	AFN	BZFP	BZFN	BZLP	BZLN	CHP	CHN	MEFP	MEFN	MXEP	MXEN	MXFP	MXFN
Argentina Fund	AF	1.00	1.00	0.23	0.27	0.26	0.19	0.34	0.36	0.32	0.53	0.32	0.48	0.30	0.48
Brazil Equity Fund	BZL	0.23	0.27	1.00	1.00	0.83	0.82	0.28	0.14	0.16	0.33	0.27	0.28	0.30	0.39
Brazil Fund	BZF	0.26	0.19	0.83	0.82	1.00	1.00	0.31	0.06	0.20	0.23	0.25	0.18	0.26	0.33
Chile Fund	CH	0.34	0.36	0.28	0.14	0.31	0.06	1.00	1.00	0.20	0.34	0.28	0.34	0.30	0.26
Emerging Mexico Fund	MEF	0.32	0.53	0.16	0.33	0.20	0.23	0.20	0.34	1.00	1.00	0.53	0.88	0.75	0.86
Mexico Equity and Income Fund	MXE	0.32	0.48	0.27	0.28	0.25	0.18	0.28	0.34	0.53	0.88	1.00	1.00	0.62	0.71
Mexico Fund	MXF	0.30	0.48	0.30	0.39	0.26	0.33	0.30	0.26	0.75	0.86	0.62	0.71	1.00	1.00

Notes: Country fund symbols in column headings with "P" suffixes denote price correlations; symbols with "N" suffixes denote NAV correlations. All variables are first-differenced logarithms.

Table 8.4. *Correlation of country fund prices and NAVs, Asia–Latin America, 7/92–3/96*

Country Fund	Symbol	AFP	AFN	BZLP	BZFN	BZFP	BZLN	CHP	CHN	MEFP	MEFN	MXEP	MXEN	MXFP	MXFN
China Fund	CHN	0.14	0.26	0.17	0.12	0.14	0.12	0.28	0.18	0.19	0.33	0.18	0.24	0.26	0.30
First Philippine Fund	FPF	0.27	0.13	0.10	−0.04	0.16	0.05	0.27	0.05	0.23	0.14	0.20	0.11	0.22	0.20
Greater China Fund	GCH	0.13	0.20	0.17	0.07	0.10	0.13	0.10	0.24	0.17	0.22	0.06	0.13	0.24	0.17
India Growth Fund	IGF	0.03	−0.03	0.04	−0.01	0.09	0.07	0.19	0.01	0.22	−0.10	0.19	−0.07	0.18	−0.09
Indonesia Fund	IF	0.20	0.13	0.14	0.14	0.11	0.13	0.32	0.15	0.16	0.11	0.15	0.06	0.16	0.11
Jakarta Growth Fund	JGF	0.20	0.16	0.17	0.12	0.16	0.08	0.30	0.14	0.07	0.13	0.13	0.09	0.13	0.14
Jardine Fleming China Fund	JFC	0.24	0.15	0.23	0.03	0.18	0.09	0.26	0.15	0.22	0.18	0.18	0.08	0.28	0.13
Korea Fund	KF	0.11	0.16	0.13	0.10	0.08	0.07	0.14	0.25	0.15	0.15	0.25	0.12	0.15	0.10
Korean Investment Fund	KIF	0.17	0.13	0.21	0.06	0.25	0.05	0.20	0.15	0.14	0.04	0.19	0.00	0.15	0.03
Malaysia Fund	MF	0.20	0.25	0.20	0.03	0.14	0.00	0.20	0.11	0.25	0.22	0.27	0.24	0.27	0.21
ROC Taiwan Fund	ROC	0.11	0.11	0.19	−0.01	0.12	0.01	0.15	0.11	0.06	0.11	0.08	0.05	0.21	0.13
Singapore Fund	SGF	0.11	0.08	0.30	−0.08	0.27	−0.04	0.34	0.10	0.15	0.06	0.20	0.02	0.28	0.03
Taiwan Fund	TWN	0.19	0.02	0.18	0.03	0.17	0.09	0.22	0.04	0.00	0.04	0.16	−0.05	0.15	0.01
Thai Capital Fund	TC	0.18	0.08	0.26	0.08	0.21	0.03	0.25	0.08	0.11	0.10	0.15	0.04	0.22	0.05
Thai Fund	TTF	0.20	0.16	0.23	0.10	0.24	0.06	0.33	0.14	0.07	0.24	0.17	0.17	0.16	0.10

Notes: Country fund symbols in column headings with "P" suffixes denote price correlations; symbols with "N" suffixes denote NAV correlations. All variables are first-differenced logarithms.

possibility of overreaction on the part of New York investors. Joint changes in fund prices may reflect changes in U.S. investors' sentiments with respect to emerging markets, not related to fundamentals.

8.4 Granger-causality tests

8.4.1 *Do the Granger-causality results support the previous finding?*

As a second approach to studying the degree of regional comovement, we estimate all the possible combinations of Granger-causality tests. In other words, we look at how past changes in country fund NAVs and prices as well as discounts affect present changes of country fund NAVs and prices. We separately test whether each country fund Granger-causes each of the other country funds, with respect to both price and NAV. We work with an error–correction model specification, due to our previous finding of cointegration between country fund prices and NAVs. The models estimated are:

$$\begin{aligned}\Delta P_t^{\mathrm{a}} &= \varpi^{\mathrm{I}} + \alpha^{\mathrm{I}} disc_{t-1}^{\mathrm{a}} + \sum_{i=1}^{L} \beta_{1i}^{\mathrm{I}} \Delta N_{t-i}^{\mathrm{a}} + \sum_{i=1}^{L} \beta_{2i}^{\mathrm{I}} \Delta P_{t-i}^{\mathrm{a}} + \gamma^{\mathrm{I}} disc_{t-1}^{\mathrm{b}} \\ &\quad + \sum_{i=1}^{L} \kappa_{1i}^{\mathrm{I}} \Delta N_{t-i}^{\mathrm{b}} + \sum_{i=1}^{L} \kappa_{2i}^{\mathrm{I}} \Delta P_{t-i}^{\mathrm{b}} + \tau^{\mathrm{I}} MXFdisc_{t-1}^{\mathrm{a}} \\ &\quad + \sum_{i=1}^{L} \theta_{1i}^{\mathrm{I}} \Delta MXFN_{t-i} + \sum_{i=1}^{L} \theta_{2i}^{\mathrm{I}} \Delta MXFP_{t-i} - \sum_{i=1}^{L} \omega_i^{\mathrm{I}} \Delta tbill_{t-i} + \upsilon_{1t}, \\ \Delta N_t^{\mathrm{a}} &= \varpi^{\mathrm{II}} + \alpha^{\mathrm{II}} disc_{t-1}^{\mathrm{a}} + \sum_{i=1}^{L} \beta_{1i}^{\mathrm{II}} \Delta N_{t-i}^{\mathrm{a}} + \sum_{i=1}^{L} \beta_{2i}^{\mathrm{II}} \Delta P_{t-i}^{\mathrm{a}} + \gamma^{\mathrm{II}} disc_{t-1}^{\mathrm{b}} \\ &\quad + \sum_{i=1}^{L} \kappa_{1i}^{\mathrm{II}} \Delta N_{t-i}^{\mathrm{b}} + \sum_{i=1}^{L} \kappa_{2i}^{\mathrm{II}} \Delta P_{t-i}^{\mathrm{b}} + \tau^{\mathrm{II}} MXFdisc_{t-1}^{\mathrm{a}} \\ &\quad + \sum_{i=1}^{L} \theta_{1i}^{\mathrm{II}} \Delta MXFN_{t-i} + \sum_{i=1}^{L} \theta_{2i}^{\mathrm{II}} \Delta MXFP_{t-i} + \sum_{i=1}^{L} \omega_i^{\mathrm{II}} \Delta tbill_{t-i} + \upsilon_{2t}. \end{aligned}$$

We estimate each equation separately to see the effect of each country fund's NAV (denoted by N) and price (P) on other NAVs and prices. Country fund a is the endogenous variable while country fund b is the exogenous variable in the model. (The delta operator Δ denotes lagged first differences.) We control for changes in the U.S. interest rate (*tbill*), because Calvo, Leiderman, and Reinhart (1993) and others find it to be the principal external factor explaining capital inflow episodes in emerging markets in the early 1990s. We also control for changes in the NAV

and price of the biggest Mexican fund (MXF).[6] Furthermore, due to the presence of cointegration we include lagged fund discounts (*disc*), as error–correction terms associated with restricted cointegrating vectors. Such restrictions on price and NAV appear plausible since, as reported previously, we have tested for cointegrating vectors and found them in general to be $(1, -1)$.[7]

The results are summarized in Tables 8.5 and 8.6. (Detailed results can be found in Frankel and Schmukler [1996b, appendix 2].) The tables tabulate Wald statistics that test the following joint hypotheses:

$$H_0: K_1^{I} = K_2^{I} = \gamma^{I} = 0$$

$$\Rightarrow \text{country fund b does not Granger-cause country fund a price.}$$

$$H_0: K_1^{II} = K_2^{II} = \gamma^{II} = 0$$

$$\Rightarrow \text{country fund b does not Granger-cause country fund a NAV.}$$

where Ks stand for the vector of k coefficients. We tried different lag specifications but only report the two-lag results.[8]

Tables 8.5 and 8.6 present the Granger-causality results for the largest country fund in each country of Asia and Latin America, respectively. These funds, listed along the left-hand margin of the tables, are taken to be representative. The first four columns of figures report the percentage of cases in which the prices and NAVs of each of these funds is Granger-caused ("explained by") or Granger-causes ("explains") all other Asian and Latin American funds (as indicated by a 10 percent significance level for the Wald statistics). The second and third sets of four columns report the percentage of cases of significant Granger-causality tests for other Asian and Latin America funds separately.

Tables 8.5 and 8.6 confirm the findings of the correlation results in Tables 8.2, 8.3, and 8.4. Latin American NAVs are more explained by Latin American funds than are Latin American fund prices. Latin American funds also explain changes in NAVs more than changes in fund prices. Within Asia, the evidence turns less conclusive. Some

[6] For instance, if we do not include the Mexico Fund we would artificially be giving explanatory power to the Argentina Fund NAV, which is very correlated with Mexican fund NAVs. It might also introduce omitted variable biases.

[7] Frankel and Schmukler (1997) test different specifications, including simultaneous estimation of the cointegrating vector. Those results lead us to impose the restrictions here.

[8] The results appear robust to various lag structures. We finally chose the two-lag specification since, following the general-to-specific methodology, we found that more lags were not statistically significant.

Table 8.5. *Significant Granger-causality test results, Asia, 1/4/85–3/8/96 (in percent)*

Country fund	Symbol	Price is explained by	Explains price of	NAV is explained by	Explains NAV of	Price is explained by	Explains price of	NAV is explained by	Explains NAV of	Price is explained by	Explains price of	NAV is explained by	Explains NAV of
		All funds				Asian funds				Latin American funds			
China Fund	CHN	17	21	28	14	19	29	33	19	14	0	14	0
First Philippine Fund	FPF	34	17	28	21	33	24	29	24	43	0	29	14
India Growth Fund	IGF	41	14	21	17	43	14	24	19	43	14	14	14
Indonesia Fund	IF	31	21	28	0	24	29	33	0	57	0	14	0
Korea Fund	KF	24	38	10	41	29	43	14	38	14	29	0	57
Malaysia Fund	MF	14	17	7	34	14	10	5	33	14	43	14	43
Pakistan Investment Fund	PKF	17	21	24	24	19	19	33	29	14	29	0	14
Singapore Fund	SGF	31	7	34	24	38	10	33	10	14	0	43	71
Taiwan Fund	TWN	28	14	31	10	29	14	33	5	29	14	29	29
Templeton Vietnam Oppty. Fund	TVF	14	14	21	14	14	10	19	19	14	29	29	0
Thai Fund	TTF	10	21	31	41	10	29	38	52	14	0	14	14
Average		24	18	24	22	25	21	27	23	25	14	18	23

Notes: Numbers indicate the percent of cases for which the Wald statistic was significant at 10%. Asia has a total of 22 country funds; Latin America has a total of 7 country funds. Beginning of sample range varies by country fund; see Table 8.A1.

Table 8.6. *Significant Granger-causality test results, Latin America, 1/4/85–3/8/96 (in percent)*

Country fund	Symbol	Price is explained by	Explains price of	NAV is explained by	Explains NAV of	Price is explained by	Explains price of	NAV is explained by	Explains NAV of	Price is explained by	Explains price of	NAV is explained by	Explains NAV of
		All funds				Asian funds				Latin American funds			
Argentina Fund	AF	7	10	14	14	5	14	9	18	17	0	33	0
Brazil Fund	BZF	17	34	28	10	14	45	27	14	33	0	33	0
Chile Fund	CH	14	7	7	7	14	5	5	5	17	17	17	17
Mexico Fund	MXF	3	69	17	24	5	73	18	9	0	67	17	83
Average		10	30	16	14	9	34	15	11	17	21	25	25

Notes: Numbers indicate the percent of cases for which the Wald statistic was significant at 10%. Asia has a total of 22 country funds; Latin America has a total of 7 country funds. Beginning of sample range varies by country fund; see Table 8.A1.

countries appear to be more connected through NAVs, whereas others are more related through country fund prices. Nevertheless, averaging the figures across countries suggests that Asian NAVs are explained to a greater extent by Asian country funds than are Asian fund prices. Asian funds also explain more changes in Asian NAVs than in Asian fund prices.

The link between the two regions clearly suggests that Latin American funds explain Asian country fund prices more than Asian fund prices explain Latin American fund prices. On average, Latin American funds explain prices of Asian funds 34 percent of the time, while the reverse causality, from Asian funds to Latin American prices, holds only 9 percent of the time. The prices of Asian funds are caused by Latin American funds more often than are NAVs.

We should remark that although the data in some cases go from 1985 to 1996, most country funds only started trading in the 1990s.[9] Therefore, these results may reflect largely the big shock of the 1994 Mexican crisis. This may explain why there seems to be Granger-causality from Latin America to Asia and not otherwise. Some years from now we will be able to test whether the relationships revealed here continue to hold.

8.4.2 *Did contagion "pass through" New York?*

In this section we test whether there is contagion specifically from Mexico and, if so, whether the transmission passes through New York. In order to do that, we put together part of the results from the previous Granger-causality estimations in Tables 8.7 and 8.8. We look at how changes in the biggest Mexican fund Granger-causes prices and NAVs of other Asian and Latin American funds. We only report the cases of the Mexico Fund (MXF) as an exogenous variable, since that fund seems to be the driving force among all Mexican funds. The other two Mexican funds, which are appreciably smaller in size, were found to be Granger-caused by changes in MXF.

The separate estimation of equations for fund prices and NAVs allows us to look at the channel through which contagion takes place. A shock in a Mexican NAV may affect both the other country fund price directly, as well as the other NAV. It may also affect the other NAV, and through it the other country fund price. Conversely, the channel may go through fund prices to NAVs.

We know that there is cointegration between each country fund NAV and price. Therefore, a permanent shock to NAVs (prices) will prompt

[9] The dates of initial public offerings (IPOs) are detailed in Appendix Table 8.A1.

Table 8.7. *Granger-causality of Asian funds by the Mexico Fund, 1/4/85–3/8/96*

Country fund	Symbol	H_0: Price is not Granger-caused	H_0: NAV is not Granger-caused
China Fund	CHN	18.98***	4.99
First Philippine Fund	FPF	19.03***	11.17**
Greater China Fund	GCH	5.79	8.15
India Fund	IFN	14.63**	2.88
India Growth Fund	IGF	11.67**	4.06
Indonesia Fund	IF	15.72***	9.16
Jakarta Growth Fund	JGF	12.26**	7.52
Jardine Fleming China Fund	JFC	6.92	4.92
Jardine Fleming India Fund	JFI	4.21	4.77
Korea Equity Fund	KEF	10.22*	2.68
Korea Fund	KF	23.14***	7.74
Korean Investment Fund	KIF	11.73**	5.63
Malaysia Fund	MF	10.87*	4.30
Pakistan Investment Fund	PKF	11.93**	3.05
ROC Taiwan Fund	ROC	5.85	4.04
Singapore Fund	SGF	21.66***	4.93
Taiwan Equity Fund	TYW	3.38	2.84
Taiwan Fund	TWN	17.43***	6.07
Templeton China World Fund	TCH	9.00	4.86
Templeton Vietnam Oppty. Fund	TVF	9.85*	11.38**
Thai Capital Fund	TC	17.60***	6.85
Thai Fund	TTF	20.38***	6.73
Percentage of null hypotheses rejected at			
	10%	73	9
	5%	59	9

Notes: Granger-causality tests reported as Wald statistics. * = significance at 10% level, ** = at 5% level, and *** = at 1% level. Beginning of sample range varies by country fund; see Table 8.A1.

prices (NAVs) to adjust gradually to the long-run relationship. The model specification allows us to estimate whether the long-run effect goes through the price–NAV cointegration, or whether both country fund prices and NAVs are affected directly from changes in the Mexico Fund. In other words, by controlling for past changes in the endogenous country fund NAV and price, we can test whether exogenous past

Table 8.8. *Granger-causality of Latin American funds by the Mexico Fund, 1/4/85–3/8/96*

Country fund	Symbol	H_0: Price is not Granger-caused	H_0: NAV is not Granger-caused
Argentina Fund	AF	7.95	11.26**
Brazil Equity Fund	BZL	14.34**	6.81
Brazil Fund	BZF	14.00**	13.07**
Chile Fund	CH	16.45***	13.24**
Emerging Mexico Fund	MEF	2.85	18.11***
Mexico Equity and Income Fund	MXE	25.83***	35.86***
Percentage of null hypotheses rejected at			
	10%	67	83
	5%	67	83

Notes: Granger-causality test results reported as Wald statistics. * = significance at 10% level, ** = at 5% level, and *** = at 1% level. Beginning of sample range varies by country fund; see Table 8.A1.

changes in MXF are statistically significant in explaining both current changes in country fund NAVs and prices, either one of them, or neither of them.

The hypothesis tests reported in Tables 8.7 and 8.8 show that, at a 10 percent significance level, Mexico Granger-causes 83 percent of Latin American NAVs and 67 percent of Latin American fund prices. At the same time, it Granger-causes 73 percent of Asian fund prices and 9 percent of Asian NAVs. Similar results are found for a 5 percent significance level. This evidence supports the view that Mexican shocks may have passed to Asia through New York, while they hit Latin American stock markets more directly.

This kind of direct contagion to Latin America and indirect spillover to Asia suggests that crises such as during December 1994 are somehow regional, at least in the short run. This was also supported by the correlation patterns and by Tables 8.5 and 8.6, which show how country fund NAVs and prices comove. Latin American funds appear more connected with the Mexican funds than are those of Asia. This is consistent with the argument of Calvo and Reinhart (1995) that the crisis was more regional than global. Nevertheless, there is transmission to Asia.

8.5 Why are some countries affected differently than others?

8.5.1 *Different patterns in different countries?*

Even though we have already found that fund NAVs and prices are correlated with other fund NAVs and prices, depending on the market in which they trade, this section asks whether individual countries react in different ways. A first glance at Table 8.1 points in that direction. By March 10, 1995, Brazilian and Argentine fund prices had suffered the biggest falls, while Chile was the least affected in Latin America. Table 8.6 also shows that Mexico is basically the only country that explains changes in NAVs and prices within Latin America country funds. The two biggest Latin American countries, Brazil and Mexico, are the only ones in the region that explain changes in Asian fund prices, and to a lesser degree Asian NAVs.

Although the entire region is affected by a shock like the Mexican crisis, each country is not hit in the same way. Chile, a country thought to have strong economic fundamentals, is much less influenced than those that are considered to be in economic situations similar to Mexico's, like Argentina. This conclusion is consistent with other findings. Burki and Edwards (1995) point out that Argentina, Brazil, and Venezuela were the countries that suffered the most severe consequences after the Mexican crisis, while Chile and Colombia showed a stronger position. The Folkerts-Landau et al. (1995) section on spillover effects points out that the Argentine and Brazilian stock markets were the most affected by the 1994 peso devaluation.

In Asia, the First Philippine Fund price decreased 28 percent, almost the same as Argentina's fall. Other countries present mixed evidence, depending on the country fund we look at. The sharpest declines were experienced in Indonesia, Pakistan, Taiwan, and Vietnam. Table 8.5 confirms this relationship more generally. It shows that the two countries whose country fund NAVs and prices are more often explained by Latin America than by Asia are the Philippines and Indonesia. At the other extreme, Korean funds were the least hit by the crisis, falling only around 6 percent after December 1994. Again, this finding holds more generally: the Korea Fund is the Asian fund whose price and NAV is least often explained by Latin America.

Tables 8.7 and 8.8 also help to understand how the Mexico Fund is related to other country funds. As pointed out in the previous section, Table 8.7 says that most Asian country funds are hit through changes in New York, rather than in Mexico City. The only countries that turn out not to be directly explained by the Mexico Fund are big countries like

China and India, as well as Taiwan. Note that these tests reflect average relationships over our sample period, whereas the Mexican crisis refers only to one specific point in time.

The price declines reported in Table 8.1 might also be due to external sources unrelated to Mexico. Nevertheless, there is some correspondence. The countries whose funds are hit both directly and indirectly are the Philippines and Vietnam. These are among the funds that experienced the greatest decline after December 1994. The Philippines has often in the literature been described as more closely related to Latin America than to Asia.

Table 8.8 shows that the NAV of Argentina, the country most associated with Mexico, is hit directly. The Argentina Fund price is affected through changes in the Argentine NAV–price relationship. This can be interpreted as Argentina's NAV being very sensitive and reacting very fast to changes in Mexican NAVs. The Mexico Fund is not statistically significant in explaining the Argentina Fund price because this effect is entirely captured by the Argentine NAV (which is included in the regression).

8.5.2 *Is contagion related to fundamentals?*

We have seen that countries appear to be affected in different ways by the crisis in Mexico. We now ask why. We take 1994 economic fundamentals as exogenous, and relate them to the different contagion measures that we have developed: the fall in fund prices from December 2, 1994, to March 10, 1995, and the results from the Granger-causality test.[10] We do not perform serious econometric analysis since we only have twenty-nine country funds. We would need more country funds to carry out a more comprehensive analysis. Furthermore, it is beyond the scope of this chapter to determine why spillover effects from the Mexican crisis were so widespread. Notwithstanding, we are able to get a first impression on why spillovers happened in the way described previously.

Figure 8.3 suggests that the fall in country fund prices after December 1994 was positively related to changes in the debt–export ratio and to the current account deficit–GNP ratio. Descriptive statistics for the fundamentals and simple regression results are reported in Tables 8.9 and 8.10. Countries with weaker external positions were the ones that suffered

[10] Data on economic fundamentals obtained from the World Bank *World Debt Tables* included GNP, exports of goods and services, current account balance, international reserves, and international debt stock. U.S. interest rate data were obtained from the International Finance Division data base, Board of Governors of the Federal Reserve System, Washington, D.C.

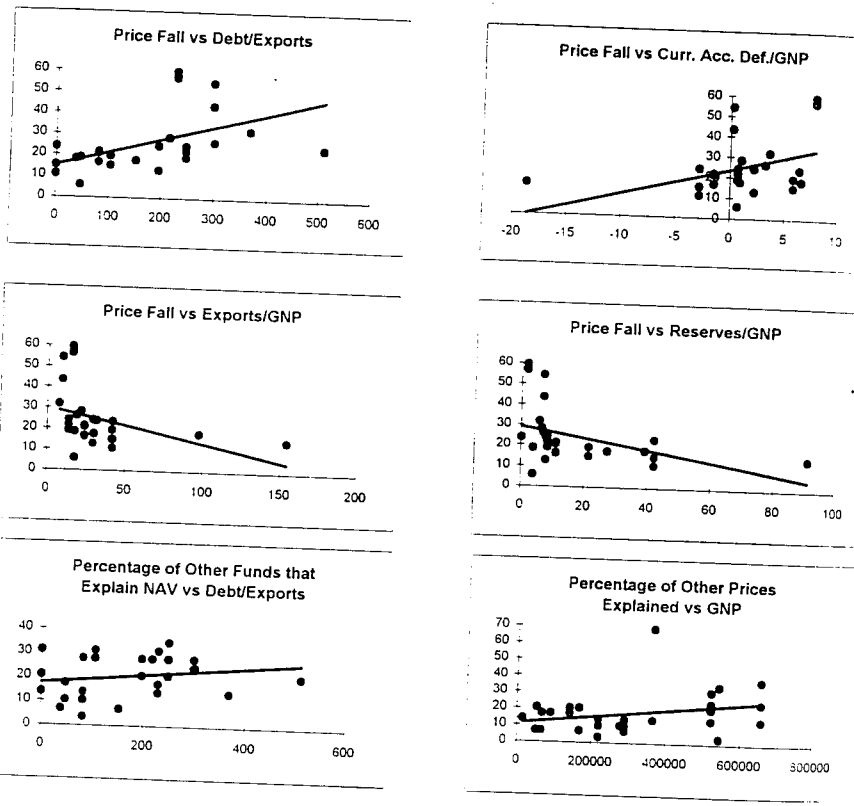


Figure 8.3. Fundamentals-contagion relationships.

higher negative spillover effects. Specifically, the countries with the most sensitive equity funds tend to be those with the highest debt–export ratios: in Asia they are Vietnam, Pakistan, India, the Philippines, and Indonesia. The least sensitive tend to have the lowest debt–export ratios: Taiwan, Malaysia, and Korea.

Price falls of country funds also appear to be negatively related to two other ratios: exports–GNP and reserves–GNP. The former relationship says that more open countries appear to suffer less contagion. This can be interpreted as investors viewing open economies as more reliable, because the cost of a policy reversal or default is higher. Reinforcing this interpretation is that the debt–export ratio is found significant in explaining the country fund price fall, while the debt–GNP ratio was not. Sachs (1985) made a very similar point. Given the size of their external debts,

Table 8.9. *Fundamentals ratios 1994 (in percent)*

	CADEF/EXP	CADEF/GNP	EXP/GNP	DEBT/EXP	DEBT/GNP	RES/GNP
Latin America						
Argentina	47.9	3.6	7.6	368.0	27.8	5.8
Brazil	2.4	0.2	9.3	298.2	27.9	7.1
Chile	3.0	0.9	30.0	151.8	45.5	27.4
Mexico	51.2	7.9	15.4	228.1	35.2	1.8
Asia						
China	−6.1	−1.5	24.0	80.4	19.3	11.1
India	5.2	0.7	13.8	247.5	34.2	8.4
Indonesia	7.5	2.2	29.3	195.8	57.4	7.9
Korea	3.9	0.7	17.7	46.9	15.3	3.9
Malaysia	6.7	6.6	97.9	37.7	36.9	39.2
Pakistan	17.3	3.3	18.8	300.4	56.6	7.1
Philippines	4.8	1.0	21.7	215.7	46.8	6.7
Singapore	−12.1	−18.7	154.3	NA	NA	91.0
Taiwan	−6.7	−2.8	42.0	0.4	0.2	42.1
Thailand	13.9	5.8	41.8	103.1	43.1	21.4
Vietnam	20.3	6.4	31.6	510.7	161.3	0.1

Notes: CADEF = current account deficit; EXP = exports of goods and services; DEBT = international debt stock; and RES = international reserves.

Table 8.10. *Determinants of country fund declines*

Dependent variable	Constant	Independent variable		Adjusted *R*-squared
Price fall	15.11	0.06	Debt/exports	0.23
	(3.58)	(3.02)		
Price fall	23.56	1.25	Curr. acc. deficit/GNP	0.15
	(8.93)	(2.43)		
Price fall	29.98	−0.16	Exports/GNP	0.07
	(7.67)	(−1.76)		
Price fall	29.29	−0.27	International reserves/GNP	0.09
	(8.44)	(−1.93)		
Percentage of other funds that explain the NAV	17.43	0.02	Debt/exports	0.03
	(6.59)	(1.36)		
Percentage of other fund prices explained	11.30	0.00002	GNP	0.08
	(2.64)	(1.81)		

Notes: Results reported for regression of price decline over period 12/2/94 to 3/10/95 on economic fundamentals, for 29 country funds. T-statistics in parentheses.

he argues that Latin American countries were hit more strongly mainly because of their weak export sectors.

In addition, we take the percentage of cases that each NAV is explained by other country funds in the sample-wide causality tests, and relate it to the debt–export ratio. We find that countries with higher proportional debt stocks tend to be more sensitive, in that their equity prices are explained by shocks in other countries. Finally, we find that countries with large GNPs are more likely to have spillover effects on other countries than are small economies. The bigger the country, the more changes in its country fund NAVs or prices explain other fund prices. This finding is consistent with Calvo and Reinhart (1995), who find one-way causality from large to small countries. They show that the capital account balances of small countries are affected by changes in larger countries in the region, but not conversely.

We have also studied the dynamics of contagion. We generated impulse-response functions and calculated variance decompositions. We analyzed how shocks in the Mexico Fund NAV and price are transmitted to other country fund prices. Shocks in Mexico appear to have more

permanent and bigger effects in Latin America than in Asia. In the latter case, some country funds exhibit price overshooting soon after the shock. The long-run effect is less important for Asian than for Latin American country funds. The variance decomposition results are very sensitive to the ordering of equations. We do not report these results in order to save space, and because of their lack of robustness.

8.6 Conclusion

This chapter used a set of data on closed-end country funds to test contagion. It showed how shocks such as the Mexican devaluation crisis of December 1994 may have been transmitted to other emerging markets. It confirmed some previous suppositions on how Asia and Latin America were affected.

We first showed that both Asian and Latin American country fund prices suffered a significant drop after the Mexican crisis. We then illustrated that Latin American NAVs show high comovement among themselves, compared with the price correlations. We found similar results for country fund prices across regions (traded in New York), compared with NAVs across regions (traded in the local markets). These fund prices and NAVs seem to be not only related to the underlying assets, but also to the markets where they trade. The overall evidence for Asia is less conclusive. We estimated all possible combinations of three-variable country fund models in an error–correction form. These models allowed us to test for Granger-causality. The results from these estimations are consistent with the pattern of correlations.

We used bivariate error–correction models to test whether the biggest Mexican fund helps to predict changes in other fund NAVs and prices. We showed, using the Mexico Fund, that Mexican shocks may have been transmitted directly to Latin American NAVs. At the same time, the effect appears to pass through New York to Asia. Changes in the Mexico Fund affect Asian country fund prices, but not NAVs, once we control for lagged changes in NAVs and prices.

Finally, we studied whether the contagion is purely regional. We found that individual countries were affected differently. The Philippines, usually claimed to be similar to Latin America, was hit directly from Mexico. Argentina, the Latin American country thought to have similar economic fundamentals to Mexico, was also hit directly. Furthermore, when we relate the extent of the crisis with some measures of fundamentals, we find interesting results. Price falls in country funds after December 1994 are positively related to weak fundamental measures, while they are negatively related to strong fundamental ones.

Similarly, those NAVs that are seen to be especially sensitive throughout the sample tend to have large debt–exports ratios. This is consistent with the general finding of stronger vulnerability to contagion in Latin America than in Asia, as well as deviations of Chile and the Philippines (respectively) from the general finding. In addition, contagion appears to be more powerful when coming from large countries than small ones.

In this chapter, we tested whether there is evidence of contagion. However, we did not test if that contagion is due to herding behavior or fundamentals contagion. Investors may have sold other country funds because of generalized fears with respect to Latin America, or because they perceive the countries in the region as having similar fundamentals. Nevertheless, our finding that contagion often passes through the New York investor community suggests that institutional details play a role, contrary to the pure models of fully integrated efficient markets. At the same time, our finding that such variables as debt–export ratios help determine vulnerability suggests that economic fundamentals also play a role, contrary to the pure models of speculation and contagion as herd behavior.

Appendix Table 8.A1. *Closed-end country funds and their initial public offering (IPO) dates*

Country funds	Symbol	IPO Date
Argentina Fund	AF	10/11/91
Asia Pacific Fund	APB	2/24/87
Asia Tigers Fund	GRR	11/18/93
Brazil Equity Fund	BZL	4/3/92
Brazil Fund	BZF	3/31/88
Chile Fund	CH	9/26/89
China Fund	CHN	7/10/92
Emerging Mexico Fund	MEF	10/2/90
Emerging Tigers Fund	TGF	2/25/94
First Philippine Fund	FPF	11/8/89
Fidelity Adv. Emerging Asia Fund	FAE	3/18/94
Greater China Fund	GCH	7/15/92
India Fund	IFN	2/14/94
India Growth Fund	IGF	8/12/88
Indonesia Fund	IF	3/1/90
Jakarta Growth Fund	JGF	4/10/90
Jardine Fleming China Fund	JFC	7/16/92
Jardine Fleming India Fund	JFI	3/3/94

Appendix Table 8.A1. *(cont.)*

Country funds	Symbol	IPO Date
Korea Equity Fund	KEF	11/24/93
Korea Fund	KF	8/22/84
Korean Investment Fund	KIF	2/13/92
Latin America DLR Income Fund	LBF	7/24/92
Latin America Equity	LAQ	10/22/91
Latin America Discovery	LDF	6/16/92
Latin America Investment	LAM	7/25/90
Malaysia Fund	MF	5/8/87
Mexico Equity & Income	MXE	8/14/90
Mexican Fund	MXF	6/3/81
Pakistan Investment Fund	PKF	12/16/93
Roc Taiwan Fund	ROC	5/12/89
Singapore Fund	SGF	7/24/90
Schroder Asian Growth Fund	SHF	12/22/93
Scudder New Asia Fund	SAF	6/18/87
Taiwan Equity Fund	TYW	7/18/94
Taiwan Fund	TWN	12/16/83
Templeton China World Fund	TCH	9/9/93
Templeton Vietnam Oppty. Fund	TVF	9/15/94
Thai Capital Fund	TC	5/22/90
Thai Fund	TTF	2/17/88

References

Bordo, Michael D., Bruce Mizrach, and Anna J. Schwartz (1995). "Real versus Pseudo-International Systemic Risk: Some Lessons from History," NBER Working Paper No. 5371, December. Cambridge, Mass.

Burki, Shahid Javed, and Sebastian Edwards (1995). "Latin America after Mexico: Quickening the Pace," August. Unpublished manuscript, World Bank, Washington, D.C.

Calvo, Guillermo (1995). "Varieties of Capital Market Crises." Center for International Economics Working Paper No. 16, University of Maryland at College Park.

Calvo, Guillermo, Leonardo Leiderman, and Carmen Reinhart (1993). "Capital Inflows and Real Exchange Rate Appreciation in Latin America: The Role of External Factors," *IMF Staff Papers* 40 (1): 108–51.

Calvo, Sara, and Carmen Reinhart (1995). "Capital Flows to Latin America: Is There Evidence of Contagion Effects?" Unpublished manuscript, World Bank and International Monetary Fund, Washington, D.C.

De Long, J. Bradford, Andrei Shleifer, Lawrence H. Summers, and Robert Waldmann (1990). "Noise Trader Risk in Financial Markets," *Journal of Political Economy* 98 (4): 703–38.

Folkerts-Landau, David, Takatoshi Ito, et al. (1995). *International Capital Markets: Developments, Prospects, and Policy Issues*. Washington, D.C.: International Monetary Fund.

Frankel, Jeffrey A. (1994a). "Introduction." In *The Internationalization of Equity Markets*, pp. 1–20. Chicago: University of Chicago Press.

(1994b). "Sterilization of Money Inflows: Difficult (Calvo) or Easy (Reisen)?" In Roberto Steiner, ed., *Afluencia de Capitales y Estabilizacion en America Latina*, pp. 241–67. Bogota: Fedesarrollo.

(1995). "Recent Changes in the Financial Systems of Asian and Pacific Countries." In Kuniho Sawamoto, Zenta Nakajima, and Hiroo Taguchi, eds., *Financial Stability in a Changing Environment*, pp. 161–200. New York: St. Martin's Press.

Frankel, Jeffrey A., and Sergio L. Schmukler (1996a). "Country Fund Discounts and the Mexican Crisis of December 1994: Did Local Residents Turn Pessimistic before International Investors?" *Open Economies Review* 7 (suppl. 1): 511–34.

(1996b). "Crisis, Contagion, and Country Funds: Effects on East Asia and Latin America," Center for Pacific Basin Monetary and Economic Studies Working Paper No. PB96-04. Federal Reserve Bank of San Francisco.

(1997). "Country Funds and Asymmetric Information." Center for International Development and Economic Research Working Paper No. C97-087. University of California at Berkeley.

Goldfajn, Ilan, and Rodrigo O. Valdés (1995). "Balance of Payment Crises and Capital Flows: The Role of Liquidity." Unpublished manuscript, Massachusetts Institute of Technology, Cambridge, Mass.

Hardouvelis, Gikas A., Rafael La Porta, and Thierry A. Wizman (1994). "What Moves the Discount on Country Equity Funds?" NBER Working Paper No. 4571. In J. Frankel, ed., *The Internationalization of Equity Markets*, pp. 345–403. Chicago: University of Chicago Press.

Lee, Charles, M. C., Andrei Shleifer, and Richard Thaler (1991). "Investor Sentiment and the Closed-end Fund Puzzle," *Journal of Finance* 46 (1): 75–109.

Sachs, Jeffrey, D. (1985). "External Debt and Macroeconomic Performance in Latin America and East Asia," *Brookings Papers on Economic Activity*, no. 2: 523–73.

Valdés, Rodrigo (1996). "Emerging Markets Contagion: Evidence and Theory," Unpublished manuscript, Massachusetts Institute of Technology, Cambridge, Mass.