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POLICY RESEARCH WORKING PAPER

# Country Funds and Asymmetric Information

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Data on country funds support the hypothesis of asymmetric information: that the holders of underlying assets have more information about local assets than the country fund holders do.



## Summary findings

Using data on country funds, Frankel and Schmukler study how differential access to information affects international investment.

They find that past changes in net asset values (NAVs) and discounts predict current country fund prices more commonly than prices and discounts predict NAVs. The price (NAV) adjustment coefficients are low and negatively correlated with the local (foreign) market variability — but not with the fund price (NAV) variability.

NAVs seem to be closer to local information. They are the asset prices that react first to local news. Later the

country fund holders receive the information and those prices react after NAVs have reacted. The 1995 Mexican crisis and the 1997 Asian crisis are two examples of this type of behavior.

These findings are consistent with the hypothesis of asymmetric information, according to which the holders of the underlying assets have more information about local assets than the country fund holders do.

Frankel and Schmukler empirically test the asymmetric information hypothesis against the noise traders hypothesis. A theoretical model is presented in the appendix.

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This paper — a product of Macroeconomics and Growth, Development Research Group — is part of a larger effort in the group to understand how international financial markets work. Copies of the paper are available free from the World Bank, 1818 H Street NW, Washington, DC 20433. Please contact Rebecca Martin, room MC3-354, telephone 202-473-9065, fax 202-522-3518, Internet address [rmartin1@worldbank.org](mailto:rmartin1@worldbank.org). February 1998. (31 pages)

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## COUNTRY FUNDS AND ASYMMETRIC INFORMATION\*

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The new trends in international capital markets, namely securitization and globalization, have made global investment more accessible to all investors. Nowadays, investors who wish to internationally diversify their portfolio, but who have no specific knowledge of particular industries or firms, can acquire shares of closed-end and open-end country and regional funds. These funds invest primarily in equities from a specific country or region. The fund manager decides the portfolio of the fund, and investors only become aware of the assets they hold at certain points in time--when the fund manager reports the fund composition.

Country fund holders trade most of their shares in Wall Street at the country fund price. The net asset value (NAV) is the dollar value of the underlying assets, which are individually traded in each domestic market. The discount, equal to the percentage difference between the NAV and the price, reflects how the holders of the individual shares value their assets relative to the country fund holders.

In a perfectly efficient and internationally integrated market, discounts would be equal to zero--since NAVs and country fund prices are two market values of the same assets. However, since the shares of closed-end country funds cannot be redeemed, perfect arbitrage becomes practically impossible. Therefore, discounts can diverge from zero. In fact, country fund discounts are large and variable even for large liquid funds traded in developed capital markets. For instance, it is not uncommon to find average discounts of around 15 percent for country funds like the German ones, the French funds, the United Kingdom Fund, the First Australian Fund, and the Mexico Fund.

In this paper we exploit the fact that country fund discounts are different from zero to study the existence of asymmetric information in international capital markets. The asymmetric information approach is appealing in several respects. On the theoretical side, asymmetric information implies that country funds trade at positive discounts. Rational country fund holders

internalize the fact that they know little about each remote country or region, so they are willing to pay less than relatively well-informed domestic investors for the same assets. Moreover, asymmetric information also explains the interaction between NAVs, fund prices, and discounts. The variable that contains more information (the NAV or the fund price) will tend to predict the other variable. The speed of adjustment will be determined by the amount of information contained in the variables.

This paper tests the asymmetric information hypothesis by computing exogeneity tests for most of European, Latin American, and Pacific Rim country funds based in the U.S..<sup>1</sup> We test whether the NAV, the price, or both adjust to the long-run and to the short-run relationships between NAVs and prices. In other words, we investigate which variable appears to be exogenous (or predicted only by its own past): the NAV or the price. The results are obtained by estimating error-correction models for each fund by full-information maximum likelihood (following Johansen, 1988, and Johansen and Juselius, 1990).

In a second stage, the paper tests whether there is a statistically significant relationship between the NAV-price adjustment coefficients and the variability of NAVs and fund prices. The asymmetric information model predicts that more noise in the “external market” reduces the adjustment coefficients. In other words, the less noise NAVs contain the faster prices react to changes in NAVs--when NAVs are closer to fundamentals. On the other hand, the “noise traders model” (which provides an alternative explanation of discounts) predicts that more noise in the New York market reduces the adjustment of prices to NAVs. Noise traders in New York disconnect prices from NAVs (namely, from fundamentals). This paper tests which model is supported by the data.

The remainder of the paper is organized as follows. Section I summarizes the existing literature on country fund discounts. Sections II tests the asymmetric information hypothesis.

Section III introduces applications of asymmetric information. The theoretical model is presented in the appendix section.

### **I. Average Discounts--The Rationale Behind Them**

As mentioned above, country funds are known to trade at high and variable average discounts. In other words, the prices at which country funds trade are in general lower than their Net Asset Values. Part A of Table I shows summary results from a sample of 61 country funds based in New York. The table demonstrates that, when statistically different from zero, mean discounts tend to be positive. Discounts are significantly positive for around 82 percent, 42 percent, and 53 percent of the European, Latin American, and the Pacific Rim funds respectively. On the other hand, discounts are significantly negative for only 12 percent, 25 percent, and 28 percent of the funds.<sup>2</sup> Average positive discounts can be observed in Figure 1 as well, which plots two representative funds from each region. The Korea Fund is an unusual case, where a premium persisted for a long time. This fund was the only channel for foreigners to invest in Korean equities, so the demand for its shares was high. When other instruments like new Korean funds became available, the Korea Fund premia declined.<sup>3</sup>

The cross-regional differences can be explained by the fact that most of the country funds started trading in the late 1980s and early 1990s. During the 1990s, the international community has been mostly optimistic about emerging markets in Asia and Latin America. Favored by low U.S. interest rates, international capital flowed toward these markets. Part of these flows were channeled through country funds. For instance, Claessens and Rhee (1994) show that new country funds account for 25 percent of the equity flows to developing countries over the 1989-1993 period.

**TABLE I**  
**SAMPLE OF 61 FUNDS, 1/4/85-3/8/96**

**PART A:**  
**PERCENTAGE OF DISCOUNT MEANS, SIGNIFICANTLY DIFFERENT FROM ZERO\***

	NUMBER OF FUNDS	DISCOUNT= 100*log(NAV/Price)	
		POSITIVE	NEGATIVE
EUROPE	17	82%	12%
LATIN AMERICA	12	42%	25%
PACIFIC RIM	32	53%	28%

\* The results are computed at a 5% significance level. Details are tabulated in Tables A1.2.

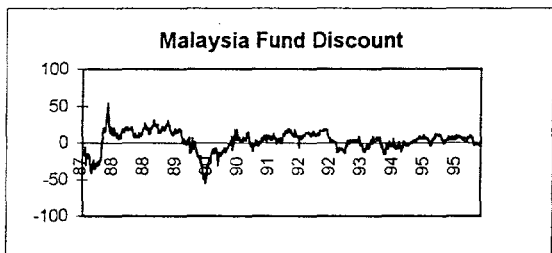
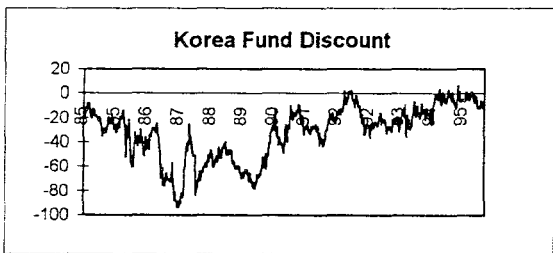
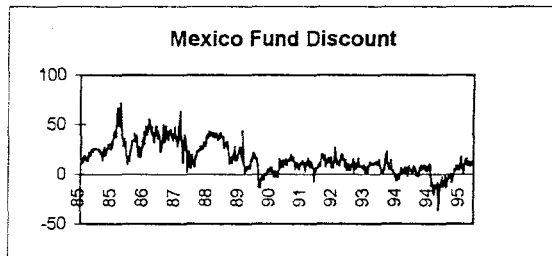
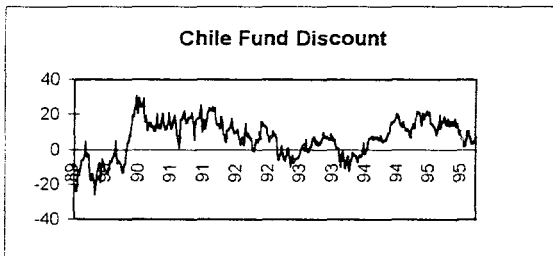
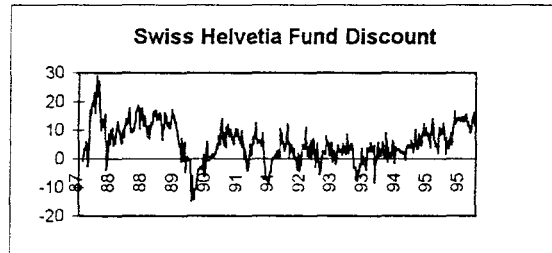
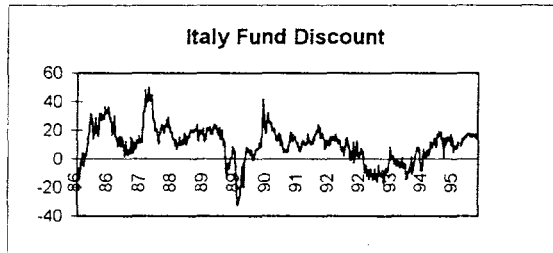
**PART B:**  
**DISCOUNT SUMMARY STATISTICS FOR EACH REGION\*\***

	NUMBER OF OBSERV.	MEAN DISCOUNT	MEDIAN DISCOUNT	STD. DEV. OF DISCOUNTS	MAXIMUM DISCOUNT	MINIMUM DISCOUNT
EUROPE	5646	8.6	11.3	13.8	50	-89
LATIN AMERICA	3163	4.3	3.4	15.6	83	-54
PACIFIC RIM	7439	-0.5	1.4	17.5	54	-94

\*\* All available observations for each region are used to calculate the summary statistics. Summary statistics by fund are displayed in Tables A1.2



**FIGURE 1**  
**SIX REPRESENTATIVE COUNTRY FUND DISCOUNTS**

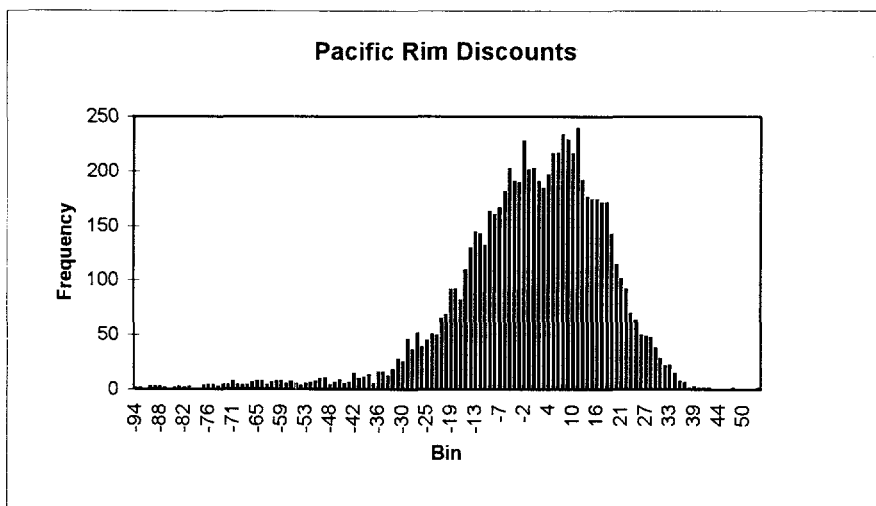
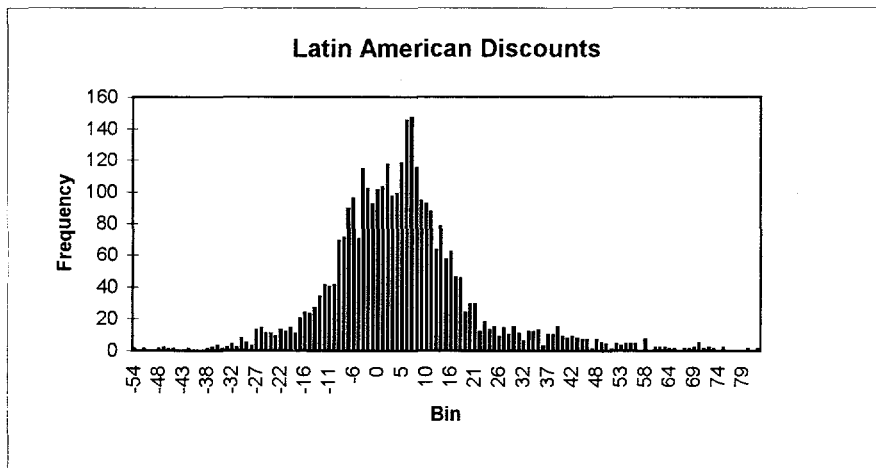
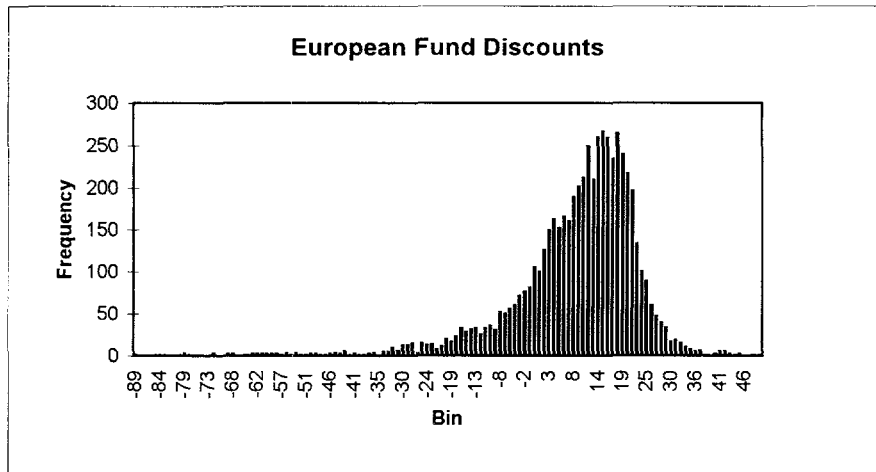


Therefore, the fact that a higher proportion of European funds trade at positive discounts (when compared with funds from the other regions) is not surprising. Optimistic U.S. investors probably pushed up the price of the country funds from emerging economies--relative to the value of their underlying assets--and discounts shrank over that period.

When all the observations are taken jointly, Part B of Table I and Figure 2 show that discounts are positive for Europe and Latin America but not for Asia. The histogram for Europe is somewhat skewed to the right, showing that discounts tend to be positive except for some observations that display large premia. The histogram for Asia is similar but it is more centered on zero. Long left tails are consistent with large premia around the initial public offering and with optimistic sentiments, in particular around the time of the fall of the Berlin Wall in 1989 and in the period of strong capital inflows to emerging Asian economies. The histogram for Latin America presents both long left and right tails, implying optimistic and pessimistic sentiments with respect to these countries.

These large and variable discounts have been rationalized in the literature in two separate ways. The first one claims that transaction costs and market segmentation impose obstacles to arbitrage. Therefore, NAVs and prices can differ from each other. In light of these barriers, Frankel and Schmukler (1996) summarize a set of possible "arbitrage strategies" intended to take advantage of the NAV-price difference. We conclude that, despite large discounts, there is no pure arbitrage strategy that can be easily followed. Closed-end funds do not admit share redemptions. Therefore, investors cannot treat the country fund shares as identical to the basket of underlying assets. In a frictionless world, a rational arbitrageur could buy the country fund and sell short its underlying assets whenever the fund traded at discount. However, closed-end funds are not meant to be open, so short selling is difficult. Moreover, different types of transaction costs--like management fees,

**FIGURE 2**  
**HISTOGRAMS OF COUNTRY FUND DISCOUNTS\***



\* Histograms are constructed using all the observations available for each fund in each region.

non-simultaneous trading, assets denominated in different currencies, and barriers to capital movement--impose additional obstacles to arbitrage. These transaction costs have been theoretically and empirically studied in Stulz (1981), Diwan, Errunza, and Senbet (1993), Errunza and Losq (1985), Bonser-Neal, Brauer, Neal, and Wheatley (1990), and Rogers (1994).

Other papers explain the existence of positive discounts due to the participation of noise traders in international capital markets.<sup>4</sup> This literature claims that a different clientele, composed by both rational and irrational agents, holds country funds. By contrast, only rational investors hold the underlying assets. Country funds are riskier than the underlying assets, because future changes in noise traders misperceptions cannot be fully predicted. In a world of risk-averse investors, the price of the country fund will be lower than the NAV. Among the papers that relate this theory to domestic closed-end funds are Lee, Shleifer, and Thaler (1991), and Chen, Kan, and Miller (1993). Other papers like Hardouvelis, La Porta, and Wizman (1994), and Klibanoff, Lamont, and Wizman (1996) look at the presence of noise traders among country fund holders.

This paper introduces asymmetric information into the discussion about country fund discounts. Asymmetric information has been widely treated in the finance and related literature. Some examples include Akerlof (1970), Grossman and Stiglitz (1980), French and Poterba (1991), Lang, Litzenberger, and Madrigal (1992), and Gehrig (1993). Asymmetric information can show up in different ways. First, domestic investors may have access to locally available information, that foreign investors do not receive. Perhaps foreign investors can obtain the same information, but must bear an extra cost to get it. Second, domestic investors may have the same information, but interpret it in a different way. Third, there may be leaks in information, and domestic investors are able to obtain it first. Fourth, country fund holders might lack information on how the fund is being managed.

Even though there is an information disadvantage, global investment may still look attractive as a consequence of high expected returns and diversification benefits (especially from emerging markets). Small uninformed investors may be more attracted to buy country funds than the underlying assets, since transaction costs are far lower. Also, they know that country fund managers are generally more informed than they are about the country, and can allocate the portfolio of assets more wisely. As a consequence, small international investors will prefer country funds to purchase local securities.

This paper claims that “foreign investors”--small international investors--realize that they are less informed than “domestic investors”--local and big foreign investors--when buying other countries’ equities. Foreign investors know that they will do worse on average when investing abroad with respect to domestic residents. As a consequence, other things equal, foreign investors are willing to pay less for the same assets, and average positive discounts are observed. The effects of introducing asymmetric information are formally presented in the Appendix.

The idea of asymmetric information differs from the noise traders model, in which country fund holders randomly overestimate or underestimate future returns on foreign investment. In this paper, foreign investors are rational agents who try to assess the best forecast of future returns. However, since they are far away from the market in which they invest, they face higher uncertainty. In other words, due to asymmetric information, foreign investors have a “higher subjective variance” than domestic investors--even though their average forecast is unbiased. They perceive investment in a foreign country as being riskier than domestic investors do.

This paper concentrates only on country funds. The same idea can be applied to domestic closed-end country funds, where most of the previous literature has focused. Small investors are the ones that usually buy domestic closed-end funds, since--compared with large investors--they have

less information about particular firms and industries. Therefore, asymmetric information might also explain discounts in domestic funds. Nevertheless, the information asymmetry is likely to show up more clearly in the case of closed-end country funds given that the underlying assets are located in distant countries.<sup>5</sup>

## **II. Empirical Testing**

Asymmetric information yields three testable empirical implications. First, discounts tend to be positive on average. Second, past large discounts and NAVs help to predict current country fund prices. Third, the adjustment coefficients are negatively correlated with the presence of noise in the other markets. We already showed in Table I that discounts are in general greater than zero for most of the funds. In this section, we empirically analyze the other two implications of our hypothesis.

## **A. Testing for Exogeneity in NAVs and Prices**

In this subsection, we try to determine which variable tends to be exogenous: the NAV or the fund price. In other words, we study whether lagged short-run changes in NAVs and prices are significant in explaining current changes in each variable, and which variable is the one that adjusts to the long-run NAV-price relationship. We expect that the variable that comprises more information about the fundamental values of the assets is the one that tends to be exogenous with respect to the other variable. If NAVs are closer to changes in fundamentals, they will tend to react first. Thus future price changes will be predicted by present NAV changes. If prices are the ones closer to fundamentals, the opposite relationship will hold. In summary, we investigate whether NAVs tend to predict prices more often than prices tend to predict NAVs.

Exogeneity of NAVs and prices needs to be analyzed in the context of non-stationarity. Our previous results show that most country fund NAVs and prices are  $I(1)$ , integrated of order 1.<sup>6</sup> Except for some European and Asian funds, we are not able to reject non-stationarity. Moreover, we computed unit root tests for the variables in first differences; non-stationarity is widely rejected.

Even though NAVs and prices seem to be non-stationary, we expect that the variables do not diverge without bound from each other. Country fund NAVs and prices are ultimately two different values of the same assets, so they tend to move together in the long run. In econometric terms, we expect to find cointegration between the variables. Specifically, NAVs and prices may be linked by a stationary (linear) long-run relationship  $P_t = \pi + \lambda N_t + \varepsilon_t$ , where the mean-zero error term  $\varepsilon$  is stationary,  $\varepsilon_t \sim I(0)$ .

Frankel and Schmukler (1997) reports the Johansen (1988), and Johansen and Juselius (1990) tests for each fund. The results vary across regions, but we find a number of cases in which the presence of one cointegrating vector cannot be rejected. For 8 out of 17 funds we cannot reject

cointegration among European funds. For 4 out of 12 funds there is evidence of cointegration in Latin American funds. In the case of Asia, cointegration is not rejected for 17 out of 32 funds. We also test for stationarity once the cointegrating vectors are constrained to be (1, -1). For almost all of the cases, the tests reject non-stationarity in discounts.

The fact that there is cointegration is in itself interesting since it confirms the a-priori economic intuition that there is a long-run equilibrium relationship linking country fund NAVs and prices. We can obtain more information from the cointegration tests. For example, 65 percent of the European fund, 66 percent of the Latin American funds, and 47 percent of the Pacific Basin funds cannot reject that the fitted  $\lambda$ s are 1. That means that shocks to NAVs (prices) are entirely transmitted to prices (NAVs) in the long run. This finding also confirms our economic intuition, which says that changes in the value of the underlying assets (country fund) will eventually be entirely reflected in the corresponding country fund price (NAV).

Given that the variables are non-stationary, usual Granger-causality tests of the variables in levels--exogeneity tests in the vector-autoregression (VAR) framework--do not yield statistics that follow standard distributions. On the other hand, VAR processes in first differences omit important information contained in the long-run relationship, and consequently may have specification biases. Nevertheless, both the short-run and the long-run dynamics are embedded in the error-correction model (ECM). The first differences of NAVs and prices are related to the one-period lagged cointegrating vector, and to lagged first differences of both variables,

$$\begin{aligned}
 \Delta P_t &= \varpi_1 + \alpha_1(P_{t-1} - \pi - \lambda N_{t-1}) + \sum_{i=1}^L \gamma_{1i} \Delta N_{t-i} + \sum_{i=1}^L \beta_{1i} \Delta P_{t-i} + v_t \\
 \Delta N_t &= \varpi_2 + \alpha_2(P_{t-1} - \pi - \lambda N_{t-1}) + \sum_{i=1}^L \gamma_{2i} \Delta P_{t-i} + \sum_{i=1}^L \beta_{2i} \Delta N_{t-i} + v_t.
 \end{aligned}
 \tag{1}$$



We estimate the entire model (1) by full-information maximum likelihood (FIML). In this way, we can simultaneously obtain estimates for  $\pi$  and  $\lambda$ , along with estimates for the other parameters of the model. Representative results from the FIML procedure are displayed in Table II. Large funds from each of the three regions are chosen. We select funds with a long history, which are not affected by particular optimism around a recent IPO.<sup>7</sup> Fitted  $\lambda$ s with their standard errors are displayed in the first two columns of Table II.

The rest of Table II tabulates exogeneity tests. Weak exogeneity tests--with respect to the parameters  $\pi$  and  $\lambda$ --are computed by looking at the adjustment toward the long-run relationship. Given that there is cointegration, either the NAV, the fund price, or both respond to deviations in the long-run relationship. A significant fitted  $\alpha_1$  ( $\alpha_2$ ) means that the price (NAV) adjusts to changes in the cointegration relationship.<sup>8</sup> Table II also displays the point estimates of  $\alpha_1$  and  $\alpha_2$ , since besides their statistical significance their size is also interesting.

Our results show that significant  $\alpha_1$ s are greater than significant  $\alpha_2$ s. Significant  $\alpha_1$ s range from values as low as 2 percent for the Korea Fund, and as high as 28 percent for the Templeton Vietnam Fund. Significant  $\alpha_2$ s range from values as low as 3 percent for the India Growth Fund, and as high as 13 percent for the Jardine Fleming India Fund. These coefficients imply half lives for prices that go from less than 2 weeks to 18 weeks, and half lives for NAVs that go from more than 3 weeks to 18 weeks. The average significant  $\alpha_1$  ( $\alpha_2$ ) is -0.11 (0.075).<sup>9</sup> They suggest that the adjustments are relatively slow, but higher in absolute value for prices than for NAVs. One could argue that these results support the asymmetric information hypothesis. Prices react more to changes in past discounts because deviations from the long-run equilibrium convey more information for prices than for NAVs.

**TABLE II**  
**FULL-INFORMATION MAXIMUM LIKELIHOOD ESTIMATION RESULTS**  
**THE CASE OF 6 REPRESENTATIVE FUNDS (2 FOR EACH REGION)\***  
**EXOGENEITY TESTS (WALD STATISTICS) AND NORMALIZED COINTEGRATING VECTORS**  
**4 LAGS - SAMPLE 1/4/85-3/8/96**

	ID	No. OBS.	FITTED LAMBDA	FITTED STAND. ERROR	LONG-RUN ADJUSTMENT (Weak Exogeneity)				SHORT-RUN ADJUSTMENT		GRANGER-NONCAUSALITY (Strong Exogeneity)	
					Chi-Squared (1)		Chi-Squared (2)		Chi-Squared (3)			
					H0: alpha1=0	alpha1	H0: alpha2=0	alpha2	H0: gamma1'=0	H0: gamma2'=0	H0: alpha1 & gamma1'=0	H0: alpha2 & gamma2'=0
<b>EUROPEAN FUNDS:</b>												
ITALY FUND	ITA	499	0.87	0.165	6.32 **	-0.050	2.56	0.021	11.10 **	1.60	19.08 ***	5.46
SWISS HELVETIA FU	SWZ	443	0.97	0.082	5.49 **	-0.076	1.07	0.019	31.81 ***	1.41	48.11 ***	2.87
<b>LATIN AMERICAN FUNDS:</b>												
CHILE FUND	CH	332	0.93	0.082	9.35 ***	-0.083	2.46	-0.027	22.78 ***	5.20	37.94 ***	6.75
MEXICO FUND	MXF	555	1.18	0.046	1.12	-0.027	7.38 ***	0.051	18.74 ***	8.03 *	25.41 ***	26.89 ***
<b>PACIFIC RIM FUNDS:</b>												
KOREA FUND	KF	584	0.69	0.306	4.37 **	-0.023	0.16	-0.002	19.13 ***	8.74 *	24.17 ***	8.74
MALAYSIA FUND	MF	453	1.09	0.116	13.04 ***	-0.085	0.19	-0.007	6.73	40.34 ***	26.42 ***	41.24 ***

\* All the results are tabulated in Tables A4 and A5.  
 \*, (\*\*), (\*\*\*) Implies significance at 10%, (5%), [1%].

Table II also reports tests regarding the short-run adjustment. These tests look at whether the set of fitted  $\gamma_1$  and  $\gamma_2$  are jointly zero. A vector  $\gamma_1$  ( $\gamma_2$ ) different from zero means that current fund prices (NAVs) adjust to past changes in NAVs (prices). Finally, Table II displays statistics that test which variable is “strongly exogenous:” the NAV, the price, or both. We call “strong exogeneity” or “Granger-noncausality” the cases when the fund NAV or price is explained only by its own past-- but not by the long-run equilibrium or by the recent history of the other variable. In other words, the strong exogeneity test looks at whether  $\alpha_1$  and  $\gamma_1$  (or  $\alpha_2$  and  $\gamma_2$ ) are jointly zero.

We use different specifications to compute exogeneity tests in order to illustrate how results vary across models. We are reluctant to work with only one model since we want to make sure that our results are robust to various specifications. The exogeneity tests are computed from three models. First, we assume that cointegration exists in all the funds, even when the tests failed to detect it. Second, we do not include the long-run relationship for the cases where we failed to find evidence of cointegration. Third, we assume that none of the funds is cointegrated. For each model we have tried several lag structures and restrictions on the variables; the case of 4 lags is reported here.<sup>10</sup> Further lags are statistically insignificant and the results appear very robust to various lag structures. In addition, the estimates do not tend to change across specifications when restrictions on the long-run relationships are imposed.<sup>11</sup>

Because the reader might be interested in a general conclusion rather than in particular country funds, Table III summarizes all the results computed in Frankel and Schmukler (1997). The table shows the percentage of funds for which NAVs and fund prices adjust to short-run and long-run changes. In addition, Table III displays the median Wald statistic for each test across every group of funds. The table shows that NAVs tend to be the exogenous variables. In other words, past changes in NAVs help to explain present changes in prices but not otherwise. Moreover,

**TABLE III**  
**PERCENTAGE OF FUNDS FOR WHICH THEIR NAVS AND PRICES**  
**REJECT EXOGENEITY AT A 5% SIGNIFICANCE LEVEL**  
**FULL-INFORMATION MAXIMUM LIKELIHOOD ESTIMATION**  
**4 LAGS - SAMPLE 1/4/85-3/8/96**

<b>PART A: ASSUMES COINTEGRATION</b>	<b>LONG-RUN ADJUSTMENT (Weak Exogeneity, w.e.)</b>			
	H0: Prices Weakly Exog.	Median Wald Statistic	H0: NAVs Weakly Exog.	Median Wald Statistic
EUROPEAN FUNDS	65%	5.59**	6%	0.86
LATIN AMERICAN FUNDS	25%	2.09	17%	1.80
PACIFIC RIM FUNDS	50%	3.69*	28%	1.07
TOTAL	50%	3.91**	20%	1.15

	<b>SHORT-RUN ADJUSTMENT</b>			
	H0: Prices Do Not Adjust	Median Wald Statistic	H0: NAVs Do Not Adjust	Median Wald Statistic
EUROPEAN FUNDS	82%	16.80***	12%	5.22
LATIN AMERICAN FUNDS	67%	15.77***	17%	4.08
PACIFIC RIM FUNDS	41%	6.50	22%	6.26
TOTAL	57%	11.19**	18%	5.54

	<b>GRANGER-NONCAUSALITY (Strong Exogeneity, s.e.)</b>			
	H0: Prices Strongly Exog.	Median Wald Statistic	H0: NAVs Strongly Exog.	Median Wald Statistic
EUROPEAN FUNDS	88%	32.28***	24%	7.29
LATIN AMERICAN FUNDS	83%	16.84***	25%	6.34
PACIFIC RIM FUNDS	56%	11.58**	34%	9.86*
TOTAL	70%	18.38***	30%	8.45

<b>PART B: DOES NOT ASSUME COINTEGRATION</b>	<b>LONG-RUN ADJUSTMENT (Weak Exogeneity, w.e.)</b>			
	H0: Prices Weakly Exog.	Median Wald Statistic	H0: NAVs Weakly Exog.	Median Wald Statistic
EUROPEAN FUNDS	79%	6.46**	7%	0.89
LATIN AMERICAN FUNDS	38%	2.01	25%	3.15*
PACIFIC RIM FUNDS	59%	4.33**	33%	1.71
TOTAL	61%	4.46**	24%	1.76

	<b>SHORT-RUN ADJUSTMENT</b>			
	H0: Prices Do Not Adjust	Median Wald Statistic	H0: NAVs Do Not Adjust	Median Wald Statistic
EUROPEAN FUNDS	82%	18.81***	12%	6.35
LATIN AMERICAN FUNDS	67%	15.77***	17%	4.65
PACIFIC RIM FUNDS	44%	8.19*	22%	6.58
TOTAL	59%	12.64**	18%	6.14

	<b>GRANGER-NONCAUSALITY (Strong Exogeneity, s.e.)</b>			
	H0: Prices Strongly Exog.	Median Wald Statistic	H0: NAVs Strongly Exog.	Median Wald Statistic
EUROPEAN FUNDS	86%	32.31***	29%	8.61
LATIN AMERICAN FUNDS	100%	16.84***	25%	7.34
PACIFIC RIM FUNDS	59%	14.74***	37%	10.22*
TOTAL	73%	20.05***	33%	9.20*

<b>PART C: ASSUMES NO COINTEGRATION</b>	<b>SHORT-RUN ADJUSTMENT</b>			
	H0: Prices Do Not Adjust	Median Wald Statistic	H0: NAVs Do Not Adjust	Median Wald Statistic
EUROPEAN FUNDS	71%	18.81***	18%	6.25
LATIN AMERICAN FUNDS	75%	20.20***	25%	4.74
PACIFIC RIM FUNDS	50%	9.32*	44%	7.81*
TOTAL	61%	14.11**	33%	6.77

\*, (\*\*), (\*\*\*) Implies significance at 10%, (5%), [1%].

deviations from the long-run equilibrium seem to be more informative for prices than they are for NAVs. The results hold for the case when cointegration is assumed, but even more strongly for the one when cointegration is not assumed. Overall, NAVs tend to be strongly exogenous. Table III shows that in 70 and 73 percent of the cases NAVs are strongly exogenous, depending on whether cointegration is assumed or not. Meanwhile, prices are only strongly exogenous in 30 and 33 percent of the cases respectively. When cointegration is ruled out, the results show that for 61 (33) percent of the cases NAVs (prices) are exogenous.

A closer look at Table III suggests interesting conclusions. First, all the exogeneity tests for every region yield the same results: NAVs tend to be the exogenous variable, while fund prices are the ones that adjust to past changes in NAVs. This evidence seems to support the hypothesis of asymmetric information in all regions. Second, this relationship holds even more strongly for Europe than for Latin America or the Pacific Rim. This fact is not entirely surprising. We have already indicated that discounts are positive for a smaller proportion of Latin American and Pacific Rim funds than European funds. As mentioned before, these funds cover a period of high capital flows to emerging countries in Asia and Latin America. A significant part of these flows was due to investors that bought foreign equities in the form of ADRs and country funds. Therefore, optimistic foreign investors may have generated a boom in country fund prices, that later on raised local stock market prices.

Our results are consistent with the fact that NAVs are closer to information about local market fundamentals, and consequently react first. Nevertheless, we recognize that in principle these results are also consistent with previous papers--which assumed that noise traders hold country funds but not the underlying assets. If country fund holders repeatedly underpredict or overpredict changes in fund prices, they are the ones who will adjust to changes in NAVs (which

are closer to fundamentals). We explore further implications of both hypotheses in the next subsection.

### **B. Why Are Adjustments Slow?**

If investors are fully rational, even if subject to asymmetric information, they will use the information in the NAVs, which is published weekly. Fund prices will mimic NAVs as soon as NAVs become available every week. However, the ECM results show that prices follow NAVs at a slower pace than that implied by asymmetric information among rational investors. It takes several weeks to complete the adjustment. Several reasons may explain this sluggishness.

First, the presence of noise traders may delay the adjustment since foreign investors face a signal-extraction problem. Changes in NAVs can be caused either by misperceptions among noise traders (who may also participate in the local market) or by changes in the country's fundamentals. Second, prices may be slow to react due to market illiquidity. Many country fund markets are shallow: few transactions take place. Therefore, prices will move toward NAVs only as transactions occur.<sup>12</sup>

Third, if there are noise traders only in the country fund market, as the noise traders literature suggests, prices will be disconnected from changes in NAVs. Noise traders' estimates of the asset values differ from the fundamental values, reflected by the NAVs. So the link between NAVs and prices is distorted by noise traders' misperceptions. Fourth, it could be the case that domestic and foreign investors have different preferences or are part of different clienteles. So NAVs and fund prices move according to each market's preferences, although they may eventually move together in the long run. Therefore, a weak connection is found between NAVs and prices in the short run.

This section tests whether the statistical evidence is consistent with any of the competing explanations of sluggish responses. We relate the adjustment coefficients to measures of noise trading and market liquidity. As a proxy for noise trading we take the standard deviation of first-differenced log NAVs and prices, given that the variables in levels are non-stationary. We assume that more noise in the markets leads to increasing variability in NAVs and prices. As a proxy for market liquidity we take the magnitude of each fund's total assets.

The first part of Table IV shows regressions of the fitted price adjustment coefficients (negative fitted  $\alpha_{1s}$ ) on three explanatory variables: the standard deviations of first-differenced NAVs and prices, and the value of the country funds' assets. The first three regressions show that more noise in the local market implies lower adjustment coefficients for country fund prices. They also show that the value of the total assets is not statistically significant in explaining price adjustments. So the market illiquidity explanation is not supported by the data. Lastly, they show that noise in the country fund market is not statistically related to the adjustment coefficient and has the wrong sign. The fourth and fifth regressions concentrate on the NAV adjustment coefficients. They suggest that the standard deviation of first-differenced log prices is negatively related to the fitted  $\alpha_{2s}$ . In other words, more volatile country fund prices imply slower adjustment of NAVs to prices.

In summary, results from Table IV suggest that the speeds of adjustment are negatively related to the variability of the "external market." The adjustment of country fund prices is negatively related to the variability of the NAVs, while the adjustment of NAVs is negatively related to the variability of the fund prices. This suggests the typical signal-extraction problem of markets with imperfect information. The statistical relationship holds more strongly for the price adjustment case. Finally, the noise trader models would predict that more noise in the country fund market is

**TABLE IV**  
**WHAT EXPLAINS SLOW ADJUSTMENT COEFFICIENTS?**  
**ADJUSTMENT COEFFICIENTS VERSUS NAV AND PRICE VARIABILITY**  
**HETEROSKEDASTICITY-CONSISTENT STANDARD ERRORS**

**Dependent Variable: PRICE ADJUSTMENT**

(negative alpha1 coefficients, higher values imply faster adjustments)

**Regression 1:**

Number of Observations: 61

**Independent Variables:**

	Coefficient	Std. Error	t-Statistic
Constant	0.12	0.02	5.35 ***
St. Dev. of First-Diff. Log NAVs	-1.42	0.57	-2.48 ***
Adjusted R-squared	0.07	S.E. of regression	0.06

**Regression 2:**

Number of Observations: 56

**Independent Variables:**

	Coefficient	Std. Error	t-Statistic
Constant	0.13	0.03	5.01 ***
St. Dev. of First-Diff. Log NAVs	-1.31	0.57	-2.31 ***
Total Assets	-3E-05	4E-05	-0.85
Adjusted R-squared	0.06	S.E. of regression	0.06

**Regression 3:**

Number of Observations: 61

**Independent Variables:**

	Coefficient	Std. Error	t-Statistic
Constant	0.09	0.04	2.53 ***
St. Dev. of First-Diff. Log NAVs	-1.76	0.79	-2.23 ***
Total Assets	-4E-05	4E-05	-0.95
St. Dev. of First-Diff. Log Prices	0.99	1.02	0.97
Adjusted R-squared	0.05	S.E. of regression	0.06

**Dependent Variable: NAV ADJUSTMENT**

(alpha2 coefficients, higher values imply faster adjustments)

**Regression 4:**

Number of Observations: 61

**Independent Variables:**

	Coefficient	Std. Error	t-Statistic
Constant	0.07	0.04	1.59
St. Dev. of First-Diff. Log Prices	-0.91	0.83	-1.10
Adjusted R-squared	0.02	S.E. of regression	0.04

**Regression 5:**

Number of Observations: 61

**Independent Variables:**

	Coefficient	Std. Error	t-Statistic
Constant	0.08	0.04	1.85 *
St. Dev. of First-Diff. Log Prices	-1.55	0.84	-1.85 *
St. Dev. of First-Diff. Log NAVs	0.67	0.45	1.49
Adjusted R-squared	0.02	S.E. of regression	0.04

\*, (\*\*), [\*\*\*] Implies significance at 10%, (5%), [1%].



related to slower price adjustments. The higher the misperception, the less related NAVs and prices are. Our results do not support this hypothesis, since the volatility of the country fund market is not statistically significant and is positively related to the speed of adjustment of prices to NAVs. Nevertheless, our results favor the asymmetric information model.

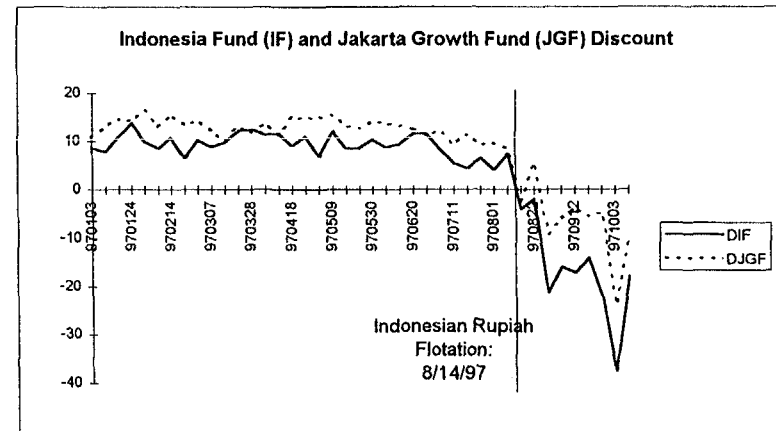
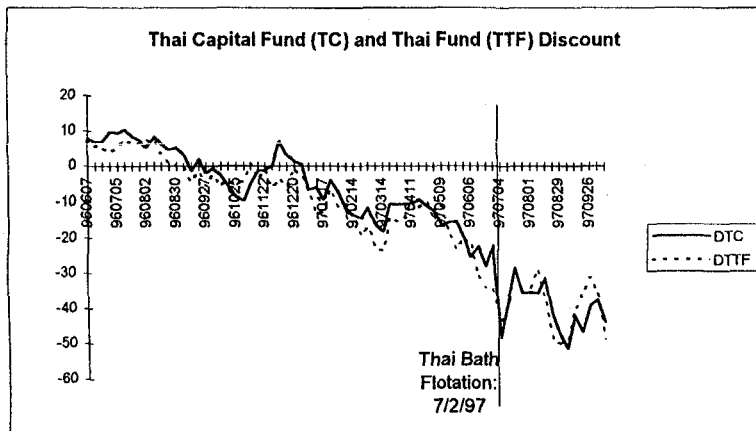
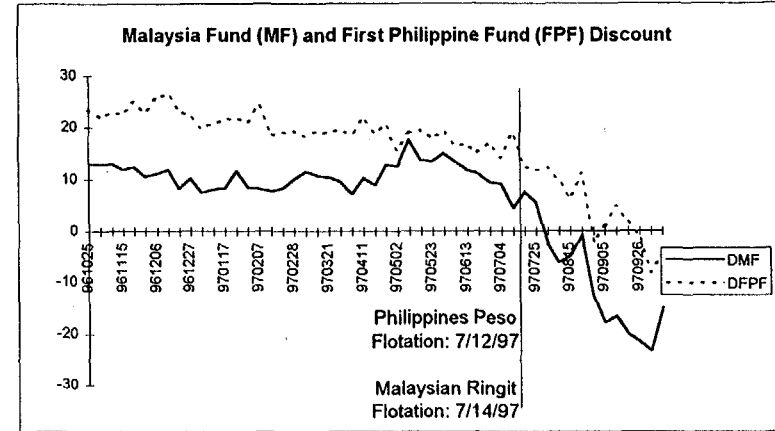
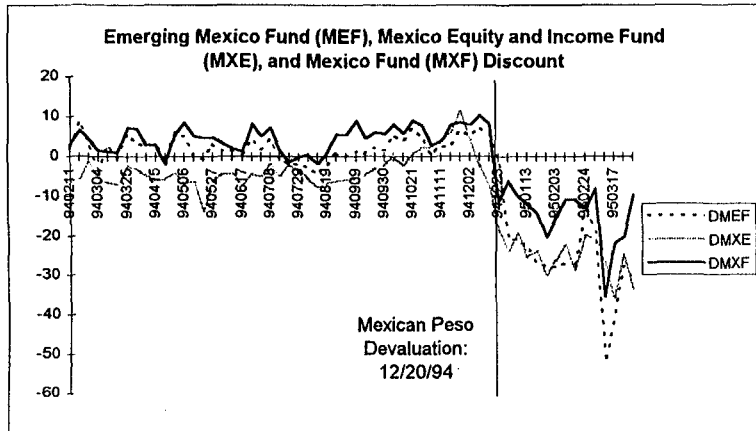
### **III. Applications of Asymmetric Information**

This section introduces applications of asymmetric information to the recent financial crises in Mexico 1994-95 and Asia 1997. The asymmetric information hypothesis suggests that the market for the underlying assets has more information than the country fund market. Therefore, we expect NAVs to react first to an ongoing crisis, anticipating the decline in fund prices. When the fall in NAVs is large relative to fund prices, average discounts turn to premia before or at the beginning of the crisis. Figure 3 shows that this has been the case for most funds that invest in the countries involved in the recent episodes.<sup>13</sup>

Frankel and Schmukler (1996) show that NAVs of the three Mexican funds fell before and faster than fund prices, prior to the Mexican devaluation of December 20, 1994. We interpret this fact as evidence that Mexican investors (the main holders of the underlying assets) reacted to the crisis of 1994 before foreign investors. Mexican investors probably knew more and foresaw the crisis, while small American investors reacted with a lag.

In the case of the more recent Asian crisis we study the four countries that have been initially affected by the crisis: Indonesia, Malaysia, the Philippines, and Thailand. The crisis erupted with the Thai Bath's free floating and depreciation on July 2, 1997. Thailand had been perceived as facing macroeconomic and financial vulnerability. The stock market had been falling since its peak in 1995

**FIGURE 3**  
DISCOUNTS AT THE BEGINNING OF CRISES



along with the two Thai country fund NAVs and prices. Nevertheless average discounts turned into premia by the end of 1996. After January 1997 the premia increased steadily, as if holders of the underlying assets were more aware of how fragile Thailand's financial sector was.

The Philippines, Malaysia, and Indonesia followed Thailand by free floating their exchange rates on July 12, July 14, and August 14 respectively. Part of the transmission to these countries has been interpreted as being pure contagion. The crisis in Indonesia seems to have been unexpected. The Indonesian stock market index did not decline as the others did. But right before the crisis, NAVs fell sharply turning small discounts into premia on the week of the rupiah's free floating. This type of behavior seems similar to the Mexican example. In the case of the Philippines and Malaysia we observe discounts shrinking before the free floating, and turning into premia afterwards. This kind of evidence suggests that the holders of the underlying assets were more pessimistic than the country fund holders after the currency depreciation in each country, as if they have understood more quickly the extent of the crisis.

#### **IV. Summary and Conclusions**

This paper has addressed several issues concerning country funds. The main finding of the paper is that country funds support the hypothesis of asymmetric information. We estimated error-correction models for each country fund, since the variables appeared to be non-stationary and due to the existence of cointegration between NAVs and prices. The exogeneity tests concluded that NAVs tend to be the exogenous variable. In other words, past NAVs and discounts predict current changes in country fund prices more often than past fund prices and discounts predict current

changes in NAVs. This relationship held in general for the three regions studied, namely Europe, Latin America, and the Pacific Rim.

The results appeared robust to various specifications. When cointegration was (not) assumed, we rejected the null hypothesis of strongly exogenous prices in 70 (73) percent of the funds, while we only rejected the null hypothesis of strongly exogenous NAVs in 30 (33) percent of the funds. On the other hand, when ruling out cointegration, we found that prices adjust in 61 percent of the cases to short-run changes in NAV, while NAVs adjust in 33 percent of the cases to short-run changes in prices. We found this evidence consistent with asymmetric information. NAVs seem to be closer to local information; they are the asset prices that react first to local news. Later on, the country fund holders receive the information, so prices react after NAVs have reacted. This type of behavior can be observed in Figure 3, where the Mexican and Asian country fund discounts are plotted around the recent currency crises.

Our empirical analysis also found sluggish adjustments to the long-run relationships between NAVs and prices. In other words, NAVs and prices react to large discounts more slowly than what asymmetric information predicts. Thus, we explored the statistical relationship between the speeds of adjustment and other variables. We worked with each market's variability as a measure of noise in the markets. The tests showed that there is a statistically significant negative relationship between the price adjustment coefficients and the standard deviation of first-differenced log NAVs. We found a similar relationship between the NAV adjustment coefficients and the standard deviation of first-differenced log prices. However, we failed to find a significant relationship between the adjustment coefficients and the variability of the markets where the assets trade.

The model introduced in the Appendix explains why one might expect average positive discounts to be the norm. Assuming asymmetric information, the theoretical model entails three

propositions. In the first proposition, the model shows that discounts are on average positive. The second proposition shows that changes in NAVs help to predict changes in prices. The third proposition extends the results by introducing noise traders; thus NAVs are not fully revealing. The last theoretical proposition demonstrates that the reaction of prices to NAVs is only partial.

The asymmetric information approach presents two main advantages over the “noise traders model.” First, it has enabled us to derive average positive discounts even excluding noise traders or irrational agents from the model. In addition, it has allowed us to include noise traders in the market of country funds as well as in the market of underlying assets. Thereby, we could see how noise in both markets affects the adjustment toward the long-run equilibrium. Finally, we have been able to test empirically the asymmetric information hypothesis against the noise traders model.

## Appendix - A Model of Asymmetric Information

This appendix introduces a model that captures our primary empirical findings. We assume a world of overlapping generations with two-period-lived domestic and international investors.<sup>14</sup> “Domestic investors” are both residents of the country (where the underlying assets are being traded) and large international investors (who have the same information than local residents). “Foreign investors” are small international investors who buy the other country’s assets. Their utility functions are respectively described by

$$U = -e^{-(2\gamma)W}, \quad U^* = -e^{-(2\gamma)W^*} \quad (2)$$

$\gamma$  represents the degree of absolute risk aversion, and  $W$  and  $W^*$  stand for their wealth. The asterisk (\*) denotes foreign investors’ variables.

In period 1, investors choose their portfolio to maximize future expected utility. They consume all their wealth in period 2 and leave no bequests to future generations. Two assets are available in the economy: a safe asset and a risky one. The safe asset, which we think of as U.S. government bonds, has a perfectly elastic supply and pays a return  $r$ . Its price is normalized to 1. The risky asset is a basket of securities from the domestic country. The risky asset can be held directly or via holding the respective country fund.  $P_t$  is the foreign market price of the country funds.  $N_t$  is the NAV, the domestic value of the portfolio of underlying assets (denominated in the foreign currency). We assume that both  $P_t$  and  $N_t$  are observable at any point in time.<sup>15</sup> The domestic and foreign investor’s demand functions are  $\phi_t^n$ ,  $\phi_t^f$ ,  $\phi_t^{*n}$ , and  $\phi_t^{*f}$ .

Investors maximize their expected utility in period 1, choosing their demand for risk-free and risky securities. Their wealth in the period they consume are

$$\begin{aligned}
W_{t+1} &= W_t(1+r) + \phi_t^n (N_{t+1} + y_{t+1} - N_t(1+r)) + \phi_t^f (P_{t+1} + y_{t+1}^f - P_t(1+r)), \\
W_{t+1}^* &= W_t^*(1+r) + \phi_t^{*n} (N_{t+1} + y_{t+1} - N_t(1+r)) + \phi_t^{*f} (P_{t+1} + y_{t+1}^f - P_t(1+r)).
\end{aligned} \tag{3}$$

The only difference between domestic and foreign investors is reflected on how they perceive future dividends. Given their information set  $I_t$ , domestic investors perceive the dividends of the underlying assets to be

$$y_{t+1} = y_t + \varepsilon_{t+1}. \tag{4}$$

$\varepsilon_{t+1}$  is the unexpected shock to the underlying assets' fundamentals. Foreign investors perceive the dividends of the underlying assets to follow

$$y_{t+1} = y_t + \varepsilon_{t+1} + \lambda_{t+1}. \tag{5}$$

$\lambda_{t+1}$  is noise that foreign investors face due to asymmetric information about foreign countries.

Finally, when both domestic and foreign investors buy the country fund, dividends are perceived to be

$$y_{t+1}^f = y_t + \varepsilon_{t+1} + \mu_{t+1}. \tag{6}$$

$\mu_{t+1}$  reflects uncertainty about the fund manager's quality.

We assume that the shocks to dividends have the following distribution

$$\begin{pmatrix} \varepsilon_t \\ \lambda_t \\ \mu_t \end{pmatrix} \sim N \left( \begin{pmatrix} 0 \\ 0 \\ 0 \end{pmatrix}, \begin{pmatrix} \sigma_\varepsilon^2 & 0 & 0 \\ 0 & \sigma_\lambda^2 & 0 \\ 0 & 0 & \sigma_\mu^2 \end{pmatrix} \right). \tag{7}$$

The assumptions made in equations (4)-(7) imply that expected values do not vary with the type of investment or with the type of investor,

$$E(y_{t+1}|I_t) = E^*(y_{t+1}|I_t^*) = E(y_{t+1}^f|I_t) = E^*(y_{t+1}^f|I_t^*) = y_t. \tag{8}$$

On the other hand, the conditional variances when buying the underlying assets are

$$Var^*(y_{t+1}|I_t^*) = \sigma_\varepsilon^2 + \sigma_\lambda^2 > Var(y_{t+1}|I_t) = \sigma_\varepsilon^2, \quad (9)$$

while the conditional variances when buying the country fund are

$$Var(y_{t+1}^f|I_t) = \sigma_\varepsilon^2 + \sigma_\mu^2 = Var^*(y_{t+1}^f|I_t^*). \quad (10)$$

In summary, for foreign investors the conditional variance of buying the underlying assets is higher than the conditional variance of buying country funds. The reverse is true for domestic investors.

$$Var^*(y_{t+1}|I_t^*) = \sigma_\varepsilon^2 + \sigma_\lambda^2 > Var^*(y_{t+1}^f|I_t^*) = \sigma_\varepsilon^2 + \sigma_\mu^2 = Var(y_{t+1}^f|I_t) > Var(y_{t+1}|I_t) = \sigma_\varepsilon^2. \quad (11)$$

Given that domestic investors have better information about the local economy, foreign investors perceive a higher variance than domestic investors when buying the underlying assets. However, since the manager decides the portfolio composition of the country fund, the domestic investors' information advantage is lost and their conditional variance increases when buying country funds. On the other hand, country fund managers have a better understanding of the country where they invest than foreign investors. As a consequence, foreign investors' conditional variance decreases if they switch from acquiring the underlying assets to buying the country fund.

Proposition 1:

*Discounts are strictly positive if the difference in information is greater than zero. Given*

*that  $\sigma_\lambda^2 > \sigma_\mu^2$ , if  $\sigma_\mu^2 > 0$ ,  $N_t - P_t > 0$ .*

Proof: Since returns are assumed to be normally distributed, investors maximize the following conditional expected utility functions

$$\begin{aligned} E(U_{t+1}|I_t) &= E(W_{t+1}|I_t) - \gamma Var(W_{t+1}|I_t), \\ E^*(U_{t+1}^*|I_t^*) &= E^*(W_{t+1}^*|I_t^*) - \gamma Var^*(W_{t+1}^*|I_t^*). \end{aligned} \quad (12)$$



In equilibrium, domestic (foreign) investors will only buy the underlying assets (country fund). Given that the dividends to both assets are perfectly correlated, there is no benefit to diversification. Moreover, one group of investors will buy the country fund while the other group will buy the underlying assets. If both groups of investors decided to buy the underlying assets (country funds),  $P_t (N_t)$  would go to zero. Finally, given the assumptions about the conditional variances, domestic (foreign) investors reduce their risk by only acquiring the underlying assets (country fund).<sup>16</sup> There is nothing here that prevents domestic (foreign) investors to buy the country fund (underlying assets). So discounts will lie within an interval before prompting investors to shift assets.

We solve the equilibrium case in which domestic investors buy the underlying assets and foreign investors buy the country fund shares. They maximize the following conditional expected utility functions

$$\begin{aligned}
E(U_{t+1}|I_t) &= W_t (1+r) + \phi_t^n (E(N_{t+1} + y_{t+1}) - N_t(1+r)) - \gamma \phi_t^{n2} \text{Var}(N_{t+1} + y_{t+1}|I_t), \\
&\text{and} \\
E^*(U_{t+1}^*|I_t^*) &= W_t^* (1+r) + \phi_t^{*f} (E(P_{t+1} + y_{t+1}^f) - P_t(1+r)) - \gamma \phi_t^{*f2} \text{Var}^*(P_{t+1} + y_{t+1}^f|I_t^*).
\end{aligned} \tag{13}$$

The maximization process yields the following demand functions for the underlying assets and for the country fund

$$\begin{aligned}
\phi_t^n &= \frac{1}{2\gamma \text{Var}(N_{t+1} + y_{t+1}|I_t)} (E(N_{t+1} + y_{t+1}) - N_t(1+r)), \\
&\text{and} \\
\phi_t^{*f} &= \frac{1}{2\gamma \text{Var}^*(P_{t+1} + y_{t+1}^f|I_t^*)} (E(P_{t+1} + y_{t+1}^f) - P_t(1+r)).
\end{aligned} \tag{14}$$

The equilibrium conditions for the risky assets are,

$$\phi_t^n = S^n \quad \text{and} \quad \phi_t^{*f} = S^f. \tag{15}$$

We assume that  $S^a$  and  $S^f$  (the supplies of underlying assets and country funds) are fixed and equal to  $S$ .

To solve for NAVs and country fund prices, we impose that the unconditional distributions of  $N_{t+1}$  and  $P_{t+1}$  are identical to the distributions of  $N_t$  and  $P_t$ . We also know that

$$\begin{aligned} \text{Var}(N_{t+1} + y_{t+1} | I_t) &= E \left[ \left( N_{t+1} + y_{t+1} - E(N_{t+1} + y_{t+1}) \right)^2 | I_t \right], \\ &\text{and} \\ \text{Var}^*(P_{t+1} + y_{t+1}^f | I_t^*) &= E^* \left[ \left( P_{t+1} + y_{t+1}^f - E(P_{t+1} + y_{t+1}^f) \right)^2 | I_t^* \right]. \end{aligned} \quad (16)$$

Then, using the demand functions and the equilibrium conditions, we obtain the following steady-state closed-form expressions

$$\begin{aligned} N_t &= \frac{1}{r} \left[ y_t - \frac{S2\gamma}{r^2} \sigma_\varepsilon^2 \right], \\ P_t &= \frac{1}{r} \left[ y_t - \frac{S2\gamma}{r^2} (\sigma_\varepsilon^2 + \sigma_\mu^2) \right]. \end{aligned} \quad (17)$$

Finally, we can derive the following expression for the country fund discount

$$N_t - P_t = \frac{S2\gamma}{r^3} \sigma_\mu^2 > 0. \quad (18)$$

QED

Proposition 2:

*NAVs explain fund prices when they deviate from the equilibrium discounts.*

Proof: We now assume that domestic investors receive some private information ( $\theta\varepsilon_{t+1}$ ) at time  $t$ , regarding future shocks to the dividends. Then, expected values differ,

$$E(y_{t+1} | I_t) = y_t + \theta\varepsilon_{t+1} \neq E^*(y_{t+1}^f | I_t^*) = y_t. \quad (19)$$

Any deviation of the NAVs from the equilibrium discount is informative for foreign investors, who interpret this change as news about future dividends. The private information foreign investors receive is transmitted to foreign investors through changes in NAVs. So, the new expected utility function is

$$E^*\left(U_{t+1}^* | I_t^*, |N_t - P_t| > \frac{S2\gamma}{r^3} \sigma_\mu^2\right) = W_{t+1}^* (1+r) + \phi_t^{*f} \left( E(P_{t+1} + y_{t+1}) + (N_t - P_t) - P_t(1+r) \right) - \gamma \text{Var}^*(P_{t+1} + y_{t+1} | I_t^*). \quad (20)$$

Then, prices respond to changes in NAVs when discounts are large

$$P_t = \frac{1}{1+r} \left[ y_t + N_t - \frac{S2\gamma}{r^2} (\sigma_\varepsilon^2 + \sigma_\mu^2) \right]. \quad (21)$$

QED

Proposition 3:

*The presence of noise traders implies that NAVs can vary due to new information received or to deviations in noise traders' misperceptions. The adjustments to changes in NAVs become slower because of a signal-extraction problem.*

Proof: The representative domestic and foreign noise trader misperceives the value of the assets by a random variable  $\eta_t$  and  $\eta_t^*$ , respectively, such that

$$\eta_t \sim N(\bar{\eta}, \sigma_\eta^2) \text{ and } \eta_t^* \sim N(\bar{\eta}^*, \sigma_\eta^2). \quad (22)$$

There is a fraction  $v$  and  $v^*$  of noise traders in both markets. The domestic and foreign representative noise traders maximize:

$$E(U_{t+1}|I_t) = W_{t+1}(1+r) + \phi_t^n (E(N_{t+1} + y_{t+1}) - N_t(1+r)) - \gamma \text{Var}(N_{t+1} + y_{t+1}|I_t) + \phi_t^n \eta_t, \quad (23)$$

and

$$E^*(U_{t+1}^*|I_t^*) = W_{t+1}^*(1+r) + \phi_t^{*f} (E(P_{t+1} + y_{t+1}^f) - P_t(1+r)) - \gamma \text{Var}^*(P_{t+1} + y_{t+1}^f|I_t^*) + \phi_t^{*f} \eta_t^*.$$

The closed-form steady-state NAV is:

$$N_t = \frac{1}{r} \left[ y_t + \theta \varepsilon_{t+1} + \frac{rv(\eta_t - \bar{\eta})}{1+r} + v\bar{\eta} - \frac{S2\gamma}{r^2} \left[ \sigma_\varepsilon^2 + \frac{v^2 \sigma_\eta^2}{(1+r)^2} \right] \right]. \quad (24)$$

The above expression shows that NAVs are affected by the private information and by changes in the noise traders' misperceptions. Foreign investors only observe changes in NAVs. They do not know whether the change in NAV comes from locally available news about fundamentals ( $\theta \varepsilon_{t+1}$ ) or from shifts in noise traders' misperceptions ( $\eta_t$ ). The only information they have is that a change in the NAV takes the following form:

$$\Delta N_t = \frac{1}{r} \theta \varepsilon_{t+1} + \frac{v}{1+r} (\eta_t - \bar{\eta}). \quad (25)$$

Any change in NAVs is a noisy signal of the change in fundamentals; then, foreign investors face a signal-extraction problem. The distributions of shocks to news and to misperceptions are public knowledge. Both shocks are independent and normally distributed, therefore

$$E^*(\theta \varepsilon_t | \Delta N_t) = \frac{\text{Cov}(\theta \varepsilon_t, \Delta N_t)}{\text{Var}(\Delta N_t)} \Delta N_t. \quad (26)$$

Foreign investors take into account the future expected change in prices, so the maximization process yields that  $\Delta P_t = \frac{1}{1+r} E^*(\theta \varepsilon_t | \Delta N_t)$ , and

$$\frac{\Delta P_t}{\Delta N_t} = \frac{1}{1+r} \frac{\left(\frac{1}{r}\right)^2 \theta^2 \sigma_\varepsilon^2}{\left(\frac{1}{r}\right)^2 \theta^2 \sigma_\varepsilon^2 + \left(\frac{v}{1+r}\right)^2 \sigma_\eta^2} < \frac{1}{1+r}. \quad (27)$$

The higher the noise in the local market, the slower the one-period adjustment of prices with respect to NAVs, given that the number of noise traders ( $\nu$ ) is positive. In other words, the lower the variability of noise relative to the total variability of NAVs and the fewer the noise traders, the more revealing NAVs are. QED

## References

- Akerlof, George, 1970, "The Market for Lemons: Quality Uncertainty and the Market Mechanism," *Quarterly Journal of Economics*, 89:488-500.
- Bonser-Neal, Catherine, 1990, Gregory Brauer, Robert Neal, and Simon Wheatley, "International Investment Restrictions and Closed-End Country Fund Prices," *Journal of Finance*, Vol. XLV, no. 2, June.
- Calvo, Guillermo, Leonardo Leiderman, and Carmen Reinhart, 1994, "The Capital Inflows Problem: Concepts and Issues," *Contemporary Economic Policy*, Vol. XII, July.
- Chen, Nai-Fu, Raymond Kan, and Merton H. Miller, 1993, "Are the Discounts on Closed-End Funds a Sentiment Index?," *Journal of Finance*, Vol. XLVIII, 2:795-800.
- Claessens, Stijn, and Moon-Whoan Rhee, 1994, "The Effect of Barriers to Equity Investment in Developing Countries," in J. Frankel, ed., The Internationalization of Equity Markets, the University of Chicago Press, Chicago.
- De Long, J. Bradford, Andrei Shleifer, Lawrence H. Summers, and Robert Waldmann, 1990, "Noise Trader Risk in Financial Markets," *Journal of Political Economy*, Vol. 98, 4:703-738.
- Diamond, Douglas, W., and Robert E. Verrechia, 1982, "Information Aggregation in a Noisy Rational Expectations Economy," *Journal of Financial Economics*, 9:221-235.
- Diwan, Ishac, Vihang Errunza, and Lemma Senbet, 1993, "Country Funds For Emerging Economies," in Stijn Claessens and Sudarshan Gooptu (eds.) Portfolio Investment in Developing Countries, Washington: The World Bank.
- Errunza, Vihang R., and Etienne Losq, 1985, "International Asset Pricing under Mild Segmentation: Theory and Tests," *Journal of Finance*, 40:105-124.
- Frankel, Jeffrey A., and Sergio L. Schmukler, 1996, "Country Fund Discounts and the Mexican Crisis of December 1994: Did Local Residents Turn Pessimistic Before International Investors?," *Open Economies Review*, Vol. 7, Fall.
- Frankel, Jeffrey A., and Sergio L. Schmukler, 1997, "Country Funds and Asymmetric Information," *Center for International and Development Economics Research, University of California at Berkeley*, Working Paper No. C97-087.
- French, Kenneth, and James Poterba, 1991, "Investor Diversification and International Equity Markets," *American Economic Review. Papers and Proceedings*, 81:222-26.
- Gehrig, Thomas, 1993, "An Information Based Explanation of the Domestic Bias in International Equity Investment," *Scandinavian Journal of Economics*, 9: 97-109.

- Grossman, Sanford J., and Joseph E. Stiglitz, 1980, "On the Impossibility of Informationally Efficient Markets," *American Economic Review*, 70:393-408.
- Hardouvelis, Gikas A., Rafael La Porta, and Thierry A. Wizman, 1994, "What Moves the Discount on Country Equity Funds?," in J. Frankel, ed., *The Internationalization of Equity Markets*, the *University of Chicago Press*, Chicago.
- Johansen, Soren, 1988, "Statistical Analysis of Cointegration Vectors," *Journal of Economic Dynamics and Control*, 12: 255-259.
- Johansen, Soren, and Katerina Juselius, 1990, "Maximum Likelihood Estimation and Inference on Cointegration - With Applications to the Demand for Money," *Oxford Bulletin of Economics and Statistics*, 52:169-210.
- Klibanoff, Peter, Owen Lamont, and Thierry A. Wizman, 1996, "Investor Reaction to Salient News in Closed-End Funds," *National Bureau of Economic Research Working Paper No. 5588*.
- Lang, Larry H. P., Robert H. Lizenberger, and Vicente Madrigal, 1992, "Testing Financial Market Equilibrium under Asymmetric Information," *Journal of Political Economy*, Vol. 100, 21:317-348.
- Lee, Charles M.C., Andrei Shleifer, and Richard Thaler, 1991, "Investor Sentiment and the Closed-end Fund Puzzle," *Journal of Finance*, Vol. 46, 1:75-109.
- Lewis, Karen K., 1995, "Puzzles in International Financial Markets," in *Handbook of International Economics*, Vol. III, edited by G. Grossman and K. Rogoff.
- Rogers, John, H., 1994, "Entry Barriers and Price Movements between Major and Emerging Stock Markets," *Journal of Macroeconomics*, Spring, Vol. 16, 2: 221-241.
- Stulz, René M., 1981, "On the Effects of Barriers to International Investment," *Journal of Finance*, Vol. XXXVI, 4:923-934.
- Tesar, Linda L. and Ingrid M. Werner, 1994, "Internal Equity Transactions and U.S. Portfolio Choice," in J. Frankel, ed., *The Internationalization of Equity Markets*, the *University of Chicago Press*, Chicago.

## Endnotes

- <sup>1</sup>. The Appendix Table describes the data used in the paper.
- <sup>2</sup>. Discounts at time  $t$  are equal to  $100 \cdot \ln(\text{NAV}_t / \text{price}_t)$ .
- <sup>3</sup>. Figure 1 shows that funds start trading at premia. Funds like the Italy Fund, the Chile Fund, the Malaysia Fund, and the Swiss Fund (although to a lesser degree) demonstrate this point. The Korea and Mexico fund were established before 1985. Fund managers planned the initial public offerings (IPO) around a time of optimistic sentiments with respect to the specific country. Over time discounts become positive.
- <sup>4</sup>. Noise traders in financial markets have been introduced by De Long, Shleifer, Summers, and Waldmann (1990).
- <sup>5</sup>. It would be interesting to compare the size of country fund discounts versus the ones of domestic funds. If the asymmetry in information is more present in international capital markets than in domestic markets, one would expect to find deeper discounts in country funds than in domestic closed-end funds. However, most of the country funds have been affected by idiosyncratic country factors--like capital inflows--which would bias any valid comparison. Perhaps, once country funds acquire a longer history, a comparison of discounts would be more appropriate.
- <sup>6</sup>. All econometric tests have been run with the variables in logarithms.
- <sup>7</sup>. Results for all the funds are detailed in Frankel and Schmukler (1997).
- <sup>8</sup>. If one of the variables is "weakly exogenous"--if it does not adjust to the long-run equilibrium--only one equation of model (1) is sufficient for efficient inference about the parameters  $\pi$  and  $\lambda$ . Nevertheless, in the present case we are particularly interested in another issue: we want to determine which variable is the one that responds to changes in the long-run equilibrium.



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- <sup>9</sup>. Note that the structure of the model implies that the expected  $\alpha_1$  are negative, while the expected  $\alpha_2$  are positive in order to have convergence towards the long-run equilibrium.
- <sup>10</sup>. Other results are available upon request to the authors.
- <sup>11</sup>. Part of our sensitivity analysis is shown in Frankel and Schmukler (1997).
- <sup>12</sup>. Note that the only data available are traded prices. Data such as the ask-bid spread would be useful to analyze how liquid markets are. Unfortunately, this kind of data is not available.
- <sup>13</sup>. Only discounts (but not NAVs or prices) are plotted in Figure 3 to make graphs clear.
- <sup>14</sup>. This kind of model enables us to compare our results to earlier papers on closed-end country funds such as De Long, Shleifer, Summers, and Waldman (1990), Lang, Litzenberger, and Madrigal (1992), Gehrig (1993), Hardouvelis, La Porta, and Wizman (1994), and Klibanoff, Lamont, and Wizman (1996).
- <sup>15</sup>. In practice, NAVs are published on a weekly basis. So the current NAV ( $N_t$ ) is unknown when the country fund price is set. This fact needs to be considered to obtain the dynamics estimated in the empirical part of the paper.
- <sup>16</sup>. This result looks plausible even though there are no public statistics about the nationality of country fund holders. Surveyed country fund managers and administrators acknowledged that country funds are mainly held by small U.S. investors. If country funds are considered “foreign equities” relative to the underlying assets, we can relate this feature to the home-country bias evidence. Several studies, like Lewis (1995), French and Poterba (1991), Gehrig (1993), and Tesar and Werner (1994), document its presence in international financial markets.

**APPENDIX TABLE  
DATA DESCRIPTION  
SAMPLE OF CLOSED-END COUNTRY FUND  
SAMPLE PERIOD 1/4/85-3/8/96**

	<u>SYMBOL</u>	<u>Initial Public Offering (IPO)</u>	<u>Total Assets (Mill.)</u> (5/31/1996)	<u>Portfolio Turnover</u> (%, 1995)	
<b><u>EUROPEAN FUNDS:</u></b>					
1	AUSTRIA FUND	OST	9/21/89	135.7	27
2	EMERGING GERMANY FUND	FRG	3/29/90	132.7	40
3	FIRST IBERIAN FUND	IBF	4/13/88	71.6	43
4	FIRST ISRAEL FUND	ISL	10/22/92	71.3	22
5	FRANCE FUND	FR	5/30/86	#N/A	#N/A
6	FRANCE GROWTH FUND	FRF	5/10/90	193.5	49
7	FUT. GERMANY FUND	FGF	3/9/90	#N/A	#N/A
8	GERMANY FUND	GER	7/18/86	208	41
9	GROWTH SPAIN	GSP	2/14/90	234.2	#N/A
10	IRISH INVESTMENT FUND	IRL	3/30/90	78.8	81
11	ITALY FUND	ITA	2/26/86	101.1	58
12	NEW GERMANY FUND	GF	1/24/90	531.7	#N/A
13	PORTUGAL FUND	PGF	11/1/89	77.8	36
14	SPAIN FUND	SNF	6/21/88	118.4	38
15	SWISS HELVETIA FUND	SWZ	8/19/87	299.7	10
16	TURKISH INVEST FUND	TKF	12/15/89	5.83	41.1
17	UNITED KINGDOM FUND	UKM	8/6/87	63.8	63.6
<b><u>LATIN AMERICAN FUNDS:</u></b>					
	<u>SYMBOL</u>				
1	ARGENTINA FUND	AF	10/11/91	126.9	25
2	BRAZIL EQUITY	BZL	4/3/92	72.6	55
3	BRAZIL FUND	BZF	3/31/88	410.6	10
4	CHILE FUND	CH	9/26/89	366.5	2
5	EMERGING MEXICO FUND	MEF	10/2/90	11.4	83
6	HERZFELD CARIBBEAN BASI	CUBA	9/10/93	9	6
7	LATIN AMERICA DLR INC FUN	LBF	7/24/92	#N/A	#N/A
8	LATIN AMERICA EQUITY FD	LAQ	10/22/91	146.1	27
9	LATIN AMERICA INVESTMENT	LAM	6/16/92	152.1	39
10	LATIN AMERICAN DISCOVER	LDF	7/25/90	164.4	122
11	MEXICO EQUITY AND INCOM	MXE	8/14/90	148.2	51
12	MEXICO FUND	MXF	6/3/81	931.1	11
<b><u>PACIFIC RIM FUNDS:</u></b>					
	<u>SYMBOL</u>				
1	ASIA PACIFIC FUND	APB	2/24/87	282.9	48
2	ASIA TIGERS FUND	GRR	11/18/93	277.9	#N/A
3	CHINA FUND	CHN	7/10/92	140.4	#N/A
4	EMERGING TIGERS FUND	TGF	2/25/94	#N/A	#N/A
5	FIDELITY ADV EMERG ASIA F	FAE	3/18/94	139.4	#N/A
6	FIRST AUSTRALIA FUND	IAF	12/12/85	191.4	#N/A
7	FIRST PHILLIPINE FUND	FPF	11/8/89	240.7	#N/A
8	GREATER CHINA FUND	GCH	7/15/92	191.3	#N/A
9	INDIA FUND	IFN	2/14/94	329.6	#N/A
10	INDIA GROWTH FUND	IGF	8/12/88	131.9	#N/A
11	INDONESIA FUND	IF	3/1/90	48.2	#N/A
12	JAKARTA GROWTH FUND	JGF	4/10/90	48.1	#N/A
13	JAPAN EQUITY FUND	JEQ	3/14/90	128.2	28
14	JAPAN FUND (Open-ended 19	JAP	4/12/62	#N/A	#N/A
15	JAPAN OTC EQTY FUND	JOF	3/14/90	99.3	79
16	JARDINE FLEMING CHINA FU	JFC	7/16/92	107.6	#N/A
17	JARDINE FLEMING INDIA FUN	JFI	3/3/94	109	#N/A
18	KOREA EQUITY FUND	KEF	11/24/93	77.8	#N/A
19	KOREA FUND	KF	8/22/84	769.9	#N/A
20	KOREAN INVESTMENT FUND	KIF	2/13/92	96.9	#N/A
21	MALAYSIA FUND	MF	5/8/87	208.9	#N/A
22	PAKISTAN INVESTMENT FUN	PKF	12/16/93	86.5	#N/A
23	ROC TAIWAN FUND	ROC	5/12/89	335	#N/A
24	SCHRODER ASIAN GROWTH	SHF	7/24/90	281.1	67
25	SCUDDER NEW ASIA FUND	SAF	12/22/93	142.3	58
26	SINGAPORE FUND	SGF	6/18/87	118.9	#N/A
27	TAIWAN EQUITY FUND	TYW	7/18/94	45.6	#N/A
28	TAIWAN FUND	TWN	12/16/83	335.5	#N/A
29	TEMPLETON CHINA WORLD	TCH	9/9/93	266.8	#N/A
30	TEMPLETON VIETNAM OPPT	TVF	9/15/94	114.1	#N/A
31	THAI CAPITAL FUND	TC	5/22/90	96.4	#N/A
32	THAI FUND	TTF	2/17/88	341.5	#N/A

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