

Country Funds and Asymmetric Information



Jeffrey A. Frankel^{a,1} and Sergio L. Schmukler^{b,*}

^a Harvard University and National Bureau of Economic Research, USA

^b World Bank, Washington, DC, USA

This paper uses data on country funds to study the role of differential access to information on international investment. It shows 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. These findings are consistent with the hypothesis of asymmetric information, according to which the holders of the underlying assets have more information about the local assets than the country fund holders do. Applications to currency crises and a theoretical model are also presented. Copyright © 2000 John Wiley & Sons, Ltd.

KEY WORDS: asymmetric information; closed-end funds; country funds; currency crises; noise traders

SUMMARY

Investors who wish to diversify their portfolio internationally can acquire shares of closed-end country funds. These funds invest primarily in equities from a specific country. 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. 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—as 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.

In this paper, we exploit the fact that country fund discounts are different from zero to evaluate the possible existence of asymmetric information in international capital markets. 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. Asymmetric information also explains the interaction between NAVs, fund prices, and discounts. The variable that contains

* Correspondence to: World Bank, 1818 H Street NW, Washington, DC 20433, USA. E-mail: sschmukler@worldbank.org

¹ E-mail: jeffery_frankel@harvard.edu

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 evaluates whether the evidence is consistent with asymmetric information by computing exogeneity tests for European, Latin American, and Pacific Rim country funds based in the US. 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 (ECMs) for each fund. 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.

This paper shows that past changes in 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. These findings are consistent with the hypothesis of asymmetric information, according to which the holders of the underlying assets have more information about the local assets than the country fund holders do. Applications to recent currency crises and a theoretical model are also presented in the paper.

INTRODUCTION

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 diversify their portfolio internationally, 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. 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—as 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% for country funds like the German ones, the French funds, the UK 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 evaluate the possible 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. 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 evaluates whether the evidence is consistent with asymmetric information by computing exogeneity tests for European, Latin American, and Pacific Rim country funds based in the US. 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 (ECMs) for each fund.

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 hypothesis predicts that more noise in the market of underlying shares 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 trader 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 (from fundamentals). To the extent that the variability of NAVs and prices are correlated with the amount of noise trading, this paper studies whether the data seem to be consistent with any of the existing models.

The remainder of the paper is organized as follows. The next section summarizes the existing literature on country fund discounts. The fourth section tests the asymmetric information hypothesis. The fifth section introduces applications of asymmetric information. A theoretical model is presented in Appendix A.

WHAT EXPLAINS AVERAGE DISCOUNTS?

As mentioned above, it is well known that country funds trade at high and variable average discounts. In other words, the prices at which country funds trade are, in general, lower than the NAVs. Part A of Table 1 shows summary results from a sample of 61 country funds based in New York. Table 1A describes the list of funds used in the paper. The data comprise most US country funds that invest in Europe, Latin America, and the Pacific Rim. Table 1A also displays the date of initial public offerings (IPOs), the value of their total assets, and the portfolio turnover ratio. The data are weekly. NAVs and prices are corrected for splits to get consistent values over time.¹

Table 1 shows that, when statistically different from zero, mean discounts tend to be positive.² Discounts are significantly positive for around 82%, 42%, and 53% of the European, Latin American, and Pacific Rim funds, respectively. On the other hand, discounts are significantly negative for only 12%, 25%, and 28% of the funds. 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, which shows how capital controls might affect the average discount. The Korea Fund traded at a

Table 1. Country fund discounts: sample of 62 funds, 1/4/85–3/8/96

Part A. Percentage of positive and negative average discounts			
	Number of funds	Discount = 100 * log(NAV/price) (%)	
		Positive	Negative
Europe	17	82	12
Latin America	12	42	25
Pacific Rim	32	53	28

Positive and negative discounts are statistically different from zero at 5%

Part B. Summary statistics of discounts by region						
	Number of observations	Mean discount	Median discount	Standard deviation 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

Table 1A. Data description. Sample of closed-end country funds; sample period: 1/4/85–3/8/96, weekly data

	Symbol	IPO dates	Total assets (mill.) (5/31/96)	Portfolio turnover (%, 1995)	
European funds:					
1	Austria Fund	OST	09/21/89	135.7	27
2	Emerging Germany Fund	FRG	03/29/90	132.7	40
3	First Iberian Fund	IBF	04/13/88	71.6	43
4	First Israel Fund	ISL	10/22/92	71.3	22
5	France Fund	FR	05/30/86	#N/A	#N/A
6	France Growth Fund	FRF	05/10/90	193.5	49
7	Future Germany Fund	FGF	03/09/90	#N/A	#N/A
8	Germany Fund	GER	07/18/86	208	41
9	Growth Spain	GSP	02/14/90	234.2	#N/A
10	Irish Investment Fund	IRL	03/30/90	78.8	81
11	Italy Fund	ITA	02/26/86	101.1	58
12	New Germany Fund	GF	01/24/90	531.7	#N/A
13	Portugal Fund	PGF	11/01/89	77.8	36
14	Spain Fund	SNF	06/21/88	118.4	38
15	Swiss Helvetia Fund	SWZ	08/19/87	299.7	10
16	Turkish Invest Fund	TKF	12/15/89	5.83	41.1
17	United Kingdom Fund	UKM	08/06/87	63.8	63.6
Latin American funds:					
1	Argentina Fund	AF	10/11/91	126.9	25
2	Brazil Equity	BZL	04/03/92	72.6	55
3	Brazil Fund	BZF	03/31/88	410.6	10
4	Chile Fund	CH	09/26/89	366.5	2
5	Emerging Mexico Fund	MEF	10/02/90	11.4	83
6	Herzfeld Caribbean Basin Fund	CUBA	09/10/93	9	6
7	Latin America Dlr Inc Fund	LBF	07/24/92	#N/A	#N/A
8	Latin America Equity Fd	LAQ	10/22/91	146.1	27
9	Latin America Investment	LAM	06/16/92	152.1	39
10	Latin American Discovery Fund	LDF	07/25/90	164.4	122
11	Mexico Equity and Income Fund	MXE	08/14/90	148.2	51
12	Mexico Fund	MXF	06/03/81	931.1	11
Pacific Rim funds:					
1	Asia Pacific Fund	APB	02/24/87	282.9	48
2	Asia Tigers Fund	GRR	11/18/93	277.9	#N/A
3	China Fund	CHN	07/10/92	140.4	#N/A
4	Emerging Tigers Fund	TGF	02/25/94	#N/A	#N/A
5	Fidelity Adv Emerg Asia Fund	FAE	03/18/94	139.4	#N/A
6	First Australia Fund	IAF	12/12/85	191.4	#N/A
7	First Philippine Fund	FPF	11/08/89	240.7	#N/A
8	Greater China Fund	GCH	07/15/92	191.3	#N/A
9	India Fund	IFN	02/14/94	329.6	#N/A
10	India Growth Fund	IGF	08/12/88	131.9	#N/A
11	Indonesia Fund	IF	03/01/90	48.2	#N/A
12	Jakarta Growth Fund	JGF	04/10/90	48.1	#N/A
13	Japan Equity Fund	JEQ	03/14/90	128.2	28
14	Japan Fund (open-ended 1987)	JAP	04/12/62	#N/A	#N/A
15	Japan Otc Eqty Fund	JOF	03/14/90	99.3	79
16	Jardine Fleming China Fund	JFC	07/16/92	107.6	#N/A
17	Jardine Fleming India Fund	JFI	03/03/94	109	#N/A
18	Korea Equity Fund	KEF	11/24/93	77.8	#N/A
19	Korea Fund	KF	08/22/84	769.9	#N/A
20	Korean Investment Fund	KIF	02/13/92	96.9	#N/A
21	Malaysia Fund	MF	05/08/87	208.9	#N/A

(Continued overleaf)

Table 1A. (Continued)

	Symbol	IPO dates	Total assets (mill.) (5/31/96)	Portfolio turnover (%, 1995)
22	Pakistan Investment Fund	PKF	86.5	#N/A
23	ROC Taiwan Fund	ROC	335	#N/A
24	Schroder Asian Growth Fund	SHF	281.1	67
25	Scudder New Asia Fund	SAF	142.3	58
26	Singapore Fund	SGF	118.9	#N/A
27	Taiwan Equity Fund	TYW	45.6	#N/A
28	Taiwan Fund	TWN	335.5	#N/A
29	Templeton China World Fund	TCH	266.8	#N/A
30	Templeton Vietnam Oppty Fund	TVF	114.1	#N/A
31	Thai Capital Fund	TC	96.4	#N/A
32	Thai Fund	TTF	341.5	#N/A

Weekly data from Don Cassidy, of Lipper Analytical Services, and Thierry Wizman.

premium that persisted for a long time. According to the Korean restrictions on cross-country capital movements, this fund was the only channel for foreigners to invest in Korean equities. The relative high demand of Korean assets increased the price of the Korea Fund, generating a premium. When restrictions to capital movement were relaxed and other instruments—including new Korean country funds—became available, the Korea Fund premium declined.

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 was mostly optimistic about emerging markets in Asia and Latin America. Favored by low US interest rates, international capital shifted toward these markets in the early 1990s. Country funds channeled part of these flows. For instance, Claessens and Rhee (1994) show that new country funds accounted for

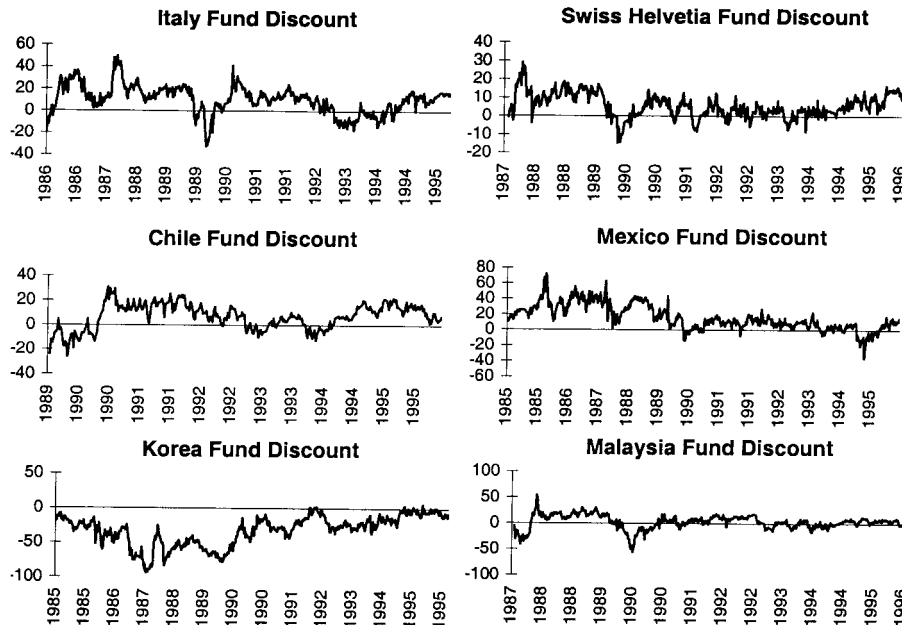


Figure 1. Six representative country fund discounts.

25% of the equity flows to developing countries over the period 1989–1993. 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 US investors probably pushed up the price of 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 1 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 a long right tail.

Two different approaches have been proposed to explain the large and variable discounts. The first one emphasizes 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. Moreover, various kinds of transaction cost—like management fees, 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), Errunza and Losq (1985), Bonser-Neal *et al.* (1990), Diwan *et al.* (1993), and Rogers (1994).

Other papers explain the existence of positive discounts by the participation of noise traders in international capital markets.³ This literature claims that a different clientele, composed of both

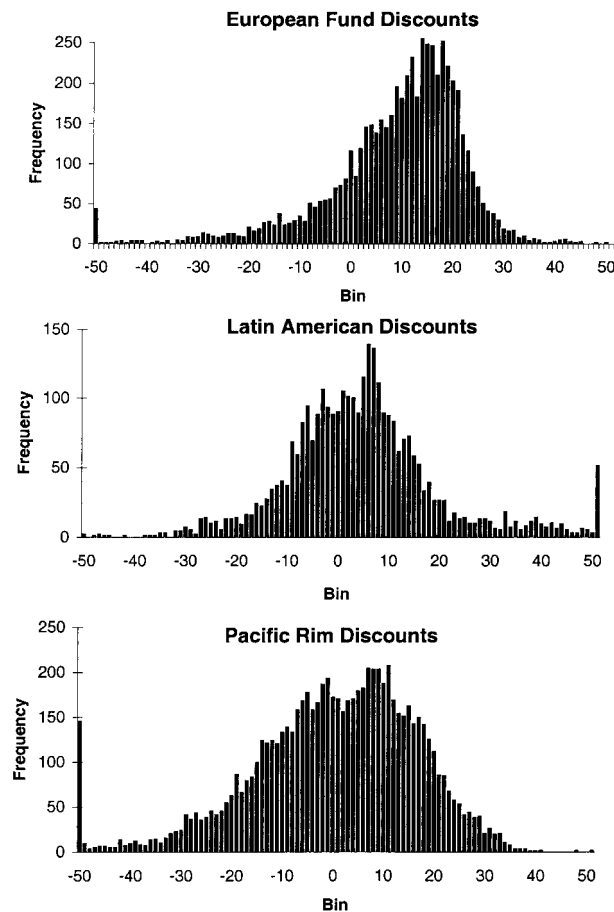


Figure 2. Histograms of country fund discounts. Histograms are constructed using all the observations available for each fund in each region.

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 *et al.* (1991) and Chen *et al.* (1993). Other papers like Hardouvelis *et al.* (1994), Bodurtha *et al.* (1995), Pontiff (1996), and Klibanoff *et al.* (1998) relate the existence of discounts to the presence of noise traders among country fund holders.

The present paper introduces asymmetric information into the discussion of 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 *et al.* (1992), Gehrig (1993), and Brennan and Cao (1997). Asymmetric information can show up in different ways. First, domestic investors may have access to locally available information, which 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, as transaction costs are far lower. Also, small investors know that country fund managers are generally more informed than they about remote countries. So managers are able to 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 Appendix A.

The idea of asymmetric information differs from the noise trader 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. However, 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, as—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.

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 1 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.

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.

The results reported in the working paper version of this paper, Frankel and Schmukler (1997), show that most country fund NAVs and prices are $I(1)$, integrated of order 1. 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 ε_t is stationary, $\varepsilon_t \sim I(0)$.

Given that the variables are non-stationary, usual exogeneity tests of the variables in levels do not yield statistics that follow standard distributions. On the other hand, vector autoregression (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 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

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

We estimate model (1) by full-information maximum likelihood (FIML), following Johansen (1988) and Johansen and Juselius (1990). In this way, we can simultaneously obtain estimates for π and λ ,

along with estimates for the other parameters of the model.

The full working paper version of this paper reports the tests for each fund.⁴ The results vary across regions, but we find a number of cases in which the presence of one cointegrating vector cannot be rejected. For eight out of 17 funds, we cannot reject cointegration among European funds. For four 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, as 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% of the European fund, 66% of the Latin American funds, and 47% of the Pacific Basin funds cannot reject that the fitted λ values 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).

Representative results from the FIML procedure are displayed in Table 2. 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. Fitted λ values with their standard errors are displayed in the first two columns of Table 2. The rest of Table 2 tabulates exogeneity tests. Weak exogeneity—with respect to the parameters π and λ —is tested by looking at the adjustment toward the long-run relationship. Given that there is cointegration, the NAV, the fund price, or both respond to deviations in the long-run relationship. A significant fitted α_1 (α_2) means that the price (NAV) adjusts to changes in the cointegration relationship.⁵ Table 2 also displays the point estimates of α_1 and α_2 , because besides their statistical significance their size is also interesting.

Our results show that significant α_1 values are greater than significant α_2 values. Significant α_1

Table 2. FIML estimation of model (1); the case of six representative funds

$$\Delta P_t = \varpi_1 + \alpha_1(P_{t-1} - \pi - \lambda N_{t-1}) + \sum_{i=1}^L \gamma_{1i} \Delta N_{t-i} + \sum_{i=1}^L \beta_{1i} \Delta P_{t-i} + v_{1t}$$

$$\Delta N_t = \varpi_2 + \alpha_2(P_{t-1} - \pi - \lambda N_{t-1}) + \sum_{i=1}^L \gamma_{2i} \Delta P_{t-i} + \sum_{i=1}^L \beta_{2i} \Delta N_{t-i} + v_{2t} \quad (1)$$

	No. of obs.	Fitted λ	λ standard error	Long-run adjustment (weak exogeneity); $\chi^2(1)$		Short-run adjustment; $\chi^2(2)$		Granger-non-causality (strong exogeneity); $\chi^2(3)$			
				H0: $\alpha_1 = 0$	α_1	H0: $\alpha_2 = 0$	α_2	H0: $\gamma'_1 = 0$	H0: $\gamma'_2 = 0$	H0: α_1 and $\gamma'_1 = 0$	H0: α_2 and $\gamma'_2 = 0$
European funds:											
Italy Fund	499	0.87	0.165	6.32**	-0.050	2.56	0.021	11.10**	1.60	19.08***	5.46
Swiss Helvetia Fund	443	0.97	0.082	5.49**	-0.076	1.07	0.019	31.81***	1.41	48.11***	2.87
Latin American funds:											
Chile Fund	332	0.93	0.082	9.35***	-0.083	2.46	-0.027	22.78***	5.20	37.94***	6.75
Mexico Fund	555	1.18	0.046	1.12	-0.027	7.38***	0.051	18.74***	8.03*	25.41***	26.89***
Pacific Rim funds:											
Korea Fund	584	0.69	0.306	4.37**	-0.023	0.16	-0.002	19.13***	8.74*	24.17***	8.74
Malaysia Fund	453	1.09	0.116	13.04***	-0.085	0.19	-0.007	6.73	40.34***	26.42***	41.24***

The table reports the estimated coefficients of the model and the Wald statistics for the exogeneity tests. All models are estimated with a four lag structure. Sample: 1/4/85-3/8/96.
 * **, *** Imply significance at 10%, 5%, and 1%, respectively.

values range from as low as 2% for the Korea Fund to as high as 28% for the Templeton Vietnam Fund. Significant α_2 values range from as low as 3% for the India Growth Fund to as high as 13% 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 α_1 (α_2) is -0.11 (0.075).⁶ 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 2 also reports tests regarding the short-run adjustment. These tests look at whether the set of fitted γ_1 and γ_2 are jointly equal to zero. A vector γ_1 (γ_2) different from zero means that current fund prices (NAV) adjust to past changes in NAVs (prices). Finally, Table 2 displays statistics that test which variable is 'strongly exogenous': the NAV, the price, or both. We call 'strong exogeneity' or 'Granger-non-causality' 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 α_1 and γ_1 (or α_2 and γ_2) are jointly zero.

We use different specifications of the exogeneity tests to illustrate how results vary across models. We are reluctant to work with only one model as we want to assure that our results are robust to various specifications. The exogeneity tests are computed from three models. First, we assume that cointegration exists in all 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 are cointegrated. For each model, we have tried several lag structures and restrictions on the variables; the case of four lags is reported here. Further lags are mostly statistically insignificant and the results appear very robust to various lag structures.

Given that the reader might be interested in a general conclusion rather than in particular country funds, Table 3 summarizes the results. The table shows the percentage of funds for which

NAV and fund prices adjust to short-run and long-run changes. In addition, Table 3 indicates when the median Wald statistic is statistically different from zero. The table shows that NAVs tend to be the exogenous variables. Past changes in NAVs help to explain present changes in prices, but not otherwise. Moreover, 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 imposed. Overall, NAVs tend to be strongly exogenous. Table 3 shows that in 70% and 73% 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% of the cases, respectively. When cointegration is ruled out, the results show that for 61% (33%) of the cases NAVs (prices) are exogenous.

A closer look at Table 3 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, the dataset covers 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 country funds. Therefore, optimistic foreign investors may have generated a boom in country fund prices, which 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, in principle, these results are also consistent with previous papers—which assume 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

Table 3. Percentage of funds that reject the exogeneity tests

$$\Delta P_t = \varpi_1 + \alpha_1(P_{t-1} - \pi - \lambda N_{t-1}) + \sum_{i=1}^L \gamma_{1i} \Delta N_{t-i} + \sum_{i=1}^L \beta_{1i} \Delta P_{t-i} + v_{1t}$$

$$\Delta N_t = \varpi_2 + \alpha_2(P_{t-1} - \pi - \lambda N_{t-1}) + \sum_{i=1}^L \gamma_{2i} \Delta P_{t-i} + \sum_{i=1}^L \beta_{2i} \Delta N_{t-i} + v_{2t}. \quad (1)$$

Part A. Assumes cointegration

	Long-run adjustment (weak exogeneity) (%)	
	H0: $\alpha_1 = 0$ Prices weakly exog.	H0: $\alpha_2 = 0$ NAV's weakly exog.
European funds	65**	6
Latin American funds	25	17
Pacific Rim funds	50	28
Total	50**	20
	Short-run adjustment	
	H0: $\gamma'_1 = 0$ Prices do not adjust	H0: $\gamma'_2 = 0$ Prices do not adjust
European funds	82***	12
Latin American funds	67***	17
Pacific Rim funds	41	22
Total	57**	18
	Granger-non-causality (strong exogeneity)	
	H0: α_1 and $\gamma'_1 = 0$ Prices strongly exog.	H0: α_2 and $\gamma'_2 = 0$ NAV's strongly exog.
European funds	88***	24
Latin American funds	83***	25
Pacific Rim funds	56**	34
Total	70***	30

Part B. Does not assume cointegration

	Long-run adjustment (weak exogeneity) (%)	
	H0: $\alpha_1 = 0$ Prices weakly exog.	H0: $\alpha_2 = 0$ NAV's weakly exog.
European funds	79**	7
Latin American funds	38	25
Pacific Rim funds	59**	33
Total	61**	24
	Short-run adjustment	
	H0: $\gamma'_1 = 0$ Prices do not adjust	H0: $\gamma'_2 = 0$ Prices do not adjust
European funds	82***	12
Latin American funds	67***	17
Pacific Rim funds	44	22
Total	59**	18

(Continued overleaf)

Table 3. (Continued)

	Granger-non-causality (strong exogeneity)	
	H0: α_1 and $\gamma'_1 = 0$ Prices strongly exog.	H0: α_2 and $\gamma'_2 = 0$ NAVs strongly exog.
European funds	86***	29
Latin American funds	100***	25
Pacific Rim funds	59***	37
Total	73***	33

Part C. Assumes no cointegration		
	Short-run adjustment	
	H0: $\gamma'_1 = 0$ Prices do not adjust	H0: $\gamma'_2 = 0$ Prices do not adjust
European funds	71***	18
Latin American funds	75***	25
Pacific Rim funds	50	44
Total	61**	33

The results are from the estimation of model (1) using FIML. Part A uses the cointegrating vector in all models. Part B includes the cointegrating vector when cointegration is found. Part C does not include cointegration in any model. All models are estimated with a four lag structure. Sample: 1/4/85–3/8/96.

, * imply that the median Wald statistic for the corresponding null hypothesis is different from zero at 5% and 1%, respectively. To calculate the percentages, rejections are taken at 5%.

changes in NAVs (which are closer to fundamentals). Under the two models, NAVs are a better approximation of the true value of the underlying assets. It is very difficult to test one model against the other. In the next subsection, we explore one alternative way to distinguish both hypotheses.

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 estimates 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.⁷ Many 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.⁸

Third, if there are noise traders only among country fund holders, as the noise trader literature suggests, prices will be disconnected from changes in NAVs. Noise traders' estimates of 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 presents statistical evidence of how the adjustment coefficients are related to different variables. 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 4 shows a regression of the fitted price adjustment coefficients (negative fitted α_1 values) on the standard deviations of first-differenced NAVs and prices and on the value of country funds' assets. The first regression shows that more noise in the local market implies lower adjustment coefficients for country fund prices. The regression also shows that the value of the total assets is not statistically significant in explaining price adjustments. So the market illiquidity explanation does not seem to be supported

by the data. Lastly, Table 4 shows that noise in the country fund market is not statistically related to the adjustment coefficient and has the wrong sign. The second regression concentrates on the NAV adjustment coefficients. The regression suggests that the standard deviation of first-differenced log prices is negatively related to the fitted α_2 values. In other words, more-volatile country fund prices imply slower adjustment of NAVs to prices.

In summary, results from Table 4 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 NAVs, while the adjustment of NAVs is negatively related to the variability of fund prices. This evidence suggests the presence of a signal-extraction problem. The statistical relationship holds more strongly for the price adjustment case. The noise trader models would predict that more noise in the country fund market is related to slower price adjustment. The higher the misperception, the less related NAVs and prices

Table 4. What explains slow adjustment coefficients? Regressions of adjustment coefficients on NAV and price variability

Dependent variable: price adjustment coefficients from model (1) (negative α_1 coefficients; higher values imply faster adjustments)

Regression 1:

Number of observations: 61

Independent variables:

	Coefficient	Standard error	<i>t</i> -statistic
Constant	0.09	0.04	2.53***
Standard deviation of first-differenced log NAVs	-1.76	0.79	-2.23***
Total assets	-4E-05	4E-05	-0.95
Standard deviation of first-differenced log prices	0.99	1.02	0.97
Adjusted R^2	0.05		
Standard error of regression	0.06		

Dependent variable: NAV adjustment coefficients from model (1) (α_2 coefficients; higher values imply faster adjustments)

Regression 2:

Number of observations: 61

Independent variables:

	Coefficient	Standard error	<i>t</i> -statistic
Constant	0.08	0.04	1.85*
Standard deviation of first-differenced log prices	-1.55	0.84	-1.85*
Standard deviation of first-differenced log NAVs	0.67	0.45	1.49
Adjusted R^2	0.02		
Standard error of regression	0.04		

Heteroskedastic-consistent standard errors.

*, **, *** imply significance at 10%, 5%, and 1%, respectively.

are. If the variability of NAVs and prices are correlated with measures of noise trading in the market for underlying assets and country funds, the evidence is not consistent with the noise trader hypothesis. The volatility of the country fund market is not statistically significant and is positively related to the speed of adjustment of prices to NAVs. On the contrary, the evidence seems to be consistent with the asymmetric information model. Nevertheless, given that the proxies used might not be appropriate, one should take this result as preliminary evidence in the road to testing these models.

APPLICATIONS OF ASYMMETRIC INFORMATION

This section introduces applications of asymmetric information to the recent financial crises in Mexico (1994–1995) 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 the funds that invest in some of the countries involved in recent episodes.⁹

In the case of Mexico, the NAVs of the three Mexican funds fell before and faster than fund prices, prior to the peso devaluation of 20 December 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. Frankel and Schmukler (1998) extend this work to analyze the channel of contagion from Mexico to other countries in Latin America and East Asia.

In the case of the more recent Asian crisis we study the four countries that were initially affected by the crisis: Indonesia, Malaysia, the Philippines, and Thailand. The crisis erupted with the Thai Baht's free floating and depreciation on 2 July 1997. Thailand had been perceived as facing macroeconomic and financial vulnerability. The

stock market had been falling since its peak in 1995 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 12 July, 14 July, and 14 August, respectively. 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 had understood more quickly the extent of the crisis. The evidence from country funds is consistent with divergent expectations observed in survey and market data, analyzed by Kaufman *et al.* (1999).

SUMMARY AND CONCLUSIONS

This paper used country fund data—from most European, Latin American, and Pacific Rim funds—to suggest that asymmetric information might be explaining the behavior of NAVs and prices. We estimated ECMs for each country fund. 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.

The results appeared robust to various specifications. When cointegration was (not) assumed, we rejected the null hypothesis of strongly exogenous prices in 70% (73%) of the funds, while we only rejected the null hypothesis of strongly exogenous NAVs in 30% (33%) of the funds. On the other

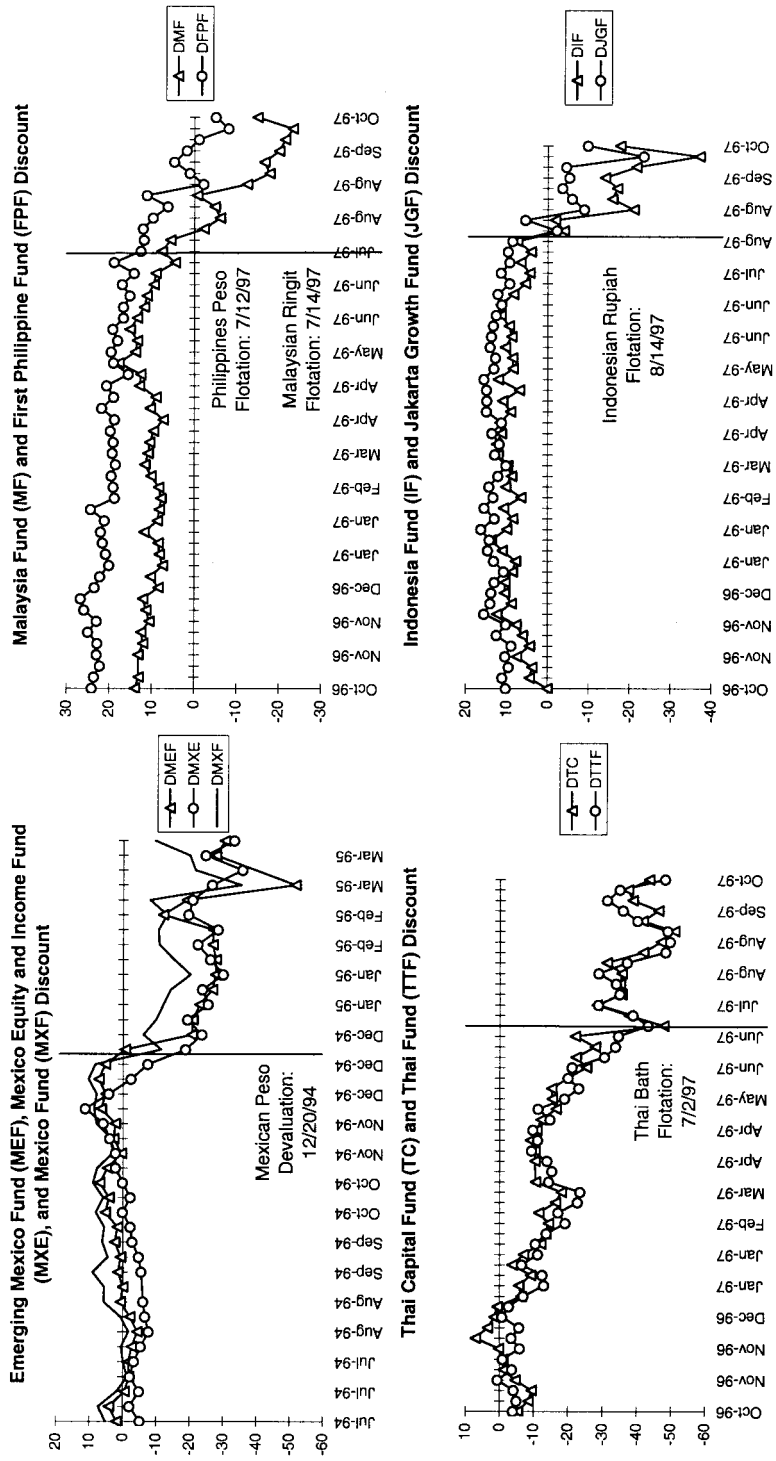


Figure 3. Discounts at the beginning of selected crises.

hand, when ruling out cointegration, we found that prices adjust in 61% of the cases to short-run changes in NAV, while NAVs adjust in 33% of the cases to short-run changes in prices.

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 at a relatively slow rate. 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. This evidence appears consistent with the hypothesis of asymmetric information and with a signal-extraction problem.

The Mexican and Asian country fund discounts were studied as examples of asymmetric information. The evidence suggests that NAVs are closer to local information; they are the ones that react first to local news. Later on, the country fund holders receive the information, so prices react after NAVs have reacted. The model introduced in Appendix A explains why one might expect average positive discounts to be the norm.

The asymmetric information approach presents two main advantages over the noise trader 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. Even though preliminary evidence suggest that one can not reject the hypothesis of asymmetric information *vis-à-vis* the noise trader model, good tests of the models still remain to be designed.

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APPENDIX A: A SIMPLE MODEL OF ASYMMETRIC INFORMATION

This appendix introduces a model that shows how asymmetric information can explain average discounts in the steady state. We assume a world of overlapping generations with two-period-lived domestic and international investors.¹⁰ '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

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

γ 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 US 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. The domestic and foreign investor's demand functions are ϕ_t^n , ϕ_t^f , ϕ_t^{*n} , and ϕ_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 is

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

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

$$y_{t+1} = y_t + \varepsilon_{t+1}. \quad (4)$$

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

$$y_{t+1} = y_t + \varepsilon_{t+1} + l_{t+1}. \quad (5)$$

l_{t+1} is the uncertainty 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

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

μ_{t+1} reflects uncertainty about the fund manager's quality.

We assume that the shocks to dividends have the following distribution:

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

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

$$\begin{aligned} E(y_{t+1}|I_t) &= E^*(y_{t+1}|I_t^*) = E(y_{t+1}^f|I_t) = E^*(y_{t+1}^f|I_t^*) \\ &= y_t. \end{aligned} \quad (8)$$

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

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

while the conditional variances when buying the country fund are

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

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

$$\begin{aligned} \text{Var}^*(y_{t+1}|I_t^*) &= \sigma_\varepsilon^2 + \sigma_l^2 > \text{Var}^*(y_{t+1}^f|I_t^*) = \sigma_\varepsilon^2 + \sigma_\mu^2 \\ &= \text{Var}(y_{t+1}^f|I_t) > \text{Var}(y_{t+1}|I_t) = \sigma_\varepsilon^2. \end{aligned} \quad (11)$$

Given that domestic investors have better information about the local economy, foreign investors perceive a higher variance than domestic investors do when buying the underlying assets. However, since the manager decides the portfolio composition of the country fund, the domestic investors' informational 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

Discounts are strictly positive if the difference in information is greater than zero. In other terms, given that $\sigma_l^2 > \sigma_\mu^2$ 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:

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

In equilibrium, domestic (foreign) investors will only buy the underlying assets (country fund). 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. Moreover, given the assumptions about the conditional variances, domestic (foreign) investors reduce their risk by only acquiring the underlying assets (country fund). There is nothing here that prevents domestic (foreign) investors to buy the country fund (underlying assets).

We solve for 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:

$$\begin{aligned}
 E(U_{t+1}|I_t) &= W_t(1+r) \\
 &\quad + \phi_t^n (E(N_{t+1} + y_{t+1}) - N_t(1+r)) \\
 &\quad - \gamma \phi_t^{n^2} \text{Var}(N_{t+1} + y_{t+1}|I_t), \\
 E^*(U_{t+1}^*|I_t^*) &= W_t^*(1+r) \\
 &\quad + \phi_t^{*f} (E(P_{t+1} + y_{t+1}^f) - P_t(1+r)) \\
 &\quad - \gamma \phi_t^{*f^2} \text{Var}^*(P_{t+1} + y_{t+1}^f|I_t^*). \tag{13}
 \end{aligned}$$

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

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

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^n 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

$$\begin{aligned}
 \text{Var}(N_{t+1} + y_{t+1}|I_t) \\
 = E[(N_{t+1} + y_{t+1} - E(N_{t+1} + y_{t+1}))^2|I_t],
 \end{aligned}$$

$$\begin{aligned}
 \text{Var}^*(P_{t+1} + y_{t+1}^f|I_t^*) \\
 = E^*[(P_{t+1} + y_{t+1}^f - E(P_{t+1} + y_{t+1}^f))^2|I_t^*]. \tag{16}
 \end{aligned}$$

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

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

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

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

□

NOTES

1. Don Cassidy, of Lipper Analytical Services, and Thierry Wizman kindly provided the data.
2. Discounts at time t are equal to $100 \cdot \ln(\text{NAV}_t / \text{price}_t)$.
3. Noise traders in financial markets have been introduced by De Long *et al.* (1990).
4. All econometric tests have been run with the variables in logarithms.
5. 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 π and λ . In the present case, we use the exogeneity analysis to determine which variable is the one that responds to changes in the long-run equilibrium.
6. Note that the structure of the model implies that the expected α_1 (α_2) is negative (positive) to have convergence toward the long-run equilibrium.
7. Other papers like Bodurtha *et al.* (1995), Pontiff (1995), and Klibanoff *et al.* (1998) have also found slow adjustments of prices to NAVs.
8. 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.
9. Only discounts (but not NAVs or prices) are plotted in Figure 3 to make the graphs clear.
10. This kind of model enables us to compare our results with earlier papers on closed-end country funds, such as De Long *et al.* (1990), Lang *et al.* (1992), Gehrig (1993), Hardouvelis *et al.* (1994), and Klibanoff *et al.* (1998).

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