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Investor Reaction to Salient News in Closed-End Country Funds

PETER KLIBANOFF, OWEN LAMONT, and THIERRY A. WIZMAN*

ABSTRACT

We use panel data on prices and net asset values to test whether dramatic country-specific news affects the response of closed-end country fund prices to asset value. In a typical week, prices underreact to changes in fundamentals; the (short-run) elasticity of price with respect to asset value is significantly less than one. In weeks with news appearing on the front page of *The New York Times*, prices react much more; the elasticity of price with respect to asset value is closer to one. These results are consistent with the hypothesis that news events lead some investors to react more quickly.

SOME RESEARCHERS BELIEVE that anomalous empirical regularities in financial returns can be explained by investor underreaction or overreaction to news.[1] A serious problem with interpreting these regularities as caused by "overreaction" or "underreaction" is that these explanations are usually ex post justifications of anomalies present in the data. The underlying problem facing financial economists is that neither fundamentals nor other possible determinants of investor behavior, such as "investor sentiment," are observable. As a result, they are usually forced to make assumptions about the properties of fundamentals before applying tests of market efficiency.

Although it may be difficult to show that investor over- or underreaction is the reason for various anomalies, it is clear that agents often do not act

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[1] For example, Shiller (1984) interprets the predictability of returns as evidence that prices overreact to dividends. The autocorrelation of returns (De Bondt and Thaler (1986), French and Roll (1986), Fama and French (1988), Lo and MacKinlay (1988)) is also sometimes interpreted as over- or underreaction. Stein (1989) finds that options prices overreact to stock-market volatility in the context of the Black–Scholes (1973) option pricing model. Numerous studies of corporate finance events interpret their findings as underreaction; see the volume edited by Thaler (1993) for examples.

rationally in laboratory settings. Experiments show that subjects make many cognitive errors (see, for example, the volume edited by Kahneman, Slovic, and Tversky (1982)).

In this paper, we focus on a particular form of cognitive error as a source of investor over- and underreaction. Specifically, we examine the hypothesis that individual investors assign more importance to more prominent news and assign less importance to less prominent news, even if the two pieces of news have the same effect on fundamental value. We stress that the hypothesis to be tested is suggested by laboratory experiments, and is *not* some anomaly already known to be present in financial market data.

The effect of relative "salience" of information on forecasts of financial time-series and trading behavior in simulated financial markets is documented by Andreassen (1990). He explores the hypothesis that subjects' forecasts of stock prices vary as a function of the relative salience of recent versus older observations, and that this relative salience is affected by news reports (see also Andreassen and Kraus (1990)). Issues of salience, availability, and various framing effects are central to a large body of studies of decisionmaking behavior.

Our objective is to use financial market data to detect this salience effect on investor reaction in a nonlaboratory setting. Our premise is that the "salience of news" is measurable. Our measure of prominence is exogenous with respect to the financial market we are studying. Specifically, we test whether the high level of salience generated by the coverage of a major news event on the front page of *The New York Times* (hereafter, the *Times*) is correlated with the degree of reaction in financial asset prices.

Closed-end country funds' prices and net asset values (NAVs) provide a natural way of testing the hypothesis concerning the salience of news because NAV is an accurate measure of fundamental value. The NAV is a benchmark against which we can gauge the response of the price of a country fund to changes in fundamentals in the presence of news. NAV's accurate reflection of fundamental value allows previous researchers, such as Lee, Shleifer, and Thaler (1991) and Hardouvelis, LaPorta, and Wizman (1994), to examine the issue of investor rationality without overly relying on auxiliary assumptions about the process of fundamentals.

A basic assumption we make is that the information on the front page of the *Times* is redundant if one knows the NAV, because the NAV already incorporates fundamental information. Under this assumption, an investor derives no pertinent information from reading the *Times* that he could not infer directly from the NAV. In this paper, we partially test the assumption that the NAV is a good measure of fundamentals by examining evidence on liquidity.

The paper is organized as follows. Section I discusses closed-end country funds and reviews the features that make them useful in testing financial market hypotheses. Section II discusses the hypothesis to be tested and the theoretical framework. Section III discusses our data, our choice of country-specific news events, and our method of measuring their salience. We present

our basic results in Section IV. In Section V we explore other explanations for these results. Section VI summarizes and presents conclusions.

I. Closed-End Funds and Country Funds

Country funds are publicly traded closed-end investment companies that hold portfolios of equities of particular foreign countries. In December 1984 only 4 U.S.-listed country funds existed. By December 1994, 54 single-country funds traded on the New York Stock Exchange, each specializing in one of 30 countries. The emergence of country funds during the 1980s and early 1990s parallels the growth in capitalization and liquidity of foreign stock markets.

Like most publicly traded closed-end funds, country funds typically trade at a discount or premium to the underlying NAV of the portfolio they hold. Dramatic deviations of price from the NAV sometimes occur in the wake of prominent news regarding the host country. For example, in autumn 1989 the fall of the Berlin Wall was accompanied by a large (but temporary) rise in the premium of the Germany Fund, which reached 100 percent in January 1990.[2]

Closed-end fund discounts and premia contradict the value-additivity principle of efficient and frictionless capital markets. The intriguing issue is the source of the market frictions or market inefficiencies causing the existence, persistence, and time-variation in closed-end fund discounts. Two literatures explain the behavior of closed-end fund discounts, one emphasizing market frictions and segmentation, and the other emphasizing nonrational agents and the role of sentiment.

For country funds, the first literature emphasizes that discounts reflect circumstances that preclude costless cross-border transactions, such as official and unofficial barriers to capital movements, transaction costs, and the risk arising from the time required to complete a full arbitrage transaction.[3] Time variation in the discounts is caused by time variation in these barriers, costs, and risks.[4]

A competing literature concludes that factors which are both empirically plausible and economically rational cannot fully explain the joint behavior of discounts and returns (see Pontiff (1995)). This literature explores the role of

[2] Because we focus on *weekly* changes in prices and asset values, our empirical methods cannot capture long-lasting phenomena, such as this episode, where extraordinary premia persist for many months. We do not think our empirical results about weekly elasticities are likely to be driven by this type of episode. That is the sense in which we claim that salience effects are not anomalies known to exist already in the data.

[3] See Pontiff (1996) for evidence that costly arbitrage plays a role in the determination of (domestic-fund) discounts both cross-sectionally and over time.

[4] Bonser-Neal, Brauer, Neal, and Wheatley (1990) and Diwan, Errunza, and Senbet (1993) apply the ideas of cross-border segmentation to the data on price and NAV of country funds. See also Errunza and Losq (1985) and Eun and Janakiramanan (1986).

irrational investors, called "noise traders," who are prominent in the closed-end fund market and who interact in this market with rational investors. In the noise trader literature, variation in noise trader demand caused by shifts in "sentiment" or by "misperceptions" of fundamental value determines variation in fund discounts. Using a sample of primarily domestic-equity funds, Lee et al. (1991) conclude that the noise-trader model of De Long, Shleifer, Summers, and Waldmann (1990) is consistent with the stylized facts about closed-end fund discounts.

In extending the empirical literature on noise-trading to country funds, Hardouvelis et al. (1994) and Bodurtha, Kim, and Lee (1995) provide evidence suggesting that mean-reverting sentiment is an important component of the price of country funds, and that the common component of sentiment across country funds accounts for part of the variation in country fund discounts. Pontiff (1997) documents that the excess volatility of fund prices is, nonetheless, largely idiosyncratic. Both Hardouvelis et al. (1994) and Bodurtha et al. (1995) show that fund prices are "sticky"; that is, they do not move as much as their respective NAVs following movements in the host country's stock market. On the other hand, fund prices are overly sensitive to movements in world and domestic (U.S.) stock returns, especially returns on small-capitalization U.S. stocks, which have a clientele (small retail investors) that resembles that of country funds.

Although a suitably complex model of rational traders could potentially explain these correlations, the variety of evidence casts doubt on the ability of rational models with market frictions to explain variation in country fund discounts. Additionally, and more importantly for our purpose, for both domestic funds (Pontiff (1995)) and country funds (Hardouvelis et al. (1994)), large discounts and premia tend to be followed by an adjustment of the fund's price toward the NAV, rather than an adjustment of the NAV toward the price of the fund. This pattern is consistent with the idea that NAV is an accurate measure of fundamental value. The existing literature suggests that time-variation in discounts, especially extreme movements, is due to changes in investor sentiment and misperception of fundamentals, and that a fund's NAV is a more accurate measure of fundamental value than its price.

In this paper, we extend the empirical literature on closed-end funds that emphasizes nonrational behavior. Lee et al. (1991) in the general case, and Hardouvelis et al. (1994) in the case of country funds, focus on the role of common "sentiment" or stochastic shocks to investors' expectations. They examine the general time-series properties of prices and NAVs of funds and the common component of fund prices. In contrast, we examine the relative impact of news on the relation between fund prices and NAVs. In our empirical specification we will use time dummies to account for common movements in fund prices, so we will have nothing to say about aggregate sentiment. We focus on idiosyncratic, country-specific events and investor reaction to those events. The next section describes our hypothesis and modeling strategy.

II. The Theoretical Framework

We have the following hypothesis about the behavior of traders: (1) some traders in the closed-end country fund market form expectations incorrectly; (2) these traders are usually slow to react to changes in fundamentals; and, most importantly, (3) "major news events" lead these traders to temporarily react more quickly than usual to changes in fundamentals. Of course, assuming some traders have incorrect expectations is not enough to cause the price of the fund shares to reflect these mistakes. We need something that will prevent fully offsetting actions by rational traders if we want prices that partially reflect the mistaken expectations.

In the Theory Appendix (Appendix B), we present a simple model of the closed-end country fund market in which irrational traders' incorrect expectations are reflected in market prices. It is worth modeling our hypotheses formally because it is not immediately obvious how the sluggish reaction of prices we describe is consistent with market equilibrium. In existing models, the nature of the irrationality itself explains why rational traders do not offset the irrational traders. In De Long et al. (1990), noise traders "create their own space" by creating sentiment risk. This undiversifiable sentiment risk adds a source of variability in prices that is enough to prevent rational investors from offsetting irrational investors. Campbell and Kyle (1993) consider specifications in which noise is correlated with fundamentals, so that stock prices "overreact" and again rational investors do not offset because of the fundamental risk. In contrast, the sluggish reaction we hypothesize decreases the risk of the asset (in a sense, the sentiment is negatively correlated with the fundamentals) and thus makes offsetting positions more attractive to rational investors.

We make arbitrage risky in our model by assuming that there are nondiversifiable stochastic shocks to the fundamentals determining the value of the fund's underlying assets, and that agents in the closed-end fund market cannot trade the underlying assets. This assumption implies that holding positions in the fund involves risk that cannot be diversified (or hedged) away. As long as rational investors are risk averse, they will not fully offset the positions of the unsophisticated investors.

To limit arbitrage, we rely on market incompleteness and fundamental risk. Alternative explanations of the limits of arbitrage include transactions costs, sentiment risk, financial constraints, agency, or anything else that deters rational investors from taking large positions (see for example Shleifer and Vishny (1997)). Any such limits to arbitrage would allow irrational investors to affect prices.

The assumption of market incompleteness is quite realistic for country funds. For many of the funds we study, trading in the underlying security is difficult for U.S. investors because of regulatory restrictions on investing and repatriating funds. Even without legal restrictions, high trading costs can create effectively segmented markets.

In this framework, prices will partially reflect incorrect explanations. Thus, we expect to see movements in the fund price more closely match movements in the NAV (which we assume perfectly incorporates all information) in periods with major news coverage than in periods when this coverage is not present. Therefore, this paper tests the hypothesis that the degree of underreaction of price to the NAV is affected by the reporting of major country-specific news events.

III. Data

A. *The Sample of Country Funds*

Our sample of country funds consists of the 39 single-country publicly traded funds that were covered in *Barron's* publicly traded funds column from January 1986 through March 1994, and that have at least twelve months of price and NAV data. We have weekly data on funds representing 25 countries: Argentina, Australia, Austria, Brazil, Chile, France, Germany, India, Indonesia, Ireland, Israel, Italy, Japan, Korea, Malaysia, Mexico, the Philippines, Portugal, Singapore, Spain, Switzerland, Taiwan, Thailand, Turkey, and the U.K. Prices and NAVs are reported as of Friday. We provide additional information in the Data Appendix (Appendix A).

Since foreign markets close on a given day prior to the close of markets in New York, prices and NAVs will only be approximately synchronous, even though they correspond to the same calendar day's trading sessions. Because of the lag involved in completing the NAV audit and disseminating the results to the financial press, most investors are unaware of the reported NAV of a country fund until after Friday's trading session in New York ends. We discuss this issue further in Section V.A.

We have a total of 9781 fund-weeks of observations; on average there are 250 weeks of observations per fund and 23 fund-observations per week. Our empirical specifications use data from all 39 funds, with a fixed effects panel data specification.

Table I shows summary statistics for the country funds in our sample. Several points stand out. First, although country funds on average traded at a discount during this period, the average discount is only about 1 percent. Second, discounts and premia vary enormously, from a premium of 205 percent to a discount of 56 percent.[5] Third, the prices of country funds are far more variable than their NAVs.[6] Last, measured price returns are signifi-

[5] The remarkable 205 percent premium, meaning that the price was more than three times the NAV, occurs during the second week of Taiwan's fund trading. Thus it might be regarded as part of the new issues puzzle, documented for closed-end funds by Weiss (1989). The Taiwan fund's premium stayed above 100 percent for ten weeks and above 50 percent for 30 weeks.

[6] Consistent with Shiller (1981), Pontiff (1997) finds that the monthly price return variances in his sample of domestic funds for the period 1965 to 1985 are 64 percent greater than monthly NAV return variances.

Table I

Summary Statistics of Weekly Data, 1986 through 1994

This table reports summary statistics for a sample of 39 country funds, using weekly data from 1986 to 1994. $P(t)$ is the price of the fund. $N(t)$ is the net asset value of the fund. $D(t)$ is the dividend and capital gain distributions paid by the fund during week t. Price return is $R_p(t) = [\ln(P(t) + D(t)) - \ln(P(t-1))]$. Net asset value return is $R_n(t) = [\ln(N(t) + D(t)) - \ln(N(t-1))]$. $|R_n(t)|$ is the absolute value of $R_n(t)$ and ln is natural log. ρ is the first-order autocorrelation coefficient. All variables are expressed as percentage points. For news weeks, ρ is the first-order autocorrelation coefficient of returns between the week in which the news occurs and the subsequent week. Full sample is all weeks with available data. News sample is the 97 weeks in which front page news appeared.

Variable	Sample	N	Mean	Std. Dev.	Min	Max	ρ
Price return: $R_p(t)$	Full	9728	0.17	5.50	−39.9	36.2	−0.07
	News	97	1.05	7.00	−17.5	24.0	−0.12
NAV return: $R_n(t)$	Full	9729	0.22	3.49	−38.1	28.8	0.09
	News	97	0.73	4.40	−15.4	9.6	0.13
Absolute price return:	Full	9728	3.83	3.94	0	39.9	0.22
$\|R_p(t)\|$	News	97	5.35	4.60	0	24.0	−0.08
Absolute NAV return:	Full	9729	2.38	2.56	0	38.1	0.29
$\|R_n(t)\|$	News	97	3.30	2.99	0	15.4	0.49
Simple premium:	Full	9781	−1.21	22.3	−56.3	205.4	0.96
$(P(t) - N(t))/N(t)$	News	97	2.67	26.6	−32.0	143.7	0.97
Log premium:	Full	9781	−3.27	19.4	−82.7	111.6	0.96
$\ln(P(t)/N(t))$	News	97	0.09	21.4	−38.6	89.1	0.96

cantly negatively autocorrelated but NAV returns are significantly positively autocorrelated.

We define the return on price to be $R_p(t) = \ln(P(t) + D(t)) - \ln(P(t-1))$ and the return on NAV as $R_n(t) = \ln(N(t) + D(t)) - \ln(N(t-1))$, where $P(t)$ is the price of the fund, $N(t)$ is the net asset value, and $D(t)$ is the total distribution (income plus capital gains distributions) made from the fund or the NAV. These returns are Friday-to-Friday returns, which one would earn by buying the fund at the closing price on Friday and holding it until the following Friday. As mentioned previously, in the real world the precise level of $N(t)$ is not in the information set of agents when they set the $P(t)$ that we observe.

B. News Events

Our goal is to find recent historical events that are "salient"—that is, dramatic, large, and, in the opinion of the average individual investor, important for stock market returns in the relevant country. We measure the salience of major news events using the column width of front page articles in the *Times*.

For each country fund, we search on the *Nexis* database for key words appearing either in an article headline or in the first paragraph of an article

Table II

Illustrative List of All News Events Associated with the First Israel Fund

This table reports the eight days in which front page articles, judged to contain news relevant to investment in Israel, appeared in the *New York Times*, October 1992 to March 1994. The table reports the dateline, the column width of the front page headline, and the complete text of the headline.

Dateline	Column Width	Headline
12/18/92	3	Israel Expels 400 From Occupied Lands; Lebanese Deploy to Bar Entry to Palestinians
8/29/93	3	Israeli Reports Agreement Toward Palestinian Rule in Gaza and Jericho
8/30/93	1	In Draft Accord, Israelis and PLO Near Recognition
8/31/93	2	Mideast Accord: The First Step; More Realism Will Be Needed Before Pact Between Israelis and PLO is a Done Deal
9/1/93	1	Mideast Accord: Israel and PLO Ready to Declare Joint Recognition
9/14/93	6	Mideast Accord: The Overview; Rabin and Arafat Seal Their Accord as Clinton Applauds 'Brave Gamble'
9/15/93	2	Mideast Accord: Gaza; Dedicated Extremists Present Twin Threat to Mideast Peace
2/26/94	4	West Bank Massacre: The Overview; At Least 40 Slain in West Bank as Israeli Fires into Mosque

on the front page of the *Times*. For example, for the Germany Fund, we search for articles containing the words "German," "Germany," "Germans," etc. We then judgmentally discard the articles that, in our opinion, are not relevant to the average investor's perception of economic fundamentals. When items appeared in more than one search, we assign the news item to multiple funds. For example, in reporting on the European currency crisis of 1993, the *Times* had front page articles mentioning both Germany and France. Thus both the German and French funds have a news dummy for that week.

This series of filters leaves us with 229 fund-weeks of news events (out of 9781 fund-weeks in the total sample). For each event, we then collect by hand the column width of the headline as a measure of the importance of the event (this variable ranges from one to six columns).

To focus on prominent news stories, in our benchmark specification we label an item as "news" if the width is greater than or equal to two columns. The two-column criterion balances the need to focus on prominence with the need to maintain an adequately large sample of news events.[7] Table II displays the entire list of events attached to one country, Israel, from 1992 (when the First Israel Fund starts) to March 1994. We record events as

[7] In their analysis of news and returns Mitchell and Mulherin (1994) delete articles smaller than three columns.

occurring within a particular week if the article appeared in the *Times* on or before that week's Friday.

In our final sample, then, salient "news" (two-or-more-column events) occurs in 66 different weeks. Because some events are attached to more than one fund, there are 97 fund-weeks in which salient news events take place. News takes place in about 1 percent of the fund-week sample. For each fund-week, we create an indicator variable, NEWS(t), equal to one if a news event occurs within the week.

Table I documents the effect of news on both $R_p(t)$ and $R_n(t)$. The absolute value and standard deviation of both price returns and NAV returns are sharply higher in news weeks. These increases are statistically significant. The increase in volatility confirms that we have correctly identified fund-specific news that affects specific funds during specific weeks.

Table I shows that in general, NEWS(t) is slightly good news, as the NAV and price returns on average are higher in news weeks, but these differences are not statistically significant.[8] The autocorrelation pattern of returns subsequent to news events is not significantly different from nonnews weeks. As a side note, although price and NAV returns are more volatile in news weeks, our news dummies explain very little of the variation in returns. The R^2 of a regression of the absolute value of price returns on the news dummy is approximately zero, in line with similar results in Cutler, Poterba, and Summers (1989).

IV. The Basic Results

A. Underreaction

Table III documents the systematic underreaction of fund prices to fund asset values, using OLS regressions. We first start in column (1) by simply regressing $R_p(t)$ on $R_n(t)$ and 39 different intercept terms for the 39 different funds. We find that when the NAV rises by 1 percent in a given week, prices rise by only 0.64 percent. This basic result, which as we will see is quite robust, is what we call "underreaction."

Column (2) adds two lags of weekly asset returns on the right-hand side. Even two weeks after the initial change in asset value, fund prices only incorporate 80 percent of the asset return (the reaction is significantly below one). This stickiness is documented by previous studies, including Hardouvelis et al. (1994) and Frankel and Schmukler (1996).[9] Note that the NAV return *two* weeks ago is still making its way into this week's price return, so

[8] If the risk of receiving large surprises in either direction is known in advance and affects the marginal utility of consumption, one might expect the fund to earn an expected risk premium while it is exposed to this risk. Jones, Lamont, and Lumsdaine (1998) examine the issue of risk premia for bonds on preannounced news dates.

[9] One study that has not found much stickiness is that by Chen, Kan, and Miller (1993). They use *monthly* data on aggregate price and NAV returns (from 1965 to 1985) to estimate a reaction parameter of 0.957, with an R^2 of 0.73. Our results also imply that, at the monthly level, the elasticity of prices to NAV is about 1.

Table III

Reaction of Prices to Net Asset Values

This table shows OLS regressions of price return on its own lagged value, contemporaneous and lagged net asset value return, and the lagged premium. The sample consists of weekly data on closed-end country funds, 1986 through 1994. $P(t)$ is the price of the fund. $N(t)$ is the net asset value of the fund. $D(t)$ is the dividend and capital gain distributions paid by the fund during week t. Price return is $R_p(t) = [\ln(P(t) + D(t)) - \ln(P(t-1))]$. Net asset value return is $R_n(t) = [\ln(N(t) + D(t)) - \ln(N(t-1))]$. The premium is $\ln(P(t)/N(t))$. All variables are expressed as percentage points. All regressions include a constant term and 38 fund-specific intercept dummies (not shown). Week dummies are 428 separate intercepts for each calendar week in the sample. Standard errors are reported in parentheses. Dependent variable: $R_p(t)$.

	Column			
	(1)	(2)	(3)	(4)
$R_n(t)$	0.64	0.62	0.66	0.50
	(0.01)	(0.01)	(0.01)	(0.01)
$R_n(t-1)$		0.12	0.21	0.19
		(0.01)	(0.02)	(0.02)
$R_n(t-2)$		0.06	0.08	0.05
		(0.01)	(0.01)	(0.01)
$\ln(P(t-1)/N(t-1))$			−0.06	−0.05
			(0.004)	(0.004)
$R_p(t-1)$			−0.15	−0.22
			(0.01)	(0.01)
Adj. R^2	0.17	0.17	0.22	0.39
Number of obs.	9724	9615	9613	9613
Week dummies	No	No	No	Yes

that it cannot only be the timing issue related to the release of NAV information that is driving the stickiness of prices.[10]

Column (3) captures the dynamic adjustment of prices to asset value by including the lagged premium and lagged price returns on the right-hand side. This regression reproduces a standard result in the closed-end fund literature: discounts and premia help forecast fund returns. $R_p(t-2)$ and $R_n(t-3)$ are not significant in this regression and so we exclude them.[11]

To control for aggregate factors in returns, we include week dummies—that is, an individual intercept for each of the 429 weeks—in the regression.[12] Column (4) shows that including week dummies slightly increases the estimated underreaction; the (idiosyncratic components of) price returns only reflect half of the (idiosyncratic) contemporaneous NAV returns.

[10] Using very different econometric techniques, Frankel and Schmukler (1996) find that it takes three to six weeks for NAV changes to become incorporated into prices.

[11] A Breusch–Godfrey LM test on the regression residuals from column (3) detects no autocorrelation at the two-, three-, or four-week horizon.

[12] The data strongly reject the hypothesis that week dummies are jointly insignificant.

The regressions in Table III restrict the coefficients to be the same across all 39 funds. There are strong reasons, from both theory and previous research, for thinking that different funds may have different characteristics.[13] We therefore reestimate column (4), allowing for different funds to have varying coefficients on the lagged premium, contemporaneous NAV returns, and on lagged price returns. The results (not shown) strongly reject the hypothesis that coefficients on the various terms are equal across funds. In the next table, therefore, we estimate 39 different slope coefficients for each of the five terms in Table III, column (4), and we include week dummies as well.

B. The Effect of News

Our null hypothesis is that the presence of news events does not change the reaction of price to contemporaneous changes in NAV. Our alternative hypothesis is one-sided: salient news raises the reaction of price to contemporaneous changes in NAV.

Table IV shows our estimates of the reaction equation in news weeks. Column (1) repeats column (2) of Table III, but now allows the coefficients on $R_n(t)$ to vary between news weeks and nonnews weeks. This regression shows the basic empirical result of this paper: Reaction to contemporaneous NAV is significantly higher in news weeks. In nonnews weeks, the elasticity of prices with respect to NAV is 0.47, significantly below one. In news weeks, the elasticity is 0.8, significantly higher than 0.47 but not significantly different from one. To account for the higher volatility in news weeks, we estimate our regressions using weighted least squares.[14] We also enter the NEWS(t) dummy itself as a control variable, although it is never significant and does not affect the coefficient of interest.

The rest of Table IV explores this result. We find that it is robust across different specifications.[15] In column (2), we allow the coefficients on all of the variables that appear in column (4) of Table III to vary across funds (including the coefficient on $R_n(t)$ in nonnews weeks). We restrict the incremental effect of news, NEWS(t)*$R_n(t)$, to be equal across funds. Again, reaction is significantly higher in news weeks. Because the lagged NEWS(t)*$R_n(t)$ terms are insignificant in column (2), we drop them in column (3).

[13] Fund prices may have different reactions to fund NAVs due to differences in liquidity, differences in the type of investor in each fund, or for other reasons.

[14] We allow the log of the variance of residuals (from our benchmark OLS regression) to depend on the individual funds and on news weeks. Using this estimated variance to weight the observations, we reestimate our benchmark regression. Using OLS instead of WLS has little effect on the size or significance of the NEWS(t) effect on reaction.

[15] Using different column widths in the definition of NEWS(t) does not change the qualitative results: the elasticity of prices to NAV is higher in news weeks. Although the effect is not significantly different across these different definitions of NEWS(t), the coefficients do increase monotonically with the column width of the news articles. The bigger the news, the greater the adjustment of prices to asset values.

Table IV

News and the Reaction of Prices to Net Asset Values

This table shows regressions of price return on its own lagged value, contemporaneous and lagged net asset value return, the lagged premium, a dummy variable for whether a relevant *New York Times* headline (at least two columns wide) occurred in the week, and contemporaneous and lagged news and net asset value return interaction. The sample consists of weekly data on closed-end country funds, 1986 through 1994, with 9613 observations. $P(t)$ is the price of the fund. $N(t)$ is the net asset value of the fund. $D(t)$ is the dividend and capital gain distributions paid by the fund during week t. Price return is $R_p(t) = [\ln(P(t) + D(t)) - \ln(P(t-1))]$. Net asset value return is $R_n(t) = [\ln(N(t) + D(t)) - \ln(N(t-1))]$. The premium is $\ln(P(t)/N(t))$. All variables are expressed as percentage points. NEWS(t) is a dummy variable equal to one if a news event occurred for that fund and week. $(|R_n(t)| > 7.48)$ is a dummy variable equal to one if the absolute value of $R_n(t)$ is greater than 7.48. "*" indicates that the regression allows this coefficient to take on different values for different funds. All regressions include a constant term, 38 fund-specific intercept dummies, and 428 week dummies (not shown). Columns (2) through (4) contain, in addition to the variables shown: one lag of $R_p(t)$, contemporaneous and two lags of $R_n(t)$, and the lagged premium, each allowed to vary across the 39 funds. All regressions use weighted least squares, modeling the log of the variance of the OLS residuals as a linear function of the fund dummies and the variable NEWS(t), and reestimating the regression with the estimated covariance matrix. Standard errors are reported in parentheses. Dependent variable: $R_p(t)$.

	Column			
	(1)	(2)	(3)	(4)
NEWS(t)*$R_n(t)$	0.33	0.37	0.35	0.36
	(0.12)	(0.13)	(0.13)	(0.13)
NEWS(t)*$R_n(t-1)$	−0.18	−0.04		
	(0.15)	(0.17)		
NEWS(t)*$R_n(t-2)$	0.12	0.07		
	(0.16)	(0.17)		
$(\|R_n(t)\| > 7.48)$*$R_n(t)$				−0.08
				(0.03)
$R_n(t)$	0.47	*	*	*
	(0.02)			
$R_n(t-1)$	0.12	*	*	*
	(0.02)			
$R_n(t-2)$	0.03	*	*	*
	(0.02)			
NEWS(t)	0.30	0.31	0.32	0.27
	(0.50)	(0.55)	(0.54)	(0.55)

Column (3) of Table IV is our benchmark equation. In addition to the NEWS(t)*$R_n(t)$ coefficient of interest, which we show, the regression includes many other variables that are not shown. It includes a constant term, 38 fund-specific intercept dummies, 428 week dummies, one lag of $R_p(t)$, contemporaneous and two lags of $R_n(t)$, and the lagged premium. These last five variables have coefficients that are estimated differently for each of the 39 funds, so the benchmark regression has a total of 664 right-hand-side variables. In what follows, we will use this benchmark regression to check robustness and investigate alternative explanations.

One concern with our baseline specification is that NEWS(t) is just a proxy for large movements in securities prices. It could well be that large changes in $R_n(t)$ have a greater effect on $R_p(t)$ for reasons unrelated to cognitive error. Perhaps large changes in NAV are more easily observable to market participants who set prices. Therefore, in the last column of Table IV we test to make sure that it is the prominent nature of news, and not the magnitude of NAV returns, which is responsible for our results. We use a dummy variable set equal to one if the absolute value of $R_n(t)$ is two standard deviations away from zero ($|R_n(t)| > 7.48$, which is 4 percent of the sample). It turns out that large movements in NAV result in a (statistically significantly) *smaller* proportional response in price returns, not a bigger response, and the response of prices in news weeks is still significantly larger than for nonnews weeks.

We also test whether our results are somehow an artifact of the volatility of news weeks using Monte Carlo methods. We simulate the distribution of the parameter estimates under the null hypothesis that the presence of news is not a determinant of the speed of adjustment to fundamentals, using random high-volatility nonnews weeks instead of news weeks. Based on the Monte Carlo frequency distribution, the probability of getting a coefficient on NEWS(t)*$R_n(t)$ that has value of greater than or equal to 0.35 is 1.5 percent.[16]

In summary, we find the evidence to be consistent with the hypothesis that investors underreact to the mundane changes in NAV that take place every week, but change their behavior when they observe dramatic news. In weeks where news events occur, they respond much more to the change in fundamentals.

Do investors "overreact" to exciting news? In our simplest specification (column (1) of Table IV), the point estimate of the elasticity of price with respect to NAV in news weeks is still lower than one, but we cannot reject that it is equal to or slightly higher than one. In our more complicated specifications, it is hard to say whether prices react more than one-for-one to NAV, because we allow different funds to have different levels of reaction. Thus we can only say with confidence that the degree of reaction is much higher in news weeks.

C. Volume and News

If irrational traders react more to salient news, one might expect volume to rise during news weeks as irrational traders increase their market participation. Table V shows evidence on changes in fund trading volume during

[16] We set NEWS(t) equal to 1 for approximately 1 percent of the sample, randomly picking nonnews weeks. We use only those random sets of weeks which had a variance of $R_n(t)$ at least as high as the level in news weeks. We then reestimate our benchmark regression (including the WLS) using the simulated NEWS(t) variable and actual data on fund and NAV returns. We repeat this process 200 times to derive a one-sided p-value of 0.015 for the coefficient on NEWS(t)*$R_n(t)$. The two-sided p-value is 0.035.

Table V

The Reaction of Volume to News

This table shows OLS regressions of trading volume on the news dummy and lagged trading volume. The dependent variable is the natural log of the average daily trading volume of the closed-end fund within the relevant week (accounting for the number of trading days contained within the week). The sample consists of weekly data on closed-end country funds, 1986 through 1994. NEWS(t) is a dummy variable equal to one if a news event occurred for that fund and week. All regressions include a constant term and 38 fund-specific intercept dummies (not shown). Week dummies are 428 separate intercepts for each calendar week in the sample. Standard errors are reported in parentheses. Dependent variable: ln(Volume(t)).

	Column		
	(1)	(2)	(3)
NEWS(t)	0.41	0.34	0.25
	(0.07)	(0.06)	(0.06)
ln(Volume(t − 1))		0.62	0.52
		(0.01)	(0.01)
Adj. R^2	0.38	0.62	0.68
Number of obs.	9672	9619	9619
Week dummies	N	N	Y

news weeks. Column (1) shows that trading volume is 41 percent higher than average during weeks in which a news event occurs. Controlling for last week's volume (column (2)) and for aggregate volume movements that affect all funds (column (3)), volume is 25 to 34 percent higher in news weeks.

Thus the evidence on volume is consistent with the presence of unsophisticated investors whose willingness to trade increases with news. The volume evidence is certainly not conclusive, because it is consistent with many other explanations, such as different (rational) interpretations of news. We study volume and the reaction of price to news further in Section V.B.

V. Alternative Explanations

A. Measurement Error and Timing Issues in Observing NAV

Time-varying measurement error in $R_n(t)$ might account for the higher reaction in news weeks. According to this explanation, $R_n(t)$ is typically measured with error. In news weeks, $R_n(t)$ primarily reflects not measurement error but rather fundamentals; thus $R_p(t)$ rationally reacts more to $R_n(t)$. One version of this explanation is that foreign markets are illiquid and that much of $R_n(t)$ reflects temporary liquidity shocks, except in news weeks when it is dominated by real news.[17]

Two sets of facts contradict this explanation. First, as documented in Hardouvelis et al. (1994), country-fund discounts help predict future price re-

[17] We thank Sheridan Titman for suggesting this explanation.

turns but in general do not help predict NAV returns, so there is no evidence that prices are a better measure of fundamentals than NAV.

Second, as shown in Table I, NAV returns are positively, not negatively, autocorrelated. If NAV is measured with error, we would expect NAV returns to be negatively correlated. The autocorrelation of both price and NAV returns is not significantly different in news weeks compared to the average week. Again, this pattern contradicts the proposed explanation.

We further explore the measurement-error explanation by splitting the funds into two groups that are likely to have different levels of measurement error in NAV. We split the sample into funds investing in emerging markets and funds investing in established markets, reasoning that emerging markets are likely to be less liquid and to have less accurate NAV data.

The first two columns in Table VI show the baseline regression estimated across these two groups. For emerging markets, the higher reaction induced by news days is somewhat higher at 0.5 versus 0.3 for established markets. However, this difference is statistically insignificant, and the higher news reaction is still marginally significant for the established markets. We conclude that measurement error is unlikely to be driving the results.

In the next two columns of Table VI, we split the sample using a different classification. The International Finance Corporation classifies 8 of our 25 countries as having some restriction on foreign ownership of equities. These 8 countries are all emerging markets. We run the regression separately for countries with investment restrictions, and for countries without. Because arbitrage is more difficult in restricted markets, we would expect to see a higher coefficient on the news interaction term in restricted markets. Again, the results are inconclusive. Although the coefficient is higher in restricted markets, the difference is insignificant.

A related issue is the knowledge about NAV that investors have when setting prices. We observe NAV and prices in a specific point in time, usually before NAV is publicly announced to the investment community. Our benchmark regression thus uses price returns that do not necessarily reflect full information about current NAV. To address this issue, we collect for each fund information about foreign exchange rates and foreign stock market indices. This information was publicly available to investors at the time we observe prices, because foreign markets close before the New York market each day. Using this information, we calculate for each fund a weekly return ($R_{\text{INDEX}}(t)$), translated into U.S. dollar terms, on the local stock price index.[18]

Across funds, the weekly return on the dollar value of the local index is highly correlated with the NAV return, with a correlation coefficient of 0.84. We reestimate our benchmark equation using $R_{\text{INDEX}}(t)$ instead of $R_n(t)$ in each place in which $R_n(t)$ occurs. Because our benchmark equation allows different contemporaneous reaction parameters for each fund, we are essen-

[18] We make sure that this foreign exchange and stock price index matches exactly the timing of the NAV and prices that we observed. So for funds that had NAV and prices as of Thursday, for example, we calculate $R_{\text{INDEX}}(t)$ on a Thursday-to-Thursday basis.

Table VI

Market Characteristics and Public Information

This table shows regressions of weekly price return on its own lagged value, contemporaneous and lagged net asset value return, the lagged premium, a dummy variable for whether news occurred in the week, and contemporaneous news and net asset value return interaction. The sample consists of weekly data on closed-end country funds, 1986 through 1994. $P(t)$ is the price of the fund. $N(t)$ is the net asset value of the fund. $D(t)$ is the dividend and capital gain distributions paid by the fund during week t. Price return is $R_p(t) = [\ln(P(t) + D(t)) - \ln(P(t-1))]$. Net asset value return is $R_n(t) = [\ln(N(t) + D(t)) - \ln(N(t-1))]$. The premium is $\ln(P(t)/N(t))$. All variables are expressed as percentage points. NEWS(t) is a dummy variable equal to one if a news event occurred for that fund and week. This table tests whether differences in foreign market characteristics, or timing issues in the release of net asset value information, affect the results. Emerging markets regression uses Argentina, Brazil, Chile, India, Indonesia, Israel, Korea, Malaysia, Mexico, Philippines, Portugal, Singapore, Taiwan, Thailand, and Turkey. Established markets regression uses Australia, Austria, France, Germany, Ireland, Italy, Japan, Spain, Switzerland, and the United Kingdom. Restricted markets regression includes Chile, India, Indonesia, Korea, Mexico, Philippines, Taiwan, and Thailand. Unrestricted markets include Argentina, Australia, Austria, Brazil, France, Germany, Ireland, Israel, Italy, Japan, Malaysia, Portugal, Singapore, Spain, Switzerland, Turkey, and the United Kingdom. The last column replaces $R_n(t)$ with $R_{\text{INDEX}}(t)$ in every place that $R_n(t)$ appears. $R_{\text{INDEX}}(t)$ is the change in the natural log of the dollar value of the local stock price index. In addition to the variables shown, all regressions include: one lag of $R_p(t)$, contemporaneous and two lags of $R_n(t)$, and the lagged premium, each allowed to vary across the 39 funds; a constant term; 38 fund-specific intercept dummies; and 428 week dummies. All regressions use weighted least squares, modeling the log of the variance of the OLS residuals as a linear function of the fund dummies and the variable NEWS(t), and reestimating the regression with the estimated covariance matrix. Standard errors are reported in parentheses. Dependent variable: $R_p(t)$.

	Sample				
	Emerging Markets	Established Markets	Restricted Markets	Unrestricted Markets	Reaction to Change in Dollar Value of Foreign Index
NEWS(t)*$R_n(t)$	0.50	0.30	0.72	0.32	
	(0.22)	(0.16)	(0.33)	(0.17)	
NEWS(t)*$R_{\text{INDEX}}(t)$					0.36
					(0.12)
NEWS(t)	0.79	−0.61	−0.67	0.13	0.89
	(1.04)	(0.58)	(1.20)	(0.72)	(0.55)
N	5114	4499	3577	6036	7022

tially allowing each fund's price return to have its own market beta on the local market, and asking whether (across funds) this beta rises in news weeks.

The results are shown in the last column of Table VI, and are very similar to the results using NAV returns. On average, price returns have a reaction to the dollar value of the local stock price index that is 0.36 higher in news

weeks than in other weeks. Put differently, fund loadings on the (foreign) market factor rise significantly in news weeks. Table VI shows that our results are not driven by the details of the timing of the information about NAV.

B. Volume and the Reaction of Price to News

As we show in Table V, fund volume is significantly higher in news weeks. One possible explanation for our results is that this higher volume in news weeks leads to more liquid markets and lower trading costs, and thus to prices that more accurately and quickly reflect new information. If this explanation is correct, one would expect that, controlling for volume, news weeks would not have greater reaction of price to NAV.

Table VII tests this hypothesis. We first construct a measure of above-average volume which controls for the fact that volume varies dramatically across different funds and different time periods. We construct VOLDEV(t), the volume deviation, as the OLS residual from a regression of log volume against fund dummies and week dummies. To construct a dummy variable similar to our NEWS(t) variable, we define HIGHVOL(t) as equal to one if VOLDEV(t) is more than two standard deviations above zero, which occurs in 2.7 percent of the observations.

In Table VII we add to our benchmark equation these two measures of abnormal volume, both interacted with $R_n(t)$ and by themselves. Controlling for the effect of volume on price reaction causes the estimated effect of news to fall somewhat, to around 0.3. These results show that news still has a sizeable and significant effect, and does not solely reflect variations in trading volume.

Additionally, the results show that higher volume is indeed associated with a greater reaction of price to asset value, as both VOLDEV(t)*$R_n(t)$ and HIGHVOL(t)*$R_n(t)$ are positive and significant. Like NEWS(t) weeks, high volume weeks increase the reaction of price returns to NAV returns. Thus there is some empirical support for the hypothesis that high volume leads to "better," more accurate prices.

We also find that both measures of volume, by themselves, are associated with positive price returns. This particular finding may reflect the sample period used. The highest volume observations came in November 1989 for the Germany Fund; in this period, both volume and price returns were extremely high.

VI. Conclusion

The hypothesis that the relative salience of news plays a role in the magnitude of investors' reaction to changes in economic fundamentals has not been extensively tested outside of a laboratory setting. We use closed-end country funds to test this hypothesis because they provide both an obvious

Table VII

Volume and the Reaction of Prices to News

This table shows regressions of weekly price return on its own lagged value, contemporaneous and lagged net asset value return, the lagged premium, a dummy variable for whether news occurred in the week, contemporaneous news and net asset value return interaction, contemporaneous volume variables, and an interaction term of contemporaneous volume and net asset value return. The sample consists of weekly data on closed-end country funds, 1986 through 1994. $P(t)$ is the price of the fund. $N(t)$ is the net asset value of the fund. $D(t)$ is the dividend and capital gain distributions paid by the fund during week t. Price return is $R_p(t) = [\ln(P(t) + D(t)) - \ln(P(t-1))]$. Net asset value return is $R_n(t) = [\ln(N(t) + D(t)) - \ln(N(t-1))]$. The premium is $\ln(P(t)/N(t))$. All variables are expressed as percentage points. NEWS(t) is a dummy variable equal to one if a news event occurred for that fund and week. VOLDEV(t) is the deviation of volume from its average for a given fund and week fund, calculated using the OLS residual from a regression of the natural logarithm of volume against dummies for fund and week. HIGHVOL(t) is a dummy variable equal to one if VOLDEV(t) is more than two standard deviations above zero. The cutoff point for HIGHVOL(t) is 1.2, which means that volume has to be 120 percent higher than average for that fund and week. HIGHVOL(t) equals 1 in about 2.7 percent of the observations. In addition to the variables shown, all regressions include: one lag of $R_p(t)$, contemporaneous and two lags of $R_n(t)$, and the lagged premium, each allowed to vary across the 39 funds; a constant term; 38 fund-specific intercept dummies; and 428 week dummies. All regressions use weighted least squares, modeling the log of the variance of the OLS residuals as a linear function of the fund dummies and the variable NEWS(t), and reestimating the regression with the estimated covariance matrix. Standard errors are reported in parentheses. Dependent variable: $R_p(t)$.

	Volume Measure	
	Volume Deviation	High Volume
NEWS(t)*$R_n(t)$	0.28	0.30
	(0.15)	(0.14)
NEWS(t)	0.002	0.31
	(0.63)	(0.59)
VOLDEV(t)*$R_n(t)$	0.27	
	(0.02)	
VOLDEV(t)	1.23	
	(0.07)	
HIGHVOL(t)*$R_n(t)$		0.49
		(0.08)
HIGHVOL(t)		2.33
		(0.29)
N	9554	9554

measure of fundamentals, the NAV, and an obvious measure of salient news, front-page *Times* articles.

We discuss a model of investor misperception, in which a group of investors incorrectly weight current fundamental signals in generating expectations of next period's fundamental signal. This framework shows that if some investors react more to fundamentals after important and well-publicized

news events focus attention on the host country (as suggested by the relative salience hypothesis), then prices will react more to NAV after these events.

Our empirical results are consistent with this hypothesis. First, the results from estimating simple return-generating equations indicate that price returns are in fact sticky, in that they display dependence on past changes in fundamentals in addition to current changes in fundamentals. Second, and more importantly, using the country-specific news events to construct a measure of prominent news, regression results suggest that the reaction to changes in fundamentals is quicker after news events. The short-run elasticity of prices to fundamentals temporarily rises.

Our finding is related to the fact that news weeks are weeks with high volume and high volatility of returns, but does not appear to reflect *only* volume and volatility. In addition to the NAV, we also use publicly observable foreign stock market indices and foreign exchange rates as measures of fundamental value. Even if NAV were an inaccurate measure of value, one might expect the loadings of closed-end country funds on the country stock market indices to be fairly constant from week to week. We find that the reaction of prices to foreign indices also rises significantly in news weeks.

The information on the front page headlines of the *Times* is redundant if one has access to NAV (from the *Wall Street Journal* or *Barron's*) and if NAV is a good measure of fundamentals. To the extent to which NAV is imperfect, newspapers could play a role in focusing the attention of rational, though computationally constrained, investors. Indeed, we expect that much of the psychological role of salience arises because salience provides a useful heuristic for processing information. However, the evidence suggests that NAV is a good measure of fundamental value, both in news weeks and in nonnews weeks. Thus there seems little reason for rational investors to react more to NAV in news weeks.

Appendix A: Data Appendix

We obtain a complete time series of weekly prices and NAVs adjusted for splits and in-kind distributions for each of the 39 country funds from *Barron's*, the *Bloomberg* system, and the funds themselves. *Standard and Poor's Dividend Record* and *Bloomberg* provide information on dividends and other distributions.

Table A.I provides the names of the funds in our sample with the dates of their initial public offerings (IPOs). The Japan Fund open-ended in 1987. A separate fund, the Japan Equity Fund, began in 1993. To conserve on degrees of freedom, we treat these two funds as a single fund, with missing values between 1987 and 1993.

A small fraction of the observations contain NAV and price observations on non-Fridays (usually Thursday). The funds compute their reported NAVs by translating the local currency price of the assets at the local market close into U.S. dollars. The translation to dollars, however, is not uniform, as some funds use the exchange rate at the local market close but others use an afternoon fix in New York.

Table A.I

Funds in the Sample and IPO Dates

This table provides the names of the funds in our sample with the dates of their initial public offerings (IPOs). Our sample consists of 39 single-country publicly traded funds that were covered in *Barron's* publicly traded funds column from January 1986 through March 1994, and that have at least twelve months of price and net asset value data.

	Fund	IPO Date
1	Argentina	10/11/91
2	Austria	09/21/89
3	Brazil	03/31/88
4	Brazil Equity	04/03/92
5	Chile	09/26/89
6	Emerging Germany	03/29/90
7	Emerging Mexico	10/02/90
8	First Australia	12/12/85
9	First Iberian0	04/13/88
10	First Israel	10/22/92
11	First Philippine	11/08/89
12	France Fund	05/30/86
13	France Growth	05/10/90
14	Future Germany	02/27/90
15	Germany Fund	07/18/86
16	Growth Spain	02/14/90
17	Helvetia	08/19/87
18	India Growth	08/12/88
19	Indonesia	03/01/90
20	Irish Investment	03/30/90
21	Italy	02/26/86
22	Jakarta Growth	04/16/90
23	Japan OTC Eqty	03/14/90
24	Japan	04/12/62
25	Korea	08/22/84
26	Korean Investment	02/13/92
27	Malaysia	05/08/87
28	Mexico Eq. & Inc.	08/14/90
29	Mexico	06/03/81
30	New Germany	01/24/90
31	Portugal	11/01/89
32	ROC Taiwan	05/19/89
33	Singapore	07/24/90
34	Spain	06/21/88
35	Taiwan	12/23/86
36	Thai Capital	05/22/90
37	Thai	02/17/88
38	Turkish Investment	12/15/89
39	United Kingdom	08/06/87

The classification of countries as restricted or unrestricted comes from the International Finance Corporation's *Emerging Stock Markets Factbook*, 1992.

News Events

Excluded articles include human interest stories, sports stories, and analysis not prompted by a news event. We also exclude items that do not contain at least part of the article actually appearing on the front page, as when the *Times* featured a picture and caption without an accompanying front-page news article.

In two cases, we judgmentally attach events to country funds even though their host countries did not appear in the headline or first paragraph. The first instance is the coup against Gorbachev in 1991, about which the *Times* mentions only Germany, but which we also attach to the Austria Fund. In the second instance, we attach the 1989 Tianannmen Square incident in the People's Republic of China to the Taiwan Fund and the ROC Taiwan Fund.

Since we work with weekly data on fund prices and NAVs, we make sure that events enter the information set of agents prior to the time when we observe the end-of-week price. For example, consider an event taking place on Friday, September 10. This event would presumably be reported in the *Times* on Saturday, September 11, and thus would be counted as affecting prices and NAVs observed on Friday, September 17. For those funds reporting Thursday or Wednesday prices and NAVs, an analogous scheme is used to match news events with the return week.

Appendix B: Theory Appendix

A Model of Investor Reaction in the Closed-End Country Fund Market

We here describe a model of the closed-end country fund market. There are two markets: a market for the underlying assets in the country fund's host country, and a market for the closed-end country fund shares in the public market of the country in which the country fund is listed. We assume that the traders in the market for the fund's underlying assets are fully rational and make use of all relevant available information, so that NAV perfectly reflects any relevant information that might be reported in the news. In the market for fund shares, we allow for nonfundamental influences on price. We assume that some participants in this market form their expectations incorrectly and trade on the basis of these incorrect expectations. Specifically, these "unsophisticated investors" underweigh current public information and overweight lagged public information in forming their expectations.

We also assume that salient news coverage temporarily reduces the extent to which unsophisticated investors underweigh current information. In our model, risk averse investors paired with nondiversifiable fundamental risk limit the scope of arbitrage. Thus our assumption on individual behavior has a similar effect on the price of the fund. Because some investors incorporate new information faster in the presence of news coverage, the fund price will also temporarily incorporate new information faster.

1. The Market for the Underlying Asset

We assume the host economy contains a riskless asset that earns a gross rate of return $1 + r$, is in perfectly elastic supply, and has a price that we normalize to equal one unit of the consumable good. Additionally, there is a risky asset that is in fixed supply (the underlying security). We normalize the supply of this asset to one. Let n_t denote the price of the risky asset at the beginning of period t.

Each period, investors receive a public signal, d_t, regarding the value of the risky asset next period. The signal, d_t, may be thought of as the (retained) earnings of the productive assets underlying the risky security. We assume that all participants in the market are overlapping generations of traders who each live two periods. Each trader invests his endowment at the beginning of the first period, consumes the gross proceeds at the beginning of the second period, and leaves no bequests. Each trader is assumed to have a negative exponential utility function with coefficient of absolute risk aversion equal to 2ω. We assume that the public signal d_t has a distribution given by:

$$d_{t+1} \sim N((1 + r)d_t, \sigma_d^2). \tag{B.1}$$

Each investor's objective is to maximize his expected utility in the second period of life:

$$EU = \lambda_{i,t}[E_t(n_{t+1}|d_t) - n_t(1 + r)] - \omega(\lambda_{i,t}^2)E_t(\sigma_{n,t+1}^2|d_t) + \text{constant}, \tag{B.2}$$

where $\lambda_{i,t}$ denotes the number of units that trader i holds of the risky asset in period t. We look for an equilibrium where the mathematical expected value of the risky asset next period is equal to the sum of its current value and the magnitude of the public signal, or $E_t(n_{t+1}|d_t) = n_t + d_t$ and the variance is constant.

Because the equilibrium price of the risky asset must be such that the demand for the risky asset equals its supply, solving for the equilibrium price yields:

$$n_t = \frac{d_t}{r} - \frac{2\omega\sigma_d^2}{r^3}. \tag{B.3}$$

The reader can verify that the assumptions invoked to derive the equilibrium are indeed satisfied by the equation above. The first term in the equilibrium pricing equation reflects the discounted expected increase in net asset value due to the fundamental signal, and the second term is the adjustment for one-period price risk which derives from variation in fundamental value.

2. The Market for the Country Fund

Consider now the market for a closed-end fund that is listed domestically and invests exclusively in the risky asset of the host foreign country. We

assume that a proportion γ of the participants in the market for the fund are "unsophisticated investors" who misperceive either the fundamental-generating process or the actual expected return on the risky asset or both. Specifically, unsophisticated investors process fundamental information as if they believed the fundamental signal had a distribution given by:

$$d'_{t+1} \sim N((1 + r)[(1 - \zeta)d_t + \zeta(1 + r)d_{t-1}], \sigma_d^2). \tag{B.4}$$

In other words, the unsophisticated investors falsely believe that the expected value of the next period's signal is a weighted sum of the current and lagged public signal. The value ζ is a measure of the stickiness of unsophisticated investors' perception of fundamentals. When $\zeta = 0$, the distribution perceived by the unsophisticated investors is the same as the one perceived by the rational investors who make up the remainder of the market.

The hypothesis we put forth in this paper is as follows: (1) there are unsophisticated investors ($\gamma > 0$); (2) these unsophisticated investors are usually slow to react to changes in fundamentals ($\zeta > 0$); and (3) "major news events" lead unsophisticated investors to temporarily react more quickly than usual (ζ temporarily decreases when a major news event concerning the foreign country occurs). To allow for this third effect, our model will allow each time period to fall into one of two possible states: the "usual" state when no major news event has occurred, and the "event" state when a major news event has occurred. Thus $\zeta = \zeta_u$ in usual periods and $\zeta = \zeta_e$ in periods with news events. We assume that there is a known, constant probability of $(1 - q)$ per time period of a major event occurring in that period.

All traders in the closed-end fund market have negative exponential utility and are born with an initial endowment Y. They have the same coefficient of absolute risk aversion as the traders in the host country and face the same source of fundamental risk. Let κ_i and κ_n denote the number of units of the fund purchased by the representative rational investor and unsophisticated investor, respectively. Let p_t denote the price of a fund share at the beginning of period t. We normalize the number of shares to one. We can express period $t + 1$ wealth of an investor as:

$$W_{t+1} = (1 + r)(Y - \kappa p_t) + \kappa(p_{t+1}). \tag{B.5}$$

The corresponding expected utilities of an unsophisticated investor (n) and a sophisticated investor (i) are:

$$\begin{aligned} EU_n = \text{constant} &+ \kappa_n(E_n(p_{t+1}|d_t,d_{t-1}) - (1 + r)p_t) \\ &- \omega(\kappa_n^2)(E_n(\sigma_{p,t+1}^2|d_t,d_{t-1})) \end{aligned} \tag{B.6}$$

$$\begin{aligned} EU_i = \text{constant} &+ \kappa_i(E_i(p_{t+1}|d_t,d_{t-1}) - (1 + r)p_t) \\ &- \omega(\kappa_i^2)(E_i(\sigma_{p,t+1}^2|d_t,d_{t-1})). \end{aligned} \tag{B.7}$$

Note that unsophisticated investors' price expectations are allowed to differ from those of rational investors. In equilibrium, the price of the fund, p_t, must be such that the demands of sophisticated investors and unsophisticated investors sum to one. Deriving each representative agent's first-order condition for maximizing expected utility, and applying the equilibrium condition, we can express price as a function of the agents' expectations:

$$p_t = \frac{1}{1+r}[\gamma E_n(p_{t+1} \mid d_t, d_{t-1}) + (1-\gamma)E_i(p_{t+1} \mid d_t, d_{t-1}) - 2\omega\sigma^2_{p,t+1}], \quad \text{(B.8)}$$

where $\sigma^2_{p,t+1} = E[(p_{t+1} - E(p_{t+1} \mid d_t, d_{t-1}))^2 | d_t, d_{t-1}]$. We allow the unsophisticated investors' expectation formation process to vary depending on whether a news event has occurred; therefore, we will have two equilibrium pricing formulas: one for usual periods and one for event periods. As before, we close the model by making assumptions about these expectations that will be true in the equilibrium we identify:

$$E_{n,e}(p_{t+1}|d_t, d_{t-1}) = E_i(p_{t+1}|d_t, d_{t-1}) - ((1-q)a_e + qa_u)(1+r) \times \zeta_e\left(n_t - (1+r)n_{t-1} - \frac{2\omega\sigma_d^2}{r^2}\right) \quad \text{(B.9)}$$

$$E_{n,u}(p_{t+1}|d_t, d_{t-1}) = E_i(p_{t+1}|d_t, d_{t-1}) - ((1-q)a_e + qa_u)(1+r)\zeta_u\left(n_t - (1+r)n_{t-1} - \frac{2\omega\sigma_d^2}{r^2}\right) \quad \text{(B.10)}$$

$$E_i(p_{t+1} \mid d_t, d_{t-1}) = ((1-q)a_e + qa_u)\left((1+r)n_t + \frac{2\omega\sigma_d^2}{r^2}\right) + ((1-q)b_e + qb_u)n_t + ((1-q)Ec_e + qEc_u), \quad \text{(B.11)}$$

where

$$p_{t+1,e} = a_e n_{t+1} + b_e n_t + c_e, \quad \text{(B.12)}$$

$$p_{t+1,u} = a_u n_{t+1} + b_u n_t + c_u. \quad \text{(B.13)}$$

Also, we assume that all conditional variances are constant across time. Substituting our assumptions into the price equations (in terms of expectations) above and rearranging the resultant equations (solving for all the

coefficients in terms of a_u) yields a preliminary expression for price in usual periods and price during event periods:

$$p_{t+1,u} = a_u n_{t+1} + \frac{a_u(1+r)\gamma\zeta_u}{1-\gamma(1-q)(\zeta_u-\zeta_e)} n_t + \frac{2a_u\omega\sigma_d^2}{r^3} \times \left(1 + \frac{(1+r)\gamma\zeta_u}{1-\gamma(1-q)(\zeta_u-\zeta_e)}\right) - \frac{2\omega\sigma_{p,t+1}^2}{r} \tag{B.14}$$

$$p_{t+1,e} = \frac{a_u(1+\gamma q(\zeta_u-\zeta_e))}{1-\gamma(1-q)(\zeta_u-\zeta_e)} n_{t+1} + \frac{a_u(1+r)\gamma\zeta_e}{1-\gamma(1-q)(\zeta_u-\zeta_e)} n_t + \frac{2a_u\omega\sigma_d^2}{r^3} \times \left(1 + \frac{(1+r)\gamma\zeta_u}{1-\gamma(1-q)(\zeta_u-\zeta_e)}\right) - \frac{2\omega\sigma_{p,t+1}^2}{r} - \frac{2a_u\omega\sigma_d^2\gamma(\zeta_u-\zeta_e)}{r^2(1-\gamma(1-q)(\zeta_u-\zeta_e))}. \tag{B.15}$$

It is interesting to compare the coefficients on the NAV terms in these two equations. If our hypothesis is correct and major news events cause the unsophisticated investors to have less sticky expectations (i.e., to be less "behind the curve"), then $\zeta_u > \zeta_e$ and the coefficient on n_{t+1} is larger in event periods than in usual periods, and the coefficient on n_t is smaller in event periods than in usual periods.

Using the definition of $\sigma_{p,t+1}^2$, the equilibrium solution of n_t above, and knowledge of the distribution of d_t we also derive a closed-form expression for the conditional variance of price:

$$\sigma_p^2 = \frac{a_u^2\sigma_d^2(1+\gamma^2 q(1-q)(\zeta_u-\zeta_e)^2)}{r^2(1-\gamma(1-q)(\zeta_u-\zeta_e))^2} + \frac{4a_u^2\omega^2\sigma_d^2\gamma^2(\zeta_u-\zeta_e)^2 q(1-q)^3((1+\gamma)\zeta_u+(1-\gamma)\zeta_e)}{r^4(1-\gamma(1-q)(\zeta_u-\zeta_e))^2(1+(1-q)(\zeta_u-\zeta_e))^2}. \tag{B.16}$$

Substituting into the above expressions for price yields closed-form expressions for the price of the closed-end fund. Furthermore, we can now go back and check that all our initial assumptions on the expectations are satisfied at these prices and see what expression this implies for a_u. We find that if we let

$$a_u = \frac{1-(1-q)\gamma(\zeta_u-\zeta_e)}{1-(1-q)\gamma(\zeta_u-\zeta_e)+\gamma\zeta_u}, \tag{B.17}$$

then these prices and expectations do indeed form an equilibrium.

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