UNIVERSITY OF NOTTINGHAM

Discussion Papers in Economics

Discussion Paper
No. 03/16

PRIOR PERFORMANCE AND CLOSED-END FUND DISCOUNTS

by Michael Bleaney and R. Todd Smith

September 2003

DP 03/16

ISSN 1360-2438

UNIVERSITY OF NOTTINGHAM

Discussion Papers in Economics

Discussion Paper
No. 03/16

PRIOR PERFORMANCE AND CLOSED-END FUND DISCOUNTS

by Michael Bleaney and R. Todd Smith

Michael Bleaney is Professor, School of Economics, University of Nottingham and R. Todd Smith is Professor of Economics, University of Alberta

September 2003

Prior Performance and Closed-End Fund Discounts

Abstract

In open-end funds, net inflows are positively correlated with past performance. This study investigates how past net asset value (NAV) returns affect the premium on closed-end funds traded in the United States and the United Kingdom. Past performance is significantly priced in stock funds, although NAV returns are persistent only for bond funds. In the United States, where realized capital gains are paid out as dividends, investors appear to interpret dividend flows as evidence of skill. There is substantial short-run inertia in fund prices, which tests indicate is explained to some extent by staleness of reported NAVs.

Keywords: Closed-end fund, discount, return.

JEL Nos: G12

It is well established that, for open-end mutual funds, net sales are positively related to past performance (Chevalier and Ellison, 1997; Gruber, 1996; Ippolito, 1992; Sirri and Tufano, 1998). There has been considerable debate about persistence in fund performance, and also about whether actively managed funds outperform passively managed funds sufficiently to justify their extra costs (see Wermers, 2000, and the references therein). Gruber (1996) finds that fund expenses do not respond to past performance, and that if anything expenses are higher for poorly performing funds. His results suggest some degree of persistence, but mostly amongst the worst-performing funds. Remarkably similar results are reported by Fletcher and Forbes (2002) for the United Kingdom. Rhodes (2000) surveys studies of the U.K. as well as the U.S. market and fails to find evidence "that information on past investment performance can be used to good effect by retail investors in choosing funds". These results imply that, although there is little return persistence, investors who select open-end funds on the basis that returns are persistent will earn much the same returns as those who ignore past return information.

There are broadly three possible interpretations of these findings. From a Bayesian perspective, there remains a non-zero posterior probability that the hypothesis of persistence in performance is true. Since there is no cost in choosing funds with better past performance, it is rational to bias one's holdings towards these funds (Baks *et al*., 2001). A second possible interpretation is that retail investors display a significant degree of irrationality, and therefore choose funds which are able to advertise good past performance even though there is negligible evidence of persistence in performance. A third interpretation, recently suggested by Berk and Green (2002), relies on the idea that investors are highly rational and swiftly adjust their holdings to the latest performance information. In this model fund managers differ in skill but suffer from increasing costs, so that their returns are better when the funds are smaller. If investors move their money between funds so as to equalise expected returns on the marginal dollar, funds with good past returns will grow, but the increase in costs will ensure that performance does not repeat.

An investigation of closed-end funds has the potential to discriminate between these alternative explanations of the findings for open-end funds, because the price of a closed-end fund can (and in general does) differ from its net asset value (NAV). To quote Gruber (1996, p. 793), "[T]he value of management in open end funds is not priced, while in closed end funds it is priced. This means that if investors believe that superior management exists and they can predict it, then they can buy it for no cost in open end funds and earn a superior return. They cannot do the same for closed end funds, for expectations of management performance should be incorporated in the price of the fund." Berk and Stanton (2003) have recently developed a model of closed-end fund discounts based on this principle.

The Bayesian interpretation would suggest that past performance would be priced in closed-end funds only in proportion to the strength of the evidence of performance persistence. If the evidence for persistence is weak, then the effect of past performance on fund prices (relative to the net asset value) should be very small. If, instead, retail investors display significant irrationality, and their demand follows performance in the way that it does for open-end funds, then past performance should be over-priced in closed-end funds (relative to the evidence of performance persistence). Finally, the Berk-Green hypothesis implies that performance of closed-end funds should show marked persistence, because the mechanism that eliminates performance persistence in open-end funds in their model (adjustment of fund size) does not operate in closed-end funds. Moreover, this persistence in performance should be appropriately priced, because investors are assumed to be rational and highly responsive to new information.

The purpose of the present paper is to use a large data set of closed-end funds traded in the U.S. and the U.K. to investigate the relationship between past NAV performance and the premium (the difference between the price and the NAV, as a proportion of the NAV) on closed-end funds. Existing studies tend to suggest that NAV returns have little persistence, and that premia are *negatively* correlated with NAV returns at shorter horizons, though perhaps positively correlated at longer horizons (Pontiff, 1995). On the face of it, this is most consistent with the Bayesian interpretation of the findings from open-end funds, but the issue merits deeper investigation.

We investigate the NAV return-premium relationship in some detail for different sets of closed-end funds. Our findings are new in several respects. First, we look at longer lags than most previous studies, and we find striking evidence that in the medium term NAV returns affect premia to a degree not justified by return persistence, particularly in the case of equity funds. Moreover this effect has not diminished over time. Second, we investigate whether phenomena observed in the relationship between returns and net sales of open-end funds, such as asymmetry between good and bad returns and sensitivity to transaction costs, are reproduced in the closed-end fund market. Fourth, we investigate the role of dividend flows in communicating past return information to investors in the U.S. market. Fifth, we show that the short-run dynamics of the premium are not well represented by simple mean-reversion, although this is an important component. Finally, we investigate possible sources of the well-known short-run inertia in fund prices.

The structure of the paper is as follows. After a brief survey of previous research in the next section, Section 2 discusses key hypotheses to be tested, and Section 3 describes the data and empirical methodology. Section 4 presents the empirical results, and the final section concludes.

1. Previous Research

Studies of closed-end funds have shown that premia tend to revert slowly to a negative mean, and that the average premium across funds varies substantially through time. The mean-reversion of discounts implies that share price returns on funds with higher discounts exceed returns on funds with lower discounts (Cheng *et al*., 1994; Pontiff, 1995; Thompson, 1978). The tendency for funds to trade at a discount has been long discussed; possible explanations are evaluated by Malkiel (1977), and a theory based on limited rationality of investors that favor closed-end funds (relative to the market as a whole) is presented by Lee, Shleifer and Thaler (1991) (see Dimson and Minio-Kozerski, 1999, for a recent survey).

Empirical investigation of closed-end funds has focused primarily on explaining the time-series behavior and cross-sectional pattern of discounts. The persistence of NAV performance and the relationship between performance and demand for funds has been less intensively researched than in the case of open-end funds. Pontiff (1995) notes the repeated observation that the correlation between premia and past performance tends to be negative at monthly horizons (a result which we confirm here), as does the first-order autocorrelation of monthly NAV returns (relative to the market return). He finds that premia do not predict future NAV returns, although Chay and Trzcinka (1999) report that premia do predict future NAV returns for equity funds (but not bond funds) in the U.S. market.

In the present study we focus on the relationships between (a) past and future NAV returns; (b) the premium and future NAV returns; and (c) the premium and past NAV returns, for equity and bond funds traded in the U.S., and equity funds traded in the U.K.[1] For the most part we do not seek to explain the time-series behavior of the average premium across all funds, nor across all funds in a certain category, but only the behavior of an individual fund's premium relative to that of others of similar investment style. As is argued below, this is necessary to isolate performance effects at the level of the individual fund from style effects and wider investment sentiment influences.

Previous research on cash flows into U.S. equity open-end funds shows a positive but non-linear relationship between inflows and prior performance. Ippolito (1992), using annual data on 143 funds from 1965 to 1984, finds that a fund's growth rate is positively correlated with its relative performance in each of the last five years, with performance in the most recent year having the greatest impact. The shape of the cash flow/performance relationship is investigated in more detail by Gruber (1996), Chevalier and Ellison (1997) and Sirri and Tufano (1998). They all find that the coefficient is much steeper at the top end of the performance scale, and Sirri and Tufano report that the relationship is almost flat amongst the bottom 20% of funds. Findings are much the same whatever the complexity of the performance measure (Sirri and Tufano, 1998). Gruber (1996) reports higher coefficents for a four-index Jensen alpha that allows for fund specialization (by firm size, value versus growth, and bonds versus stocks) than for a one-index alpha based on the S&P 500, which suggests that consumers take account of performance relative to similar funds. Ippolito (1992) investigates asymmetries in the impact on cash inflows between above-average and below-average performance, and finds the coefficient to be nearly twice as large for good as for bad performance. He also finds that the coefficient is significantly larger for load funds

[1] No closed-end bond funds exist in the U.K., because the tax regime does not favor them.

than for no-load funds, which suggests a transaction cost effect. We test for both of these effects in closed-end funds.

2. **Hypotheses to be tested**

Denote the NAV returns to fund *j* over period *t-k* to *t* by R_{jtk}. Let

$$Y_{jt} \; = \; \ln \; (SP_{jt}/NAV_{jt}) \tag{1}$$

where SP is the fund's stock price and NAV is its net asset value. Thus Y_{jt} is the end-of-period premium on fund j. The hypothesis which we wish to test is that Y is correlated with past $R's$ after controlling for a vector of market-wide and fund-specific factors (X_{jt}). We therefore estimate the regression

$$Y_{jt} \; = \; a \; + \; b_k R_{jtk} + gX_{jt} + e_{jt} \tag{2}$$

for values of *k* between one and 48 months, where e_{jt} is a random error term. When (2) is estimated as a pooled regression, this incorporates both cross-section and time series relationships. In order to focus on the cross-section relationship, we subtract the mean of Y for that investment style in that time period from Y_{jt}, and the mean of R for that investment style in that time period from R_{jtk}.

In Section 4 below, we report results from estimating (2) for different samples of closed-end funds. We test whether there is asymmetry between good and bad performance by allowing b to vary between above-average and below-average returns. To test whether transaction costs make a difference to the return coefficient, we add an additional regressor (NAV returns times a proxy for transaction costs). Finally, we test two hypotheses of price inertia that are explained below: staleness of NAV data (Pontiff (1995)) and a trading cost hypothesis.

3. **Data and Methodology**

Our sample of U.S. funds includes domestic closed-end funds with an inception date no later than December 1995 belonging to the main investment styles identified in CDA/Wiessenberger. The main investment styles and number of funds are: Corporate and High Yield (22 funds), Multi-Sector Bond (9 funds), Growth and Income (17 funds), and

Growth (11 funds). End-of-month price and NAV are from Bloomberg Financial Markets. Dividend yields are obtained from Datastream (where price and NAV data overlap in Bloomberg and Datastream the figures are identical). Dividend yields reported in Datastream are annualized. We therefore adjust the reported figures when the frequency of our return period is not twelve months. The funds and sample ranges are shown in Appendix Table 1.

Our sample of U.K. funds is domestic closed-end funds belonging to the main investment styles listed by the Association of Investment Trust Companies. These funds belong to three main investment styles: General (7 funds), Income Growth (8 funds), and Smaller Companies (8 funds). End-of-month data on price, NAV, and dividend yields are from Datastream. The funds and sample ranges are shown in Appendix Table 2.

One of our control variables is a fund's beta, which could be measured using a fund's share price return or its NAV return, and one or both of these are included as control variables depending on the dependent variable. Betas are calculated in a rolling 12-month manner. The market indexes used to compute the betas (and also in the test reported in Table 13) are as follows. For U.S. bond funds we use the Lehman Brothers U.S. Aggregate Bond Total Return Index (from Datastream). For U.S. equity funds we use the Datastream U.S. Market Global Return Index. For U.K equity funds we use the Datastream U.K. Global Return Index. When the premium is the dependent variable we include as control variables both betas.

Another control variable is a short-term interest rate. The interest rate used is the one-month eurodollar and eurosterling deposit rate, measured at the beginning of the month. These rates, from Datastream, are defined as the "middle rate"--the average of the bid and ask.

We also include as a control variable a measure of transactions costs for trading equity in the funds. The measure used is the inverse of the average stock price, where the average is calculated over a rolling six-month window.

As mentioned above, in our empirical work we study fund premia (and NAV and stock returns) that are in most cases measured relative to the average for funds of that particular investment style. Specifically, for each monthly observation we demean the data using the mean across funds for that monthly observation. The results presented below are based on three groups of funds: (1) the three styles of U.S. stock funds; (2) the three styles of U.K. stock funds; and (3) the two styles of U.S. bond funds. Note that demeaning is done within a style rather than within the full group of funds in these three datasets.

We estimate the parameters of the models by OLS. OLS standard errors are, however, questionable because both heteroskedasticity and serial correlation are likely present in the error term – due to the cross-sectional nature of the dataset, and because previous work suggests that the error term in (2) is very likely to be serially correlated. For this reason we estimate the standard errors of the OLS parameter estimates using a technique that is robust to both autocorrelation and heteroskedasticity. The variance-covariance estimator we use is the Newey-West estimator with the bandwidth chosen optimally, as discussed by Newey and West (1994). Small sample bias with these estimators of the variance-covariance matrix (e.g. Newey and West (1994)) is not an issue here due to the sample size.

4. **Results**

If investors believe that NAV returns are predictable, one would expect relative premia to reflect this belief. Consequently relative premia should be positively correlated with subsequent relative NAV returns. In general this has not been found to be the case in previous studies, although Chay and Trzcinka (1999) find such a correlation for U.S. equity funds (but not bond funds). Table 1 shows the results of a regression of NAV returns on past premia for horizons of 1, 3, 6 and 12 months for our three classes of funds: U.S. equity funds, U.S. bond funds, and U.K. equity funds. Although the premium coefficient is typically positive, in only one of these twelve exercises is the coefficient significantly different from zero at the 0.10 level (or the 0.05 level, assuming that a one-tailed test is appropriate), and that is for U.S. stock funds at the shortest horizon. Even in this case, the relationship is scarcely economically significant, since it suggests that a 10% higher premium is associated with an extra one-month NAV return of only 0.26%. These findings are consistent with previous work in showing that relative premia do not predict subsequent relative NAV performance.

Table 1. Do Relative Premia Predict Relative NAV Returns?

Horizon (months)	Coefficient of Premium	(*t*-statistic)	*p*-value
U.S. stock funds			
1	0.0262	(2.32)	*0.020*
3	0.0215	(1.11)	*0.269*
6	00280	(0.84)	*0.398*
12	0.0253	(0.43)	*0.666*
U.S. bond funds			
1	0.0458	(1.56)	*0.119*
3	0.0238	(0.56)	*0.574*
6	-0.0041	(-0.06)	*0.950*
12	-0.0367	(-0.40)	0.693
U.K. stock funds			
1	0.0062	(1.44)	*0.150*
3	0.0182	(1.48)	*0.138*
6	0.0256	(1.14)	*0.254*
12	0.0208	(0.45)	*0.652*

Notes. The regression estimated was of the form: *NAV return from t to t+h = a + b(Premium at time t) + c(12-month Beta)*. NAV return and premium are calculated relative to style average. The number of observations for the three samples is respectively 3659, 3941 and 4724. Estimation method: OLS with Newey-West (1994) standard errors.

We next investigate whether there is any evidence of persistence in NAV returns. Table 2 shows the results of an autoregression of NAV returns (relative to the style average) for 1-month and for 12-month returns. In the case of 1-month returns, U.K. equity funds show a significant positive coefficient for the first lag, but it is very small (0.07) and the R-squared for the whole regression is below 1%. For U.S. funds, the coefficient of the first lag is actually negative, particularly in the case of bond funds. In the case of 12-month returns, relative returns for equity funds in both the U.K. and the U.S. display no autocorrelation, but bond funds do, with the expected positive coefficients. In short, only bond funds show evidence of persistent differences in relative NAV returns between funds. It is a little surprising, therefore, that bond fund premia do not incorporate this information and predict NAV returns.

Table 2. Autoregressions of Relative NAV Returns

Regressor	U.S. stocks	U.S. bonds	U.K. stocks
One-month returns			
Constant	0.00177 (1.52)	–0.00030 (–0.52)	0.00002 (0.02)
1-month lag	–0.124 (–2.14)	–0.379 (–3.91)	0.068 (3.68)
2-month lag	–0.084 (–1.68)	0.017 (0.17)	0.023 (1.20)
3-month lag	–0.071 (–1.29)	0.033 (0.66)	–0.029 (–1.72)
4-month lag	–0.034 (–1.52)	0.019 (0.40)	0.009 (0.55)
5-month lag	0.045 (1.14)	0.048 (1.57)	0.016 (0.98)
6-month lag	0.090 (2.26)	0.032 (1.55)	0.017 (0.76)
12-month beta	–0.00223 (–1.40)	0.00035 (0.98)	–0.00005 (–0.05)
Sample size	3653	3942	5552
R-squared	0.0339	0.147	0.007
Standard error	0.0368	0.0231	0.0183
12-month returns			
Constant	0.0408 (2.92)	–0.00316 (–0.61)	0.00495 (0.66)
12-month lag	0.008 (0.10)	0.161 (1.90)	0.061 (0.99)
24-month lag	–0.138 (–1.36)	0.197 (3.56)	0.037 (0.74)
36-month lag	–0.044 (–0.58)	0.078 (1.95)	–0.053 (–1.13)
12-month beta	–0.0567 (–3.54)	0.0038 (0.66)	–0.0045 (–0.55)
Sample size	2648	2825	4724
R-squared	0.106	0.097	0.008
Standard error	0.107	0.0578	0.071

Notes. Figures in parentheses are *t*-statistics. Dependent variable is NAV return in logs relative to style average. Estimation method: OLS with Newey-West (1994) standard errors.

If NAV returns are not persistent, the market should not rationally price differences in past performance through the premium. This would lead us to expect that only for bond funds should the premium be related to past NAV returns. The results of a regression of end-of-month premia on past NAV returns appear in Table 3.

Table 3. Premia and Past NAV Returns

	Coefficient of NAV returns over previous *k* months in a premium regression		
	U.S. stocks	U.S. bonds	U.K. stocks
k = 1	–0.150 (–3.88)	–0.111 (–0.93)	–0.082 (–3.16)
k = 3	–0.093 (–3.04)	–0.051 (–0.67)	–0.030 (–1.60)
k = 6	–0.074 (–2.25)	–0.055 (–0.93)	–0.016 (0.87)
k = 12	0.025 (0.80)	–0.034 (–1.05)	0.044 (2.35)
k = 24	0.097 (1.98)	–0.019 (–0.21)	0.111 (2.62)
k = 36	0.084 (2.78)	–0.006 (–0.17)	–0.017 (–0.67)
k = 48	0.108 (3.56)	–0.001 (–0.03)	0.019 (0.98)
	With premia and NAV returns calculated relative to style average		
	U.S. stocks	U.S. bonds	U.K. stocks
k = 1	–0.241 (–4.32)	–0.522 (–9.29)	–0.297 (–4.39)
k = 3	–0.097 (–1.90)	–0.426 (–5.23)	–0.040 (–0.64)
k = 6	–0.039 (–0.75)	–0.279 (–3.49)	0.083 (1.40)
k = 12	0.047 (0.99)	–0.117 (–1.75)	0.165 (3.01)
k = 24	0.089 (2.13)	–0.040 (–0.76)	0.174 (3.25)
k = 36	0.103 (2.95)	–0.033 (–0.82)	0.127 (2.61)
k = 48	0.091 (2.65)	–0.018 (–0.47)	0.087 (2.00)
	Coefficient of average NAV returns across funds in time series regression for average premium		
	U.S. stocks	U.S. bonds	U.K. stocks
k = 1	–0.074 (–0.97)	0.340 (1.48)	–0.148 (–3.41)
k = 3	–0.087 (–1.38)	0.184 (1.22)	–0.093 (–2.66)
k = 6	–0.097 (–1.61)	0.116 (0.91)	–0.087 (–2.39)
k = 12	–0.036 (–0.64)	0.139 (1.40)	–0.084 (–2.23)
k = 24	0.017 (0.29)	0.139 (1.95)	–0.105 (–2.38)
k = 36	0.032 (0.93)	0.044 (0.59)	–0.069 (–1.92)
k = 48	0.034 (1.14)	–0.017 (–0.19)	–0.078 (–2.36)

Notes. Figures in parentheses are *t*-statistics. Dependent variable is log (price/NAV). Estimation method: OLS with Newey-West (1994) standard errors. Also included in the cross-section regressions were: interest rates, 12-month betas for prices and NAVs, and the inverse of price (a measure of transaction costs).

The top panel of Table 3 shows the results of a pooled regression of the raw premium on raw NAV returns over 1, 3, 6, 12, 24, 36 and 48 months. For U.S. stock funds, there is a significant negative relationship between the premium and past returns up to six months, which becomes significantly positive from 24 months onwards. For U.S. bond funds, the coefficients are always negative but never significant. For U.K. stock funds, there is a significant negative coefficient for one-month returns, and significantly positive ones for 12-month and 24-month returns.

One problem with this regression is that it incorporates both the time-series and the cross-section components of the relationship, which may behave in a quite different way. The time-series relationship will primarily reflect the behavior of investor sentiment towards closed-end funds in general, whereas the cross-section relationship will capture the impact of relative returns on the demand for individual funds. To separate these two components, the remaining two panels of Table 3 show the effect of (a) demeaning the variables cross-sectionally, and (b) estimating the time-series relationship between these cross-sectional means.

The middle panel of Table 3 shows the results when the premium and NAV returns are calculated relative to the average for that investment style. These results reflect a pure cross-section relationship, since the fluctuations in average premia and returns over time have been removed by demeaning. This produces a much more consistent picture across U.S. and U.K. stock funds, with a significant negative coefficient of relative NAV returns at a one-month horizon, and significantly positive ones at longer horizons (from 24 months for U.S. stocks, and from 12 months for U.K. stocks). For bond funds, the negative relationship between the relative premium and relative NAV returns is significant and very strong up to six months, with no sign of a positive relationship at longer horizons.

The last panel of Table 3 shows the time-series relationship between average premia and average NAV returns. This is significantly negative for U.K. stocks over all horizons, close to zero for U.S. stocks, and tends to be positive (but insignificant) for bonds. If the average premium is treated as a measure of investor sentiment, then sentiment does not seem to be strongly driven by past returns.

In the remainder of the paper we use demeaned data, as in the middle panel of Table 3, in order to focus on the cross-section relationships.

The results in Table 3 suggest that the effect of past relative performance is built into the relative premium only slowly (and indeed the initial movement is in the opposite direction). The short-run negative correlation between the NAV return and the premium has been observed before (Pontiff, 1995), and we investigate possible reasons for it later. As this "price inertia" gradually unwinds, the impact of past relative performance on the relative premium becomes positive for stock funds (but not bond funds). If we split the 48-month NAV returns into 48 separate monthly returns, we find that the effect peaks at a lag of about twelve months for U.S. stocks and about nine months for U.K. stocks (results not shown). For U.K. stocks, the coefficient declines steadily after nine months and is effectively zero after 36 months, but for U.S. stocks it remains almost at its peak level up to 48 months.

Is it rational for investors to respond to stale information in this way? For new money flowing into the closed-end fund market, it is rational to use returns over a fair period of time in order to judge skill, so that luck averages out; but for money that is already in the market, it is not rational to react to anything other than the latest information. If a portfolio is reviewed once a month in the light of past NAV performance, then only the latest month's NAV performance is new information. Therefore only the most recent performance figures should trigger reallocation of funds. The effect reported in Table 3 could, however, come about if investors use performance rankings over one or more years in making reallocation decisions, ignoring the fact that much of this information is stale. A similar effect certainly operates in the open-end funds market. Ippolito (1992) finds that net flows into open-end funds significantly reflect relative performance up to five years in the past (with steadily but not rapidly declining weights – performance in the past year has a coefficient only twice as great as performance three years previously).

Recall that Table 2 showed that there was persistence in relative performance only for bond funds, and not for stock funds. It is therefore paradoxical that (after some initial price inertia) the premium should be positively correlated with prior performance only in stock funds. Rationally one would expect the market to price performance in bond funds but not stock funds, given the evidence in Table 2. One possibility is that the market is gradually converging towards this situation by learning from experience. To test this hypothesis we split the sample at the end of 1993, and compare the coefficients of relative NAV performance before and after this date. If the learning hypothesis is correct, for stock funds the coefficients for returns over a longer period should be closer to zero in the later period, because there is in fact no persistence in relative returns, whereas for bond funds they should be positive (or less negative) in the later period. The evidence is presented in Table 4, and it is not consistent with the learning hypothesis. For stock funds the coefficients of past NAV returns are more (not less) positive in the later period, and for bond funds the coefficients are more (not less) negative.

Table 4. Relative Premia and Relative NAV Returns, 1980-93 and 1994-2001

	1980-1993		
	U.S. stocks	U.S. bonds	U.K. stocks
k = 1	–0.345 (–3.63)	–0.461 (–11.33)	–0.307 (–3.17)
k = 3	–0.190 (–1.59)	–0.334 (–4.12)	–0.036 (–0.39)
k = 6	–0.100 (–0.94)	–0.187 (–1.88)	0.112 (1.30)
k = 12	–0.021 (–0.23)	–0.159 (–0.21)	0.182 (2.32)
k = 24	0.034 (0.42)	0.025 (0.51)	0.162 (2.36)
k = 36	0.094 (1.21)	0.004 (0.10)	0.104 (1.71)
k = 48	0.184 (1.84)	0.001 (0.03)	0.064 (1.21)
	1994-2001		
	U.S. stocks	U.S. bonds	U.K. stocks
k = 1	–0.201 (–3.97)	–0.769 (–3.06)	–0.288 (–3.96)
k = 3	–0.070 (–1.43)	–0.582 (–3.40)	–0.056 (–1.12)
k = 6	–0.020 (–0.35)	–0.382 (–3.52)	0.019 (0.43)
k = 12	0.072 (1.42)	–0.245 (–3.17)	0.112 (2.33)
k = 24	0.126 (3.31)	–0.154 (–2.06)	0.216 (3.96)
k = 36	0.133 (4.19)	–0.085 (–1.41)	0.246 (5.27)
k = 48	0.122 (3.84)	–0.047 (–0.91)	0.203 (5.01)
Sample size			

Notes. Figures in parentheses are *t*-statistics. Dependent variable is log (price/NAV) relative to style average. Estimation method: OLS with Newey-West (1994) standard errors.

Although calculating returns relative to the average for that investment style represents a significant degree of risk adjustment, it is possible to go further in this direction by estimating Jensen alphas – the intercept from a regression of the fund excess NAV return on the market excess return. We use twelve months of data for these regressions, and update the estimated alphas for each observation. Table 5 shows the results of regressing the relative premium on a fund's estimated alpha.[2] The estimated coefficients show very much the same pattern as the cross-section results in Table 3.

Table 5. Premia and Jensen alphas

	Coefficient of Jensen alpha over previous *k* months in a premium regression		
	U.S. stocks	U.S. bonds	U.K. stocks
k = 1	–0.103 (–2.06)	–0.205 (–3.38)	–0.035 (–1.28)
k = 3	0.025 (0.16)	–0.294 (–2.27)	0.028 (0.94)
k = 6	0.266 (0.89)	–0.293 (–1.63)	0.055 (1.60)
k = 12	0.778 (1.64)	–0.173 (–0.64)	0.066 (2.09)
k = 24	1.190 (2.17)	–0.057 (–0.21)	0.035 (1.78)
k = 36	1.499 (2.68)	–0.084 (–0.36)	0.018 (1.22)
k = 48	1.526 (2.35)	–0.325 (–0.84)	0.010 (0.93)

Notes. Figures in parentheses are *t*-statistics. Dependent variable is log (price/NAV) relative to style average. Estimation method: OLS with Newey-West (1994) standard errors.

How large are these estimated effects? Table 5 shows the point estimate of the effect on the premium of an improvement in performance by one standard deviation, using relative

[2] For horizons of less than twelve months the alpha is calculated as the excess NAV return over *k* months minus the twelve-month beta times the market excess return over *k* months.

NAV returns (the middle panel of Table 3) and estimated alphas (Table 5). For U.S. stocks the estimated effect is more than two percentage points using 36-month relative NAV returns, but only 1.5 percentage points using alphas. For U.K. stocks the estimated effect peaks at 2 percentage points for 24-month relative NAV returns, but is below one percentage point using alphas.

Table 6. Estimated Impact on the Premium of a 1-S.D. Improvement in Performance

	Using relative NAV returns over previous *k* months		
	U.S. stocks	U.S. bonds	U.K. stocks
k = 1	–0.88	–1.26	–0.56
k = 3	–0.56	–1.40	–0.11
k = 6	–0.30	–1.29	0.41
k = 12	0.51	–0.81	1.17
k = 24	1.58	–0.43	2.06
k = 36	2.03	–0.44	1.96
k = 48	2.21	–0.28	1.64
	Using Jensen alphas over previous *k* months		
	U.S. stocks	U.S. bonds	U.K. stocks
k = 1	–0.50	–0.82	–0.13
k = 3	0.62	–0.64	0.18
k = 6	0.47	–0.50	0.47
k = 12	1.03	–0.25	0.85
k = 24	1.33	–0.08	0.78
k = 36	1.51	–0.11	0.62
k = 48	1.47	–0.26	0.44

Notes. Effects are measured in percentage points.

Compared to the dramatic effects which good performance can have on the size of open-end funds, these estimates do not seem very large. To generate a gain of two percentage points in the premium after 36 months requires outperformance of the average by 16.2% in U.S. stock funds and by 14.2% in U.K. stock funds. Consequently the premium effect adds only a small proportion to the variance of returns across funds.

Studies of flows of money in and out of open-end funds suggest other hypotheses that can be investigated for closed-end funds. One is that the impact on demand of good and bad performance is not symmetrical. Ippolito (1992) estimates the effect of performance on inflows to be about 2.5 times as great for good as for bad performance. Gruber (1996), Chevalier and Ellison (1997) and Sirri and Tufano (1998) all find that this asymmetry comes from a dramatic steepening of the flow-performance relationship at the top end (i.e. for the top 10-15% of funds when ranked by performance). Another hypothesis is that the effect of performance on premia is inversely related to transaction costs – Ippolito (1992) finds that net inflows to open-end funds respond more strongly to performance in no-load funds than in load funds.

To test the first hypothesis, we divide the sample according to whether prior NAV performance is above or below the average for that investment style, and then investigate the cross-section relationship between the premium and NAV performance separately for each sub-sample. The results are shown in Table 7. For U.K. stocks, the pattern is consistent with that observed in open-end funds – good performance has a much larger effect on the premium than poor performance. For U.S. stocks, we get the opposite result – the positive relationship between prior performance and the premium seems to come almost entirely from poorly performing funds. For bonds also, the coefficient is less negative for below average performance. There is no obvious explanation for these differences between U.K. and U.S. funds.

Table 7. Differential Impact on the Premium of Good and Bad Performance

	Positive relative NAV returns over previous *k* months		
	U.S. stocks	U.S. bonds	U.K. stocks
k = 1	–0.326 (–1.22)	–0.601 (–2.51)	–0.344 (–2.39)
k = 3	–0.129 (–0.77)	–0.429 (–2.17)	–0.109 (–1.03)
k = 6	–0.082 (–0.65)	–0.296 (–1.89)	0.055 (0.56)
k = 12	0.009 (0.09)	–0.170 (–1.75)	0.168 (2.00)
k = 24	0.058 (0.76)	–0.091 (–1.23)	0.278 (3.51)
k = 36	0.065 (1.02)	–0.082 (–1.08)	0.267 (4.12)
k = 48	0.045 (0.73)	–0.051 (–0.71)	0.218 (4.01)
	Negative relative NAV returns over previous *k* months		
	U.S. stocks	U.S. bonds	U.K. stocks
k = 1	–0.160 (–0.84)	–0.48 (–1.94)	–0.253 (–1.62)
k = 3	–0.063 (–0.44)	–0.423 (–2.36)	0.024 (0.17)
k = 6	0.011 (0.08)	–0.267 (–2.13)	0.108 (0.83)
k = 12	0.092 (1.07)	–0.084 (–0.85)	0.163 (1.38)
k = 24	0.158 (2.48)	–0.016 (–0.22)	0.110 (1.12)
k = 36	0.195 (3.18)	–0.012 (–0.21)	0.049 (0.60)
k = 48	0.238 (3.47)	–0.006 (–0.10)	0.015 (0.23)

Notes. Figures in parentheses are *t*-statistics. Dependent variable is log (price/NAV) relative to style average. Estimation method: OLS with Newey-West (1994) standard errors.

Table 8 shows what happens if the coefficient of prior NAV performance is allowed to vary with the bid-ask spread, where the inverse of the price is used as a proxy for the spread, as in Pontiff (1996). The hypothesis suggests that the relationship should be negative, i.e. the coefficient should be less positive (or more negative) when the bid-ask spread is higher. That is borne out in Table 8, but the relationship is never statistically significant.

Table 8. Transaction Cost Effects in the Response of the Premium to Past Returns

	Coefficient of transaction cost times relative NAV returns over previous *k* months when added to regressions shown in middle panel of Table 3		
	U.S. stocks	U.S. bonds	U.K. stocks
k = 1	–0.643 (–1.15)	–1.985 (–1.18)	–0.796 (–0.62)
k = 3	–0.684 (–1.25)	–0.807 (–1.02)	–0.639 (–0.51)
k = 6	–0.722 (–1.30)	–0.128 (–0.35)	–0.044 (–0.03)
k = 12	–0.646 (–1.37)	0.052 (0.22)	0.145 (0.11)
k = 24	–0.365 (–0.80)	–0.043 (–0.20)	–0.166 (–0.12)
k = 36	–0.272 (–0.65)	–0.139 (–0.84)	–1.491 (–1.14)
k = 48	0.054 (0.13)	–0.268 (–1.64)	–1.882 (–1.48)

Notes. Figures in parentheses are *t*-statistics. Dependent variable is log (price/NAV) relative to style average. Estimation method: OLS with Newey-West (1994) standard errors.

There are at least two important differences between the closed-end fund market in the U.K. and the U.S. (Dimson and Minio-Kozerski, 1999). One is the much greater participation of institutional investors in the U.K. market; and the other is the regulations concerning dividend pay-outs. In the U.K., at least 85% of dividend payments received must be paid out (and the remainder may be saved in a revenue reserve to support future dividend payments), but with the exception of payments out of this revenue reserve, capital gains must remain within the fund. In the U.S., on the other hand, 90% of capital gains realized have to be paid out as a capital gains dividend, and all dividend income must be paid out as an income dividend. The capital gains dividend for U.S. funds will therefore depend on the past NAV performance of the fund, as well as on the turnover rate of the fund's holdings and whether the managers tend to sell winners or losers (the last two factors determine when gains are realized). For our purposes the relevant point is that in the U.S. (but not the U.K.) the dividend conveys information about past fund performance, and it may be that the retail investors who prevail in the U.S. market focus primarily on this as a signal of managerial quality. In the U.K., on the other hand, dividends simply reflect dividend flows from the underlying stocks, and investors must rely on published NAV return data to deduce quality.

To illustrate the point, Table 9 shows the results of a regression of the dividend rate (income plus capital gains in the case of the U.S.) on 12-month NAV returns in each of the last four years. For U.S. stock funds all the coefficients are significantly positive, as expected. For bond funds the coefficients are significantly positive except for the most recent year. For U.K. stocks, the coefficients are significantly *negative* for the most recent two years. Thus it is clear that in the U.S. the dividend stream *does* convey information about returns at least four years into the past, whereas in the U.K. it does not. The negative coefficients for the U.K. funds reflect the expected pattern for the underlying assets – that prices respond immediately to expected future profitability, but dividend flows react only to realized profits, which creates a negative short-run correlation between prices and the dividend-price ratio.

Table 9. The Dividend Ratio and Past NAV Returns

Regressor	U.S. stocks	U.S. bonds	U.K. stocks
Constant	0.976 (6.14)	2.07 (10.1)	0.933 (18.6)
12-month NAV return	1.19 (3.11)	–0.748 (–0.96)	–0.188 (–2.72)
12-month NAV return (t-12)	1.17 (2.57)	1.44 (2.32)	–0.294 (–3.56)
12-month NAV return (t-24)	1.69 (3.50)	0.943 (2.33)	–0.105 (–1.05)
12-month NAV return (t-36)	1.59 (3.48)	1.58 (2.72)	0.018 (0.19)
Sample size	2638	2824	4724
R-squared	0.093	0.090	0.032
Standard error	0.925	0.868	0.317

Notes. Figures in parentheses are *t*-statistics. The dependent variable is 100 log (dividend/NAV). Estimation method: OLS with Newey-West (1994) standard errors.

To test the hypothesis that investors in the U.S. market respond indirectly to relative NAV returns (i.e. through dividend flows), rather than directly to NAV return information, we add the dividend rate to the regressions shown in the middle panel of Table 3. The results are shown in Table 10. For all three types of fund the dividend coefficient is positive and significant, but particularly so for U.S. funds. For U.S. stock funds, when dividends are included as a regressor, prior performance is no longer significantly positive at longer horizons; for bond funds prior performance always has a significantly negative coefficient at all horizons; and for U.K. stock funds the coefficients of past relative NAV returns are much as in Table 3. This is what we would expect to observe if investor demand for U.S. funds responds to dividend information as a signal of skill rather than directly to return information. It also explains the significance of the very long lags of past returns for U.S. funds in Table 3: the realization of capital gains is very spread out over time. For U.K. funds there is investor preference for funds with higher dividend rates, but dividends do not reflect past performance and investor demand seems to respond directly to performance information.

Table 10. The Relative Premium and Past Relative NAV Returns with Dividends

	Coefficient of :	
	Relative NAV returns over previous *k* months	Quarterly dividend rate
	U.S. stocks	
k = 1	–0.294 (–4.75)	3.85 (5.03)
k = 3	–0.170 (–2.72)	3.90 (5.08)
k = 6	–0.109 (–1.92)	3.90 (5.13)
k = 12	–0.014 (–0.26)	3.83 (4.91)
k = 24	0.038 (0.37)	5.17 (6.51)
k = 36	0.039 (1.08)	5.41 (6.30)
k = 48	0.037 (0.99)	5.52 (6.08)
	U.S. bonds	
k = 1	–0.571 (–9.65)	2.10 (4.40)
k = 3	–0.514 (–6.98)	2.25 (4.77)
k = 6	–0.345 (–4.72)	2.24 (4.82)
k = 12	–0.179 (–2.56)	2.24 (4.67)
k = 24	–0.109 (–2.08)	2.71 (5.18)
k = 36	–0.111 (–2.73)	3.23 (5.84)
k = 48	–0.094 (–2.35)	3.57 (6.01)
	U.K. stocks	
k = 1	–0.314 (–4.76)	3.29 (2.46)
k = 3	–0.056 (–0.91)	3.27 (2.43)
k = 6	0.077 (1.29)	3.19 (2.39)
k = 12	0.164 (2.91)	3.20 (2.42)
k = 24	0.181 (3.36)	2.96 (2.17)
k = 36	0.139 (2.75)	2.68 (1.84)
k = 48	0.100 (2.30)	2.40 (1.57)

Notes. Figures in parentheses are *t*-statistics. Dependent variable is log (price/NAV). Estimation method: OLS with Newey-West (1994) standard errors. Also included in the cross-section regressions were: interest rates, 12-month betas for prices and NAVs, and the inverse of price (a measure of transaction costs).

How significant is the effect of prior performance on the premium relative to the effects of premium mean-reversion? Table 11 shows a regression of the 36-month change in the relative premium on 36-month relative NAV returns and the initial premium. In the bottom half of Table 11, this regression is used to compare the effects on fund returns of (1) better relative NAV performance over 36 months by one standard deviation (assuming the premium unchanged), (2) the estimated impact of this on the premium, and (3) an initial discount that is one standard deviation above the style average. It is clear that the performance of the fund's assets is the major factor in returns to shareholders over the medium term, dominating movements in the premium. Of the two elements of the change in the premium, the impact of NAV performance is less important than mean-reversion, even for stock funds.

Table 11. Regressions for the 36-Month Change in the Relative Premium

Regressor	U.S. stocks	U.S. bonds	U.K. stocks
Constant	0.00020 (0.33)	0.00308 (0.69)	0.00050 (0.11)
36-month relative NAV returns	0.0962 (3.11)	–0.040 (–0.96)	0.148 (2.95)
Relative premium (t-36)	–0.390 (–4.99)	–0.543 (–7.87)	–0.856 (–15.4)
Sample size	2982	3196	5000
R-squared	0.192	0.209	0.475
Standard error	0.0784	0.0621	0.0685
Estimated effect on fund returns of one standard deviation changes in variables			
Direct impact of 1 S.D. improvement in relative 36-month NAV returns*	+ 0.162	+ 0.130	+ 0.142
Impact on premium of the above	+ 0.016	– 0.005	+ 0.021
Impact on premium of premium (t-36) lower by 1 S.D.	+ 0.037	+ 0.037	+ 0.062

Note. *Assuming premium unchanged. Figures in parentheses are *t*-statistics. Dependent variable is the 36-month change in the log (price/NAV) relative to style average. Estimation method: OLS with Newey-West (1994) standard errors.

Table 11 does not tell us whether past NAV returns help to predict future fund returns, after taking the current premium into account. To investigate this issue, we estimate a regression of k-month fund returns on the premium and NAV returns over the previous k months, as shown in Table 12. The results confirm the significant negative correlation between the current premium and future returns found by previous authors. For stock funds, past NAV returns help to predict fund returns at relatively short horizons (up to the point where the effect of NAV returns has largely been absorbed into the premium). For bond funds, NAV returns are important at horizons up to twelve months, because of the unwinding of price inertia; they are important again at 36 and 48 months because of the persistence of relative NAV returns revealed in Table 2. In short, for all types of funds relative NAV returns help to predict future relative premium movements, in part because of the unwinding of price inertia, and for bond funds relative NAV returns help to predict future relative NAV returns at long horizons.

Table 12. Do Relative NAV Returns Help to Predict Relative Fund Returns?

	Coefficient of :	
	Relative premium at date *t*	Relative NAV returns over months *t-k* to *t*
	U.S. stocks	
k = 1	–0.050 (–5.17)	0.107 (3.91)
k = 3	–0.094 (–4.10)	–0.025 (–0.30)
k = 6	–0.141 (–3.48)	0.187 (4.01)
k = 12	–0.218 (–3.02)	0.027 (0.23)
k = 24	–0.315 (–2.19)	–0.036 (–0.18)
k = 36	–0.427 (–2.14)	0.149 (1.11)
k = 48	–0.312 (–1.30)	0.059 (0.44)
	U.S. bonds	
k = 1	–0.131 (–10.08)	0.001 (0.02)
k = 3	–0.247 (–8.92)	0.191 (2.04)
k = 6	–0.339 (–6.88)	0.358 (3.40)
k = 12	–0.456 (–6.56)	0.405 (4.29)
k = 24	–0.813 (–2.02)	0.243 (1.10)
k = 36	–0.685 (–5.09)	0.299 (3.46)
k = 48	–0.703 (–3.76)	0.341 (3.98)
	U.K. stocks	
k = 1	–0.093 (–11.42)	0.340 (8.45)
k = 3	–0.196 (–10.56)	0.273 (5.71)
k = 6	–0.289 (–8.85)	0.277 (3.92)
k = 12	–0.463 (–6.12)	0.158 (1.88)
k = 24	–0.752 (–5.60)	0.062 (0.76)
k = 36	–0.914 (–5.82)	–0.035 (–0.41)
k = 48	–1.08 (–5.60)	–0.041 (–0.53)

Notes. Figures in parentheses are *t*-statistics. Dependent variable is return on fund over months *t* to *t+k* relative to the investment style average. Estimation method: OLS with Newey-West (1994) standard errors.

We turn now to the issue of price inertia (i.e. the negative correlation between NAV returns and the premium at short horizons). This has been observed in previous studies, but to our knowledge no tests of possible explanations have been reported. One hypothesis is that NAV data are not updated frequently enough, or, even if they are, that some of the stocks held are only infrequently traded, so that the price recorded does not always reflect recent movements in investors' valuation of them (Pontiff, 1995). For erroneous NAV information to have an effect on the premium requires that investors have some idea of the true NAV (presumably derived from knowledge of the fund's portfolio of holdings) and adjust their demand accordingly, so that the fund's price carries information about the true NAV that is not contained in the published NAV. It should be noted that reported NAVs need to be more than half a month out of date on average for staleness of NAVs to induce a negative correlation between the NAV return and the premium. Suppose that the true NAV (in logarithms) follows a random walk:

$$NAV_t = NAV_{t-1} + u_t \tag{3}$$

but the measured NAV (MNAV) is out of date by a fraction of a time period:

$$MNAV_t = MNAV_{t-1} + \lambda u_{t-1} + (1-\lambda)u_t \tag{4}$$

Here λ is a measure of the degree of staleness. If the true premium (SP - NAV) also follows a random walk with innovation v, then the change in the measured premium will be given by

$$\Delta(SP_t - MNAV_t) = v_t + u_t - \lambda u_{t-1} - (1-\lambda)u_t = v_t + \lambda u_t - \lambda u_{t-1} \tag{5}$$

If $\lambda < ½$, then, as is apparent from a comparison of (4) and (5), the positive correlation between the change in the premium and reported NAV returns through u_t will dominate the negative correlation through u_{t-1}.

If reported NAVs are out of date, then variables that are correlated with the true NAV return, such as the return on a relevant index, should be positively correlated with subsequent *reported* NAV returns. This suggests a simple empirical test, the results of which are shown in Table 13. The expected positive correlation between reported NAV returns and lagged index returns appears for U.S. equity funds and also for bond funds. For U.K. equity funds, the correlation is negative, contrary to the hypothesis.

Table 13. A Test for Stale NAVs using Index Returns

Regressor	U.S. stocks	U.S. bonds	U.K. stocks
Constant	0.00682 (7.38)	0.00083 (1.16)	0.0123 (15.2)
Index return (t-1)	0.139 (3.64)	0.389 (6.11)	–0.0956 (–3.15)
NAV return (t-1)	–0.0775 (–1.37)	–0.0936 (–0.82)	0.249 (8.54)
NAV return (t-2)	–0.00624 (–1.86)	0.131 (2.61)	–0.0912 (–7.06)
NAV return (t-3)	–0.0623 (–1.79)	–0.0107 (–0.39)	–0.0718 (–5.96)
NAV return (t-4)	–0.0329 (–1.35)	0.0402 (1.27)	0.0211 (1.54)
NAV return (t-5)	–0.0365 (–1.02)	0.0202 (0.82)	–0.0340 (–2.72)
NAV return (t-6)	0.0256 (0.75)	–0.0051 (–0.28)	–0.0596 (–4.10)
Sample size	3793	4092	5667
R-squared	0.049	0.042	0.046
Standard error	0.0485	0.0330	0.0514

Notes. Figures in parentheses are *t*-statistics. Dependent variable is monthly NAV return. Estimation method: OLS with Newey-West (1994) standard errors.

Alternatively, if fund prices contain information about the true NAV which the published NAV will only reveal later, then the previous month's fund price return should help to predict the current month's reported NAV return.[3] Table 14 reports tests of this hypothesis. For U.S. funds (both equity and bond) the lagged price return is positive and highly significant in a NAV return regression, whereas for U.K. funds it is insignificant and negative. Thus the results of both tests suggest staleness in NAV data for the U.S. but not the U.K.

[3] For price inertia to occur, fund prices must contain such information.

Table 14. A Test for Stale NAVs using Lagged Share Price Returns

Regressor	U.S. stocks	U.S. bonds	U.K. stocks
Constant	0.00784 (8.47)	0.00305 (4.06)	0.0117 (15.6)
Share price return (t-1)	0.195 (4.15)	0.205 (6.42)	–0.0036 (–0.19)
NAV return (t-1)	–0.160 (–2.56)	–0.202 (–1.91)	0.178 (7.92)
NAV return (t-2)	–0.0893 (–2.56)	0.105 (2.03)	–0.0783 (–5.68)
NAV return (t-3)	–0.0657 (–1.77)	0.0007 (0.04)	–0.0668 (–5.09)
NAV return (t-4)	–0.0270 (–1.28)	0.0322 (1.02)	0.0224 (1.51)
NAV return (t-5)	–0.0428 (–1.26)	0.0102 (0.46)	–0.0335 (–2.38)
NAV return (t-6)	0.0167 (0.52)	–0.0017 (–0.11)	–0.0594 (–4.31)
Sample size	3793	4092	5667
R-squared	0.034	0.106	0.044
Standard error	0.0482	0.0319	0.0503

Notes. Figures in parentheses are *t*-statistics. Dependent variable is monthly NAV return. Estimation method: OLS with Newey-West (1994) standard errors.

An alternative explanation of price inertia is based on trading costs. Suppose that market makers set prices based on the flow of orders only, and ignore NAV information. In any one time period there are two groups of traders: those who are net buyers or sellers of closed-end funds, and those who are not. Traders who are not net buyers or sellers will only trade if the premium moves sufficiently to justify paying the transaction costs of selling one asset and buying another. Net buyers and sellers of the market, on the other hand, are likely to adjust their demands as soon as there is any movement in the premium. If the net buyers/sellers represent only a small fraction of the market in any one time period, then in the short run they may not affect market makers' holdings enough to shift prices. Stock prices will then display inertia, as movements in the NAV will not be fully reflected in prices.

This "menu cost" type of argument implies that inertia should disappear once NAV movements are large enough that the expected returns from rebalancing portfolios exceed the transactions costs. The degree of inertia should thus be negatively related to the absolute size of monthly NAV returns. Table 15 reports the results of a test of this hypothesis. Although the inertia effect is indeed attenuated (i.e. the coefficient is less negative) when NAV movements are greater in all three samples, the coefficient is never statistically significant.

Table 15. Tests of the Transaction Cost Explanation of Inertia

	Coefficient of relative NAV return multiplied by absolute value of NAV return	*t*-statistic
U.S. stocks	0.437	(0.79)
U.S. bonds	0.163	(0.53)
U.K. stocks	1.20	(1.62)

Notes. Results refer to the addition of this variable to a regression of the relative premium on current and 48 lags of monthly relative NAV returns.

5. **Conclusions**

At the beginning of this paper we outlined three competing explanations of the tendency for money to chase past performance in open-end funds. These explanations attribute different degrees of rationality and knowledge to investors. Our results for closed-end funds favor the low-rationality explanation. There is evidence of persistence in NAV returns only for bond funds, and not stock funds, and yet the premium is positively related to past performance only for stock funds and not bond funds. This anomaly is not disappearing over time – if anything it is getting stronger. Our results are inconsistent with the Berk-Green (2002) model, which assumes that investors are highly knowledgeable and rational. This model would predict considerable NAV return persistence for all closed-end funds (because skill of fund managers is assumed to be persistent) and that it would be priced in the premium so as to equalize risk-adjusted returns across funds. An alternative possibility is that money chases performance in open-end funds only because rational investors suspect, but are not 100% certain, that there is no performance persistence. It costs them nothing to insure against performance persistence in open-end funds by biasing their portfolios towards funds with good prior performance (Baks *et al*., 2001). The fact that performance is priced through the premium in closed-end funds should act as a significant disincentive to this behavior. According to this model one would expect to see the premium reflect past performance only in bond funds, where there is some performance persistence, and not in stock funds, for which repeated studies have shown a lack of persistence in NAV returns. We find the opposite result. Thus we are left with the conclusion that there is considerable investor irrationality in the market for managed funds.

If we adopt the view of Gruber (1996) and others that the market consists of a mixture of rational and irrational investors, then how would rational investors trade in the closed-end fund market? Our results show that rational investors can do better than trading on the discount alone (at least before trading costs are taken into account), because for relatively short horizons past NAV returns help to predict fund prices. In the case of bond funds, past NAV returns help to predict prices at longer horizons as well, because of persistence in NAV returns.

Our results for stock funds hold as much for the United Kingdom, where there is considerable institutional participation in the market, as for the United States. In the United States, where dividend payments reflect realized capital gains, demand for funds appears to respond to the performance information conveyed in the current dividend, which is highly correlated with past NAV returns because dividend payments reflect realized capital gains. In the United Kingdom, where dividend payments simply reflect the flow of dividend income, the premium reacts directly to NAV returns over the previous thirty months. The apparently much longer-lasting effect of past returns on premia in U.S.-traded funds seems to be a consequence of the relationship between dividends and long lags of NAV returns in the U.S. market.

A further feature of the data is that there is a negative relationship between returns and the premium in the short run (extending to months in the case of bond funds, for reasons that are unclear). This is not a new finding, but we implement some new tests of possible causes of this price inertia. Our results suggest that inertia is caused by the staleness of reported NAVs for U.S.-traded funds, but not for U.K.-traded ones. The evidence for an alternative explanation of this phenomenon based on transactions costs is only mixed.

References

Baks, Klaus P., Andrew Metrick and Jessica Wachter (2001), Should Investors Avoid All Actively Managed Mutual Funds? A Study in Bayesian Performance Evaluation, *Journal of Finance* 56, 45-85.

Berk, Jonathan B., and Richard C. Green (2002), Mutual Fund Flows and Performance in Rational Markets, Working Paper no. 9275, National Bureau of Economic Research.

Berk, Jonathan B., and Richard Stanton (2003), A Rational Model of the Closed-End Fund Discount, mimeo, University of California at Berkeley, Haas School of Business.

Chay, J.B., and Charles A. Trzcinka (1999), Managerial Performance and the Cross-Sectional Pricing of Closed-End Funds, *Journal of Financial Economics* 52, 379-408.

Cheng, A., L. Copeland and J. O'Hanlon (1994), Investment Trust Discounts and Abnormal Returns: UK Evidence, *Journal of Business Finance and Accounting* 21, 813-30.

Chevalier, Judith, and Glenn Ellison (1997), Risk Taking by Mutual Funds as a Response to Incentives, *Journal of Political Economy* 105, 1167-1200.

Dimson, Elroy, and Carolina Minio-Kozerski (1999), Closed-End Funds: A Survey, *Financial Markets, Institutions and Instruments* 8, 1-41.

Fletcher, J., and D. Forbes (2002), An Exploration of Persistence of UK Unit Trust Performance, *Journal of Empirical Finance* 9, 475-93.

Gruber, Martin J. (1996), Another Puzzle: The Growth in Actively Managed Mutual Funds, *Journal of Finance* 51, 783-810.

Ippolito, Richard A. (1992), Consumer Reaction to Measures of Poor Quality: Evidence from the Mutual Funds Industry, *Journal of Law and Economics* 35, 45-70.

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

Malkiel, Burton (1977), The Valuation of Closed-End Investment Company Shares, *Journal of Finance* 32, 847-59.

Newey, Whitney K. and Kenneth D. West (1994) Automatic Lag Selection in Covariance Matrix Estimation, *Review of Economic Studies* 61, 631-653.

Pontiff, Jeffrey (1995), Closed-End Fund Premia and Returns: Implications for Financial Market Equilibrium, *Journal of Financial Economics* 37, 341-70.

Pontiff, Jeffrey (1996), Costly Arbitrage: Evidence from Closed-End Funds, *Quarterly Journal of Economics* 111, 1135-51.

Rhodes, Mark (2000), *Past Imperfect? The Performance of UK Equity Managed Funds*, Occasional Paper in Financial Regulation no. 9, London: Financial Services Authority.

Sirri, Erik R., and Peter Tufano (1998), Costly Search and Mutual Fund Flows, *Journal of Finance* 53, 1589-622.

Thompson, Rex (1978), The Information Content of Discounts and Premiums on Closed-End Fund Shares, *Journal of Financial Economics* 6, 151-86.

Wermers, Russ (2000), Mutual Fund Performance: An Empirical Decomposition Into Stock-Picking Talent, Style, Transactions Costs, and Expenses, *Journal of Finance* 55, 1655-1703.

Appendix Table 1: U.S. Closed-End Funds

Growth Funds	Sample Range	**Multi-Sector Bond Funds**	Sample Range
General American Investors	1988.2-2001.7	US Life Income	1988.1-2001.7
Salomon Brothers Fund	1990.5-2001.6	Allmerica Securities	1988.1-2001.6
Central Securities	1988.2-2001.7	MFS Multimarket Income Trust	1988.1-2001.7
Engex	1988.2-2001.6	Putnam Master Income Trust	1988.2-2001.7
Gabelli Equity Trust	1988.2-2001.7	Putnam Premier Income Trust	1988.2-2001.7
Zweig Fund	1988.2-2001.7	Oppenheimer Multisector Trust	1989.4-2001.7
Royce Value Trust	1988.2-2001.7	Van Kampen Income	1988.4-2001.7
Smallcap Fund	1989.11-2001.7	Liberty Colonial Intermarket Income	1990.1-2001.7
Royce Micro-Cap Trust	1994.7-2001.7	All-American Term	1994.4-2001.6
Morgan FunShares	1994.7-2001.6		
Alliance All-Market Advantage Fund	1994.11-2001.7		
Corporate High-Yield Bond Funds	Sample Range	**Growth and Income Funds**	Sample Range
Credit Suisse Income	1988.1-2001.7	Lincoln National	1988.1-2001.6
MSDW Hi Income Advantage	1988.1-2001.7	Adams Express	1988.2-2001.6
High Yield Income	1988.1-2001.6	Tri-Continental Corp	1988.2-2001.7
CIM High Yield	1988.2-2001.6	Bergstrom Capital	1994.6-2001.7
New America High Income	1988.3-2001.6	Source Capital	1988.2-2001.7
Scudder High Income	1988.4-2001.7	Bancroft Convertible	1988.2-2001.7
High Yield Plus	1988.5-2001.6	Castle Convertible	1988.2-2001.7
Zenix Income	1988.4-2001.7	Ellsworth Conv.	1988.2-2001.7
Liberty-Colonial	1988.11-2001.7	Liberty All-Star	1988.2-2001.7
CIGNA High Inc	1988.8-2001.6	TCW Conv.	1988.2-2001.6
Pacholder	1988.11-2001.7	Blue Chip Value	1988.2-2001.7
Prospect Street	1988.12-2001.7	Putnam Conv.	1988.1-2001.7
Van Kampen High Income	1989.1-2001.7	Zweig Total Return	1988.10-2001.7

Appendix Table 1: U.S. Closed-End Funds (continued)

Corporate High-Yield Bond Funds	Sample Range	**Growth and Income Funds**	Sample Range
Salomon Bros. High Income	1993.2-2001.7	Franklin Universal	1988.12-2001.7
Managed High Income	1993.10-2001.7	Gabelli Convertible	1995.3-2001.7
Senior High Income	1994.12-2001.7	Franklin Multi-Income	1991.11-2001.7
Putnam Managed High Yield	1994.1-2001.7	MFS Special Value	1990.7-2001.7
Corporate High Yield	1994.6-2001.7		
Corporate High Yield II	1994.6-2001.7		
MSDW Hi Income III	1989.3-2001.7		
Van Kampen High Income II	1989.6-2001.7		
High Income Opportunity	1994.7-2001.7		

Appendix Table 2: U.K. Closed-End Equity Funds

General Equity		**Equity Income Growth**	
3i UK Select	1981.12-2001.8	City of London	1980.1-2001.8
Albany	1980.1-2001.8	Dunedin Income Growth	1980.1-2001.8
Edinburgh	1980.1-2001.8	Lowland	1980.1-2001.8
Finsbury Growth	1980.1-2001.8	Merchants	1980.1-2001.8
Finsbury	1981.3-2001.8	Murray Income	1980.1-2001.8
Fleming Claverhouse	1980.1-2001.7	Securities Trust of Scotland	1980.1-2001.8
Govett Strategic	1980.1-2001.8	Temple Bar	1980.1-2001.8
		Value and Income	1981.7-2001.8
Small Companies			
3i Quoted Smaller Companies	1980.1-2001.8		
Dresdner RCM Smaller Companies	1980.1-2001.8		
Dunedin Smaller Companies	1980.1-2001.8		
Gartmore Smaller Companies	1980.1-2001.8		
Henderson Smaller Companies	1980.1-2001.8		
INVESCO English	1980.1-2001.8		
Perpetual UK Smaller Companies	1988.2-2001.8		
Throgmorton	1980.1-2001.8		