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The Closed-End Fund Discount and Performance Persistence

by

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The Closed-End Fund Discount and Performance Persistence

Abstract: We examine the extent to which the discount on closed-end funds can be explained by the quality of a fund's management. Using a comprehensive sample of British funds, we use Sharpe's (1992) returns-based style analysis to measure manager quality after adjusting for factor exposure. We find no evidence of performance persistence amongst closed-end funds, and no indication that fund discounts reflect expected managerial performance. We also show that when a fund has high residual risk, its discount is likely to be more extreme.

1. Introduction

A closed-end fund is a collective investment company that typically holds other publicly traded securities. The fund's market capitalization is fixed, and the stock price has only an indirect link with the value of the assets corresponding to each share. These securities are unique in that they provide contemporaneous and observable market-based rates of returns for both the fund and the underlying asset portfolio. Moreover, for most funds the value of the underlying portfolio is known with considerable accuracy since the component assets are listed on the stock market. However, closed-end funds typically trade at a substantial discount to the underlying value of their holdings, the net asset value (NAV) of the fund. The discount is not constant, and varies considerably over time.

The history of the closed-end fund discount and premium mirrors the popularity of these funds. In the 1960s, when closed-end funds were popular with private investors in the UK, the discount used to fluctuate around 10 percent. By the middle of the 1970s, private as well as institutional investors lost interest in such funds and the discount on British closed-end funds widened to nearly 50 percent. The bull market of the 1980s and the introduction of funds with novel objectives, new structures and tax-exempt investment wrappers, fostered a renewal of interest in closed-end funds. By the mid-1990s the average discount had narrowed to some 5-10 percent though in recent years it has reverted to around 10-15 percent. **Figure 1** displays the month by month fluctuations in the discount on British closed-end funds, and illustrates the similarity between the behavior of the discount in the UK and in the US.

While the discount on individual closed-end funds tends to reflect the average discount for the industry, some funds have experienced violent fluctuations that cannot be related to market conditions. An example is the Germany Fund in the period following the fall of the Berlin Wall, when the shares moved from a discount to a sustained premium of over 100 percent. This behaviour was contagious, and other country funds also experienced a dramatic but short-lived narrowing of the discount or rise in the premium (Hardouvelis, La Porta and Wizman (1994)). Episodes like this

occur relatively frequently,[1] and these fluctuations in the discount, over time as well as across funds, are difficult to explain.

There is a large literature that seeks to explain the level of, and fluctuations in, the closed-end fund discount. Financial economists have emphasized four groups of theories that have the potential to explain the existence of the discount: bias in estimates of NAV (overhanging tax liabilities or illiquid assets); agency costs (managerial dissipation and the present value of management fees); the loss of potential tax-timing options; and explanations based on segmented markets. However, none of these theoretical frameworks has been able to provide a full explanation. As a result, the literature has also diverged from the efficient market paradigm, and has introduced models based on limited rationality. Individuals, who are the major shareholders of US funds, are identified as non-rational investors who trade on 'sentiment', in contrast to institutions that behave rationally. However, this approach is inconsistent with the empirical evidence of persistent discounts for UK closed-end funds, which are dominated by institutional rather than private owners.

Recent research on open-end funds reveals that fund performance can be measured reliably only when it is estimated using a factor model of returns. With factor-based measures of performance, there is now evidence of limited performance persistence amongst open-end funds (see, for example, Elton, Gruber and Blake (1996a) and Hendricks, Patel and Zeckhauser (1997)). By contrast, studies of closed-end funds such as Malkiel (1977) and Pontiff (1995) have hitherto adopted crude measures of managerial performance, often using the raw NAV return as the performance metric. Yet, because closed-end funds are so frequently invested in specialised segments of the market, it is of particular importance that their performance should be evaluated in relation to an appropriate, fund-specific benchmark.

In this paper, we evaluate the quality of UK closed-end fund managers using Sharpe's (1992) 'style analysis' multi-factor regression to extract measures of managerial skill. We document three substantial results. First, contrary to Elton, Gruber and Blake's (1996a) study of open-end funds, we can discern no evidence amongst closed-end funds of persistence in managerial performance. In terms of the pricing of these funds, we also find that share price returns exhibit no performance persistence. On the contrary, there is weak evidence of price reversal, which we attribute to mean-reversion in the discount. Second, whereas Gruber (1996) suggests that closed-end fund prices might incorporate expectations of managerial performance, our results provide no evidence to support this hypothesis. Discounts weakly reflect past performance, but do not predict subsequent

managerial performance. Finally, using our sample of British closed-end funds, we confirm Pontiff's (1996) finding that the higher the residual risk of a fund, the more its share price is likely to deviate from net asset value.

The structure of our paper is as follows. In the next section, we review some key elements of the literature on closed-end funds. In section 3 we provide an overview of the market for closed-end funds, and present the methodology that underpins our research. We employ two different procedures to identify the value added by the managers of closed-end funds − unconstrained factor models and returns-based style analysis. In section 4 we show that style analysis performs much better on an out-of-sample basis, and is the preferred method for evaluating the performance of closed-end funds. In section 5, we use returns-based style analysis to search for evidence of persistence in managerial performance, and to examine whether closed-end fund discounts provide any indication of subsequent managerial performance. In section 6 we summarize and present our conclusions.

2. Review of the Literature

Closed-end funds are characterized by one of the most puzzling anomalies in finance − the existence and behaviour of the discount. Closed-end fund shares are issued at a premium to net asset value of up to 10 percent. This premium represents underwriting fees and start-up costs. Subsequently, often within a matter of months, the shares trade at a discount. Upon termination (liquidation or 'open-ending') of the fund, the share price rises and the discount disappears. How can it be that a portfolio of traded securities starts its life being worth more than the value of its constituents, spends most of its life worth less than its constituents, while ending up at a price that is equal to the value of its constituents? This section reviews some key elements of the literature on the puzzling behaviour of US and UK closed-end funds. A more detailed review is provided in Dimson and Minio-Kozerski (1999).

2.1. US studies

Closed-end funds suffer from a number of restrictions in terms of tax and regulatory status. Like open-end funds, US closed-end funds are required to distribute 90 percent of realized capital gains to qualify for exclusion from corporation tax. Closed-end equity funds rarely take on any leverage.[2] However, they have been a popular vehicle for enabling investors to gain exposure to specialized portfolios, often with a focus on foreign or illiquid assets.

Several theories of the pricing of closed-end funds have attempted to make sense of the discount within the framework provided by the efficient market paradigm, but none can explain all parts of the puzzle. Two essential classes of explanation are miscalculation of the NAV and the existence of agency costs. The NAV may be misestimated because of tax liabilities related to unrealized capital gains or because of illiquidity of the funds' holdings. Under fairly generous assumptions, Malkiel (1977) finds that tax liabilities can account for a discount of no more than 6 percent. Furthermore, the evidence that closed-end fund prices rise upon open-ending (Brauer (1984), Brickley and Schallheim (1985)) does not support the hypothesis that NAV is overestimated.

From an agency perspective, the discount may be regarded as a consequence of investors anticipating managerial dissipation and capitalizing future management fees. Malkiel (1977), however, finds no correlation between discounts and management expenses. The performance hypothesis suggested by Boudreaux (1973) claims that discounts reflect the expectation of future managerial performance. However, Malkiel (1977), Lee, Shleifer and Thaler (1991) and Pontiff (1995) find no significant relationship between discounts and future NAV performance. Roenfeldt and Tuttle (1973) find only a weak relationship in contemporaneous performance.

Constantinides (1983, 1984) argues that, since taxes on capital gains and losses are levied upon realization and not accrual, the optimal tax-trading strategy is to realize capital losses immediately and defer gains until a forced liquidation. The discount may therefore be explained by the fact that a portfolio of options to realize gains is more valuable than an option on the corresponding portfolio. Brickley, Manaster and Schallheim (1991) and Kim (1994) find evidence consistent with the hypothesis that managed funds deny taxable investors the tax-trading opportunities associated with the idiosyncratic movements of the individual security prices in the portfolio. Nevertheless, there is evidence that few investors trade to reduce their tax payments, and most buy and hold stocks for the longer term (Seyhun and Skinner (1994) and Odean (1998)).

A further group of explanations for the closed-end fund discount focus on various forms of market segmentation. Internationally, closed-end funds may provide exposure to markets whose equity returns are determined by a different investor base than in the home market of the fund. Domestically, funds may be priced so as to reflect private investors' responses to the managers' or sponsors' sales efforts, or the different valuations placed on these companies by institutions as compared to individuals. However, as shown in Dimson and Minio-Kozerski (1999), these approaches are unable to resolve the puzzle of the discount.

A number of studies show that returns can be earned from simple trading strategies based on the level of the discount (see, for example, Thompson (1978), Pontiff (1995) and Sias (1997)). The apparent inefficiency of the US closed-end fund market has led De Long, Shleifer, Summers and Waldmann (1990) to develop their model of limited rationality. They assert that the irrational sentiment of individual investors, the most prominent holders of closed-end fund shares in the US, places an additional noise trader risk on the assets they trade. This risk will be priced in equilibrium because fluctuations in sentiment are correlated across investors and cannot be diversified away. Lee, Shleifer and Thaler (1991) show that discounts are correlated with the prices of other securities, such as small stocks, that are affected by the same investor sentiment. Nevertheless, Chen, Kan and Miller (1993) challenge the investor sentiment theory by questioning the link between discounts and the premium on small firms. The investor sentiment and this contemporaneous correlation between closed-end fund discounts and small firm returns have been further investigated by Swaminathan (1996). He recognizes that (mean-reverting) small investor sentiment should not only affect current stock prices but also forecast future stock returns. The empirical tests produce reliable evidence that discounts forecast small firm returns better than they forecast large firm returns.

2.2. UK studies

Compared to their American counterparts, British closed-end funds have a number of structural advantages. Other than the obligation to distribute at least 85 percent of the dividends received from their holdings, they benefit from considerable flexibility. Capital gains cannot be distributed and are therefore reinvested in the fund, but capital gains have been exempt from corporate taxation since 1980. Many UK closed-end funds make use of the opportunity to leverage their portfolios. However, despite differences in leverage, taxation and ownership structure, the behaviour of UK closed-end fund discounts is in many respects similar to the US. This provides a valuable opportunity to consider whether theories that originate in the US are sufficiently robust to explain the behaviour of the discount in the UK. The limited-rationality theory, for example, reflects the observation that (in the US) individual investors own the largest proportion of closed-end fund shares. Yet, as Ammer (1990) points out, the clientele for closed-end funds is, and for a long time has been, largely institutional.[3] Despite this, British closed-end funds have gone through periods of discount and premium that are comparable to American funds.

Levis and Thomas (1995) show that UK closed-end fund IPOs are subject to 'hot' issue periods that tend to coincide with a marked narrowing in the discounts of seasoned funds. Their aftermarket

performance is similar to that of general equity IPOs, though compared to Weiss' (1989) and Peavy's (1990) findings for the US, the long-term underperformance of British funds is smaller. Draper (1989) finds that UK closed-end fund share prices react rapidly to news of takeovers, open-ending and liquidation; by the end of the announcement month all the information about the open-ending has been incorporated in the price and no significant rise occurs thereafter. Compared to Brauer's (1984) results for the US, prices in the UK market seem to react more rapidly to the announcement of open-ending. Furthermore, Draper demonstrates that the apparently significant post-announcement returns from funds that open-end arise only if mid-market prices are used: when prices are adjusted for transaction costs, abnormal returns do not even approach the levels found in the US by Brickley and Schallheim (1985). Draper and Paudyal (1991) show that a modification of Thompson's (1978) discount based strategies earn excess returns, but the results are not statistically significant. Cheng, Copeland and O'Hanlon (1994) conclude that abnormal returns may be earned by following a discount based strategy, but these returns are generally smaller than transaction costs. Overall, the behavior of UK closed-end funds appears closer to rationality and efficiency than is the case in the US. British researchers have not, however, investigated the relationship between discounts and managerial performance.

2.3. Managerial Performance

One of the first papers to suggest a relationship between discounts and anticipated managerial performance is Boudreaux (1973). He argues that the persistent divergence of the price from NAV is consistent with market efficiency and depends on future portfolio alterations. The price can be expected to equate to (or to diverge by a constant proportion of) its NAV only if the market believes that the fund manager would never alter the holdings of the portfolio. Discounts and premiums reflect the perception of managerial ability to perform relative to a passive investment strategy.

The quality of mutual fund management has been investigated in the literature largely in relation to stock-picking or market-timing ability. Daniel, Grinblatt, Titman and Wermers (1997) measure portfolio performance using benchmarks based on the characteristics of the stocks held in the portfolio (i.e. market capitalization, book-to-market and prior year characteristics) and find that open-end funds, particularly aggressive-growth funds, exhibit some selection ability, but no characteristic timing ability. Bello and Janjigian (1997) investigate domestic equity open-end funds. They document positive and significant market-timing and security-selection abilities. Chevalier and Ellison (1999) extend the research and show that managerial characteristics – age and average

undergraduate institution SAT score – can predict future returns. There is therefore an emerging body of evidence that some managers may simply be better than others.

Gruber (1996) shows that investors can, and do, identify superior managers, and direct incremental money to the open-end funds that are better managed. Zheng (1999) examines the statistical and economic significance of Gruber's 'smart money' effect and confirms the existence of fund selection ability. If superior funds are closed-end, however, it follows that discounts can be expected to reflect investor expectations of future managerial performance, and Gruber suggests that funds might trade at a smaller discount (or even at a premium) if the market anticipates good managerial performance. Ammer (1990) reports that in Britain this view is prevalent in trade publications and among practitioners.

Despite the belief that discounts should reflect the quality of management of closed-end funds, the existing evidence presents something of a puzzle, in that discounts appear to be *negatively* related to subsequent measures of performance. **Table 1**, for example, measures the correlation between discounts and returns over the following one-month to one-year periods.[4] The results show that larger discounts (a low ratio of price to NAV) tend to be associated with *high* share price and NAV returns, although this relationship is mostly not statistically significant. Consistent with Malkiel (1977) and Pontiff (1995), Table 1 demonstrates that smaller discounts (a high ratio of share price to NAV) are *not* associated with the expectation of higher NAV returns.

The difficulty of identifying a linkage between closed-end fund discounts and managerial performance helps explain why so few studies have looked at managerial performance. Either the expected linkage between the discount and subsequent performance does not exist, or there is a need for a more sophisticated test procedure. This paper therefore revisits the managerial performance theory, which predicts that if a fund pays more than the 'fair' value for managerial expertise, its shares should sell at a discount, and vice versa. Whereas previous studies defined managerial performance as the fund's NAV return, we introduce a measure of managerial performance that adjusts for the fund's effective asset exposure. By rectifying weaknesses in the traditional definition of fund performance, we are able to examine the persistence and predictability of closed-end fund performance in much greater detail.

3. Data and Methodology

It is 130 years since the first closed-end fund was floated on the London Stock Exchange (LSE). By the late 1990s, there were 364 funds listed on the LSE, with a total market capitalization of $80 billion (based on a US dollar/pound exchange rate of 1.66). UK closed-end funds represent more than 15 percent of all securities listed on the LSE and nearly 5 percent of total market capitalization. British closed-end funds have a market capitalization that is equal to 25 percent of the capitalization of open-end funds (AUTIF (1998)). In contrast, US closed-end equity funds have an aggregate market value of $51 billion, which is under 2 percent of the capitalization of US open-end stock funds (Investment Company Institute (1998)). The relative importance of British closed-end funds, taken together with their high level of institutional ownership, provide a further motivation for studying the closed-end fund market in the UK.

3.1. Sample and data

In the UK, closed-end funds are allocated to one of the 21 categories described in **Table 2**. This study investigates almost the entire industry, with the exception of funds that invest in unquoted securities (Venture & Development and Venture Capital), specialist funds (Commodity & Energy and Property), Emerging Market funds and Split Capital (dual purpose) funds. The sample includes fourteen categories, corresponding to a total of 244 funds.[5] In addition, we include 94 funds that disappeared during the 1980-96 period: 56 as a result of a merger or bid, 34 open-ended and 4 liquidated; these correspond to the funds that Datastream classifies as 'dead' funds and for which it keeps a backhistory. Adding the 94 dead funds to the 244 survivors, the overall sample covers 338 different funds.

3.2. Measuring the discount and total returns

For the entire UK closed-end fund industry, Datastream provides share prices, dividend yields and NAVs.[6] In the UK, funds reveal their NAVs on a daily, weekly or monthly cycle. During the interval preceding the next announcement the NAVs are estimated daily, but once the actual NAVs are revealed, Datastream uses the new information to correct past estimates. Share price and NAV returns, and hence discounts, are computed using monthly data from January 1987 to December 1996.[7] Discounts and total returns are defined below. The performance benchmarks – a series of market and style indexes – are described later in section 3.3.

3.2.1. The discount

The closed-end fund discount is conventionally calculated as the difference between the share price and NAV, divided by the NAV. However, following Pontiff (1995), we define the discount, d_t, as a logarithmic difference,

$$d_t = ln\,(P_t / NAV_t) \tag{1}$$

where P_t and NAV_t are the share price and the NAV per share of the closed-end fund, respectively. We use the logarithm of the ratio of price to NAV because changes in the discount can then be interpreted as returns. Definition (1) of the discount implies that when this measure decreases, it corresponds to a widening in the discount.[8]

The definition given in equation (1) implies that, if dividends can be ignored, changes in the discount are equivalent to the difference between the share price return and the NAV return:

$$\begin{aligned} \Delta d_t &= d_t - d_{t-1} \\ &= ln\,(P_t) - ln\,(NAV_t) - [ln\,(P_{t-1}) - ln\,(NAV_{t-1})] \\ &= R_{Price,t} - R_{NAV,t} \end{aligned} \tag{2}$$

where $R_{Price,t}$ is the continuously compounded share price return and $R_{NAV,t}$ is the continuously compounded NAV return. If dividends are paid by the fund, equation (2) holds as an approximation.[9]

Finally, note that the average discount, $\bar{d}_t$, of a category or group of funds is defined as the logarithm of the equally-weighted average of the price to NAV ratios,

$$\bar{d}_t = ln \sum_{i=1}^{n} (P_{i,t} / NAV_{i,t}) / n \tag{3}$$

where n is the number of funds in a category.

3.2.2. Price returns

Following Fama and French (1998), we define the monthly share price return as the sum of the monthly price appreciation and one-twelfth of the fund's annual dividend yield:

$$\begin{aligned} R_{Price\,j,\,t} &= ln\,[(P_{j,\,t} + Div_{j,\,t}) / P_{j,\,t-1}] \\ &= ln\,[P_{j,\,t} / P_{j,\,t-1} + Y_{j,\,t-1} / 12] \end{aligned} \tag{4}$$

where $P_{j,t}$ is the share price of fund j at time t. We approximate the dividend paid in month t by the fund, $Div_{j,t}$, by one-twelfth of the annual dividend yield, $Y_{j,t-1}$, measured at time t-1. The Fama-French definition of returns has the advantage that we can use the same formula for share returns as for NAV and index returns.

3.2.3. NAV returns

We define the monthly NAV total return as the sum of the monthly NAV capital appreciation and one-twelfth of the fund's annual dividend.[10] Since the share price usually differs from NAV, we adjust the dividend yield as follows:

$$\begin{aligned} R_{NAV\,j,t} &= ln\,[(NAV_{j,t} + Div_{j,t}) \;/\; NAV_{j,t-1}] \\ &= ln\,[NAV_{j,t} / NAV_{j,t-1} \;+\; Y_{j,t-1}\; P_{j,t-1} / 12\, NAV_{j,t-1}] \end{aligned} \qquad (5)$$

where $NAV_{j,t}$ is the net asset value of fund j at time t. We again approximate the dividend received in month t by the portfolio, $Div_{j,t}$, by one-twelfth of the expected annual dividend of the fund, $Y_{j,t-1}$. The closed-end fund dividend is paid out of the portfolio's income, after deducting expenses. This measure of total NAV return is, therefore, net of fees and expenses.[11]

3.2.4. Index returns

We define monthly index total returns as the sum of the monthly index capital appreciation and one-twelfth of the index's annual dividend yield:

$$\begin{aligned} R_{Index\,i,t} &= ln\,[(Index_{i,t} + Div_{i,t}) \;/\; Index_{i,t-1}] \\ &= ln\,[Index_{i,t} / Index_{i,t-1} \;+\; Y_{i,t-1} / 12] \end{aligned} \qquad (6)$$

where $Index_{i,t}$ is the value of index i at time t. We approximate the dividend paid in month t by the index, $Div_{i,t}$, by one-twelfth of the annual dividend yield, $Y_{j,t-1}$, measured at time t-1.

3.3. Measuring performance

At the heart of our study is a definition of performance that can capture the manager's ability to select the 'right' stocks. The idea is that if a fund is exposed to an asset class that is doing well, this does not imply that the manager is necessarily good. The manager outperforms only if he or she does better than a passive strategy with the same asset mix. We use multi-index models to adjust for the fund's effective asset exposure, and thereby obtain more refined measures of managerial performance. NAV returns, rather than share price returns, are used to judge managerial

performance because they are not affected by fluctuations in the discount. We define managerial performance (referred to as the selection return) at time *t* as the difference between the NAV return at time *t* and the return on a passive portfolio with the same effective asset mix as the fund. The fund's effective asset mix for month *t* is estimated using rolling returns from months *t-36* to *t-1*. The rolling methodology allows for changes over time in the fund's asset exposure.

We examine two different procedures: unconstrained and constrained multi-index regressions. The first approach involves regression of fund returns on up to fifteen index returns. Other than the decision about which index series enter the regression, this procedure imposes no *a priori* constraints on the coefficients. The second approach is Sharpe's (1992) returns-based style analysis, in which factor loadings are constrained to be non-negative and sum to unity. The residuals from the unconstrained regression and constrained style analysis procedures are our measures of managerial performance. In the following subsections, we compare the different methodologies. We investigate their performance, on an out-of-sample basis, in section 4 below.

3.3.1. Unconstrained regression using all fifteen indexes

Elton, Gruber and Blake (1996a) and Gruber (1996), amongst others, use a multi-index regression to adjust NAV returns for the risk exposure of a fund. They investigate the persistence of risk-adjusted mutual fund performance identifying four domestic style factors: the local equity market index (in their case, the S&P 500), a size index, a bond index and a market-to-book index (represented, in their case, by the relative performance of capital versus income-growth stock portfolios). Since open-end funds sell at NAV, the excess return of each fund is regressed on these factors, and mutual fund managers' performance is defined as the intercept from this four-index regression. Since our research focuses on funds that invest internationally, we introduce a series of international equity market indexes alongside the style indexes. Our use of a monthly interval for measuring returns ensures that our research procedure does not suffer from thin trading biases.[12] Our 36-month rolling window ensures that our model is sensitive to changes over time in the asset mix selected by the manager of each fund.

The risk-adjusted performance of the funds is measured using a regression model with fifteen index returns as independent variables. The first two factors are home market indexes, representing the investment universe and the market in which the funds are listed: our proxies for these are the returns on the FT/S&P World index and the returns on the FTSE 100 index. The next eight factors are foreign market indexes, chosen to reflect the investment objectives of the funds in our sample.

Most of these funds have a significant exposure to the UK market[13] and we therefore incorporate five equity style indexes which are used to measure the size effect, the market-to-book effect and the debt premium. The size effect is measured using the return on the Extended Hoare Govett Smaller Companies index and the return on the FTSE 100 index; the market-to-book effect is measured using the return on the FTSE 350 Growth and the FTSE 350 Value indexes; and the debt premium is measured using the return on the FTA Government All Stock index and the Interbank one-month middle rate.

Managerial performance is defined as the difference between a fund's NAV return and the return on a passive portfolio whose effective asset exposure is estimated over the previous three years. Equations (7) and (8) describe the two-stage procedure.

$$R_{NAVj,t} = \beta_{1,t} R_{World,t} + \beta_{2,t} R_{UK,t} + \sum_{i=3}^{10} \phi_i \beta_{i,t} R_{Mi,t} + \sum_{i=11}^{15} \beta_{i,t} R_{Si,t} + \varepsilon_{j,t} \quad (7)$$

$$S_{j,t} = R_{NAVj,t} - \left(\hat{\beta}_{1,t} R_{World,t} + \hat{\beta}_{2,t} R_{UK,t} + \sum_{i=3}^{10} \phi_i \hat{\beta}_{i,t} R_{Mi,t} + \sum_{i=11}^{15} \hat{\beta}_{i,t} R_{Si,t} \right) \quad (8)$$

$R_{NAVj,t}$ is the monthly NAV total return for fund j at time t. $S_{j,t}$ is the month t selection return, which is our measure of managerial performance for fund j. $\beta_{i,t}$ is the coefficient measuring the exposure of fund i and $\hat{\beta}_{i,t}$ is the estimate computed from equation (7) using data from months *t-36* to *t-1*. $R_{Mi,t}$ represents the factor return on the i^{th} geographical market (i = 3…10) for month t. $R_{Si,t}$ represents the factor return on the i^{th} style index (i = 11..15) for month t. Index returns include dividends and are sterling denominated. For the fifteen-factor model $\phi_i = 1$ throughout. All factors are described in **Table 3**.

Managerial performance is the sum of monthly selection returns over one-, two- and three-year periods. This measure of performance credits the manager with all his or her gains in excess of a passive replicating-portfolio. It therefore incorporates both stock selection and market timing into the estimate of selection return (see Sharpe (1992)). The rolling window methodology requires three years of data to estimate the first monthly selection return. In order to increase the coverage of the research, we back-fill the estimates of selection return by using data from month *t+36* to *t+1* to compute month *t* performance on a rolling out-of-sample basis.[14]

3.3.2. Unconstrained regression using nine preselected indexes

The rolling estimation procedure, using the entire palette of fifteen indexes, allows us to construct a passive benchmark that captures the fund's effective asset allocation, even if this changes over time.

However, using fifteen independent variables reduces the degrees of freedom of the multi-factor regression. A solution to this problem could be to adopt a substantially longer window for estimating the model, but this would reduce the number of months of out-of-sample selection returns.[15] Alternatively, one might switch from a monthly to a weekly or daily differencing interval for returns, but this would introduce bias from the bid/ask spread, thin trading, time-zone differences and NAV estimation errors. Instead, we reduce the number of indexes from fifteen to nine, where we preselect two of the eight geographical markets that that most closely reflect the investment objectives of the fund, as revealed in the exposures reported in closed-end fund trade publications. Equations (7) and (8) measure the selection returns. For the nine-factor model, the binary variable has the value $\phi_i = 1$ for two of the eight geographical markets and $\phi_i = 0$ for the other six markets, which are hence not allowed to enter the regression. All factors are as described earlier in Table 3.

3.3.3. Constrained regression: returns-based style analysis

The unconstrained regression approach makes use of estimated factor loadings, $\hat{\beta}_{i,t}$, which are noisy, and may even be manifestly inappropriate as measures of subsequent portfolio exposures. For example, the estimated $\hat{\beta}_{i,t}$ may be negative, despite the fact that short sales of market exposure are unusual in the closed-end fund industry. Returns-based style analysis, originally suggested by Sharpe (1992), is an alternative approach for measuring the value added through active management. This technique has been widely adopted by both researchers and investment professionals (Fung and Hsieh (1997), Sortino, Miller and Messina (1997) and Brown and Goetzmann (1997)). Sharpe uses quadratic programming to determine a fund's effective exposures to the major asset classes. The coefficients representing each exposure are constrained to lie between zero and one, and the sum of the effective exposures is forced to be unity. Equations (7) and (8) describe the constrained regression where selection returns are measured using the entire palette of fifteen indexes. The binary variable is $\phi_i = 1$ for all market indexes. As before, index returns include dividends and are sterling denominated, and all the factors are as described previously in Table 3. As for the other two rolling estimation procedures, we back-fill the estimates of selection return for the first three years by using data from month *t+36* to *t+1* to compute month *t* performance.

The in-sample R-squared from this constrained regression procedure is inevitably lower than the R-squared for unconstrained regression with the same independent variables. However, the constrained coefficients may conform more closely to the investment policy of the funds. By imposing constraints on the coefficients, the out-of-sample fit may be improved. We show in the

next section that Sharpe's returns-based style analysis does in fact provide a superior benchmark for evaluating the quality of management of closed-end funds.

4. Closed-End Fund Performance Measurement

The unconstrained and constrained (style analysis) multi-index regressions each provide a measure of managerial performance after adjusting for a fund's effective asset mix. The quality of these managerial performance estimates depends on the accuracy of the estimated exposures for each fund. In this section we compare the alternative procedures by measuring the in- and out-of-sample R-squared from the regression of fund returns on index returns. The in-sample R-squared for each fund is defined as the mean of the R-squared values across all the 36-month regressions. The out-of-sample R-squared is defined as $R^2 = 1 - Var(S_{j,t}) / Var(R_{NAVj,t})$ where $S_{j,t}$ is the fund's monthly selection return from equation (8) and $R_{NAVj,t}$ is the fund's monthly NAV return. **Table 4** shows for each approach the in-sample and out-of-sample R-squared averaged across all constituents (surviving and non-surviving) for each closed-end fund category.

The in-sample R-squared for the unconstrained methodologies is naturally highest when all fifteen indexes enter the regression. As can be seen at the foot of Panel A, the overall sample average for the fifteen-factor model is 85 percent and the corresponding value for the nine-factor model is 77 percent.[16] The average in-sample R-squared for the fifteen-factor constrained methodology is 71 percent, which we noted earlier is inevitably lower than the equivalent value for the fifteen-factor unconstrained model. Of the 338 funds, seventy percent have an R-squared above 75 percent, and ninety percent have an R-squared higher than 50 percent. These results resemble the study by Fung and Hsieh (1997), who run style analysis regressions for 3,327 open-end mutual funds, and find that forty-seven percent of funds have an R-squared above 75 percent, while ninety-two percent have an R-squared higher than 50 percent.

The predictive accuracy of alternative models needs to be compared in terms of their out-of-sample accuracy. Comparison of the two unconstrained approaches in Panel B shows that the nine-factor model performs better with out-of-sample data than the fifteen-factor model. The average out-of-sample R-squareds are respectively 26 and 23 percent. The nine-factor regression can be considered as a partially constrained approach where the loadings, β_i, on six market indexes are forced to zero. This suggests that no important variable is omitted when we prespecify the two geographical markets. The out-of-sample accuracy of the fund benchmarks can be enhanced if we introduce appropriate constraints.

The most interesting result, therefore, is what happens when a substantial number of constraints are applied in the context of Sharpe's (1992) style analysis procedure. It turns out that this approach performs very much better out-of-sample than the unconstrained regressions. The R-squared of the returns-based style analysis averages 50 percent, roughly twice the explanatory power of the unconstrained regression models. Our conclusion is that Sharpe's constrained regression defines a superior performance benchmark for analyzing the performance of closed-end funds.

5. Empirical Results

After having defined a measure of managerial performance that adjusts for the fund's effective asset exposure, we investigate whether managers who have in the past been superior, tend also to outperform in the future. We go on to test whether the discount reflects anticipated future managerial performance. Finally, we investigate the relationship between a fund's residual risk and its discount.

5.1. Managerial performance persistence

Studies of performance persistence aim to determine whether investors would do better by choosing some funds rather than others. The literature has a strong focus on mutual funds. Gruber (1996) confirms the results of Hendricks, Patel and Zeckhauser (1993) and Goetzmann and Ibbotson (1994). All find evidence of persistence in mutual fund performance over relatively short horizons (one to three years). On the other hand, Grinblatt and Titman (1992) and Elton, Gruber, Das and Hlavha (1993) suggest a pattern of persistence over periods of five to ten years into the future. Finally, Hendricks, Patel and Zeckhauser (1997) show that mutual funds are characterized by true performance persistence over and above the spurious persistence induced by survival bias. Evidence of fund performance persistence is very extensive, but Carhart (1997) argues that persistence of returns can be attributed mainly to the difference in expenses charged. Much of the remaining persistence is driven by the one-year momentum effect of Jegadeesh and Titman (1993) and the consistent underperformance of worst-return mutual funds.

Using our sample of closed-end funds, we test the hypothesis of managerial performance persistence. Style analysis of NAV returns is used to measure past performance over one-, two- and three-year periods. Funds are ranked on the level of past performance and allocated to deciles. Allowing a one-month gap to avoid bias from NAV publication delays, the risk-adjusted returns of the ten portfolios are then computed over the following one-year period, referred to as the

performance period. Panel A of **Table 5** shows the average results over these non-overlapping test periods, while panel B presents the difference between deciles and various test of statistical significance – we use the Spearman rank correlation and t-tests. The Spearman correlation is a nonparametric measure of the correlation between the ranks of the deciles and their average return over the subsequent performance period. To test the difference in means between top and bottom deciles (and quintiles), we calculate the t-statistic under the null hypothesis that the means are equal. Panel C displays the results from a regression of the 338 funds' NAV performances on their prior performances over one, two and three years.

Returns-based style analysis reveals no evidence of performance persistence. Neither the rank correlation coefficients nor the t-tests of the performance difference between the top and bottom groups are significant; out of nine measures, only one reaches the 10 percent confidence limit (as might be expected by chance). The cross-sectional regressions provide no indication of momentum in performance. Top performing funds do not outperform in the following period. We also measure performance persistence using equal length selection and performance periods (results available on request); on this basis, our conclusions are unchanged from those presented here using a one-year performance period. We conclude that there is no evidence of managerial performance persistence in the UK closed-end fund market.

The lack of performance persistence among UK closed-end funds is not consistent with Gruber's (1996) finding of performance persistence in the US mutual fund industry. A possible explanation for the different results in the two markets might be related to fees. We examine performance persistence after deduction of fees, while Gruber's study relates to gross, rather than net, performance. If good managers charge more, gross NAV persistence could disappear with our measure. Carhart (1997) suggests that persistent differences in mutual fund expenses may explain at least part of Gruber's results.

5.2. Share price performance persistence

Investors cannot buy or sell closed-end funds at their NAV because these funds systematically trade at a price that differs from NAV. We therefore examine the share price performance persistence of closed-end funds, and investigate whether these securities display price momentum. Jegadeesh and Titman (1993) show that a relative strength strategy – buying past winners and selling past losers – generates significant profits when returns are measured over three- to twelve-month periods. On the

other hand, the contrarian literature shows that buying past losers and selling past winners earns abnormal returns over very short intervals (one week to one month, Jegadeesh (1990)).

Funds are ranked on the level of past performance, measured by total share price return, and allocated to deciles. Past performance is computed over one-, two- and three-year periods, referred to as the selection periods. The share price performance of the ten portfolios is then computed over the following one-, two- and three-year periods, referred to as performance periods. Selection and performance returns are separated by a one-month gap to adjust for negative autocorrelation created by the bid/ask spread and thin trading. **Table 6** presents our evidence on share price performance persistence.

The results in Table 6 provide no support for the Jegadeesh-Titman momentum hypothesis. Winners over the preceding year do not perform better than losers. On the contrary, performance measured over two and three years is characterized by a negative and significant rank correlation – past winners tend to do *worse* than past losers. There is evidence from the cross-sectional regressions that this pattern applies also to individual funds. Furthermore, these findings are robust with respect to the length of the performance period: analysis based on six-month intervals (not shown here) yields similar results. While there is no indication of momentum amongst closed-end funds, our findings are consistent with evidence of closed-end fund price reversal (Minio-Paluello (1998)) and long-term price reversal in UK equities (Dissanaike (1996, 1997)).

5.3. Discount as a predictor of managerial performance

The managerial performance theory suggests that discounts reflect investors' perceptions of managerial ability to outperform a passive investment strategy. In this section we revisit the hypothesis using our definition of managerial performance adjusted for the fund's effective asset exposure. The relationship between discounts and subsequent managerial performance is investigated using the same ranking methodology. At the beginning of each calendar year, the 338 funds are allocated to deciles based on the level of their discounts. The performance of each fund within a decile is measured using returns-based style analysis and we report the equally-weighted average of the funds' performance.

The hypothesis that discounts anticipate future managerial performance implies that the small-discount portfolio (Decile 1) should earn a higher NAV return. Measuring two- and three-year performance of the portfolios constructed based on the discount level at the beginning of each

calendar year, would use overlapping observations. To overcome the problem of interpreting the significance of the average results from the rankings we use non-overlapping periods. For the two-year performance we test the relationship using, first, the odd-numbered rankings, and then the even-numbered rankings; we then report the average of the two series. For the three-year performance the results are the average of three series. The Spearman rank correlation coefficient and the test of the difference in risk-adjusted returns between the top and bottom deciles measures that relationship. **Table 7** shows the results.

Over performance periods of longer than a year, funds with a large discount tend to provide investors with superior, rather than inferior, NAV returns. It is clear that Table 7 provides absolutely no support for the managerial performance theory that discounts reflect investors' expectations of future managerial performance. Neither the rank correlation coefficients, nor the test for the difference in performance between top and bottom groups, nor the cross-sectional regressions suggest a positive and significant relationship between discounts and future managerial performance. There is no evidence that small discounts (high price to NAV ratios) are an indication of good future managerial performance.

On the other hand when funds are ranked on *past* managerial performance, measured over one, two and three years, and allocated to deciles, the worst performing portfolios tend to be characterised by wider discounts (low ratios of price to NAV). If the manager has performed poorly in the past, the fund can be expected to trade at a larger discount. The evidence, however, is not very strong, in particular when performance is measured over one-year periods. **Table 8** shows the results. The analysis of the relationship between discounts and managerial performance suggests that price weakly reflects past performance, but incorporates no expectations of future performance.

5.4. Residual risk and cost of hedging

If arbitrage were costless, the share prices of closed-end funds would be driven to a level that precludes making a riskless profit. Yet there is evidence of profit opportunities that can be achieved by taking hedged positions in closed-end funds whose price is extreme relative to NAV (see Dimson and Minio-Kozerski (1999)). The ease or difficulty of hedging the NAV of a fund influences the extent to which an arbitrageur can profit from perceived mispricing. If hedging is costly or impossible, arbitrage cannot equate the fund's price to the sum of the NAV and the 'correct' discount. Pontiff (1996) shows that in the US, the share price is more likely to deviate from NAV for funds that are characterised by higher unhedgeable risk, measuring the latter by the volatility of

the residuals from regressing NAV returns on a set of asset class returns. Practitioners also believe that a prerequisite for arbitrage is ease of hedging the portfolio (see Herzfeld (1993), page 65).

Returns-based style analysis defines selection returns as the difference between the fund's NAV return and the return on a passive portfolio with the same effective asset mix as the fund. The fund's residual risk is thus the volatility of the selection return. Using returns-based style analysis, we rank the funds on residual risk measured over one-, two- and three-year periods and construct ten portfolios. Funds are ranked at the beginning of each calendar year. At the start of the following year the absolute value of each decile's discount is then computed.[17] **Table 9** shows the results. The rank correlation coefficients, the test for the difference in residual risk between the top and bottom groups, and the cross-sectional regressions all indicate that high risk portfolios are associated with extreme discounts. The higher the residual risk, the higher is the absolute value of the discount. The results confirm Pontiff's (1996) evidence for the US.

6. Conclusion

This paper revisits one of the traditional theories of the closed-end fund discount, namely managerial performance. The theory asserts that discounts reflect investors' perceptions of managerial ability to perform relative to a passive portfolio. The fact that discounts do not seem to be positively correlated with subsequent NAV returns may explain why so few studies have looked at managerial performance. However, prior tests have focused on raw estimates of NAV returns, and have limited power. The literature implies either that the relationship between discounts and managerial performance does not exist, or that the power of tests based on NAV returns is too low.

Recent evidence, such as Daniel, Grinblatt, Titman and Wermers (1997), indicates that there are identifiable and predictable differences in skill between different open-end fund managers. However, these varying levels of managerial ability are only discernible after taking account of the factor exposure of the managers' portfolios. This paper rectifies the weakness of using the return on NAV as the definition of managerial performance for closed-end funds. We measure performance after adjusting for the risk and factor exposures of each fund. To define the value added by active management we use Sharpe's (1992) returns-based style analysis, in which factor loadings are constrained to be non-negative and to add to unity, and we identify the selection return as the measure of managerial performance.

Using a comprehensive sample of UK closed-end funds, we find no evidence of managerial performance persistence in the closed-end fund market. In terms of their pricing, we find no evidence of share price performance persistence. On the contrary, there is evidence of price reversal. Gruber (1996) argues that the price of closed-end funds should incorporate the expectations of future managerial performance. We find that discounts weakly reflect past performance, but do not seem to predict performance. The results suggest that researchers and practitioners should not interpret discounts as an indication of the quality of closed-end fund management teams.

Finally we test the hypothesis that a fund's residual risk affects its discount. Pontiff (1996) shows that funds with large unhedgeable risk trade at higher discounts. Defining residual risk as the variance of selection returns, we confirm his results. The greater the difficulty of hedging a fund's exposure, as measured by the residual risk of the underlying portfolio, the more extreme is the discount of the fund.

Notes

[1] Two further examples of apparently inexplicable premiums appeared in connection with the First Israel and the Turkish Investment Fund. First Israel traded at a deep discount in 1993; but from January to November 1994, with the prospect of a peace settlement between Israel and its Arab neighbors, the fund traded at sharp premiums, often as high as 25 percent. The Turkish Investment Fund, on the other hand, traded at close to its NAV in late 1993. In the first few months of 1994, however, its NAV sank by over 70 percent, mirroring a similar drop in the dollar-adjusted Turkish stock market. During the same period, the share price fell by only 49 percent. Consequently, premiums increased dramatically, even reaching 100 percent on one occasion.

[2] Up to 1988, no US closed-end equity funds were leveraged. At the time of writing, only 11 out of 167 US closed-end equity funds had any leverage, and the aggregate debt ratio for this sector was less than one percent. We are grateful to Maria Ketchledge of CDA/Wiesenberger for providing these estimates.

[3] Warburg Securities (1988-1990) reports that by the end of the 1980s, 93 per cent of British closed-end funds had the majority of their shares registered to institutions. Currently, some two-thirds of the shares in British closed-end funds are on average held by institutions, and for many funds the institutional proportion is much higher than this (Crédit Lyonnais Laing (1998)).

[4] The sample comprises the same 338 funds as those that are studied in this paper. Returns are based on non-overlapping observations and are continuously compounded. The bid/ask spread and thin trading may induce a negative cross-autocorrelation between discounts and share price returns, both computed using the same time *t* share price. To adjust for this bias the cross-autocorrelation is measured with a one-month gap between discounts and returns.

[5] Because of their small number and similarity to the funds in the Continental Europe category, we include the three funds of the Pan Europe category in the Continental Europe category. Additionally, some dual-purpose funds have listings for a 'unit' that comprises a package of securities. We include 17 such funds within the 244-fund sample. The discount for a 'unit' of a dual-purpose fund is computed by summing the market capitalizations of all classes of shares, and comparing it to the sum of the net assets attributable to each class.

[6] Net asset value is defined as the market value of total assets less all prior charges valued at par, all divided by the number of shares in issue. Prior charges are defined as including all debentures, loans, short-term loans and overdrafts that are for investment purposes, reciprocal foreign currency loans, currency facilities to the extent that they are drawn down, index-linked securities, all types of preference or preferred capital and the income shares of split capital funds. None of these prior charges are treated as current liabilities even if they are short-term and would so appear in a published balance sheet. Originally, prior charges were valued also at market value. Because of the insignificant difference between the two procedures, market value estimation has been dropped.

[7] This interval was chosen because some of the data was available only since the beginning of 1987. In particular, FT-SE International has constructed the FTSE 350 Growth and Value Index starting from January 1987. This was also the date when the Hoare Govett Smaller Companies Index was launched.

[8] Pontiff (1995, page 344) points out that his conclusions are unaffected if the discount is defined as the difference between the share price and NAV, divided by the NAV. Preliminary testing on our data shows that this is also the case for the UK.

[9] If there are dividends, equation (2) needs to be modified. Let $Y_{Price,t}$ be (one plus) the dividend yield on the share price (i.e., $Y_{Price,t} = 1 + Div_t / P_t$) and $Y_{NAV,t}$ be (one plus) the dividend yield on the net asset value (i.e., $Y_{NAV,t} = 1 + Div_t / NAV_t$). Then

$$\begin{aligned} \Delta d_t &= ln(P_t\ Y_{Price,t}) - ln(NAV_t\ Y_{NAV,t}) - [ln(P_{t-1}\ Y_{Price,t-1}) - ln(NAV_{t-1}\ Y_{NAV,t-1})] \\ &= R_{Price,\,t} - R_{NAV,\,t} + ln(Y_{Price,t} / Y_{Price,t-1}) - ln(Y_{NAV,t} / Y_{NAV,t-1}) \end{aligned}$$

$= R_{Price,\,t} - R_{NAV,\,t} + \Delta\, ln(Y_{Price,t}) - \Delta\, ln(Y_{NAV,t})$

$\approx R_{Price,\,t} - R_{NAV,\,t}$

[10] In the UK, closed-end fund dividends are accumulated in an income account, to be distributed to shareholders in the form of periodic interim and final dividend payments. These dividend balances are not included in the NAVs which measure the capital value of the fund.

[11] British closed-end funds are legally required to pay out at least 85 percent of the income received from the fund's holdings. Dividends on the fund are paid out of income, not out of capital. During our sample period, management fees were deducted from income before declaring the dividend on the fund. Note, however, that after 1996 UK closed-end funds were allowed to charge management expenses and borrowing costs to the capital value of the assets, though most funds continue to charge expenses solely to income.

[12] Dimson and Marsh (1983) show that risk estimates can be affected by thin trading. The London Business School *Risk Measurement Service* (Dimson and Marsh (1998b)) indicates that UK-listed closed-end funds do not suffer from undue liquidity problems. The market capitalization-weighted average trading frequency for the closed-end fund categories included in our study (see Table 2) is 0.4 days, while the equally-weighted average trading frequency is 0.8 days, implying that the typical closed-end fund trades at least several times per week.

[13] We do not include style factors for foreign markets given the evidence of Chang, Eun, and Kolodny (1995) that US closed-end country funds exhibit significant exposure to the market in which the fund is listed and behave more like domestic securities than do their underlying assets. Bodurtha, Kim and Lee (1993) also show that returns on country funds are more correlated with domestic market returns than the underlying indices.

[14] We use post-1990 data to calculate out-of-sample selection returns for 1987-1989. For example, we use data for 1/1990-12/1992 to estimate the $\hat{\beta}_{i,t}$ for t=12/1989, and data for 12/1989-11/1992 to estimate the $\hat{\beta}_{i,t}$ for t=11/1989. This back-filling procedure maintains the out-of-sample attributes of our selection return measure. It is in this respect superior to simply inferring performance from the in-sample residuals of the regression (see next footnote). Nevertheless, our conclusions are unchanged if we exclude the first 36 monthly rankings corresponding to the back-filled estimation of selection returns.

[15] Elton, Gruber and Blake (1996a) estimate their model using the entire time series of fund and index returns, and infer performance from the in-sample alpha of the regression. Investors cannot follow a trading strategy that would give rise to the performance observed in the Elton, Gruber and Blake study.

[16] The additional explanatory power with all fifteen factors is confirmed by the R-squared adjusted for degrees of freedom, which is 76 percent for the fifteen-factor model, as compared to 70 percent for the nine-factor model. We focus on unadjusted R-squared because this facilitates comparisons with the results from the constrained (style analysis) regression, for which the degrees of freedom are not clearly defined (see Lobosco and DiBartolomeo (1997)).

[17] The absolute value of the discount is defined as $\left| d_t \right| = \left| ln\left(P_t / NAV_t\right) \right|$, where P_t and NAV_t are the share price and the net asset value of the closed-end fund, respectively. We define the average absolute value of the discount for a group of n funds as $\left| d_t \right| = ln\left(1+ \sum_{i=1}^{n} \left| P_{i,t} / NAV_{i,t} - 1 \right| / n \right)$

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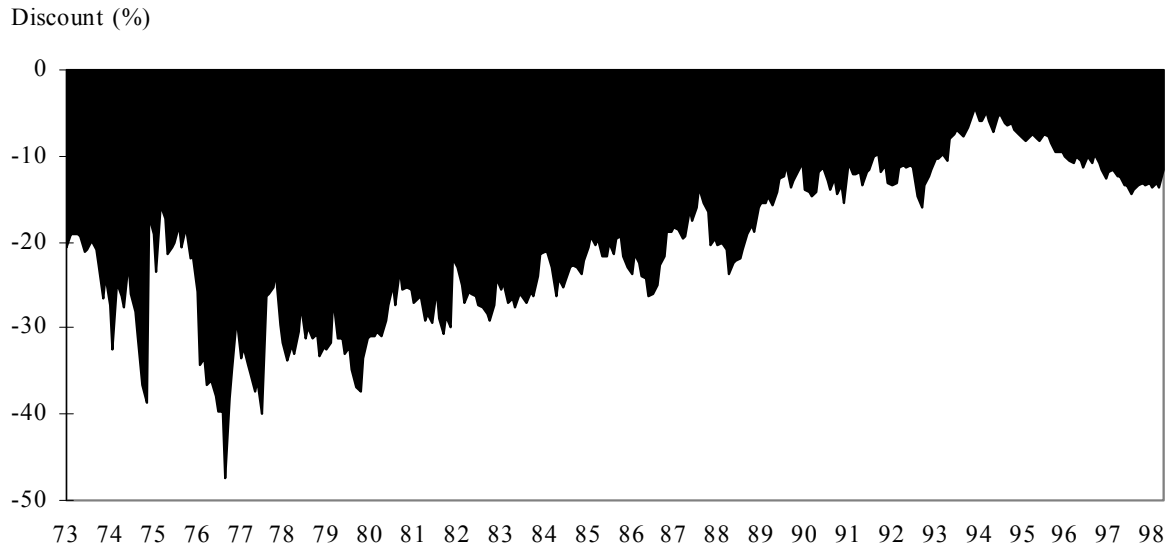
Figure 1: The Closed-End Fund Discount 1970-1998

The average discount is expressed as the logarithm of the unweighted mean ratio of Share Price to NAV. Panel A shows that the average discount of UK closed-end funds widened dramatically during the first half of the 1970s. Since then it has narrowed from almost 50 percent to around 10 percent in recent years. For the UK, we consider almost the entire industry, with the exception of funds that invest in unquoted securities (Venture & Development), specialist funds (Commodity & Energy and Property), Emerging Markets and Split Capital Funds. The data source for panel A is Datastream. Panel B shows the average discount of US domestic equity closed-end funds, using data made available by CDA/Wiesenberger.

Panel A: UK average discount



Panel B: US average discount

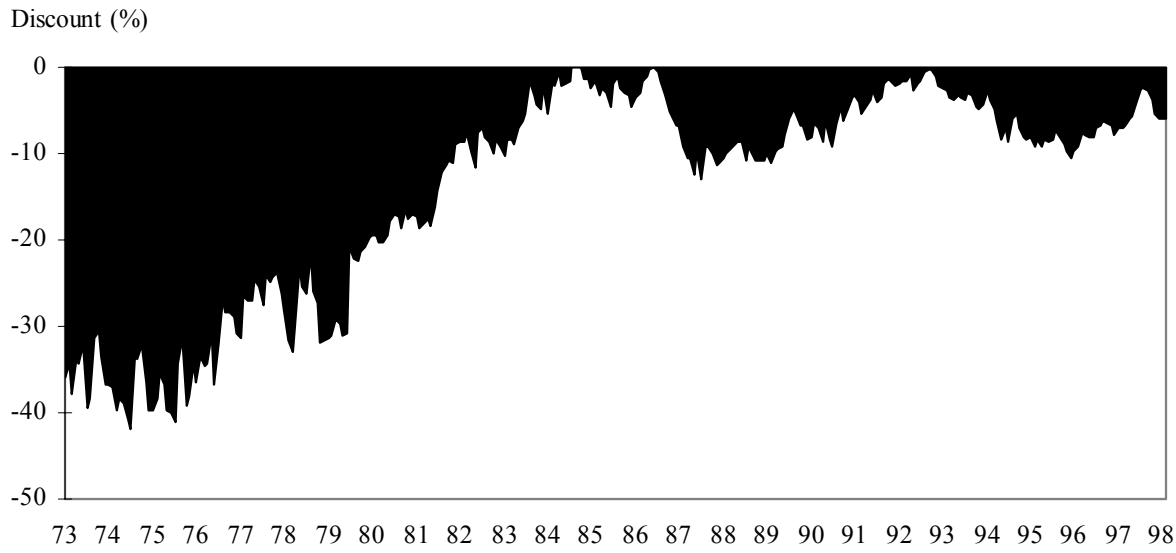


Table 1: Correlation between Discounts and Subsequent Price and NAV Returns

The correlation between discounts and subsequent price and NAV total returns is computed for each of 338 closed-end funds. Discounts are defined as $D_t = ln\ (P_t / NAV_t)$. Returns are measured over one-month to one-year periods, with non-overlapping observations. The results are the equally-weighted average correlation coefficient across the 338 funds. To avoid the negative autocorrelation induced by the bid/ask spread and thin trading, we introduce a one-month gap between measuring discounts and returns. We use data from January 1980 to December 1996. The t-statistic for the correlation coefficient is defined as $t = r\sqrt{N-2} / \sqrt{1-r^2}$ where r is the correlation coefficient between discounts and returns and N is the number of observations. Significance levels are denoted by *** (1% level), ** (5% level) and * (10% level).

Return measure	Statistic	1 month	3 months	6 months	12 months
Price return	Correlation	-0.17	-0.22	-0.24	-0.38
	t-statistic	-2.43 **	-1.81 *	-1.38	-1.57
NAV return	Correlation	-0.05	-0.05	-0.07	-0.26
	t-statistic	-0.67	-0.44	-0.41	-1.04
Number of observations		204	68	34	17

Table 2: UK Closed-End Fund Categories

UK closed-end funds are allocated to one of the 21 categories described in the table. Dimson and Marsh (1998b) and BT Alex Brown (1998) provide the number of funds and the market capitalization for all categories as at mid-1998. US dollar values are based on a dollar/pound exchange rate of 1.66.

	Category	Investment policy as at mid-1998	Number (mid-1998)	Value $ bn
	Categories included in this study			
1.	International General	< 80 % in any one geographical area	17	15
2.	International Capital Growth	< 80% in any one geographical area. Policy to accentuate capital growth	25	7
3.	International Income Growth	< 80% in any one geographical area. Policy to accentuate income growth	4	2
4.	UK General	> 80% in UK-registered companies	13	4
5.	UK Capital Growth	> 80% in UK-registered companies. Policy to accentuate capital growth	13	2
6.	UK Income Growth	> 80% in UK-registered companies. Policy to accentuate income growth	16	6
7.	High Income	> 80% in equities and convertibles. Yield > 25% above FTSE All-Share	14	1
8.	Closed-End Funds	> 80% in other closed-end investment companies	7	1
9.	Smaller Companies	> 50% invested in the shares of smaller and medium sized companies	39	6
10.	North America	> 80% of their assets in North America	9	2
11.	Far East: excluding Japan	> 80% of their assets in Far East securities, with exception of Japan	28	4
12.	Far East: including Japan	> 80% in Far East securities but less than 80% in Japan	5	3
13.	Japan	> 80% of their assets in Japan	13	2
14.	Continental Europe	> 80% of their assets in Continental Europe	19	3
15.	Pan Europe	> 80% in Europe (including UK) with at least 40% in Continental Europe	3	2
	Categories omitted from this study			
16.	Property	> 80% of their assets in listed Property shares	4	<1
17.	Commodity & Energy	> 80% of their assets in listed Commodity & Energy shares	3	1
18.	Emerging Markets	> 80% of their assets in emerging markets	27	5
19.	Venture & Development	A significant portion invested in the securities of unquoted companies	22	10
20.	Split Capital	Funds with a fixed wind-up date and > 2 classes of equity capital	62	4
21.	Venture Capital	Funds, with a different tax status, invested in private equity	21	1
	Total		**364**	**80**

Table 3: Index Descriptions

The multi-index regressions described in equations (7) and (8) measure managerial performance after adjusting for the fund's effective asset exposure. The table defines the indexes (i=1..15) used to estimate the exposures.

Type of Index		Symbol	Definition	Source
Base index	1.	R_{World}	FT/S&P World Index	Datastream
	2.	R_{UK}	FTSE 100 Index	Datastream
Foreign market	3.	R_{M3}	S&P 500 composite Index	Datastream
	4.	R_{M4}	Nikkei 500 Index	Datastream
	5.	R_{M5}	MSCI Pacific Basin excluding Japan Index	Datastream
	6	R_{M6}	MSCI Europe excluding UK Index	Datastream
	7.	R_{M7}	Milan Banca Commerciale Italiana Index	Datastream
	8.	R_{M8}	MSCI France Index	Datastream
	9.	R_{M9}	MSCI Spain Index	Datastream
	10.	R_{M10}	DAX 100 Index	Datastream
Style exposure	11.	R_{S11}	FTA Government All Stocks Index	Datastream
	12.	R_{S12}	UK Interbank 1 month (middle rate)	Datastream
	13.	R_{S13}	Extended Hoare Govett Smaller Companies Index	Dimson-Marsh (1998a)
	14.	R_{S14}	FTSE 350 Growth Index	FT-SE International
	15.	R_{S15}	FTSE 350 Value Index	FT-SE International

Table 4: Accuracy of the Unconstrained and Constrained Regressions

Panel A shows the in-sample R-squared from the regression of monthly NAV returns on the index returns specified in Table 3. Unconstrained 15 factors represents the mean R-squared for the unconstrained fifteen-index model, Unconstrained 9 factors the unconstrained approach using nine pre-selected indexes, and Constrained 15 factors the returns-based style analysis using fifteen indexes. For each fund category we define the R-squared as the equally-weighted average of the mean R-squared from the individual regressions. Panel B provides corresponding estimates for the out-of-sample R-squared, using the same 36-month rolling window procedure for all three regression procedures. The sample includes 338 closed-end funds over the period 1987-96.

	Panel A: In-sample R-squared (%)			Panel B: Out-of-sample R-squared (%)		
Fund category	Unconstrained 15 factors	Unconstrained 9 factors	Constrained 15 factors	Unconstrained 15 factors	Unconstrained 9 factors	Constrained 15 factors
International General	92	85	83	35	38	59
International Capital Growth	88	78	74	20	21	53
International Income Growth	91	84	80	49	41	57
UK General	92	90	87	40	44	66
UK Capital Growth	84	74	66	27	27	51
UK Income Growth	95	94	93	59	64	74
Smaller Companies	90	86	81	22	28	58
North America	79	67	43	14	22	40
Japan	87	73	65	14	4	39
Closed-End Funds	83	76	74	21	29	59
High Income	88	84	79	20	35	49
Continental / Pan Europe	77	66	63	1	7	37
Far East: excluding Japan	76	61	49	10	2	29
Far East: including Japan	91	78	72	20	10	43
Open-ended	89	82	79	42	47	54
Bid / Merged	78	69	59	4	2	43
Liquidated	71	64	54	0	18	40
All categories	**85**	**77**	**71**	**23**	**26**	**50**

Table 5: Managerial Performance Persistence

The risk-adjusted returns for the selection and the performance periods are measured using returns-based style analysis. Funds are ranked on past performance, measured over the selection period, and allocated to deciles at the beginning of each calendar year. Panel A shows the portfolios' performance measures (the equally-weighted average of the funds' selection returns) estimated over the following one-year performance period. The results from the performance period are based on non-overlapping observations. Selection and performance periods are separated by a one-month gap. Panel B reports the differences in performance and the Spearman rank correlation coefficients computed between the value of each decile's average performance and its rank. Panel C shows the results from the cross-sectional regressions. We report the average intercept, the average t-statistic for the intercept, the average coefficient and the average t-statistic for the coefficient. All values are tested against the null hypothesis that the population value is zero. Significance levels are denoted by *** (1% level), ** (5% level) and * (10% level). The sample includes 338 UK closed-end funds over the period 1987-1996.

Panel A: Average Performance (% per year)

Decile of NAV performance over selection period	1-year performance based on previous 1-year performance	1-year performance based on previous 2-year performance	1-year performance based on previous 3-year performance
1 (Highest performance)	-0.3	0.0	-4.4
2	1.5	2.0	1.2
3	0.9	1.3	0.7
4	0.8	1.3	2.4
5	0.9	1.1	1.4
6	0.0	1.6	1.1
7	0.7	0.3	2.4
8	0.2	0.2	-0.5
9	-0.2	0.0	1.3
10 (Lowest performance)	-0.3	-0.9	-1.8
Panel B: Rank Correlation Test and Diferences in Performance			
Spearman Rank Coefficient	0.41	0.58 *	-0.07
Top - Bottom decile	-0.02	0.88	-2.60
Top - Bottom quintile	0.84	1.44	-1.34
Panel C: Cross-Sectional Regressions			
Intercept	0.00	0.01	0.01
t (Intercept)	0.41	0.66	1.46
Coefficient	0.01	0.03	-0.01
t (Coefficient)	0.14	0.33	-0.17
Adjusted R-squared (%)	0.03	-0.32	-0.55

Table 6: Share Price Performance Persistence

Funds are ranked on past share price performance, measured over one-, two- and three-year selection periods, and allocated to deciles at the beginning of each calendar year. The portfolios' return (the equally-weighted average of the funds' share price performance) are measured over the following one-year performance period. The results from the performance period are based on non-overlapping observations. Selection and performance periods are separated by a one-month gap. Spearman rank correlation coefficients are also computed between the value of each decile's average performance and its rank. Panel C shows the results from the cross-sectional regressions. We report the average intercept, the average t-statistic for the intercept, the average coefficient and the average t-statistic for the coefficient. All values are tested against the null hypothesis that the population value is zero. Significance levels are denoted by *** (1% level), ** (5% level) and * (10% level). The sample includes 338 UK closed-end funds over the period 1987-1996.

Panel A: Average Share Price Performance (% per year)

Decile of share price performance over selection period	1-year performance based on previous 1-year performance	1-year performance based on previous 2-year performance	1-year performance based on previous 3-year performance
1 (Highest performance)	12.2	9.8	7.3
2	13.9	8.9	7.8
3	11.9	11.3	12.2
4	13.7	12.2	11.9
5	11.7	13.3	12.9
6	11.6	13.0	9.6
7	12.1	13.9	10.8
8	14.0	10.8	10.5
9	15.2	17.2	13.7
10 (Lowest performance)	17.8	17.9	16.2

Panel B: Rank Correlation Test and Diferences in Performance

Spearman Rank Coefficient	-0.47	-0.79 ***	-0.65 **
Top - Bottom decile	-5.65	-8.09 *	-8.94
Top - Bottom quintile	-3.47	-8.23 **	-7.39

Panel C: Cross-Sectional Regressions

Intercept	0.13 *	0.15 *	0.14
t (Intercept)	6.96 *	7.28 *	6.24
Coefficient	-0.15 **	-0.10 **	-0.14 **
t (Coefficient)	-2.22 **	-2.04 ***	-2.91 ***
Adjusted R-squared (%)	4.01	2.78	6.54

Table 7: Managerial Performance of High and Low Discount Portfolios

Funds are ranked on the level of the discount and allocated, at the beginning of each calendar year, to deciles. The performance of the ten portfolios is measured using returns-based style analysis. For each decile, percentage selection returns are cumulated over one-, two- and three-year periods. To avoid the problem of overlapping observations when measuring performance over periods longer than one year, we create non-overlapping sub-series. For performance measured over two- and three-year periods, the table reports the average of two and three sub-series, respectively. Spearman rank correlation coefficients are also computed between the value of each decile's average performance and its rank. Panel C shows the results from the cross-sectional regressions. We report the average intercept, the average t-statistic for the intercept, the average coefficient and the average t-statistic for the coefficient. All values are tested against the null hypothesis that the population value is zero. Significance levels are denoted by *** (1% level), ** (5% level) and * (10% level). The sample includes 338 UK closed-end funds over the period 1987-1996.

Panel A: Average Managerial Performance (% per year)

Decile of discount	1-year performance based on discount	2-year performance based on discount	3-year performance based on discount
1 (Largest premium / smallest discount)	-1.0	-1.3	-0.7
2	-1.6	-0.9	0.5
3	-0.3	0.0	1.0
4	-1.1	-0.5	-0.3
5	1.3	1.6	1.5
6	2.0	1.0	1.2
7	0.4	1.4	1.4
8	0.9	1.0	1.1
9	0.1	0.8	1.0
10 (Largest discount)	-2.7	0.5	2.1
Panel B: Rank Correlation Test and Diferences in Performance			
Spearman Rank Coefficient	-0.18	-0.58 *	-0.73 **
Top - Bottom decile	1.63	-1.74	-2.81 *
Top - Bottom quintile	-0.04	-1.73 *	-1.66
Panel C: Cross-Sectional Regressions			
Intercept	0.00	-0.01	0.00
t (Intercept)	-0.03	-0.28	0.43
Coefficient	0.04	-0.07	-0.14
t (Coefficient)	0.49	-0.50	-0.75
Adjusted R-squared (%)	2.33	2.32	1.15

Table 8: Discounts of the High and Low NAV Return Portfolios

Funds are ranked on the level of past managerial performance, measured over one-, two- and three-year periods, and allocated to deciles at the beginning of each calendar year. The table shows the percentage discount of each decile. The discounts are the logarithm of an equally-weighted average of the funds' ratios of share price to NAV. Spearman rank correlation coefficients are also computed between the value of each decile's average discount and its rank. Panel C shows the results from the cross-sectional regressions. We report the average intercept, the average t-statistic for the intercept, the average coefficient and the average t-statistic for the coefficient. All values are tested against the null hypothesis that the population value is zero. Significance levels are denoted by *** (1% level), ** (5% level) and * (10% level). The sample includes 338 UK closed-end funds over the period 1987-1996.

Panel A: Average Discount

Decile of NAV performance over selection period	Discount based on 1-year performance	Discount based on 2-year performance	Discount based on 3-year performance
1 (Highest performance)	-13.8	-11.1	-11.3
2	-12.4	-12.5	-9.3
3	-10.9	-9.3	-10.2
4	-13.4	-11.6	-10.4
5	-12.5	-13.0	-11.3
6	-13.7	-11.3	-10.4
7	-13.2	-12.8	-12.0
8	-14.7	-12.3	-11.0
9	-12.7	-11.6	-13.0
10 (Lowest performance)	-16.3	-15.7	-15.3
Panel B: Rank Correlation Test and Differences in Discount			
Spearman Rank Coefficient	0.44	0.54 *	0.70 **
Top - Bottom decile	2.51	4.67 **	3.99 *
Top - Bottom quintile	1.38 *	1.86	3.83 **
Panel C: Cross-Sectional Regressions			
Intercept	0.88 ***	0.88 ***	0.89 ***
t (Intercept)	107.50 ***	103.83 ***	107.75 ***
Coefficient	0.05	0.07 *	0.08 *
t (Coefficient)	0.53	0.91	1.56 *
Adjusted R-squared (%)	1.49	2.68	4.79

Table 9: Absolute Discount and Residual Risk

Funds are ranked on the level of residual risk, measured by the standard deviation of monthly selection returns, and allocated to deciles at the beginning of each calendar year. Residual risk is measured over one-, two- and three-year periods. The table shows the mean absolute value of each decile's discount, defined as the logarithm of 1 plus the mean absolute value of the price-to-NAV ratio minus 1. The table reports the results from the test of the difference between the top and bottom deciles alongside the Spearman rank correlation coefficients. Panel C shows the results from the cross-sectional regressions. We report the average intercept, the average t-statistic for the intercept, the average coefficient and the average t-statistic for the coefficient. All values are tested against the null hypothesis that the population value is zero. Significance levels are denoted by *** (1% level), ** (5% level) and * (10% level). The sample includes 338 UK closed-end funds over the period 1987-1996.

Panel A: Deciles Based on Residual risk

Decile of residual risk	Discount based on 1-year residual risk	Discount based on 2-year residual risk	Discount based on 3-year residual risk
1 (Highest risk)	14.1	13.8	12.0
2	12.8	12.8	11.9
3	12.5	12.1	11.7
4	13.7	12.6	11.8
5	11.9	11.7	11.2
6	12.4	11.4	10.0
7	12.4	10.6	10.4
8	12.3	11.9	10.5
9	11.6	11.4	11.0
10 (Lowest risk)	12.2	11.6	11.4
Panel B: Rank Correlation Test and Differences in Residual Risk			
Spearman Rank Coefficient	0.82 ***	0.76 **	0.68 **
Top - Bottom decile	1.87 **	2.23 **	0.57
Top - Bottom quintile	1.47 *	1.92 *	0.74
Panel C: Cross-Sectional Regressions			
Intercept	0.13 ***	0.11 ***	0.11 ***
t (Intercept)	11.28 ***	9.47 ***	8.02 ***
Coefficient	0.36	0.63 **	0.57
t (Coefficient)	1.21 *	1.52 **	1.07 *
Adjusted R-squared (%)	2.29	2.46	1.69