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A POSSIBLE RECONCILIATION OF SOME OF THE CONFLICTING FINDINGS ON CLOSED-END FUND DISCOUNTS: A NOTE

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INTRODUCTION

The shares of closed-end mutual funds are often observed to trade at a substantial discount from net asset value.[1] The most obvious explanation is what we term 'managerial contribution', which is simply the difference between managerial performance and managerial fees (Boudreaux, 1973). That is to say, a discount may reflect the *ex ante* capitalization of expenses incurred by management in their unsuccessful attempt to outperform the market. Similarly, premiums, which are observed much less often may reflect management's perceived ability to outperform the market net of all costs.

The empirical evidence, however, is very much mixed. Roenfeldt and Tuttle (1973) detect a marginal negative correlation between performance and discounts. On the other hand, Malkiel (1977) finds no significant relationship between managerial fees and/or fund performance and the level of discounts. Lee, Shleifer and Thaler (1991a) show that funds with large discounts tend, in fact, to have higher subsequent net asset value performance than those with low discounts. Arguing that this result is the opposite of what might be expected from rational discounting of managerial contribution, they conclude that 'agency costs cannot even explain the primary fact they are alleged to address, the existence of discounts' (Lee, Shleifer and Thaler, 1990, p. 157).

An alternative line of argument (Brauer, 1984; and Brickley and Schallheim, 1985) suggests that discounts may be related to the potential for open-ending a fund. Such mutualization makes it possible for shareholders to obtain the net asset value for their shares instead of having to sell them on the open market at a discount. To the extent that an open-ending attempt is anticipated or deemed likely, one might expect to see lower discounts. In fact, Brauer (1988) found that abnormal returns could be earned by portfolio formation based on likely future open-ending activity.[2]

It is natural to expect that the incentive to initiate a mutualization attempt should be positively related to discounts. Since discounts are in turn negatively related to the magnitude of managerial contribution, the probability of open-

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ending should increase with declines in managerial contribution. After all, shareholders have the most to gain from mutualization when discounts are high. To be fair, the inverse relationship between managerial contribution and the probability of open-ending need not hold in all cases. For example, there are closed-end funds that have clauses in their prospectuses mandating movement to open-end status at a specified future date. Also, there may be cases where a higher managerial contribution means a higher incentive for management to initiate a mutualization attempt due to the potentially larger benefit accruing to management from a larger fund.[3]

In any event, the direct and indirect effects that managerial contribution may have on fund discounts, must be recognized. On the one hand, poor performance and high expenses lead to higher discounts; on the other hand, poor performance and high expenses lead to a higher probability of open-ending, which in turn leads to lower discounts.

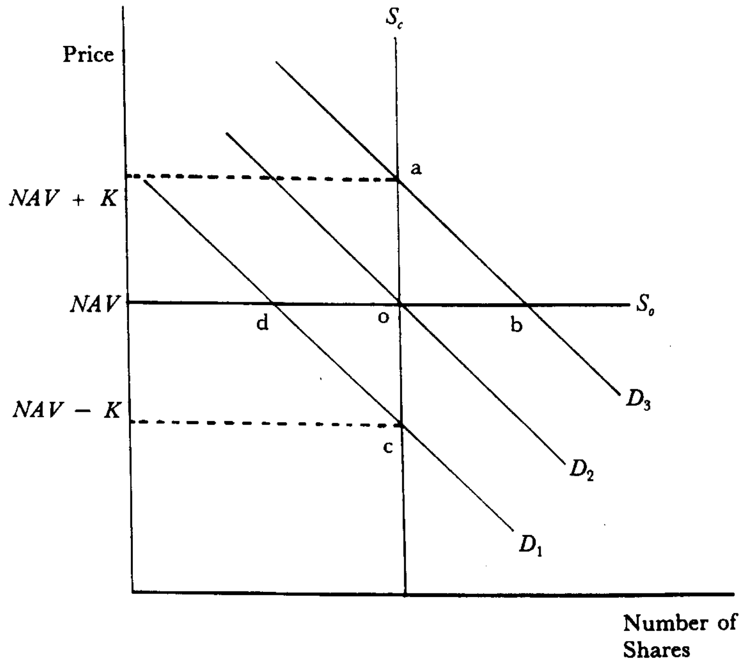
In this paper, a model that explicitly takes account of both the direct and indirect effects of managerial contribution on discounts is developed. As such, it may provide a partial explanation for the conflicting empirical finding cited earlier. The model, which takes the existence of closed-end funds as given, is grounded in the rationality of all investors.[4] It is not suggested that we have accounted for all the closed-end fund puzzles, merely that it may be possible to account for some of the stylized facts without abandoning market efficiency.[5] For example, we abstract from the potential role of taxes (Malkiel, 1977). Further, our model does not provide an answer to the question why anyone would subscribe to initial public offerings of closed-end funds, given that they are typically issued at an average premium of about seven percent, and move to an average discount of over ten percent 120 days after the initial offering (Weiss, 1989). Lee, Shleifer and Thaler (1991b) argue that initial investors are irrational. We have great sympathy with this view. Nevertheless, our contribution is to account for, under reasonable parametric assumptions, the puzzling empirical finding that managerial contribution and discounts are not necessarily negatively related, and to do so under the maintained hypothesis of market efficiency.[6]

THE RATIONALE BEHIND CLOSED-END FUND PREMIUMS AND DISCOUNTS

Figure 1 illustrates the essential differences between closed-end and open-end fund shares. The supply of the former (S_c) is set at issue and does not respond to changing managerial fees or perceptions of managerial performance. Once the original shares are issued, no more shares can ever come into existence. Further, the investment company itself will not redeem shares for their owner. On the other hand, the supply of open-end funds (S_0) is perfectly elastic at net asset value (NAV). This is so because open-end funds are always ready to receive additional capital from investors, and, in addition, must stand ready

Figure 1

Supply and Demand for Closed-End Versus Open-End Fund Shares



to redeem shares from investors.

Begin with a situation where there are two identical funds, one open-end and one closed-end. Initially, perceived performance is exactly identical to managerial fees. For example, the marginal perception is that management can earn two percent more than a well-diversified market-emulating portfolio, but the managerial fee is also two percent. For both funds, the demand curve will be at D_2 and shares will trade (or be issued and redeemed) at *NAV*. Investors of course do have differences of opinion. Infra-marginal investors for both types of funds would be willing to pay more than *NAV* if they had to, since they believe that management can earn more than two percent over and above the market. Investors on D_2 below *NAV* could be enticed into the market if management were to lower its fees.

Suppose that certain investors become more optimistic about the ability of management to beat the market. The demand curve for shares shifts to the right to D_3. If the fund is a closed-end fund, the result will be an increase in price, pushing the fund to a premium position (i.e., the move from 'o' to 'a' in Figure 1). For an open-end fund, the response is a quantity response. Additional demand for shares is met with an expansion of the size of the fund (i.e., additional shares are issued, which is reflected in the move from 'o' to 'b' in Figure 1). This is very much consistent with what is observed in the market: successful funds tend to be popular and large.

A similar story can be told about market pessimism with regard to performance (i.e., a shift in the demand curve from D_2 to D_1). The result is closed-end fund discounts (i.e., the move from 'o' to 'c' in Figure 1), and open-end fund shrinkage or even disappearance (i.e., shares are redeemed, which is reflected in the move from 'o' to 'd' in Figure 1). This simple background tells us why we should expect discounts to monotonically decrease with managerial contribution. In the next section, we introduce the complication of open-ending or mutualization. As we show, this leads to a more complex relationship between discounts and managerial contribution.

THE MODEL

The value of a closed-end fund share at t (CEV_t) can be written as:[7]

$$CEV_t = \frac{E_t\widetilde{CF}_{t+1} + E_tV_{t+1}}{1+r}; \tag{1}$$

where $\widetilde{CF}_t$ is the (per closed-end fund share) cash flow at t; V_t is the value of the claim at t; r is the relevant discount rate; and E_t is the expectation operator.

During each period open-ending is assumed to occur with probability p.[8] If it takes place at $t+1$ the closed-end share will be worth its net asset value (NAV_{t+1}); otherwise, it will be worth its value as a closed-end fund share (CEV_{t+1}). Therefore we have:

$$E_tV_{t+1} = pE_tNAV_{t+1} + (1-p)E_tCEV_{t+1}. \tag{2}$$

The existence of managerial contribution opens up the possibility that the cash flows accruing to the shareholder in a comparable open-end fund may differ from those of the closed-end fund.[9] Letting α be the mean periodic incremental cash flow due to managerial performance and β the mean periodic reduction in cash flow due to managerial expenses, one can write

$$\widetilde{CF}_t = CF_t(1 + \alpha - \beta); \tag{3}$$

where CF_t are the t-period cash flows for an equivalent-risk open-end fund (or, more simply, a passively selected well-diversified fund with identical risk).[10] For simplicity we assume that both α and β are time-invariant.[11]

Of course NAV_t can be expressed in terms of expected values of these 'pure' cash flows:

$$NAV_t = \frac{E_tCF_{t+1} + E_tNAV_{t+1}}{1+r}. \tag{4}$$

Substitution of (2) and (3) into (1) yields

$$CEV_t = \frac{E_tCF_{t+1}(1+\alpha-\beta)+pE_tNAV_{t+1}+(1-p)E_tCEV_{t+1}}{1+r}. \tag{5}$$

By recursive substitution and the use of (4), one can derive the initial value of the closed-end fund share as:

$$CEV_0 = \sum_{t=1}^{\infty} K_tPVCF_t; \tag{6}$$

where

$$PVCF_t = \frac{E_0CF_t}{(1+r)^t}; \tag{7}$$

$$K_t = 1 + (\alpha - \beta)(1-p)^{t-1}. \tag{8}$$

It should be stressed that CEV_0 above, whether or not a discount is implied, is a full-information or efficient price. The reason is that this price is a rational capitalization of both managerial contribution and the probability of open-ending, as well as any interrelationships between the two.

Note that when $(\alpha - \beta) = 0$, the value of the closed-end fund is equal to the sum of the discounted cash flows and is independent of the probability of open-ending. Namely,

$$CEV_0 = \sum_{t=1}^{\infty} PVCF_t = NAV_0. \tag{9}$$

Further, when the fund is to be open ended at $t=1$ with certainty (i.e., $p=1$),

$$CEV_0 = \sum_{t=1}^{\infty} PVCF_t + (\alpha-\beta)PVCF_1 = NAV_0 + (\alpha-\beta)PVCF_1; \tag{10}$$

and, when the probability of open-ending is equal to zero (i.e., $p=0$),

$$CEV_0 = (1+\alpha-\beta)\sum_{t=1}^{\infty} PVCF_t = (1+\alpha-\beta)NAV_0. \tag{11}$$

In the former case, managerial contribution will persist for one period, while in the latter it is permanent. If $\alpha > \beta$, the fund trades at a premium, and logically the probability of open-ending is zero. Why break up a good thing?

By dividing equation (6) by NAV_0, one can re-express CEV_0 as PR_0, which is defined to be the initial gross premium (or the premium to net asset value plus unity). Thus,

$$PR_0 = \sum_{t=1}^{\infty} K_t pvcf_t; \tag{12}$$

where

$$pvcf_t = \frac{PVCF_t}{NAV_0}. \tag{13}$$

From (8) and (12) it appears that, *ceteris paribus*, a decline in α or an increase in β, should lead unequivocally to a higher discount (i.e., lower PR_0).[12] The relationship between managerial contribution and discounts is not so simple however. To explicitly take into consideration the relationship between p and $(\alpha-\beta)$, take the derivative of PR_0 in equation (12) with respect to $(\alpha-\beta)$. This yields

$$\frac{\partial PR_0}{\partial(\alpha-\beta)} = \sum_{t=1}^{\infty} K_t' pvcf_t; \tag{14}$$

where

$$K_t' = (1 - p)^{t-1}\left[1 - \frac{(\alpha-\beta)(t-1)p'}{1 - p}\right]; \tag{15}$$

$$p' = \frac{\partial p(\alpha-\beta)}{\partial(\alpha-\beta)} < 0. \tag{16}$$

Intuitively, since for large t the K_t' will be negative, it is quite possible that discounts will increase with increases in managerial contribution, at least over a range of reasonable values for α and β.

In terms of Figure 1, rather than having a single shift parameter for the demand curve, namely managerial contribution $(\alpha-\beta)$, we now have two shift parameters, $(\alpha-\beta)$ and $p(\alpha-\beta)$. It is therefore possible that as managerial contribution declines, causing the demand curve to shift down via the first shift parameter, at some point, via the second parameter (the probability of open-ending), which works in the opposite direction, the net effect can be an upward shift in the demand curve. The reason is that investors are attaching an increased probability to open-ending, which by definition moves the price to NAV.

A HEURISTIC EXAMPLE

It is possible to specify many functional forms for the probability of open-ending. Consider the following heuristic example. Suppose we specify a simple cubic polynomial, where the probability is set equal to zero when $(\alpha-\beta)$ is zero, and unity when $(\alpha-\beta)$ is -0.5.[13] This is a reasonable characterization: Lee, Shleifer and Thaler (1990) point out that annual managerial expenses range from 0.5 percent to two percent of net asset value. Taking the midpoint, assuming no stock-picking ability (i.e., $\alpha = 0$), and given a six percent real discount rate; this translates into a managerial contribution (i.e., $(\alpha-\beta)$) of -0.20 and an associated probability of about seven percent.[14,15]

Figure 2

Gross Premium and Probability of Open-Ending as a Function of Managerial Fees (β)
(α = 0)

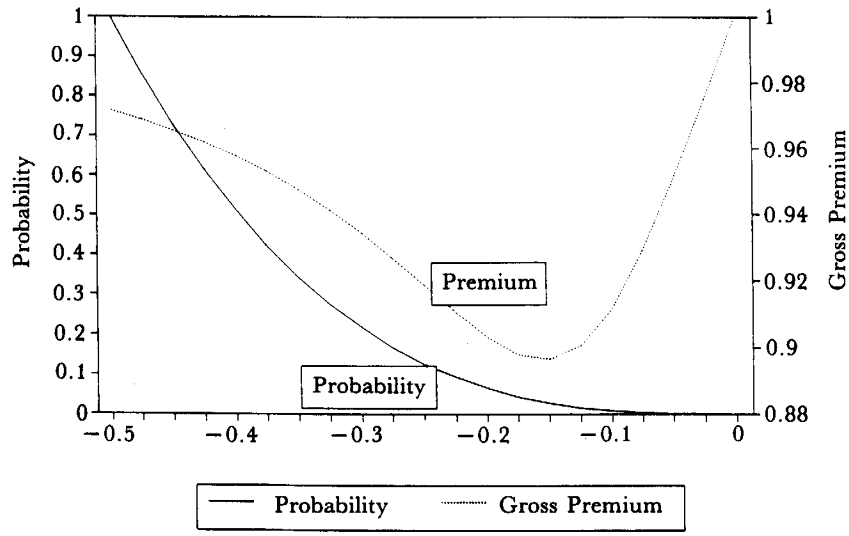


Figure 2 plots the gross premium and probability of open-ending as a function of β, with α set equal to zero. Notice that, beginning at zero, as β increases (i.e., a leftward movement on the horizontal axis), the gross premium declines. Equivalently, the discount widens. At the same time, the probability of open-ending increases. In the neighborhood of $\beta = -0.15$, the discount actually starts to narrow due to the greater strength of the latter effect. At this point the discount is greater than ten percent.

Similarly, Figure 3 plots the gross premium and probability of open-ending as a function of α with β set equal to 0.2. Notice that when $\alpha = 0.2$ managerial contribution is equal to zero and the fund is sold at par. If $\alpha > 0.2$, the fund is sold at a premium. This reinforces the fact that our model can account for premiums as well as discounts. Once perceived performance falls below managerial fees, discounts result, but as before the relationship is not monotonic due to the fact that the probability of open-ending is positive.

Table 1 provides some additional information, with variation in maximum managerial contribution $(\alpha - \beta)$ (where MAX$(\alpha - \beta)$ is the $\alpha - \beta$ such that $p(\alpha - \beta) = 1$), r and the polynomial order allowed for. Each cell provides the minimum gross premium (i.e., the maximum discount) and (below) the associated $\alpha - \beta$, as these parameters are varied. Notice that the maximum discount increases when: MAX$(\alpha - \beta)$ increases; the discount rate increases; or the

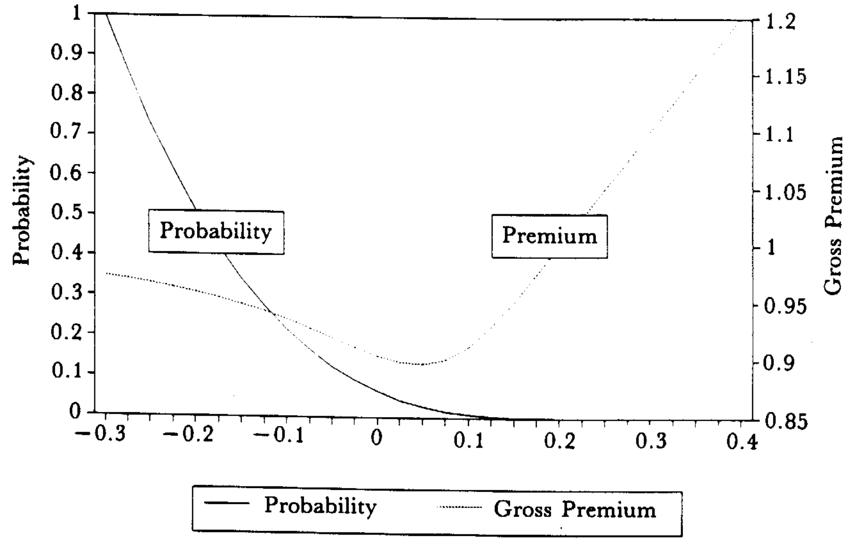
Table 1

Minimum Gross Premiums and Associated Managerial Contributions $(\alpha-\beta)$'s as Functional Form, MAX$(\alpha-\beta)$ and r are Varied

Functional	$MAX(\alpha-\beta) = -0.7$ Real Discount Rate			$MAX(\alpha-\beta) = -0.5$ Real Discount Rate			$MAX(\alpha-\beta) = -0.3$ Real Discount Rate		
Form	*4%*	*6%*	*8%*	*4%*	*6%*	*8%*	*4%*	*6%*	*8%*
Linear	0.970	0.960	0.948	0.978	0.972	0.963	0.986	0.982	0.977
	−0.7	−0.7	−0.7	−0.5	−0.5	−0.5	−0.3	−0.3	−0.3
Quadratic	0.927	0.914	0.901	0.947	0.939	0.929	0.968	0.963	0.958
	−0.15	−0.175	−0.2	−0.1	−0.125	−0.15	−0.05	−0.075	−0.075
Cubic	0.870	0.855	0.841	0.907	0.896	0.886	0.943	0.938	0.932
	−0.2	−0.225	−0.25	−0.125	−0.15	−0.175	−0.075	−0.1	−0.1
4th-Order	0.820	0.803	0.778	0.870	0.860	0.848	0.921	0.917	0.909
	−0.25	−0.275	−0.275	−0.175	−0.2	−0.2	−0.1	−0.125	−0.125

Figure 3

Gross Premium and Probability of Open-Ending as a Function of Managerial Performance (α)
(β = 0.2)



polynomial order increases. The maximum discounts range from 22.5 percent (r = 8 percent, order 4, MAX($\alpha-\beta$) = -0.7) to a low of 1.4 percent (r = 4 percent, linear, MAX($\alpha-\beta$) = -0.3). It seems fair to say that there are a number of combinations of assumed parameter values that both appear reasonable and, at the same time, are able to generate discounts of the magnitude that are often observed in the market.

PERSPECTIVE

The closed-end fund discount puzzle is indeed one of the more perplexing asset pricing anomalies. The most obvious explanation, the interplay between managerial performance and fees, has been called into disrepute because of the inability of researchers to consistently document a negative relationship between managerial contribution and discounts. We have shown that there is no need for the relationship to be monotonic. The reason is that, as expected future performance worsens, there is a greater incentive for the process of mutualization to be attempted, and such a process permanently eliminates discounts.

The upshot of this is that any tests assuming a simple relationship between managerial contribution and discounts are misspecified, which may account for the conflicting findings cited above. Still, it is far from clear how one could test variants of the model presented above. One difficulty is in measuring α. The problem is that this parameter is forward-looking. One could probably estimate quite closely expected future managerial expenses, but it is impossible to obtain *ex ante* superior performance. Further, fund management teams change over time, so that is no reason to believe that α is time-invariant. Similarly, time-variance is likely to apply for the probability function, as open-ending might be expected to come in spurts.

To conclude, no claim is made that this constitutes anything other than a piece of the puzzle. Some role for irrationality (as in the Lee, Shleifer and Thaler, 1991b, noise trader explanation) might be required as well. Still, the demonstration that the existence of discounts for seasoned funds may be explained by a rational capitalization of managerial contribution should give food for thought.

NOTES

1 Although funds do sometimes sell at a premium, in recent years discounts of 10 to 20 percent have been typical. For example, at year-end 1987 the average closed-end fund in the Herzfeld (1988) closed-end fund index sold at a 16.6 percent discount.

2 Similar results were obtained by Thompson (1978) who based his portfolio selection based on the sign and magnitude of the funds' discounts.

3 We would like to thank an anonymous referee for bringing this point to our attention and for providing the examples cited above.

4 The explanation proposed by Lee, Shleifer and Thaler (1991b), for example, requires the existence of *some* irrational (i.e., noise) traders.

5 Lee, Shleifer and Thaler (1990) characterize the anomaly as a four part one. Apart from the existence of mean discounts, the puzzles are the fact that funds appear on the market at a premium and then move to a discount; discounts vary widely both cross-sectionally and over time; and on termination prices converge to net asset value and not the opposite.

6 An alternative explanation is provided by Lee, Shleifer and Thaler (1990 and 1991b). They adopt the noise trader approach to explaining discounts and premiums suggesting that smart money traders have only limited opportunities to trade to exploit departures from net asset value. This is so because there is little way to arbitrage the differential. Further, the number of investors willing to make long-term bets against prices that depart from net asset values is quite limited.

7 The setup of the model and some of the notation are similar to Brauer (1988).

8 When investors evaluate a fund at a point in time, according to our model, they assign the same probability of open-ending to each future period. Nevertheless, as their perceptions of performance change over time — for example, due to a new manager being hired, or due to past superior performance — the probability assigned to open-ending will potentially be revised. This might explain why funds can move back and forth from premiums to discounts.

9 For open-end funds, managerial contribution does not exist in the sense that marginal investors in the fund deem performance to be exactly offset by managerial fees.

10 Thus $\alpha-\beta$ can be viewed as the negative of agency costs.

11 As will become clear below, since we assume that probability of mutualization, p, is a function of $(\alpha-\beta)$, this implies that p is also viewed to be constant over time.

12 If the probability of open-ending equals zero, (12) reduces to $PR_0 = 1 + \alpha - \beta$. This follows from (8) which indicates that all K_t are unity if $p = 0$.

13 In other words, $p(\alpha-\beta) = 8(\alpha-\beta)^3$, $-0.5 < (\alpha-\beta) < 0$. All other functions utilized below are single-term polynomials of this type (with different degrees and constants).

14 Brickley and Schallheim (1985) report that over a 20 year period (1962–1982) 16 funds either were open-ended or liquidated, and that, as of March 1983, there were 45 closed-end investment companies.

15 Given a real discount rate of six percent and a managerial fee of 1.25 percent, one obtains a net return of 4.75 percent which is equivalent to a 20 percent reduction in cash flows (1.25/6 = 0.2).

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