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Do Investors Care about Sentiment?*

Results of recent research indicate small investor sentiment, as measured by the change in the discount on closed-end funds, is an important factor in the return generating process for common stocks. We find no evidence of it being an important factor in the return generating process. We next examine its impact on expected returns and whether one set of firms with high sensitivity to this factor—closed-end funds—offers, and can be expected to offer, a higher expected return. Our findings do not support small investor sentiment as a priced factor, either in common stocks or closed-end funds.

I. Introduction

Lee, Shleifer, and Thaler (1991) claim they have uncovered a new influence, small investor sentiment, that affects the risk of common stocks.[1] Furthermore, they believe that this factor is especially important in explaining the return pattern of closed-end funds and small stocks. They claim that firms with high sensitivity to this factor must earn an extra return as compensation for this extra risk (market price of risk positive). Finally, they argue that small investor sentiment can be measured by the change in the discount on closed-end equity funds.

Determining which factors explain the return of individual securities is one of the key issues in investments research. Which of these factors are priced is the fundamental issue of asset pricing theory. Thus their claims, if correct, make an important contribution to our understanding of how capital markets function.

In this article we explore whether small investor sentiment, as measured by the change in the

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1. Also see Chen, Kan, and Miller (1993*a*, 1993*b*); and Chopra, Lee, Shleifer, and Thaler (1993*a*, 1993*b*).

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discount on closed-end funds, is an important factor in the return generating process for common stocks and whether one set of firms, closed-end funds, with high sensitivity to this factor offers, and can be expected to offer, a higher expected return. Our results do not support any of the contentions of Lee et al. (1991). We first explore the importance of their sentiment in the return generating process. Initially we show that the Lee et al. (1991) sentiment index (the change in the discount on closed-end funds) does not enter the return generating process more frequently than a set of indices constructed in an analogous manner from a set of firms not subject to small investor sentiment (large, institutionally held industrial firms). In fact, the frequency with which the change in the discount for closed-end funds enters the return generating process is not much different from what would be expected by chance. Second, we show that if the indices are computed as industry return indices rather than changes in discounts, they enter the return generating process more frequently. Industry return indices are used as a reference because industry return indices are not considered systematic factors. Third, when we examine the pattern of sensitivity to the change in the discount of closed-end funds across size categories using the same two-factor model employed by Lee et al., we get a pattern like theirs. However, using a more general multifactor model, this pattern disappears. Finally, we show that the Lee et al. sentiment index is not related to a set of empirically derived factors.

Next we examine expected returns. Our findings that sentiment risk as defined by Lee et al. is uncorrelated with the time series of returns on stocks or portfolios of stocks implies that sentiment risk should not be related to expected returns. This is exactly what we find. We show that closed-end funds do not have higher average returns than would be expected given their sensitivities to a multi-index model that does not include the Lee et al. sentiment index. We then show that the discount on closed-end funds is fully explained by influences not related to a sentiment index. Thus, there is no evidence that firms with higher sensitivity to the change in discount on closed-end funds give a higher return.

The remainder of this article is divided into five sections. In the next section we discuss the return generating process, sample data, and index return construction. In Section III we present evidence on whether sentiment affects the return generating process. In Section IV we provide evidence on whether sentiment risk is priced. In Section V we examine whether the discount on closed-end funds is sufficiently large to require the existence of sentiment risk to explain it. Section VI concludes this article.

II. The Return Generating Process, Data, Samples, and Index Construction

In this section we discuss the return generating process (RGP), the data, the samples we employ, and the construction of the investor sentiment index.

A. The Return Generating Process

In order to measure the importance of adding sentiment to the RGP we need to specify a base RGP that does not include sentiment. We use two different base RGPs. First, because Lee et al. use a one-index model as a base to which they added sentiment, we employ a similar one-index model. The one-index model is

$$R_{it} = \alpha_i + \beta_{ij} R_{jt} + \epsilon_{it}, \tag{1}$$

where[2]

R_{it} = the return in month t of a security or portfolio i minus the return on 1-month Treasury bills;
R_{jt} = the return on portfolio j in period t minus the return on 1-month Treasury bills;
β_{ij} = the sensitivity of stock or portfolio i to index j;
α_i = the nonsystematic mean return of stock or portfolio i; and
ϵ_{it} = the residual of stock or portfolio i in period t.

We do not believe that a one-index model is an appropriate RGP; rather, we rely on recent literature that finds evidence for a four-index or at most a five-index model.[3] The multi-index RGP can be represented as

$$R_{it} = \alpha_i + \sum_j \beta_{ij} \mathrm{R}_{jt} + \epsilon_{it}. \tag{2}$$

We employ a four-index form of the model developed and tested in Elton, Gruber, and Blake (1996*a*, 1996*b*). The indices we employ are the excess return on the Standard and Poor's (S&P) 500 over the 1-month Treasury bill rate, an index that represents the return on a portfolio of small (low capitalization) stocks minus the return on a portfolio of large capitalization stocks, an index that represents the return on a portfolio of "growth" stocks minus the return on a portfolio of "value" stocks, and an index of the excess return over the 1-month Treasury bill rate of a portfolio of bonds.[4]

2. R_{jt} is the difference in return between two portfolios. When the index is a difference in return between two stock portfolios the risk-free rate is not subtracted off. The indices used are described below in the text.

3. See Connor and Korajczyk (1986); Fama and French (1993); and Elton, Gruber, and Blake (1996*a*, 1996*b*).

4. See Elton, Gruber, and Blake (1996*a*) for details on index construction. Empirical tests of this model versus alternative models are contained in Elton, Gruber, and Blake (1997). In interpreting some of the results presented in this article, it might help the reader to recognize that the growth-value index is highly negatively correlated with the high book-to-market minus low book-to-market index that Fama and French (1993), among others, have employed in their research.

B. Data

We use data from six sources. All security returns, including market returns on closed-end funds, are from the monthly Center for Research in Security Prices (CRSP) tape. Index returns for the S&P index, the value-weighted CRSP index, and returns on size deciles are also from CRSP. The small-minus-large index and value-minus-growth indices are from Prudential Bache. The bond return index is the government corporate index from Shearson-Lehman. Finally, open-end mutual fund data are provided by Micropal.

Net asset value comes from two sources: for closed-end funds it is provided to us by Lipper; for industrial companies it comes from the Compustat tapes.

C. Samples

To test the return generating process we use two samples of individual security returns and three samples of portfolio returns. The first individual security return sample is made up of the 586 New York Stock Exchange (NYSE) stocks that have continuous return history on CRSP from January 1969 to December 1994. Closed-end funds and utility stocks are excluded from the stock sample.[5] The second sample of individual security returns consists of the 99 utility stocks which have a complete history of data on CRSP from January 1969 to December 1994. We use this sample because Lee et al. argued that utility stocks have low institutional ownership and are therefore subject to small investor sentiment.

We also test the return generating process on three samples of portfolios consisting of two sets of passive and one set of active portfolios. The first set of passive portfolios are the CRSP size deciles. These are selected because of their use by Lee et al. (1991) and the more general use of size portfolios in testing return generating processes. The second set of passive portfolios are 28 industry return indices. These indices are constructed by sorting our 586 industrial firms into groups by two-digit standard industrial classification (SIC) code. Then, for all industries with more than five members, a value-weighted return index is constructed.[6]

The active portfolios we employ consist of a sample of 267 mutual funds that have data from January 1979 to January 1993 and list ''com-

5. To guard against a concern that this sample is not representative of the full population, we also employ as a check a sample of all stocks listed on CRSP that have a minimum of 30 quarters of history between January 1980 and December 1994. This sample contains 4,967 firms. We do not report results for this sample since they are very close to the results obtained from the 586-firm sample.

6. Industry return has also been used in several tests of the RGP, e.g., Gibbons, Ross, and Shanken (1989).

mon stock'' as their investment objective according to Wiesenberger's Mutual Funds *Panorama*. These portfolios are especially interesting because mutual funds have an incentive to offer funds that span the set of indices affecting returns. If small investor sentiment is an index that investors care about, then the mutual fund industry should offer an array of funds with different loadings on this factor. If they do not, then a mutual fund would gain a large inflow of funds if they offered differential sensitivity to it, and other funds would likely follow suit. Thus, examining mutual fund returns is a useful way of examining which factors are important.

D. *Index Construction*

Since our sample period does not coincide with that of Lee et al., it is necessary to reconstruct their small investor sentiment indices. For each closed-end mutual fund we compute the ratio of the net asset value per share of the fund minus the market price per share of the fund to the net asset value per share of the fund.

The discount index is a market-value weighted portfolio of this ratio for each fund multiplied by 100. Like Lee et al., we use the monthly change in the discount index as the sentiment index. When the monthly change in the discount index is calculated, we maintain a common number of funds at the start and end of the month. Thus, if a fund would have entered our index during the month of January, it is not used in calculating the change in discount for January but is used in February. This exactly replicates the Lee et al. procedure for index construction. The primary change we made from their procedure is to exclude from the index all funds in the first 6 months of their existence.[7] We do this because of evidence that during this period the discount on closed-end funds is affected by arbitrage and price-stabilizing actions of investment bankers and behaves differently from the discount of other closed-end funds.

We calculate two measures of the discount on closed-end funds, one for stock funds and one for bond funds. Both are interesting to study. The discount on closed-end equity funds is the primary measure used by Lee et al. It has the disadvantage that small investor sentiment can affect both market value and net asset value of closed-end funds. Thus, Lee et al. went to some lengths to try to argue that closed-end equity funds held large stocks whose price was determined by institutions not subject to small investor sentiment. But this argument is clearer in the

7. There is one other change. Lee et al. (1991) used weekly data on discounts to approximate monthly data. Then they used discounts on the Friday closest to month end to calculate the month-end discount. This was necessary because their data on net asset value came from the *Wall Street Journal*, which only reports it as of Friday. We used Lipper data on net asset value. The Lipper data are net asset value at the end of the month so the exact monthly net asset return can be calculated.

case of closed-end bond funds. Bond markets are dominated by institutional traders. Thus, it is hard to argue that individual bonds are subject to small investor sentiment. The discount on closed-end bond funds is thus a purer measure of what the equity market will pay for a set of assets whose value is unaffected by small investor sentiment. Our indices contain many more funds than those constructed by Lee et al. as there are more funds in existence during the more recent period of our study. Over our period we have a maximum of 32 closed-end stock funds and 38 closed-end bond funds. Since Lee et al. primarily use an equity sentiment index, we will emphasize the results for this index.

Later we will compare the performance of these closed-end fund indices to a set of indices that are constructed in an analogous manner but use data for industrial firms. We select the four industries with the largest number of firms in our stock sample, where industries are determined by two-digit SIC code. The industries that meet these criteria are transportation, industrial machinery, electronics, and chemicals. For these industries we rank firms by market capitalization. We then select from each industry the largest firms that had over 50% institutional ownership. If ''sentiment'' is related to irrational behavior of small investors, then these firms should be least affected by sentiment. Since for industrial firms net asset value (i.e., book value) is only available quarterly, these indices are computed quarterly.

Finally, we construct a set of return indices for the four industries and two closed-end fund types described above. These indices are market-value weighted and comprise the same closed-end funds and industrial firms that we use in constructing the discount indices. For comparison purposes, all indices that could be computed monthly were also computed on a quarterly basis.

III. Does Sentiment Affect the Return Generating Process?

The basic premise underlying modern asset pricing theory is that in order for sensitivity to a factor to be priced it is necessary for the factor to be a systematic influence. Identifying systematic influences is a complex process. The return on any industry portfolio will enter the return generating process for some securities. In fact, the return on most random portfolios of securities would also enter the return generating process for some set of securities. Thus, to see if small investor sentiment, as measured by the change in the discount on closed-end funds (called ΔD-EF for equity funds or ΔD-BF for bond funds), is systematic, it is necessary to compare its importance in the return generating process to some factors most investigators would believe are not priced. Industry return indices are a natural candidate. An industry return index will surely enter the return generating process for most firms used in its construction and likely for many firms in closely related industries. One test we will use for examining the importance of sentiment in the return generating process is to see how often it is significant in time-series estimates of this process, relative to a set of industry-return indices.

Before we compare the significance of ΔD-EF or ΔD-BF with the significance of industry-return indices, it is useful as an intermediate step to compare the significance of the change in discount on closed-end funds with the significance of the change in discount for a set of industry indices constructed in such a way that small investor sentiment is unlikely to play a role. As discussed earlier, the comparison group is the change in discount on a value weighted portfolio of 20 large firms that exhibit high institutional ownership drawn from each of four industries.[8] Sentiment is supposed to affect small firms with low institutional ownership. Because of large firm size and high institutional ownership, these industry indices should not be affected by small investor sentiment.

A. *The Significance of Sentiment*

As stated earlier, we use several samples of individual securities and portfolios to judge the importance of factors in the return generating process. Tables 1 and 2 show the number of times in a time-series regression that the sensitivity (beta) of a factor is significant at the 5% level for each of the six candidates for an additional factor in the return generating process. In panels A and B, the candidates examined are the equity sentiment index (ΔD-EF), the bond sentiment index (ΔD-EF), and the change in discount for each of the four industry samples. Table 1 presents the results when the RGP is estimated using individual securities, while table 2 presents the results when the return generating process is estimated for portfolios of securities. In both tables 1 and 2 panel A shows the results for the two-index model (the S&P plus one of the six ΔD's), while panel B shows the results for the five-index model (the S&P, small-minus-large, value-minus-growth, a bond index, plus one of the six ΔD's). Panels C and D parallel panels A and B except that the indices measuring change in discounts are replaced with market-weighted excess returns (over the riskless rate) indices for each of the four industries and two closed-end fund types described earlier.[9]

Consider first the results for the two-index return generating process shown in panel A of table 1. For individual security returns, the beta

8. The sample was the 20 largest firms with over 50% institutional ownership from each industry.

9. We checked to see whether using monthly rather than quarterly data affected the number of times ΔD-EF and ΔD-BF were significant. The results were essentially the same. We also repeated the analysis excluding the firms in the industries for which we constructed industry indices. Again, the results were essentially unchanged.

Table 1 **Number of Times Individual Security Sensitivities to Discounts or Returns are Significant at the 5% Level**

	Discounts				Returns			
	A. 2-Index Model		B. 5-Index Model		C. 2-Index Model		D. 5-Index Model	
Security Group	Industrial Stock Sample (586)	Utility Stock Sample (99)	Industrial Stock Sample (586)	Utility Stock Sample (99)	Industrial Stock Sample (586)	Utility Stock Sample (99)	Industrial Stock Sample (586)	Utility Stock Sample (99)
Closed-end stock funds	35	0	48	2	58	1	55	3
Closed-end bond funds	53	36	74	34	71	73	82	30
Transportation industry	155	4	69	3	255	5	103	6
Industrial machinery industry	85	3	63	0	202	37	63	2
Electronics industry	103	5	67	4	172	49	100	25
Chemicals industry	90	4	99	25	70	9	70	6

NOTE.—The table shows the number of times the individual security sensitivities are significant at the 5% level in regressions of the excess returns of the securities against various models. The indices in the two-index model are the excess return on the S&P 500 index plus the index shown. The five-index model contains the excess return on the S&P 500 index, the difference in return between a small cap portfolio and a large cap portfolio based on Prudential-Bache indices, the difference in return between a growth portfolio and a value portfolio based on Prudential-Bache indices, the excess return on the Shearson Lehman Government Corporate bond index, and the index shown. The models in panels A and B contain ΔD's, which represent the change in the value weighted discount index, where the index is given by the difference between the book value and the market value divided by the book value for the four industries and the difference between the net asset value and market value divided by the net asset value for the closed-end funds. The models in panels C and D contain value-weighted industry returns. Returns and discount changes are of a quarterly frequency. The sample period is from 1980 through 1994. At the 5% significance level, if there is no effect we should expect to see 29.3 and 5.0 significant for the industry and utility stock sample, respectively. Sample sizes are in parentheses.

Table 2 Number of Times Portfolio Sensitivities to Discounts or Returns are Significant at the 5% Level

	Discounts						Returns					
	A. 2-Index Model			B. 5-Index Model			C. 2-Index Model			D. 5-Index Model		
Security Group	Mutual Funds (287)	Size Ports (10)	SIC Ports (28)	Mutual Funds (287)	Size Ports (10)	SIC Ports (28)	Mutual Funds (287)	Size Ports (10)	SIC Ports (28)	Mutual Funds (287)	Size Ports (10)	SIC Ports (28)
Closed-end stock funds	15	0	2	24	0	4	35	9	3	20	0	3
Closed-end bond funds	45	4	1	43	1	4	75	2	4	41	0	4
Transportation industry	100	10	18	40	0	6	133	10	19	52	1	11
Industrial machinery industry	33	2	9	30	1	3	144	10	21	51	4	9
Electronics industry	31	3	12	27	0	8	47	9	16	40	1	8
Chemicals industry	35	3	5	45	4	8	64	3	9	28	3	6

NOTE.—The table shows the number of times the portfolio sensitivities are significant at the 5% level in regressions of the excess returns of the portfolios against various models. The indices in the 2-index model are the excess return on the S&P 500 index plus the index shown. The 5-index model contains the excess return on the S&P 500 index, the difference in return between a small cap portfolio and a large cap portfolio based on Prudential-Bache indices, the difference in return between a high growth portfolio and a value portfolio based on Prudential-Bache indices, the excess return on the Shearson Lehman Government Corporate bond index, and the index shown. The models in panels A and B contain ΔD's, which represent the change in the value-weighted discount index, where the index is given by the difference between the book value and the market value divided by the book value for the 4 industries and the difference between the net asset value and market value divided by the net asset value for the closed-end funds. The models in panels C and D contain value-weighted industry returns. Returns and discount changes are of a quarterly frequency. The sample period is from 1980 through 1994. At the 5% significance level, if there is no effect we should expect to see the following number significant at the 5% level for each sample: mutual funds: 14.4, size portfolios: 0.5, SIC portfolios: 1.4. Sample sizes are in parentheses.

associated with ΔD-EF is significant in fewer cases than the beta for any other ΔD's. In fact, the 35 significant betas for the sample of 586 industrial firms is only six more than would be expected by chance, and the zero for utilities is five less than would be expected by chance. Furthermore, the betas for other ΔD's not affected by small investor sentiment come in more often than ΔD-EF. Part of this is likely to arise because these indices are better proxies for other variables omitted from the return generating process. For the stock sample, ΔD-BF enters the return generating process more often than ΔD-EF but still enters the return generating process less frequently than the industrial indices. For the utility sample it enters the return generating process much more frequently. Lee et al. excluded all bond funds from the results they reported for their sentiment index. However, as discussed earlier, ΔD-BF could be viewed as a sentiment index.

Panel B shows the results when the ΔD's are added to a four-index base model. This model has been shown to work about as well as any return generating process in other studies.[10] The beta associated with ΔD-EF is significant a few more times when the five-index, rather than the two-index model is used but is still not significant much more than one would expect by chance across the two stock samples. Furthermore, with one exception, once again the betas associated with all the other ΔD's are significant more often than the beta associated with ΔD-EF. If we were to select another index in the return generating process it would be one of the other ΔD's. Note also that in panels A and B the beta associated with the change in the discount on equity funds is significant a smaller percentage of the time for utility stocks than it is for industrial stocks. This is exactly the opposite of the conjecture of Lee et al. Once again, the beta on ΔD-BF is significant more often than the beta on ΔD-EF. In all samples it enters the return generating process about as often as the change in industry discounts.

The results for portfolios (panels A and B of table 2) are similar. When the two-index model is used (panel A), the beta associated with ΔD-EF enters the return generating process about the number of times we would expect by chance. In addition, the beta associated with ΔD-EF enters less than the number of times the betas associated with other ΔD's enter with one exception (the beta on ΔD-BF for the 28 industry portfolios). When the five-index model is used, ΔD-EF has more significant betas than the other ΔD's in only one case (out of 15 cases).

When the five-index model is examined, many of the betas associated with the ΔD's are significant slightly more often than would be expected by chance. However, they enter much less often than any of the four indices in the base four model. For the mutual fund sample,

10. See Fama and French (1993); and Elton, Gruber, and Blake (1996*a*, 1996*b*, and 1997).

the S&P index enters significantly 265 times, the small-minus-large 155 times, the value-minus-growth 148 times, and the bond index 107 times. This is much larger than the number of times any of the betas associated with the ΔD's are significant. For the size and SIC groups, the index with the least significance from the base four-index model is significant about the same number of times as the most significant ΔD, but which one of the indices is least significant varies across samples.

In the analysis above we have seen that the betas associated with ΔD-EF enters a return generating process at most slightly more than we would expect on the basis of chance and, in the majority of cases, less often than the betas associated with ΔD's computed for a set of widely held industrial stocks. The question remains as to whether the ΔD's enter because they are simply a proxy for an index of industry return. The ΔD's are, of course, correlated with industry returns (given the way ΔD is constructed, the correlation is negative). For the industry sample the book values will change very slowly over time. Thus ΔD will be primarily affected by the change in market value. This is reflected in the correlation of the value-weighted return indices and the ΔD. For the four industrial ΔD's these correlations are $-.54$, $-.53$, $-.77$, and $-.41$, respectively. Likewise, the book value for the bond closed-end funds will change less than the market value and fairly independently of the market value. Thus one would expect a high correlation between industry return of the closed-end bond funds and ΔD-BF, and the simple correlation is $-.52$. Since equity market movements affect both the market and book value for equity funds, we would expect a lower correlation between this sample's sentiment index and returns, and this is what we observe ($-.38$). However, the question still remains whether even the limited significance of ΔD in the return generating process is primarily due to the effect of industry returns on the ΔD's. To test this, we construct a value-weighted industry return index for each of our four industries and the two closed-end fund samples.

The results are shown in panels C and D of tables 1 and 2 for the two- and five-index models. First, compare the results for the two-index ΔD model and the two-index return model (panels A and C). In only one of 30 cases is the ΔD term more significant than the industry return index. This is true whether the sample is individual security returns or a portfolio of returns. Now compare the five-index models. Once again, whether the sample is individual securities or portfolios, the return index in general has more significant coefficients than did the ΔD's. The evidence in total supports the notion that it is industry return indices that explain security or portfolio returns, and even the limited significance of the ΔD's is primarily because they are a proxy for an industry return index.

However, whether one looks at either ΔD's or industry returns, the results do not support the idea that ΔD-EF represents a systematic risk.

B. *Does Another Variable Proxy for the Lee et al. (1991) Sentiment?*

Others have argued that the ΔD-EF measure for small investor sentiment might be important but have its presence masked because it is correlated with one or more variables that are accepted as systematic and included in the return generating process. For that to happen, ΔD-EF would have to be correlated with the indices in our four-index model. To test this we regressed ΔD-EF against the four-index model described earlier. The R^2 was zero (the adjusted R^2 was negative). Thus, sentiment is not an explanation for the presence of size or growth minus value in the return generating process.

C. *Sentiment and Size*

One of the major ways to judge the contribution of a set of indices to the return generating process is to use portfolios formed on the basis of size as the unit of observation in time-series tests. Size portfolios have been used as the unit of observation by Gibbons, Ross, and Shanken (1989) and Fama and French (1992), among others, and play a key role in the testing of sentiment by Lee et al. Thus it is worthwhile to examine this sample in more detail.

As discussed earlier, we use as our 10 size portfolios the CRSP size deciles ordered from smallest to largest formed from NYSE stocks. To better allow comparison with the Lee et al. results, in this section we follow their procedure and use a value-weighted NYSE index (VWNY) as the market index, rather than the S&P index used in other parts of this study.[11]

In table 3 we present the detailed results for the period from October 1979 through December 1994. Panel A of table 3 shows the results of a regression of the return of each size portfolio on the change in the discount of closed-end equity funds (ΔD-EF) and the VWNY index (a two-factor RGP). The first column is the beta on the ΔD-EF, the second column is the t-statistic, and the third column is the R^2. These results are comparable to table VII of Lee et al. although they report results for the period 1975–85. Note that the R^2s are close to those found by Lee et al. In addition, the pattern of regression coefficients is also suggestive of their results. The portfolios of small stocks have negative weights; the portfolios of large stocks positive weights. Like Lee et al. we find the regression coefficient increases in general as we examine larger firms. In fact, the rank correlation between deciles and the regres-

11. All tables were also constructed with the S&P index substituted for the NYSE, and both the results and conclusions are virtually identical.

Table 3 **Regression Results of CRSP Market Capitalization Deciles against Index Models and the Sentiment Index**

	A. 2-Index Model			B. 5-Index Model		
Decile	β(Δ*D*-EF)	*t*-Statistic	R^2	β(Δ*D*-EF)	*t*-Statistic	R^2
1	−.110	−.292	.564	.185	1.000	.905
2	−.177	−.697	.706	.020	.170	.946
3	−.141	−.707	.795	.018	.170	.951
4	−.018	−.100	.843	.110	1.300	.967
5	−.035	−.222	.855	.097	1.310	.971
6	−.092	−.644	.876	.010	.940	.972
7	−.003	−.028	.905	.088	1.300	.972
8	−.108	−1.037	.924	−.035	−.460	.967
9	−.034	−.496	.964	.015	.270	.977
10	.028	.541	.973	−.014	−.510	.993

NOTE.—This table shows results from regressions of returns of the CRSP market capitalization deciles against the 2-index and 5-index models. The 2-index model is the excess return on the CRSP value-weighted NYSE index and the sentiment index. The 5-index model is the excess return on the CRSP value-weighted NYSE index, the difference in return between a small cap portfolio and a large cap portfolio based on Prudential-Bache indices, the difference in return between a high-growth portfolio and a value portfolio based on Prudential-Bache indices, the excess return on the Shearson Lehman Government Corporate bond index, and the sentiment index. β(Δ*D*-EF) is the regression coefficient on the sentiment index Δ*D*-EF. Returns and discount changes are of a quarterly frequency so that they can be compared with industry indices. The sample period is from 1980 through 1994.

sion coefficients on Δ*D*-EF is .71. As in the 1975–85 period studied by Lee et al., none of the regression coefficients on Δ*D*-EF from any of the 10 size portfolios are statistically different from zero. Despite the lack of significance, Lee et al. interpret these results as indicating that there is a small investor sentiment index and that different size firms have different sensitivity to it.

In table 3 we also report analogous results for the five-index regression. The goodness of fit (particularly for small stocks) is much better than in the case of the two-index model. However, the relationship between the regression coefficient on Δ*D*-EF and the size deciles is actually reversed. Large companies tend to have negative loadings, and small companies positive loadings (the Spearman rank correlation is −.71). Thus, the pattern of coefficients that Lee et al. argued supported small investor sentiment as an influence is reversed when a more realistic return generating process is used. This occurs even though the correlation of Δ*D*-EF with a size variable, or in fact any of the variables in the return generating process, is quite low. This is added evidence that Δ*D*-EF is not a systematic influence in the return generating process.

From an examination of the relation between the betas on sentiment and size deciles in the two-index model, Lee et al. speculate that the Δ*D*-EF index is a proxy for a systematic sentiment index that affects small stocks and large stocks differently. According to Lee et al. the sentiment index is related to the return on size portfolios because both closed-end mutual funds and small stocks have low institutional ownership. If this were the explanation for the small investor sentiment index having the relationship to size hypothesized by Lee et al., then replacing ΔD-EF with one of the industrial ΔD's employed earlier should not lead to the type of results presented in panel A of table 3. Recall that these ΔD's were computed using only large firms with high institutional ownership.

When we replace ΔD-EF with any of the industrial ΔD's, we not only find the same type of results as those reported in table 3, but the pattern of the results is even stronger. For example, when ΔD for the transportation index (ΔD-TR) is substituted for ΔD-EF as the second index in the two-index model, the multiple correlation for each decile increases (better fit), the pattern of the coefficients across deciles (from minus to plus) is much stronger, and the regression coefficient on ΔD-TR for each decile is statistically significant at the 10% level for each decile. Furthermore, the rank correlation between decile rank and the regression coefficient with ΔD-TR is higher (.96).[12]

When we employ the five-index model using ΔD-TR rather than ΔD-EF as the fifth index, the results are very similar. The explanatory power of the five-factor model is much higher than that of the two-factor model for each decile. However, as in the case of ΔD-EF, none of the regression coefficients associated with the industry ΔD's are statistically significant, and the rank correlations between the decile rank and the betas associated with the ΔD's become negative. There does not seem to be anything unique about the use of a sentiment index formulated as ΔD-EF. In fact, the use of ΔD formulated for any industry using stocks with high institutional ownership produces analogous but statistically stronger results.[13]

D. *Sentiment and Empirically Derived Factors*

In an earlier section we use four prespecified factors as a return generating process. An alternative way to specify the return generating process is to derive factors empirically. We use as our empirically derived model an updated estimate of the factors described in Connor and Korajczyk (1986).[14] These factors are derived from the variance covariance matrix of stock returns using principal components analysis. If sentiment is an important influence systematically affecting stock returns, it should be related to a set of empirically derived factors that affect

12. Similar results are found when ΔD is formulated on the electronic and industrial machinery industries.

13. If we replace ΔD with returns, we get the same pattern of results, only stronger. This suggests, once again, that ΔD is likely simply proxying for return.

14. We thank Bob Korajczyk for supplying us with the factors. The data end in December 1992, which is slightly shorter than our sample period in the rest of the study.

Table 4 Correlation Matrix of Change in Sentiment Indices and Five Stock Market Factors

Sentiment/Discount Index	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5
Closed-end equity	−.02	−.05	.02	−.01	.06
Transportation industry	−.55	.28	−.42	.20	.14
Industrial machinery industry	−.60	−.26	.02	.13	.21
Electronics industry	−.79	−.01	−.24	.29	.36
Chemicals industry	−.64	−.53	−.05	.46	.28

NOTE.—This table shows the correlations between changes in the ΔD-EF sentiment index or changes in the four industry value-weighted discounts and five stock market factors. The data are of a quarterly frequency. The sample period is from June 1980 through December 1992. The factors are updated versions of those developed by Connor and Korajczyk (1986).

stock returns. Table 4 shows the simple correlation of the equity sentiment index with the first five empirically derived factors from Connor and Korajczyk (1986). The largest value is .06 with factor 5. With only one exception, each of the factors has a higher correlation with each of the industry indices than it has with the equity sentiment index.

We also regressed each of the empirical factors against the four-index base model with and without the addition of an equity sentiment index. For each factor other than the first, the adjusted R^2 was lowered when sentiment was included in the regression (for the first factor it was unchanged). For each factor, the F-test associated with adding a sentiment index to the base model finds the sentiment index results in no improvement at the 5% level. Thus, equity sentiment does not appear to be related to empirically derived factors.

The fact that equity sentiment is not related to empirically derived factors is powerful evidence that sentiment is not in the RGP. The concern with empirical factors has always been that one can have too many factors and that some are spurious. Since one is unsure what an empirically derived factor represents, a factor can occur and not have any economic significance. However, it is hard to understand how a factor that is supposed to have economic significance, such as sentiment, could possibly enter the return generating process and yet not be related to any of the empirical factors.

In Section III of this article we have shown that the sentiment index does not play a role in explaining the time series of returns on assets or portfolios of assets. Based on this we would not expect sentiment risk to affect expected return. This is the subject to which we now turn.

IV. Sentiment and Expected Returns

According to Lee et al., investors require an extra return from closed-end funds because they are subject to small investor sentiment risk. The shares of closed-end funds are traded assets. With a properly defined asset pricing model, the average alpha on traded assets should be zero. If we accept this argument and mistakenly leave small investor-sentiment risk out of the estimation of the return generating process for closed-end funds, this should result in a positive alpha. Similarly, when we include this source of risk in the return-generating process the alpha should decrease. The decrease in alpha should occur because of the Lee et al. hypothesis that sentiment risk has a nonzero price and that closed-end funds have a larger than average sensitivity to this source of risk.[15]

When we employ our four-index model on closed-end funds, we find that the risk-adjusted return (α) is $-.174\%$ per month for stock funds and $-.161\%$ per month for bond funds. While these alphas are not statistically different from zero, the evidence weighs heavily against arguing that the alphas are positive because of an omitted variable.

We can directly examine the effect of including the sentiment index in our estimates of the excess return for closed-end funds. In order to have the index expressed in terms of excess return on a set of zero-investment portfolios, a portfolio of stocks was formed to replicate ΔD-EF. This was done by forming a portfolio of stocks that has a return pattern that most closely replicated changes in ΔD-EF over our sample period.[16] The R^2 between the replicating portfolio and ΔD-EF was .996.

The return on this replicating portfolio minus the riskless rate was then introduced as a fifth index. When this was done, the α on closed-end stock funds increased from $-.174$ to $-.083$.[17] This is the opposite of what should occur if sentiment risk had the impact hypothesized by Lee et al. Since the alpha actually increased rather than decreased, looking at risk-adjusted returns provides no evidence that sentiment risk affects expected returns in a manner consistent with it being a source of risk to closed-end fund holders.

V. Discounts on Closed-End Funds and Expected Returns

There is one remaining part of the Lee et al. discussion that we should deal with. They hypothesize that closed-end funds must offer a higher rate of return to compensate investors for sentiment risk. To do this

15. For the way Lee et al. (1991) define sentiment risk, both the betas and market prices are negative, causing a positive effect of sentiment on return.

16. We solved the quadratic programming problem that minimized the squared deviation between the matched portfolio and ΔD-EF (where each is demeaned), while requiring the weights across the stocks to add to one. Because of limitations of our quadratic programming software we used a randomly selected 200 stocks out of 586 to construct the replicating portfolio.

17. The analysis was also repeated simply using ΔD-EF as the fifth index. The alpha estimate increased from $-.174\%$ to $-.161\%$ and moved in the same direction as when the replicating portfolio was used.

the rate of return on closed-end funds must be higher than the rate of return on net asset value, and closed-end funds must sell at a discount.

In this section we show that the discount on closed-end funds is easily explained by management performance (negative net asset value [NAV] alpha) and the added risk of investor return relative to NAV return. Before doing so we need to develop the relationship between NAV return and investor return.

A. *Investor Return and NAV Return*

The return on the shares in a closed-end fund can be related to the return on the underlying assets in the following way: define

R_I as the return to an investor in a closed-end fund,
R_{NAV} as the return on the net asset value,
P_t as the price at time t,
D_t as the dividend at time t,
N_t as the net asset value at time t, and
d_t as the discount at time t.

The return to the investor, the return on the NAV from time 0 to 1, and the discount at time 1 are given respectively by[18]

$$R_I = \frac{P_1 + D_1 - P_0}{P_0}, \tag{3}$$

$$R_{NAV} = \frac{N_1 + D_1 - N_0}{N_0}, \tag{4}$$

and

$$d_1 = \frac{N_1 - P_1}{N_1}. \tag{5}$$

From these definitions it follows that investor return is related to the return on the NAV as follows:

$$(1 + R_I) = (1 + R_{NAV})\left(\frac{1 - d_1}{1 - d_0}\right) + \frac{D_1 d_1}{P_0}. \tag{6}$$

While the discount will vary from year to year, the expected value of a change in the discount must be zero.[19] If it were negative (positive) an investor would have to expect the price of the fund to grow (decline)

18. P_1 and N_1, and hence returns, are defined (and calculated) after expenses.

19. Mean reversion might result in short term changes in the expected value of the discount being nonzero.

continuously relative to the net asset value of the fund until the price was much greater (less) than the net asset value. Taking the expected value of both sides and setting the expected value of the change in the discount to zero, we have

$$E(R_{\mathrm{I}}) = E(R_{\mathrm{NAV}}) + \frac{D_1 d_1}{P_0}. \tag{7}$$

From this equation we see that if the price of the fund is below the net asset value of the fund (the fund sells at a discount), then the expected return to investors exceeds the expected return on fund assets. This occurs because the discount allows the dividend stream to be purchased at a lower price.

B. NAV Alphas and the Discount

In this part we examine the NAV alphas and show that they are sufficiently large negative numbers to explain the discount. We do this assuming that the risk to investors is the same as the risk of NAV returns. In the next part we explore differences in risk.

Employing the four-index model used earlier we find that over our sample period both the closed-end stock fund and closed-end bond fund NAV alphas are negative (−2.27% and −.36% per year, respectively). The NAV alphas are what would have been earned if the fund were an open-end fund. The negative alpha is consistent with the results found for open-end funds when returns are analyzed after expenses (see Blake, Elton, and Gruber 1993; or Elton, Gruber, and Blake 1996*a*).[20] Thus, the results obtained are as expected. The magnitude of the alpha on NAV return is a larger negative number for closed-end stock funds and a smaller negative number for closed-end bond funds than the alphas typically found in studies of open-end funds.

The discount in our sample period is about 12% on average for equity funds and 3% for bond funds. Of greater importance, these numbers are consistent with the closed-end fund discounts found over long time periods. Using equation (7) and historical data we can arrive at estimates of the difference between investor returns and returns on net asset value. For an expected return of 10.6% for stocks and 5.1% for bonds (numbers roughly consistent with Ibbotson [1997]) and the size of the historical discount, the $E(R_{\mathrm{I}})$ would be expected to exceed

20. One could argue that closed-end funds should have different α's than open-end funds. There are arguments that would lead to larger or smaller alphas on closed-end funds relative to open-end funds. One argument why it should be larger is that closed-end funds do not have to worry about redemptions and therefore hold less cash (the use of futures eliminates this problem). An argument for smaller alpha is that closed-end funds do not have the market discipline of inflows and outflows owing to performance and therefore are less performance oriented.

Table 5 Closed-End Sample Four-Index Regression Results

	α	$\beta_{S\&P}$	β_{Sm-Lg}	β_{Gr-Vl}	β_D	R^2
Stock funds:						
Investor	−.174	.758**	.505**	−.119	.284**	.52
NAV	−.189	.752**	.371**	.168**	.147*	.76
Investor−NAV	.015	.006	.134**	−.287**	.137	.075
Bond funds:						
Investor	−.161**	.191**	.172**	−.411**	.934**	.34
NAV	−.030*	.053**	.069**	−.062**	.979**	.77
Investor−NAV	−.131**	.138**	.104**	−.349**	−.045	.082

NOTE.—This table shows average values from regressions of excess returns of the closed-end stock and bond samples against the the excess return on the S&P 500 index, the difference in return between a small cap portfolio and a large cap portfolio based on Prudential-Bache indices, the difference in return between a high-growth portfolio and a value portfolio based on Prudential-Bache indices, and the excess return on the Shearson Lehman Government Corporate bond index. The stock sample consists of 32 funds. The bond sample consists of 38 funds. Returns are of a monthly frequency. The sample period is from 1980 through 1994.

* Significant at 5% level.

** Significant at 1% level.

$E(R_{NAV})$ by 1.3% for stock funds and .10% for bond funds. The possible increase in alpha due to the discount is smaller in magnitude than the annualized negative alphas on NAV returns we find for closed-end funds. Therefore, the size of the discount is more than explained (it is too small) to turn the negative alpha on NAV returns into a positive alpha for investor returns.[21] Thus, the discount is fully explained without investor sentiment risk. While we feel it is the less appropriate case, the same analysis was run using the single index model, and the conclusions were identical.

C. *The Risk of Closed-End Funds*

The analysis in the previous section assumes the risks on NAV return and investor return are the same. In this section we show that investor return has higher risk than NAV return, and this higher risk is due to the fact that closed-end funds are small and have low market-to-book ratios and thus greater sensitivity to small-minus-large and value-minus-growth indices. The higher risk makes it even more unlikely that the discount is sufficiently large to make the alpha on investor returns positive when the sentiment index is left out.

In table 5 we report the average sensitivities (betas) associated with investor return and NAV return from our four-index model, as well as differences in the sensitivities and the *t*-statistics associated with these differences.[22] For stock funds the sensitivity of the NAV return and

21. The alpha should be positive if sentiment risk is important and we leave it out of the RGP, as we did.

22. In this section we demonstrate that the differences in the sensitivity of investor returns and NAV returns to each of several indices is related to fundamental characteristics. The approach we have taken links the sensitivities of models such as the Fama and French

investor return to the S&P index are virtually the same. However, the sensitivity varies on each of the other indices, and the differences are statistically significant for two of these indices. We believe that the direction of the difference in each of these indices is consistent with the relationship between sensitivities and firm characteristics found in general and that the direction of the differences found in our sample period is consistent with the difference in characteristics of closed-end funds and the characteristics of the firms they hold. Thus, the results we show in table 5 are likely to be general and not a result of the period studied.

The investor return has a much higher sensitivity (beta) to the small-minus-large return variable than does the NAV return. To analyze if this is explained by characteristics of closed-end funds, we examine whether the beta on the small-large return index is related to the size of firms. We first divide the 586 stocks in our common stock sample into 20 groups, with the first group containing the one-twentieth of the stocks with the smallest total equity capitalization and the twentieth group the one-twentieth of the stocks with the largest capitalization. We measure capitalization at the beginning of each year and reform the portfolios each year. The return on each group is calculated using an equally weighted portfolio of the stocks within the group. Time-series data is then used to regress the return on each group against our four-index model. The beta on the small-large variable is then regressed (in cross section) on the natural logarithm of the average capitalization of the firms (in millions of dollars) in each group. The results are as follows:

$$\beta_{S-L} = 1.857 - .194 \ln(\text{size}), \quad R^2 = 0.954. \tag{8}$$

There is obviously a very strong relationship between the sensitivity to the small-minus large index and the size of the companies involved. Companies that are smaller in size have a larger beta in our model.

The average size of the stocks held by closed-end funds was $5,572 million, while the average size of the closed-end funds themselves is $343 million. The closed-end stock funds are much smaller in size than the companies they hold. The difference in size, combined with the negative sign on size in equation (8), explains why investor returns have a larger beta than NAV returns.

Furthermore, the relationship between the sensitivity of a stock to the small-minus-large return index and the size of the stock provides one explanation why the sensitivity to the index is a source of risk and

model with the direct use of firm characteristics such as risk measures (see Daniel and Titman 1997). To the extent that increased risks for investors are not explained by fundamental characteristics, they may be due to management creating additional risks by their action.

should have a positive price. Small firms have higher liquidity costs and therefore require a higher pretransaction cost return (see Amihud and Mendelson 1986). Small firms also have higher leverage (see Chan and Chen 1991) and are more vulnerable to financial distress and the business cycle (see Fama and French 1992). Finally, small firms have fewer analysts following them and less information available about them, thus increasing the risk to investors.

To examine whether the lower sensitivity to the growth-value variable for NAV versus investor return is also plausible, given the characteristics of a fund relative to the firms it holds, we repeated the process we employed earlier. We rank the 586 stocks in our sample by market-to-book ratios at the beginning of each year and split them into 20 equal-sized groups. The return on an equally weighted portfolio of the stocks in each of these groups is then calculated. This return series is then regressed on the four-index model. The beta on the growth-minus-value index for each of the 20 groups is then regressed in cross section on the average market-to-book ratio for each group. The results are as follows:

$$\beta_{G-V} = -.255 + .370 \ln\left(\frac{Market}{Book}\right), \quad R^2 = .899. \tag{9}$$

There is strong evidence that firms that have higher market-to-book ratios have larger betas with respect to our growth-minus-value return index.

The average market-to-book ratio for stocks held by funds is 3.9, while the market-to-book ratio for the funds themselves is .9. Thus the closed-end equity funds have a smaller market-to-book ratio than the assets they hold. Given the relationship just described, this would imply that the sensitivity on the growth-value index should be smaller for investor returns than NAV returns. In fact, this is what we find (see table 5).[23] The relationship between the market-to-book ratio and the sensitivity to the value-minus-growth index provides one explanation for why sensitivity to this index should have a positive price. Low market-to-book firms are more subject to financial distress and the business cycle (see Fama and French 1992). Thus, these firms have low outcomes at the time investors most value the returns, and investors should require a higher average return.

The final sensitivity to examine is the sensitivity to the bond factor. We related this sensitivity to dividend yield. We once again used the same procedure as in the previous two cases. However, in this case our 586 stock sample was divided into 20 portfolios based on dividend yield (the dividend-to-price ratio). Then the sensitivity of each portfolio

23. We are not implying that the management behavior cannot affect betas.

to the bond variable is regressed (cross-sectionally) against the average dividend yield for each portfolio. The results are

$$\beta_{\text{bond}} = -.255 + 3.434 \left(\frac{Dividend}{Price}\right), \quad R^2 = .334. \qquad (10)$$

While this relationship is weaker than those found for the size and growth betas, it is still significant at the 1% level.

To maintain the tax advantage afforded to mutual funds, closed-end funds must pay out 95% of their income from dividends and capital gains received each year. This results in larger dividend yields for closed-end funds than the stocks or bonds they hold. Given the relationship just discussed, the beta for the bond index should be higher for closed-end funds than the assets they hold, and this is what we find.

The three sensitivities that are different for investor return than for NAV return for closed-end stock funds are consistent with the difference between the characteristics of the closed-end stock funds and the characteristics of the assets they hold. Thus the differences in investor beta and NAV beta found empirically are what should be expected and are explained by differences in firm characteristics. The higher sensitivity to size, the resemblance to value rather than growth, and the greater sensitivity to bonds all imply that investor return is riskier than NAV return. Investors should require a discount to compensate for these differences in risk.

The results for closed-end bond funds are even clearer. For bond funds the beta on bonds is about the same for investor return as NAV return. However, the sensitivity to the S&P return is much higher for investor return than NAV return. This is to be expected since bond returns are relatively uncorrelated with equity returns and since the shares of closed-end funds are equity. Since higher sensitivity to the S&P requires a higher return, the difference in required return for investors relative to NAV is likely to be even higher for bond funds. As in the case of stock funds, investors must require a discount to compensate for the differences in risk between investor return and NAV return.

Let us summarize what we have learned in the previous two sections. Closed-end funds have prices and returns freely determined in the open market. They also sell at discounts. There are two reasons why they need to sell at discounts. First, the alpha on NAV returns is negative. Second, because of differences in closed-end fund characteristics relative to the assets they hold, the risk of the stream of returns to investors is greater than the risk of NAV returns. The discounts observed are too small to compensate for the negative NAV alphas and the greater risk. Thus a "missing factor" is not needed to explain discounts. Furthermore, including sentiment risk causes the alpha to move in the wrong direction. Examining equilibrium returns does not support a sentiment story.

VI. Conclusion

In this article we explore whether sentiment could reasonably be expected to be a factor affecting expected return. Modern asset pricing theory implies that only sensitivity to systematic factors in the return-generating process be priced. We first explore whether sentiment is a factor in the return generating process. We show that a sentiment index computed from closed-end funds in most cases enters the return generating process no more than expected by chance and almost always less often than indices computed in the same way from large firms in industries that have high institutional ownership. Thus, institutional ownership is not a factor in the importance of an index. We next show that sentiment indices enter the return generating process less often than industry return indices. Since industry return indices are not considered priced indices, this makes it less likely that sentiment indices are priced. In doing all of this analysis we employ both a two-index model similar to that of Lee et al. and a five-index model that also included a size, growth, and bond variable. When we explore in detail the size sample emphasized by Lee et al., we find that using a five-index model rather than a two-index model reverses the pattern of sensitivities to sentiment across size categories. Thus, the Lee et al. (1991) pattern of sensitivity and size is a result of a misspecification of the return generating process.

As another test of the role of sentiment indices in the RGP, we examine whether sentiment was related to empirically derived factors. We use the Connor and Korajczyk factors. The simple correlation of the sentiment indices derived from closed-end funds was less than .06 for each of five factors found by Connor and Korajczyk. Sentiment is not related to any of the systematic factors derived from the variance-covariance matrix of security returns.

Finally, we examine whether the index is priced. For traded assets the alpha from a properly defined asset pricing model should be zero. Lee et al. argue that if sentiment is important, investors require a higher return than the return on NAV and we should observe a discount. We show that the historical discount has been insufficient to compensate for the negative alpha on NAV returns and the greater risk of investor return relative to NAV return. Thus the historical discount has been so small that it provides no evidence in support of a priced sentiment risk. If we leave out sentiment, and sentiment is important in the asset pricing model, then the alphas should be positive. We show that the alpha investors receive has historically been negative. Furthermore, when sentiment is added the alpha increases. This is directly opposite to what should happen according to the sentiment story. The discount on closed-end funds is insufficient to provide a positive alpha, and there is no evidence supporting sentiment as part of the return generating process or asset pricing model.

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